CITY OF CAMAS
CLARK COUNTY, WASHINGTON

WATER SYSTEM PLAN

G&O No. 08495
June 2010

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF CAMAS

CLARK COUNTY, WASHINGTON

WATER SYSTEM PLAN

RUSSELL L. PORTER
STATE OF WASHINGTON
35688
REGISTERED
PROFESSIONAL ENGINEER
6/7/10

G&O #08495
JUNE 2010

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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June 10, 2010

Mr. Andy Anderson, P.E.
Washington State Department of Health
Southwest Drinking Water Operations
243 Israel Road SE, 1st Floor
Tumwater, Washington 98501

SUBJECT: FINAL WATER SYSTEM PLAN
CITY OF CAMAS, CLARK COUNTY, WASHINGTON
G&O #08495

Dear Mr. Anderson:

Enclosed are three copies of the City of Camas's Final Water System Plan for your review. The Department of Health project submittal form and checklist can be found in Appendix B of the Plan.

Please contact the undersigned if you have any questions on this submittal.

Very truly yours,

GRAY & OSBORNE, INC.

Russell Porter, P.E.

RP/sn
Encl.

cc: Mr. Mike Stevens, City of Camas
Mr. Eric Levison, City of Camas
Mr. Jim Hodges, City of Camas
Mrs. Jacquie Andresen, Washington State Department of Commerce

701 Dexter Avenue N., Suite 200 Seattle, Washington 98109 (206) 284-0860 Fax (206) 283-3206

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DOH COMMENT RESPONSE FORM

DOH Comment No.	DOH Comment	Water System Response	Page Number of Response	Other Water System Comments
1	*According to Table 4-20, it appears the City has insufficient storage capacity in the 343 and 542 pressure zones. By 2015, it appears all pressure zones except 455 and 852 will be deficient. Please re-evaluate the capacities and clarify how the City will address any deficiencies. Please indicate whether the City will restrict new connections in any area.*	Added: The deficits shown in Table 4-20 and 4-21 are for a single zone analysis. Excess storage is available in other zones to eliminate any single zone deficiencies. The City has adequate total system storage through the 6-year planning period. In 2015, excess storage in the UPH Reservoir will supplement the 544 Lacamas zone (not the 544 NUGA). There is currently a City policy in place that limits the growth in the 542 Gregg zone. The LPH Reservoir will supplement the 343 Butler zone. Growth will not occur within the 542 and 544 NUGA zones until reservoirs are constructed. Footers have been added to Table 4-20 and 4-21 to explain the storage capacities: Table 4-20 footers: (1) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 343 Butler Zone. (2) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 542 Gregg Zone. Table 4-21 footers: (1) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 343 Butler Zone. (2) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 542 Gregg Zone. (3) NUGA growth is dependent on the construction of additional storage by developers. (4) Excess storage in the 852 UPH Zone eliminates the deficit shown in the 544 Lacamas Zone.	4-23	

2	*According to Table 4-13, it appears that the City will have deficient source capacity to serve all pressure zones except for 542 (UGA) by 2015. Please re-evaluate the capacities and clarify how the City will address any deficiencies. Please indicate whether the City will restrict new connections in any area.*	Table 4-13 shows the deficits if no improvements are made to the system and growth is allowed to continue as projected. Table 4-14 shows the deficits once the Crown Road Booster Station is constructed (3,200 gpm). This eliminates all deficiencies except for the 343 Zone and the 852 Zone. Well 14 has been designed, and after construction will add 1.44 MGD to the 343 Zone, eliminating the deficit. The 852 Zone deficit is eliminated with a temporary portable 125 gpm booster pump, which has been added to the CIP. Footers have been added to Table 4-14 to explain the pumping capacities: (3) The construction of Well 14 will produce an additional 1.44 MGD to the 343 Zone and eliminate this deficiency. (7) This deficit will be eliminated with a temporary portable 125 gpm booster pump.	4-18	
3	*It is difficult to identify the capacity limitations in each pressure zone and what steps the City is taking to address them. Please consider presenting the water system demands and capacities in a graphical form.*	Table 4-23 shows triggers for the CIP projects. Figure 8-1 shows the locations of CIP projects. An additional Table 8-8 has been included which summarizes the system deficiencies and the CIP projects the City is taking to eliminate them.	4-28, 4-29, Figure 8-1, Table 8-8	
4	*ERU estimates based on average day demands are only appropriate for evaluating annual water rights and, sometimes, standby storage. To evaluate source capacity and capacity-related storage in ERUs, please use estimates based on maximum day demands.*	The instantaneous water rights analysis on page 4-9, source analysis on page 4-13, and pumping analysis on page 4-17 uses maximum day demands (MDD). The ERU triggers in Table 4-23 uses MDD.	4-9, 4-13, 4-17, Table 4-23	

Ch 3: 1	*Page 3-3. Municipal water supplies must provide their service area policies and conditions of service including how new service will be provided per WAC 246-290-106 (4). Please provide a copy or discuss your current service area policies. This discussion should clearly define how service would be provided, how the water system will process applications, identify associated costs, and provide time frames for water service. In addition, the water system should discuss such things as the appeal process for a service condition or denial, whether only direct service is available or if you will consider remote service, latecomer agreements and differences between service within or outside the urban growth area (see Enclosed Fact Sheet Service Area Policies). Furthermore, you should discuss and reference the Clark County Coordinated Water System Plan.*	City policies are outlined and referenced in Table 2-2. The Clark County CWSP is referenced in Table 2-2 and discussed on page 2-12. Inter-local agreements establishing water service boundaries Vancouver and Washougal are included in Appendix G. The intertie agreement with Washougal is also included in Appendix G. Water service policies and referenced CMC's are included in Appendix G.	Appendix G	
Ch 3: 2	*Page 3-3. Proposed rules and guidelines relating to issues of plan consistency are set for final adoption in 2006". Please verify if this occurred.*	Deleted: 'Proposed rules and guidelines relating to issues of plan consistency are set for final adoption in 2006.' Replaced with: 'Rules and guidelines relating to issues of plan consistency were adopted by DOH in 2008 under the MWL.'	3-3	
Ch 3: 3	*Page 3-8. The City maintains two PRV interties with the City of Washougal. Please provide copies of any intertie agreements.*	Intertie agreements are located in Appendix G.	Appendix G	
Ch 3: 4	*Page 3-16. The N used to calculate PHD should be equal to the number of ERUs during peak demands. In other words, N = Max Day Production / Max Day Demand per ERU. Please revise the calculation.*	Using average values: N=8,458,333 gpd/(296*2.2)=12,989 ERUs PHD=(296*2.2/1440)(1.6*12,989+225) +18 =9,518 gpm PHD/MDD = 9,518/(8,458,333/1440) = 1.62 Using 2007 values: N=6,999,000/(284*1.86)=13,250 ERUs PHD=(284*1.86/1440)(1.6*13,250+225)+18 =7,877 gpm PHD/MDD = 7,877/(6,999,000/1440) = 1.62 Thus, the value of 1.8 is conservative and will be used throughout the Plan.	3-16 and 3-17	The value calculated in the Plan is higher than the actual value calculated here. The 1.8 value is used as it is more conservative.

Ch 3: 5	*On Page 3-17, the value of 280 gpd is used to represent ADD. However, Page 3-23 indicates the ADD value used to evaluate capacity should be 296 gpd. Please fix the discrepancy.*	The value of 296 gpd/ERU should have been used. Replaced in that sentence. Added: '(See DOH comment/response matrix for further explanation of this calculation.)	3-17	
Ch 3: 6	*On Page 3-17, the value of 647 gpd is used to represent MDD. The ADD assumption and the equation result appear to be incorrect. Please fix the discrepancy.*	Deleted: 'The total number of ERUs for the water system in the year 2007 was calculated by dividing the average day consumption of each customer class plus distribution system leakage by 296 gpd.' Replaced with: 'The number of service connections, N, is equal ot the maxium day production divided by the maximum day demand per ERU. The result is a total system ERU value of 12,989.' Deleted: 'MDD = 280 gpd/ERU * 2.2 = 647 gpd/ERU' Replaced with: 'MDD = 296 gpd/ERU * 2.2 = 651 gpd/ERU' Deleted: 'for the year 2007' Deleted: '9,318' Replaced with: '9,518' Deleted: 'entire system is 1.8. (9,318/(7,433,000/1440) = 1.8).' Replaced with: 'entire system is 1.62. (9,518/(8,458,333/1440) = 1.62).'	3-16 and 3-17	
Ch 4: 1	*Page 4-18, Note 2. "At this time" appears to be an incomplete sentence. Please clarify the intent.*	Deleted: 'At this time'	4-18	Table 4-14, footnote 2
Ch 4: 2	*Page 4-24. This section is written as a recommendation from the consultant and does not reflect what has actually been adopted by the system. The City should indicate which recommendations it plans to pursue by the time the final copy of the plan is approved. Additionally, the WSP should indicate what the City plans to do. Please revise the wording to document with certainty the description of what activities, both existing and future, have been formally adopted by the system.*	The language in this section has been modified to what the City 'will and shall' do to meet system deficiencies. 'It is recommended' phrases have been deleted from this section. Added: 'The City will pursue the latter option and limit growth within the NUGA until improvements are made.'	4-24 through 4-28 4-26	

Ch 5: 1	*Figure 5-1. Please indicate if the fire flow deficiencies have been communicated with the fire department.*	The City has communicated the fire flow deficiencies with the fire department.	Email attached	
Ch 5: 2	*Figure 5-3. Please include a figure of model results showing 2008 PHD without improvements or indicate why it is not necessary.*	This figure is included behind this matrix and before the TOC.	Figure attached	
Ch 6: 1	*"Unaccounted for water" does not have a standardized definition. Please use the term "authorized consumption" and "distribution system leakage" to comply with the Water Use Efficiency Rule.*	'Authorized consumption' and 'distribution system leakage' have been inserted where necessary to replace 'unaccounted for water' language.	6-4 through 6-13	
Ch 6: 2	*Page 6-9. Establishing Water Use Efficiency goals must be established thru a public process (WAC 246-290-830(4)(a)).Please provide documentation showing public process was followed by including the following: the date the notification was given, the date the meeting was held, a description of the notification process used and a summary of the meeting discussion.*	2008 WUE program was accepted through a public process. Notification was given 2 weeks ahead of the October 20, 2008 meeting on the City's website and at the post office. The revisited goals in this Plan were adopted at a meeting on June 7, 2010. Notification was given on the City website 2 weeks in advance. The Resolution will be forwarded on June 22, 2010.	Draft of meeting minutes attached.	
Ch 6: 3	*Page 6-12. WAC 246-290-100 (4) (c)) requires demand forecasts to include 6 and 20 year projections* ***with*** *and* ***without*** *water savings from your WUE program. Please provide these projections.*	These projections are included in Table 6-10.	6-13	
Ch 7: 1	*The City recently identified which tasks shift operators could perform at the Water Treatment Plant. Please consider including that policy (and others like it) in the plan.*	Included in Appendix M.	Appendix M	
Ch 8: 1	*Please evaluate current and future water system deficiencies and identify which capital improvements projects will remedy them. Explain how.*	A deficiencies table has been included to summarize the deficiencies and how each project remedies them. Table 8-8.	8-13 through 8-15	
Misc: 1	*Local Government Consistency. Please provide signed and dated Local Government Consistency Statements from Clark County and the City.*	Included in Appendix R	Appendix R	
Misc: 2	*Prior to ODW Final Approval of the WSP, an informational meeting of the water system consumers must be held (WAC 246-290-100(S) (a)). Please provide documentation showing this meeting took place.*	Attached. This Plan was approved on June 7, 2010. The resolution will be forwarded to DOH on June 22, 2010.	Draft of meeting minutes attached.	

Misc: 3	*Prior to ODW Final Approval of the WSP, the governing body or elected board must approve the WSP. Please submit documentation showing the WSP has been approved and adopted by the governing board.*	Attached. This Plan was approved on June 7, 2010. The resolution will be forwarded to DOH on June 22, 2010.	Draft of meeting minutes attached.	
Misc: 4	*Please clarify if a copy of the WSP has been sent to Clark County and adjacent water systems per the Coordinated Water System Plan (CWSP) requirements.*	Digital copies of this Plan have been sent to adjacent systems.		
App D: 1	*Please provide a signed and dated Determination of Non-significance (DNS).*	Included in Appendix D.	Appendix D	
App D: 2	*Please provide a signed and dated SEPA Checklist.*	Included in Appendix D.	Appendix D	
App H: 1	*Coliform Monitoring Plan. Please include a rotation schedule for each sample station.*	Included in Appendix H.	Appendix H	
App H: 2	*Three repeats for the Total Coliform Rule are required: (a) Same site, (b) up-line, and (c) down-line. Will sample stations be used or will taps located at service connections be used? Repeat sites need to be located for each sample station. Please include information about repeat sample locations if a routine sample station sample is unsatisfactory.*	Repeat sites and clarification are included in Appendix H.	Appendix H	An updated Coliform Monitoring Map is included.
App H: 3	*Only Well #5 (S06) has 4-log removal. Please be reminded that if a distribution sample collected for the Total Coliform Rule is unsatisfactory, all other wells need to be sampled within 24-hours of the unsatisfactory coliform sample PRIOR to treatment.*	Noted.		
App H: 4	*Please include the system ID number in the Coliform Monitoring Plan.*	Included.	Appendix H	
App N: 1	*Appendix N is listed as Chapter 5. Please revise.*	Revised as Appendix N.	Appendix N	
App N: 2	*The Emergency Response Plan does not address how the City would respond to localized emergency scenarios for water outages including but not limited to major water main breaks, reservoir failures, or GWR response after a coliform hit. Please provide information on how the system would respond to such scenarios and return the system hack to normal operations.*	Emergency plan scenario response is now included at the end of Appendix N.	Appendix N	

App N: 3	*Remove or revise the sections that use the word "should" or "recommend" with text that describes what the City has adopted for implementation. For Example, tables 5-5, 5-6, 5-7, 5-9, and 5-10 lists "recommended" actions for emergency response scenarios.*	Text has been revised to describe what the City will do.	Appendix N	
App N: 4	*Page N-9 states the emergency phone list is in Appendix G. This list seems to be missing. Please clarify.*	Emergency phone list included at the end of Appendix N.	Appendix N	
App N: 5	*Page N-14, bottom paragraph. The City should contact the Department of Health, Office of Drinking Water, Southwest Regional Operations at (360) 236-3030. Please revise.*	Revised.	Appendix N	
App N: 6	*Page N-20. Boil Water Notification. This paragraph states there is a suggested boil water notification form sample presented in appendix K. This form is missing. Please provide this form.*	Included.	Appendix N	
App N: 7	*The City should develop contact lists for susceptible populations such as schools, hospitals, elder cares, day cares, and food services. Communication and response strategies should be developed to contact these populations in the event of a health advisory or water interruption.*	Susceptible population contact list has been included in Appendix H: Coliform Monitoring Plan.	Appendix H	
App N: 8	*Please provide signatures and dates showing the Emergency Response Plan has been adopted.*	Accepted on June 7, 2010. The signed resolution will be forwarded to DOH on June 22, 2010.	Draft of meeting minutes attached.	
App P: 1	*Please provide documentation showing the City has notified regulatory agencies, local governments, and emergency incident responders (police and fire) of the location of potential and known sources of ground water contamination within the wellhead protection area boundaries (WAC 246-290-130 (3)).*	Included in Appendix P.	Appendix P	
App P: 2	*Please provide documentation showing the City has notified all owner/operators of the location of potential and known sources of ground water contamination within the wellhead protection area boundaries (WAC 246-290-130 (3)).*	Included in Appendix P.	Appendix P	

Ecology Comment No.	Ecology Comment	Water System Response	Page Number of Response	Other Water System Comments
1	***City of Camas Water System & Municipal Water Law*** *On June 11, 2008, King County Superior Court issued a decision in Lummi Indian Nation, el al.* *v. State, in which sections of the Municipal Water Law, RCW 90.03.015(3) and (4) were held to be unconstitutional because they violated separation of powers under the State Constitution. These particular subsections of the Municipal Water Law defined municipal water suppliers and municipal water supply purposes. The King County Superior Court decision has been appealed by all involved parties to the State Supreme Court and it may be one or more years before final resolution of this uncertainty. The* *State is urging the Supreme Court to reverse the King County Court's ruling and find that all parts of the 2003 Municipal Water Law are constitutional. Meanwhile the King County decision is the current law.*	No response required.		
2	***Water Right Self Assessment Table*** *The Water Rights Self Assessment (WRSA) tables found in Appendix C show the City holds 15 water rights authorizing a total instantaneous quantity of 14,045 gallons per minute and an annual quantity of 11,090 acre-feet per year for Municipal Supply purposes[1], However, since the instantaneous quantities of Surface Water Certificate (SWC) numbers 711 and 712 are not available for use during peak water use months, their quantities are not used in the instantaneous total for planning purposes. Thus, the tables show a total instantaneous quantity of 12,475 gpm. The information depicted in the WRSA tables is consistent with Ecology's records.* *[1] All water rights are for "Municipal Supply Purposes" except for SWC 711, which is for "Domestic Supply Purposes".*	No response required.		
WRSA table corrections 2-1	*The priority date of SWC 711 is listed in the WRSA as 9/05/90. The actual priority date of this water right is 9/05/30.*	Revised.		

2-2	*Claim no. 121022 or G2-CV1-2P159 should be listed as the first claim in the WRSA. However, the WRSA has Claim no. 121023 or G2-CV1-2P160 listed twice.*	The first claim has been revised.		
2-3	*The above errors should be amended on the "Existing Status", "6 Year Forecast", and "20 Year Forecast" tables.*	Revised in all forecasts.		
2-4	*The WRSA Table 1 does not include a total instantaneous quantity used by the System.*	Included.		
3	***Water Right Documents*** *The draft Plan does not contain copies of all the City's most current water right documents. The final Plan should contain these documents.*	All water right documentation is included.		
4	***Current Use and Future Demand*** *Existing Rights and Consumption* *Since WRSA Table 1 does not give a total instantaneous quantity, Table E-3 was used for review purposes. The City currently withdraws a peak instantaneous quantity of 5,378 gpm, and annual quantity of 3,460 afy. This is within limits authorized by water rights.* *Future Demand* *According to WRSA Table 2, the City anticipates water use in the 6 year planning period will equal about 9,054 gpm and 6,639 afy, within limits authorized by water rights. According to WRSA Table 3, the City anticipates water use in the 20 year planning period will equal 14,174 gpm and 10,523 afy. This exceeds the authorized instantaneous quantity. The City is aware of the need to secure additional water rights in order to meet future water demands. Pending applications are currently on file with Ecology.*	No revisions required.		
5	***Watershed Plan*** *Ecology has determined this Water System Plan is "not inconsistent" with the adopted watershed plan for WRIA 28 - the Salmon/Washougal Watershed.*	No revision required.		

RESOLUTION NO. 1188

A RESOLUTION adopting the Water System Plan, including the Water Use Efficiency Program Update and Water System Emergency Response Plan found therein, subject to required revisions from the Department of Health.

WHEREAS, the City has prepared an update to its Water System Plan, including the Water Use Efficiency Program Update and Water System Emergency Response Plan found therein, as required by State Law, and

WHEREAS, the City has submitted the updated Water System Plan, including the Water Use Efficiency Program Update and Water System Emergency Response Plan found therein, to the Department of Health for review, and

WHEREAS, the City has submitted additional materials to the Department of Health in response to Department of Health comments, and

WHEREAS, the City Council conducted a public hearing on the Water System Plan, including the Water Use Efficiency Program Update and Water System Emergency Response Plan found therein, on June 7, 2010, and

WHEREAS, the Council desires to adopt the Water System Plan, including the Water Use Efficiency Program Update and Water System Emergency Response Plan found therein, subject to any revisions required by the Department of Health in response to its review of the additional material submitted by the City,

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF CAMAS as follows:

SECTION I

The City hereby adopts the Water System Plan, revised June 2010, including the Water Use Efficiency Program Update and Water System Emergency Response Plan found therein, subject to required revisions from the Washington State Department of Health.

ADOPTED BY THE COUNCIL AND APPROVED BY THE MAYOR AT A REGULAR MEETING this 21ST day of June, 2010.

SIGNED: _____
Mayor

ATTEST: _____
Clerk

APPROVED as to form:

_____
City Attorney

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
http://www.ci.camas.wa.us

STAFF REPORT
PUBLIC HEARING
WATER SYSTEM PLAN
GENERAL SEWER AND WASTEWATER FACILITY PLAN (2007), (REVISED 11/2009)
GENERAL SEWER PLAN AMENDMENT (APRIL 2010)

FILE #S WS-672, WS-656
STAFF REPORT DATE: JUNE 2, 2010

PROPOSAL: Public Hearing in consideration of adoption of the Water System Plan, General Sewer and Wastewater Facility Plan, and the General Sewer Plan Amendment.

TO: Mayor and City Council

FROM: Staff

HEARING DATE: June 7, 2010

LOCATION: Citywide.

INFORMATION: These three plans are in three different stages of review from State regulatory agencies.

- The *Water System Plan* has been through its first review with the Washington State Department of Health (DOH). Submittal of responsive information to DOH is imminent. This plan may be adopted "subject to required revisions from DOH."

- The 2007 *General Sewer Plan and Wastewater Facility Plan,* revised in November 2009, has been approved by the Washington State Department of Ecology (DOE) and may be adopted without contingency.

- The *General Sewer Plan and Wastewater Facility Plan*, last revised in April 2010, is currently in its second review by DOE. This plan may be adopted "subject to required revisions by DOE."

These plans provide the means for determining future projects to include in the Capital Facilities Plan (CFP). These projects are factored in the calculations that FCSG and staff provide as a means of recommending system development charges and monthly rates.
Included in the *Water System Plan* are Water Use Efficiency Goals, which must be established through a public process per WAC 246-290-830(4). An Emergency Response Program is found in Appendix N. Staff recommends that both the Water Efficiency Goals and the Emergency Response Program be addressed in a resolution that would adopt the *Water System Plan.*

Attached is a spreadsheet identifying City revisions and responses to DOH regarding their review comments on the *Water System Plan.* Staff intends to have the revised pages to this plan at the public hearing. The revisions will create the document that will be known as the *Water System Plan*, revised June 2010.

RECOMMENDATION: Staff recommends that Council hold the public hearing; consider any public testimony; and direct staff to prepare resolutions for adoption on June 21st for the following:

1. The *Water System Plan,* revised June 2010, including Water Efficiency Goals and the Emergency Response Plan, subject to required revisions from the Washington State Department of Health.
2. The 2007 *General Sewer and Wastewater Facility Plan*, revised November 2009.
3. The *General Sewer Plan Amendment,* revised April 2010, subject to required revisions from the Washington State Department of Ecology.

CITY OF CAMAS, WASHINGTON
CITY COUNCIL AGENDA
REGULAR MEETING

MONDAY, JUNE 7, 2010 **7:00 P.M.**

I. CALL TO ORDER:

II. ROLL CALL:
Roll call of Council members.

III. CONSENT AGENDA:

a. Approve minutes of the May 17, 2010, Camas City Council meeting and the work session minutes of May 17, 2010.
b. Approve claim checks as approved by the Finance Committee.
c. Authorize Mayor to sign an Antenna Lease Agreement with Verizon for the antenna site at Prune Hill Sports Park. Mayor's signature will be withheld until Verizon receives authorization through the City of Camas conditional use process that is on-going.
d. Authorize the Mayor to sign a Professional Service Agreement with Berger ABAM for a Phase I Environmental Site Assessment (ESA) of the Fallen Leaf Lake site.
e. Authorize Mayor to sign an Interlocal Agreement between the City of Washougal and the City of Camas for mutual support of professional staff in the field of protective inspection services (Building Inspection).
f. Authorize Mayor to sign a Professional Services Contract, related to the Osprey Landing civil regulatory order, with Normandeau Associates, Inc. for an amount not to exceed eight thousand, four hundred eighty-nine dollars($8,489.00).
g. Authorize Pay Estimate #5 for WS-664A Well #14 and Transmission Main to RC Northwest, Inc., in the amount of one hundred fifty-two thousand, fifteen dollars and four cents ($152,015.04).
h. Authorize Pay Estimate #2 on Project SS-540 2010 Maintenance & Plantings for NW Parker Street & NW Lake Road to Jones Landscape, Inc. in the amount of six thousand, one hundred ninety-two dollars and zero cents ($6,192.00).
i. Authorize Retainage Release for Project P-824 Fire Station 41 Remodel to Larry O'Collins, in the amount of fifteen thousand, five hundred seven dollars and five cents ($15,507.05).
j. Authorize Pay Estimate #3 for WS-656 Wastewater Treatment Facilities Improvements, Phase II, to McClure & Sons, Inc. in the amount of three hundred seventy-eight thousand, eight hundred seventy eight dollars and fifty-three cents ($378,878.53).
k. Authorize Pay Estimate #9 for P-820 Washougal River Trail to Tapani Underground, Inc., in the amount of one hundred thirty-six thousand, fourteen dollars and nine cents ($136,014.09).
l. Write-off ambulance billings that are uncollectible for twenty-five thousand, one dollar and twenty-nine cents ($25,001.29).

NOTE: Any item on the consent agenda may be removed from the consent agenda for general discussion or action.

IV. NON-AGENDA ITEMS:

a. Public.
b. Staff.
c. Council.

V. MAYOR:

a. Announcements.
b. Appointments.

VI. PUBLIC WORKS:

a. Public hearing to revise and extend the Comprehensive Six (6) Year Street Plan.
b. Public hearing-Water System Plan, General Sewer and Wastewater Facility Plan, General Sewer Plan.

VII. COMMUNITY DEVELOPMENT:

a. Public Hearing: 2010-2029 Capital Facilities Plan List.
b. Meeting to consider a 10% annexation petition filed by Joseph and Martha LouAnne Witler (File No. Annex 10-02).

VIII. ADMINISTRATION:

a. Resolution No. 1184 revising the job description and salary schedule for the Community Development Director.
b. Resolution No. 1185 revising the job description and salary schedule for the Public Works Director position.
c. Resolution No. 1186 creating a new position entitled "Public Works Operations Supervisor", and establishing the salary range for the position.

IX. EXECUTIVE SESSION:

a. Real Property Acquisition
b. Litigation

X. ADJOURNMENT:

NOTE: Accommodation of need for disabled persons can be made upon request. For more information, call 834-6864.

Draft minutes pending Council's approval on June 21, 2010.

Regular Council Meeting - 7:00 p.m.
June 7, 2010

CALL TO ORDER: Mayor Paul Dennis presided.

FLAG SALUTE:

COUNCIL:

Present: Anderson, Chaney, Dietzman, Gerde, Higgins, Hogan, and Smith.

Excused:

STAFF MEMBERS: Berquist, Bourquin, Carothers, Halverson, Knapp, and Levison.

PRESS: None present.

CONSENT AGENDA:
It was moved by Council member Hogan, seconded by Council member Gerde to approve the Consent Agenda of May 17, 2010, City Council Meeting. The motion carried unanimously.

- **a.** Approve minutes of the May 17, Camas City Council meeting and the work session minutes of May 17, 2010.
- **b.** Approve claim checks numbered 105868-105873 and 106174-106327 in the amount of one million, one hundred fifty-nine thousand, six hundred and fifteen dollars and seven cents ($1,159,615.07 as approved by the Finance Committee.
- **c.** Authorize Mayor to sign an Antenna Lease Agreement with Verizon for the antenna site at Prune Hill Sports Park. Mayor's signature will be withheld until Verizon receives authorization through the City of Camas conditional use process that is on-going.
- **d.** Authorize the Mayor to sign a Professional Service Agreement with Berger ABAM for a Phase I Environmental Site Assessment (ESA) of the Fallen Leaf Lake site.
- **e.** Authorize Mayor to sign an Interlocal Agreement between the City of Washougal and the City of Camas for mutual support of professional staff in the field of protective inspection services (Building Inspection).
- **f.** Authorize Mayor to sign a Professional Services Contract, related to the Osprey Landing civil regulatory order, with Normandeau Associates, Inc. for

DRAFT

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l. Write-off ambulance billings that are uncollectible for twenty-five thousand, one dollar and twenty-nine cents ($25,001.29).

NON-AGENDA ITEMS:

Public: There were no comments.

Mayor acknowledged Scout Troop 554's attendance. They are working toward their communications badge.

Staff: There were no comments.

Council: There were no comments.

MAYOR:

Appointments: Mayor appointed Carla Foth Christian to the Board of Adjustment to fill the unexpired term of Al Steinmann ending December 31, 2010.

It was moved by Gerde and seconded by Higgins to appoint Carla Foth Christian to fill the unexpired term of Al Steinmann ending December 31, 2010. The motion carried unanimously.

Mayor appointed Eric Levison as the new Public Works Director with the resulting three structural changes included.

It was moved by Chaney and seconded by Smith to appoint Eric Levison to the Public Works Director position. The motion carried unanimously.

Announcements: Mayor asked and Higgins responded that he will be attending the

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retirement for Tanis Knight.

PUBLIC WORKS:

Public Hearing – to Revise and Extend the Comprehensive Six Year Street Plan:

James Carothers, City Engineer, reviewed the proposed revisions and reason for the extension to the City of Camas Comprehensive Six Year Street Plan.

Mayor asked and there were no questions.

Mayor opened the public hearing at 7:06 p.m.

There was no public testimony.

Mayor closed the public hearing at 7:07 p.m.

It was moved by Higgins and seconded by Smith to direct the city attorney to prepare a resolution for revising and extending the City of Camas Comprehensive Six Year Street Plan. The motion carried unanimously.

Public Hearing – Water System Facility Plan, General Sewer and Wastewater Facility Plan, General Sewer Plan, and General Sewer Plan Amendment:

Carothers introduced Ken Alexander from Gray & Osborne, Inc., who introduced Mallory Taylor also of Gray & Osborne. Mr. Alexander gave a presentation including an overview of the plans, the history and purpose of the plans and what is being considered for approval.

Alexander mentioned the inclusion of the Water Use Efficiency Program Update and Water System Emergency Response Plan within the Water System Plan.

Mayor asked and there were no questions.

Mayor opened and closed the public hearing at 7:33 p.m. as there was no public testimony.

It was moved by Dietzman, seconded by Hogan to direct staff to prepare resolutions for adoption of the Water System Plan, the General Sewer and Wastewater Facility Plan and the General Sewer Plan and amendment for adoption. The motion carried unanimously.

COMMUNITY DEVELOPMENT:

Public Hearing – 2010-2029 Capital Facilities Plan List:

Phil Bourquin, Community Development Director, explained that the Capital Facilities Plan List is synonymous with the Capital Improvements Plan discussed at prior meetings. Bourquin clarified that the Comprehensive Six Year Street Plan, the Water System Plan, General Sewer and Wastewater Facility Plan, General Sewer Plan,

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and General Sewer Plan Amendments were considered in the Capital Facility Plan and all are consistent with the Comprehensive Plan.

Bourquin said staff's recommendation is to open the hearing, take public comment and to prepare an ordinance for adoption.

Questions were asked and clarifications were made.

Mayor opened and closed the public hearing at 7:35 p.m. as there was no public testimony.

It was moved by Gerde and seconded by Dietzman to direct the city attorney to prepare an ordinance for adoption of the 2010-2029 Capital Facilities Plan List. The motion carried unanimously.

10% Annexation Petition (Wittler Property) Meeting:

Bourquin stated that the 10% Annexation Petition was submitted by Joseph and Martha LouAnne Witler. Bourquin explained that the purpose of the petition request is to annex the property located at 2222 SE 283rd Ave.

Staff's recommendation is that Council accept the petition to include the subject property and modify the area to include all portions of the abutting right-of-way, to establish the zoning simultaneous with the annexation and to require assessment and taxation of all property at the same rate and at the same basis as the City of Camas as well as to assume the existing City indebtedness.

Approval of this petition enables filing the 60% petition.

Mayor asked and there were no questions.

It was moved by Higgins seconded by Chaney to accept the 10% petition and modify the geographic area to include Clark County Parcel No. 123232000 and all portions of the SE 283rd right-of-way abutting said property, require and determine the appropriate zoning simultaneous with annexation and require assessment and taxation of all property at the same rate and at the same basis as within the City of Camas and to require the area to be annexed to assume the existing City indebtedness. The motion carried unanimously.

ADMINISTRATION:

Resolution No. 1184 – Revising the Job Description and Salary Schedule for the Community Development Director:

Lloyd Halverson, City Administrator, explained the purpose of Resolution No. 1184.

Mayor asked and there were no questions.

It was moved by Gerde, seconded by Smith that Resolution No. 1184 be read by title only. The motion carried unanimously.

DRAFT

It was moved by Gerde, seconded by Hogan that Resolution No. 1184 revising the job description and salary schedule for the Community Development Director be adopted. The motion carried unanimously.

Resolution No. 1185 – Revising Job Description and Salary Schedule for the Public Works Director:

Lloyd Halverson explained the purpose of Resolution No. 1185.

Mayor asked and there were no questions.

It was moved by Higgins, seconded by Smith that Resolution No. 1185 be read by title only. The motion carried unanimously.

It was moved by Gerde, seconded by Anderson that Resolution No. 1185 revising the job description and salary schedule for the Public works Director be adopted. The motion carried unanimously.

Resolution No. 1186 – Revising Job Description and Salary Schedule for the Public Works. Operations Supervisor:

Halverson explained the purpose of Resolution No. 1186.

Mayor asked and there were no questions.

It was moved by Higgins, seconded by Dietzman that Resolution No. 1186 be read by title only. The motion carried unanimously.

It was moved by Higgins, seconded by Dietzman that Resolution No. 1186 creating the position of Public Works Operations Supervisor, adopting a job description, and establishing a salary scale for the position be adopted. The motion carried unanimously

EXECUTIVE SESSION:

Real Property Acquisition and Litigation:

The meeting recessed at 7:43 p.m. for discussion regarding real property acquisition and litigation for an estimated 15 minutes with no further action anticipated.

ADJOURNMENT:

The meeting adjourned at 7:59 p.m.

Mayor

City Clerk

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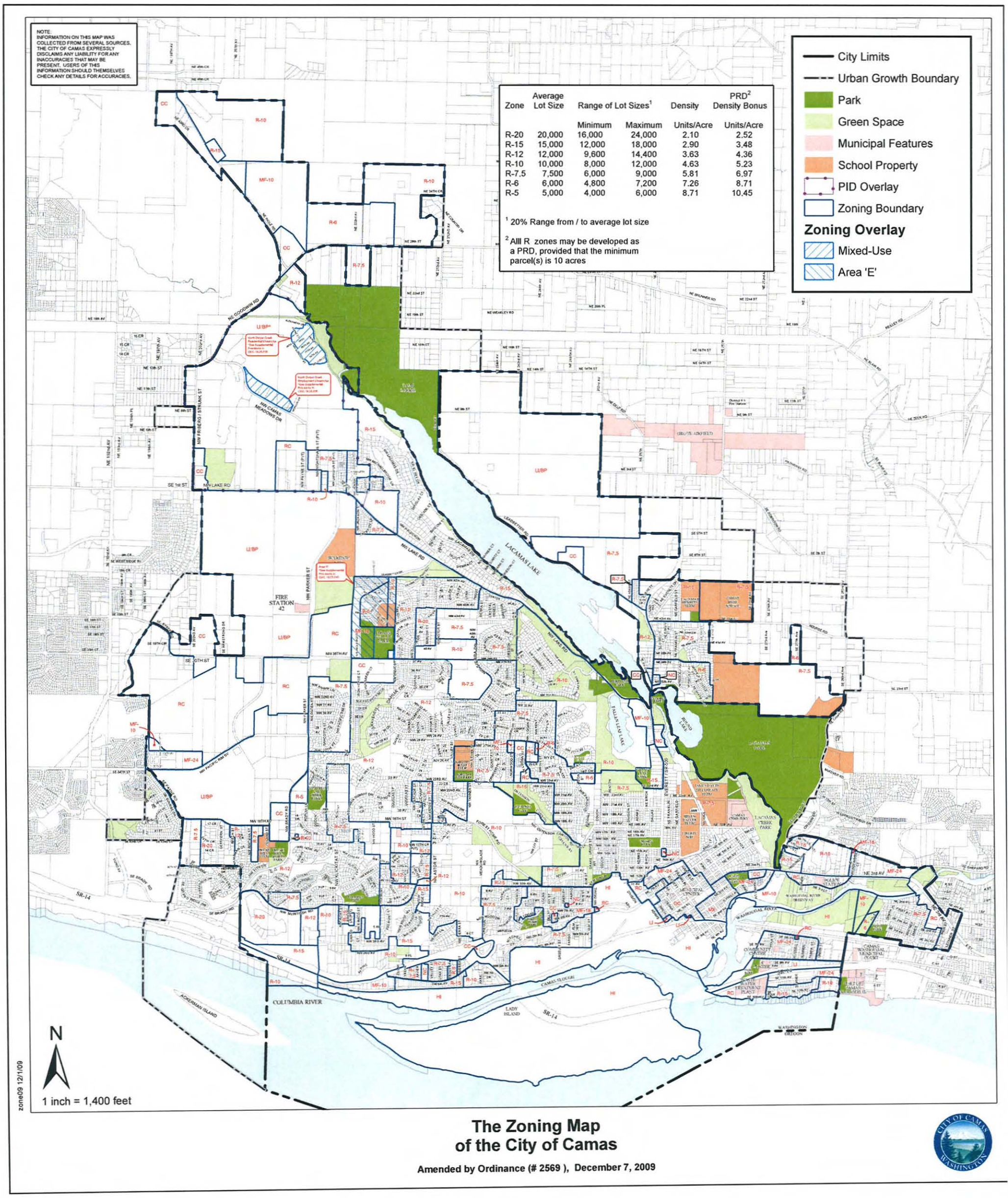

Zone	Average Lot Size	Range of Lot Sizes[1]		Density	PRD[2] Density Bonus
		Minimum	Maximum	Units/Acre	Units/Acre
R-20	20,000	16,000	24,000	2.10	2.52
R-15	15,000	12,000	18,000	2.90	3.48
R-12	12,000	9,600	14,400	3.63	4.36
R-10	10,000	8,000	12,000	4.63	5.23
R-7.5	7,500	6,000	9,000	5.81	6.97
R-6	6,000	4,800	7,200	7.26	8.71
R-5	5,000	4,000	6,000	8.71	10.45

[1] 20% Range from / to average lot size

[2] Alll R zones may be developed as a PRD, provided that the minimum parcel(s) is 10 acres

The Zoning Map of the City of Camas

Amended by Ordinance (# 2569), December 7, 2009

Figure 3-1A

Mallory

Is this what you wanted as far as written confirmation from the Fire Marshall in regards to fire flow deficiencies?

>>> Randy Miller 5/28/2010 9:06 PM >>>
Greetings Eric and Mike,

The water supply serving Camas and the utilization of this system for the fire departments prevention and suppression needs has been a cooperative and successful effort with the water department to provide our business community and citizens life safety and property protection through a reliable water service.

The water department has historically in large fire events made rapid adjustments in the water system to increase pressure and or increase available water by utilizing the flexibility and capabilities of the system to meet our fire incident flow demands.

Many fires that occur throughout the year in Camas are successfully handled with our fire apparatus during suppression activities at "Engine Idle" needing only to utilize the available hydrant pressure. In the rare areas where water may have a significantly lower GPM it is being communicated to our suppression crews via the hydrants painted black. Temporary deficiencies due to repairs or other issues are directly communicated to the Fire Marshals office with a coordinated contingency plan put in place for water needs in potential fire incidents.

Significant cooperation and progressive thinking from the water department has occurred in helping the Fire Marshal's office provide our citizens the capability to provide adequate water flow for the installation of Life Safety Residential Fire Sprinklers. In the one thousand plus installations of Residential Fire Sprinklers in Camas there have been a small percentage where the standard "3/4 full" meter was not adequate and a one inch meter was necessary to meet the suppression systems design needs, overcoming friction loss and or overcoming lower water pressure. Residential Fire Sprinkler Systems are also helping to decrease the use of water in Camas since during a structure fire a sprinkler head operates at approx. 13 GPM to control and extinguish most fires at the incipient stage compared to a fire hose flow at 150 to 250 GPM or a 1000 GPM master stream flow during a free burning stage. Further water savings occurs through less incident site and equipment clean-up and a significant reduction in environmental impacts occur through minimizing toxic water run-off from the structure fire into our ground water. Significant and dramatic decreases in the use of resources for replacement materials also occur through minimal water use occurring at the early stages of a fire.

Forward thinking by the water department has also provided for a waiver in the increased water meter up-size fee from a 3/4 full to a 1 inch when required for the Residential Sprinkler, helping to keep these water reducing fire sprinkler systems affordable to our citizens.

The limited areas in Camas where the water system has not yet been developed but houses are being approved for construction, has the absence of hydrants mitigated through the effective use of an onsite tank and pump at the residence, providing a minimum 10 minute fire flow to the life safety residential fire sprinkler system.

Coordinated communication between the Water Department and the Fire Marshal's office are in place to minimize, but yet provide, adequate flushing for commercial fire sprinkler mains and newly constructed/installed hydrants in order to meet the National Fire Protection Association (NFPA) requirements as well as providing for accountability of water utilized to meet these standards.

I look forward to the continued cooperation and progressive thinking between the water department and the Fire Marshals office in the utilization of a reliable water source to serve and protect our Camas Community.

Regards

RM

Randy Miller
Fire Marshal
Camas Fire Department

PH 360-834-6191
Ext. 4531
FAX 360-834-8866
rmiller@ci.camas.wa.us

(Office Location)
Camas City Hall
616 NE 4th Avenue
Suite III
Camas WA 98607

"FIRE SPRINKLERS SAVE LIVES"

Have You Tested Your Smoke Detectors Lately ?

"The purest form of Fire Suppression
is through Fire Prevention and this
aspect is the hardest to measure"

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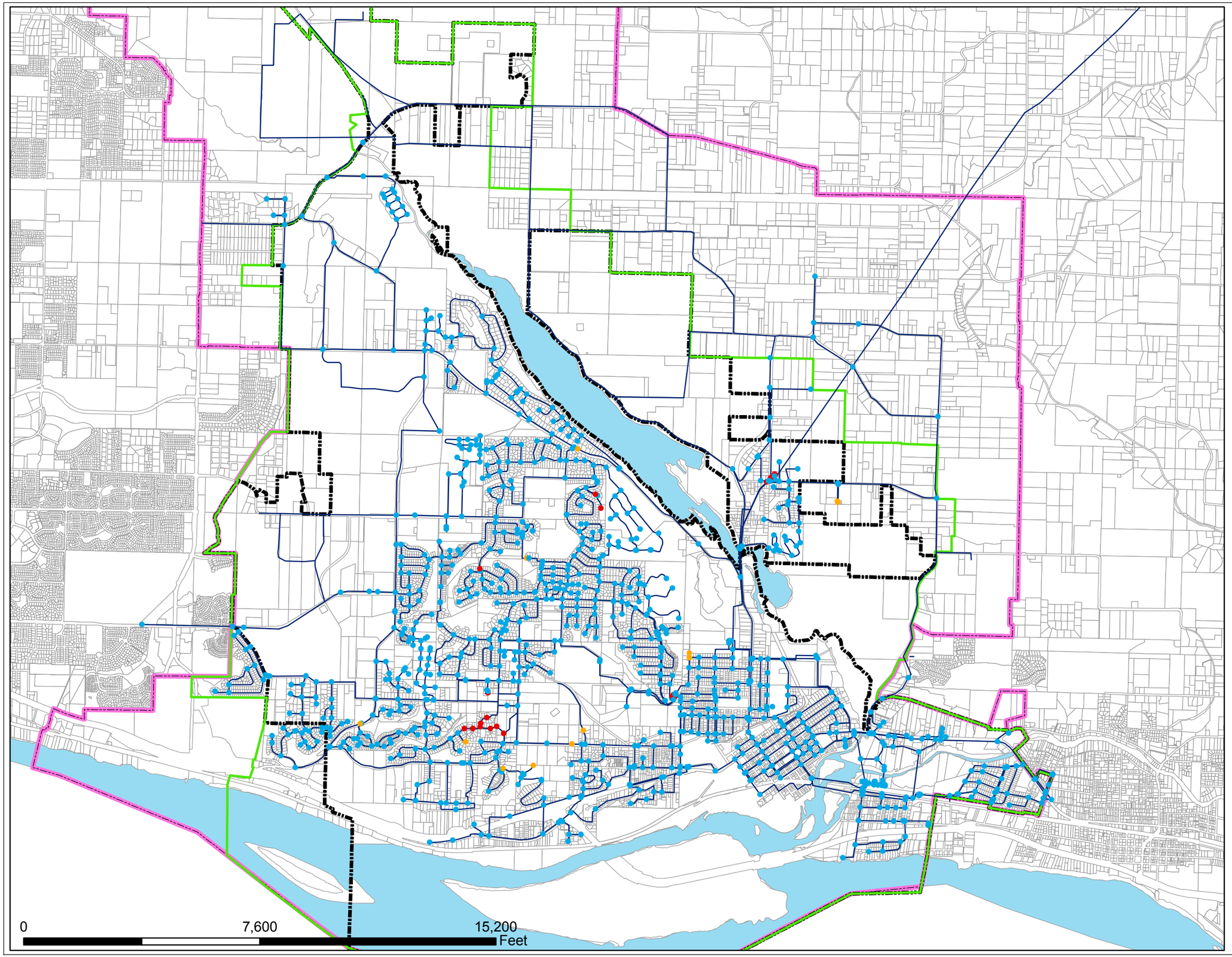

Legend

Pressure (psi)

- < 20
- 20 - 30
- > 30
- Urban Growth Boundary
- City Limits
- Water Service Boundary
- Pipe Lines

SOURCE: CITY OF CAMAS

CITY OF CAMAS WASHINGTON

DOH RESPONSE
2008 PHD PRESSURE
WITHOUT IMPROVEMENTS

L:\CAMAS\08495 WSP\Fig5-1.mxd

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
SOUTHWEST DRINKING WATER REGIONAL OPERATIONS
PO Box 47823, Olympia, Washington 98504-7823
TDD Relay 1-800-833-6388

MAR 1 6 2010

March 11, 2010

Michael Stevens
Camas Municipal Water Sewer System
1620 Southeast 8th Avenue
Camas, Washington 98607

Subject: Camas Municipal Water Sewer System, ID #108002, Clark County; Water System Plan, ODW Project #10-0101

Dear Michael Stevens:

Thank you for providing the Water System Plan for the Camas Municipal Water Sewer System (City) received by the Office of Drinking Water (ODW) on January 7, 2010.

The following comments need to be addressed before ODW can approve the plan.

1. According to Table 4-20, it appears the City has insufficient storage capacity in the 343 and 542 pressure zones. By 2015, it appears all pressure zones except 455 and 852 will be deficient. **Please re-evaluate the capacities and clarify how the City will address any deficiencies. Please indicate whether the City will restrict new connections in any area.**
2. According to Table 4-13, it appears the City will have deficient source capacity to serve all pressure zones except for 542 (UGA) by 2015. **Please re-evaluate the capacities and clarify how the City will address any deficiencies. Please indicate whether the City will restrict new connections in any area.**
3. It is difficult to identify the capacity limitations in each pressure zone and what steps the City is taking to address them. **Please consider presenting the water system demands and capacities in a graphical form.** For example, you could create a graph of demands vs. capacity (in gpd) for each year and for each pressure zone. Proposed improvements could be added as dashed lines on the capacity curve beginning the year the improvements are likely to be implemented.
4. ERU estimates based on average day demands are only appropriate for evaluating annual water rights and, sometimes, standby storage. **To evaluate source capacity and capacity-related storage in ERUs, please use estimates based on maximum day demands.**

CHAPTER 3

1. Page 3-3. Municipal water suppliers must provide their service area policies and conditions of service including how new service will be provided per WAC 246-290-106 (4). **Please**

provide a copy or discuss your current service area policies. This discussion should clearly define how service would be provided, how the water system will process applications, identify associated costs, and provide timeframes for water service. In addition, the water system should discuss such things as the appeal process for a service condition or denial, whether only direct service is available or if you will consider remote service, latecomer agreements and differences between service within or outside the urban growth area (see enclosed Fact Sheet Service Area Policies). Furthermore, you should discuss and reference the Clark County Coordinated Water System Plan.

2. Page 3-3. "Proposed rules and guidelines relating to issues of plan consistency are set for final adoption in 2006". **Please verify if this occurred.**
3. Page 3-8. The City maintains two PRV interties with the City of Washougal. **Please provide copies of any intertie agreements.**
4. Page 3-16. The N used to calculate PHD should be equal to the number of ERUs during peak demands. In other words, N = Max Day Production / Max Day Demand per ERU. **Please revise the calculation.**
5. On Page 3-17, the value of 280 gpd is used to represent ADD. However, Page 3-23 indicates the ADD value used to evaluate capacity should be 296 gpd. **Please fix the discrepancy.**
6. On Page 3-17, the value of 647 gpd is used to represent MDD. The ADD assumption and the equation result appear to be incorrect. **Please fix the discrepancy.**

CHAPTER 4

1. Page 4-18, Note 2. "At this time" appears to be an incomplete sentence. **Please clarify the intent.**
2. Page 4-24. This section is written as a recommendation from the consultant and does not reflect what has actually been adopted by the system. The City should indicate which recommendations it plans to pursue by the time the final copy of the plan is approved. Additionally, the WSP should indicate what the City plans to do. **Please revise the wording to document with certainty the description of what activities, both existing and future, have been formally adopted by the system.**

CHAPTER 5

1. Figure 5-1. **Please indicate if the fireflow deficiencies have been communicated with the fire department.**
2. Figure 5-3. **Please include a figure of model results showing 2008 PHD without improvements or indicate why it is not necessary.**

CHAPTER 6

1. "Unaccounted for water" does not have a standardized definition. **Please use the term "authorized consumption" and "distribution system leakage" to comply with the Water Use Efficiency Rule.**
2. Page 6-9. Establishing Water Use Efficiency goals must be established thru a public process (WAC 246-290-830 (4) (a)). **Please provide documentation showing public process was**

followed by including the following: the date the notification was given, the date the meeting was held, a description of the notification process used and a summary of the meeting discussion.

3. Page 6-12. WAC 246-290-100 (4) (c)) requires demand forecasts to include 6 and 20 year projections *with* and *without* water savings from your WUE program. **Please provide these projections.**

CHAPTER 7

1. The City recently identified which tasks shift operators could perform at the Water Treatment Plant. **Please consider including that policy (and others like it) in the plan.**

CHAPTER 8

1. **Please evaluate current and future water system deficiencies and identify which capital improvements projects will remedy them. Explain how.**

MISCELLANEOUS DOCUMENTS

1. Local Government Consistency. **Please provide signed and dated Local Government Consistency Statements from Clark County and the City.**
2. **Prior to ODW Final Approval of the WSP**, an informational meeting of the water system consumers must be held **(WAC 246-290-100(8) (a)). Please provide documentation showing this meeting took place.**
3. Prior to ODW Final Approval of the WSP, the governing body or elected board must approve the WSP. **Please submit documentation showing the WSP has been approved and adopted by the governing board.**
4. **Please clarify if a copy of the WSP has been sent to Clark County and adjacent water systems per the Coordinated Water System Plan (CWSP) requirements.**

APPENDIX D

1. **Please provide a signed and dated Determination of Non-significance (DNS).**
2. **Please provide a signed and dated SEPA Checklist.**

APPENDIX H

1. Coliform Monitoring Plan. **Please include a rotation schedule for each sample station.**
2. Three repeats for the Total Coliform Rule are required: (a) Same site, (b) up-line, and (c) down-line. Will sample stations be used or will taps located at service connections be used? Repeat sites need to be located for each sample station. **Please include information about repeat sample locations if a routine sample station sample is unsatisfactory.**
3. Only Well #5 (S06) has 4-log removal. **Please be reminded that if a distribution sample collected for the Total Coliform Rule is unsatisfactory, all other wells need to be sampled within 24-hours of the unsatisfactory coliform sample PRIOR to treatment.**

4. **Please include the system ID number in the Coliform Monitoring Plan.**

APPENDIX N

1. Appendix N is listed as Chapter 5. **Please revise.**
2. The Emergency Response Plan does not address how the City would respond to localized emergency scenarios for water outages including but not limited to major water main breaks, reservoir failures, or GWR response after a coliform hit. **Please provide information on how the system would respond to such scenarios and return the system back to normal operations.**
3. **Remove or revise the sections that use the word "should" or "recommend" with text that describes what the City has adopted for implementation.** For Example, tables 5-5, 5-6, 5-7, 5-9, and 5-10 lists "recommended" actions for emergency response scenarios.
4. Page N-9 states the emergency phone list is in Appendix G. This list seems to be missing. **Please clarify.**
5. Page N-14, bottom paragraph. The City should contact the Department of Health, Office of Drinking Water, Southwest Regional Operations at (360) 236-3030. **Please revise.**
6. Page N-20. Boil Water Notification. This paragraph states there is a suggested boil water notification form sample presented in appendix K. This form is missing. **Please provide this form.**
7. The City should develop contact lists for susceptible populations such as schools, hospitals, elder cares, day cares, and food services. Communication and response strategies should be developed to contact these populations in the event of a health advisory or water interruption.
8. **Please provide signatures and dates showing the Emergency Response Plan has been adopted.**

APPENDIX P

1. **Please provide documentation showing the City has notified regulatory agencies, local governments, and emergency incident responders (police and fire) of the location of potential and known sources of ground water contamination within the wellhead protection area boundaries (WAC 246-290-130 (3)).**
2. **Please provide documentation showing the City has notified all owner/operators of the location of potential and known sources of ground water contamination within the wellhead protection area boundaries (WAC 246-290-130 (3)).**

DEPARTMENT OF ECOLOGY

The enclosed copy of March 10, 2010, Ecology's comment letter identifies discrepancies with your water rights. Please work with Ecology on these and any other issues identified in their comment letter.

Please remember that ODW's approval of your WSP will not provide any guarantee and should not be considered to provide any guarantee concerning legal use of water or subsequent water rights

decisions by Ecology. Depending on Ecology's future actions on your water rights, additional planning or other submittals may be required.

Ecology has determined this WSP is "not inconsistent" with the adopted watershed plan for WRIA 28 – the Salmon/Washougal Watershed.

Please submit three copies of the revised WSP on or before June 10, 2010. In order to expedite the review of your revised submittal, please provide a summary on how these comments were addressed in the revised WSP and where each response is located (page numbers, appendices, etc.).

Regulations establishing a schedule of fees for review of planning, engineering, and construction documents were adopted August 3, 2007, (WAC 246-290-990). An itemized invoice for $3,705 is enclosed.

If you have any questions, please contact Darin Klein at (360) 236-3038 or Andy Anderson at (360) 236-3033.

Sincerely,

Darin Klein
Office of Drinking, Regional Planner

Andy Anderson P.E.
Office of Drinking Water, Regional Engineer

Enclosures

cc: Russ Porter, Gray & Osborne Inc.
Clark County Health
Clark County Planning
Amy Nielson, Ecology

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

GRAY & OSBORNE, INC.
RECD - SEATTLE
MAR 17 2010
JOB #

March 10, 2010

Michael Stevens
City of Camas Water System
1620 SE 8th Ave.
Camas, WA 98607

Darin Klein
Department of Health
Southwest Drinking Water Operations
PO Box 47823
Olympia, WA 98504-7823

Re: City of Camas Water System, ID #10800, Clark County; Water System Plan, ODW Project #10-0101

Thank you for the opportunity to review the documents associated with the City of Camas Water System. Consistent with the Memorandum of Understanding between the Department of Health and the Department of Ecology, I reviewed the relevant portions of the proposed Water System Plan (WSP) and offer the following comments.

City of Camas Water System and the Municipal Water Law

On June 11, 2008, King County Superior Court issued a decision in *Lummi Indian Nation, et al. v. State*, in which sections of the Municipal Water Law, RCW 90.03.015(3) and (4) were held to be unconstitutional because they violated separation of powers under the State Constitution. These particular subsections of the Municipal Water Law defined municipal water suppliers and municipal water supply purposes.

The King County Superior Court decision has been appealed by all involved parties to the State Supreme Court, and it may be one or more years before final resolution of this uncertainty. The State is urging the Supreme Court to reverse the King County Court's ruling and find that all parts of the 2003 Municipal Water Law are constitutional. Meanwhile the King County decision is the current law.

Water Right Self Assessment Table

The Water Rights Self Assessment (WRSA) tables found in Appendix C show the City holds 15 water rights authorizing a total instantaneous quantity of 14,045 gallons per minute and an annual quantity of 11,090 acre-feet per year for Municipal Supply purposes[1]. However, since the instantaneous quantities of Surface Water Certificate (SWC) numbers 711 and 712 are not available for use during peak water use months, their quantities are not used in the instantaneous total for planning purposes. Thus, the tables show a total instantaneous quantity of 12,475 gpm. The information depicted in the WRSA tables is consistent with Ecology's records.

[1] All water rights are for "Municipal Supply Purposes" except for SWC 711, which is for "Domestic Supply Purposes".

WRSA table corrections

1. The priority date of SWC 711 is listed in the WRSA as 9/05/90. The actual priority date of this water right is 9/05/30.
2. Claim no. 121022 or G2-CV1-2P159 should be listed as the first claim in the WRSA. However, the WRSA has Claim no. 121023 or G2-CV1-2P160 listed twice.
3. The above errors should be amended on the "Existing Status", "6 Year Forecast", and "20 Year Forecast" tables.
4. The WRSA Table 1 does not include a total instantaneous quantity used by the System.

Water Right Documents

The draft Plan does not contain copies of all the City's most current water right documents. The final Plan should contain these documents.

Current Use and Future Demand

Existing Rights and Consumption
Since WRSA Table 1 does not give a total instantaneous quantity, Table E-3 was used for review purposes. The City currently withdraws a peak instantaneous quantity of 5,378 gpm, and annual quantity of 3,460 afy. This is within limits authorized by water rights.

Future Demand
According to WRSA Table 2, the City anticipates water use in the 6 year planning period will equal about 9,054 gpm and 6,639 afy, within limits authorized by water rights.

According to WRSA Table 3, the City anticipates water use in the 20 year planning period will equal 14,174 gpm and 10,523 afy. **This exceeds the authorized instantaneous quantity.**

The City is aware of the need to secure additional water rights in order to meet future water demands. Pending applications are currently on file with Ecology.

Watershed Plan

Ecology has determined this Water System Plan is "not inconsistent" with the adopted watershed plan for WRIA 28 – the Salmon/Washougal Watershed.

Thank you for the opportunity to review this project. Please contact me at (360) 407-6116, or at amy.nielson@ecy.wa.gov if you have questions regarding my review or need additional information.

Sincerely,

Amy Nielson
Water Resources Program
Southwest Regional Office

AN:th

cc: Andy Anderson, P.E., DOH – ODW
Russell L. Porter, P.E., Gray & Osborne, Inc.

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Executive Summary

INTRODUCTION

The City of Camas 2010 Water System Plan (Plan) provides a long-term planning strategy for the City's water utility for the 6- and 20-year planning periods. It has been prepared consistent with Department of Health requirements specified in Washington Administrative Code Chapter 246-290. The Department of Health, who will review this plan, considers this Plan to represent a commitment by the City to follow-up and implement the Plan's recommendations and capital improvements.

The City's water system currently consists of two surface water sources, one water treatment filtration plant, nine groundwater wells, seven storage reservoirs, nine booster stations, and approximately 130 miles of distribution and transmission piping. The City's Urban Growth Area (UGA) population has grown approximately 8 percent in the last 5 years.

The principal issues discussed in the Plan are as follows:

- Improvements to transmission and distribution capacity to supply the 544 and 455 Zone. These pressure zones, including the North Urban Growth Area (NUGA), encompass the majority of the City's projected growth in water consumption

- Development of a conservation program to reduce distribution system leakage, reduce 6-year and 20-year water system source and water right needs, and delay improvements.

- Financing for capital improvement program to meet projected growth and water system needs.

WATER DEMAND FORECASTING

Population projections suggest that the City's Water Service Area will grow in population by approximately 141 percent over the next 20 years. According to current land use and zoning, the City will reach buildout of its current UGA in 2038. Table E-1 illustrates the water use projections analyzed in the Plan.

Table E-1 Water Service Area Demand Projections

Year	Total Population	Total Residential and Commercial Demand (gpd)	Total Industrial Demand (gpd)	Total DSL(1) @ 11% (gpd)	Total ADD(2) (gpd)	Total MDD(3) (gpd)	Total PHD(4) (gpm)
2008	16,700	2,371,400	1,267,559	449,759	4,088,718	8,995,180	11,244
2009	17,135	2,433,178	1,364,874	469,422	4,267,475	9,388,444	11,736
2010	17,581	2,496,566	1,462,189	489,284	4,448,039	9,785,686	12,232
2011	18,817	2,659,001	1,559,503	521,388	4,739,892	10,427,763	13,035
2012	20,064	2,823,130	1,656,818	553,701	5,033,649	11,074,028	13,843
2013	21,324	2,988,997	1,754,133	586,230	5,329,359	11,724,590	14,656
2014	22,596	3,156,648	1,851,447	618,978	5,627,074	12,379,562	15,474
2015	23,881	3,326,130	1,948,762	651,953	5,926,845	13,039,059	16,299
2016	25,180	3,497,490	2,046,076	685,160	6,228,726	13,703,197	17,129
2017	26,492	3,670,776	2,143,391	718,605	6,532,772	14,372,098	17,965
2018	27,817	3,846,039	2,240,706	752,294	6,839,039	15,045,887	18,807
2019	29,158	4,023,331	2,338,020	786,234	7,147,586	15,724,689	19,656
2020	30,512	4,202,705	2,435,335	820,432	7,458,472	16,408,637	20,511
2021	31,882	4,384,214	2,532,650	854,893	7,771,757	17,097,865	21,372
2022	33,267	4,567,914	2,629,964	889,625	8,087,504	17,792,508	22,241
2023	34,668	4,753,863	2,727,279	924,635	8,405,777	18,492,710	23,116
2024	36,086	4,942,118	2,824,594	959,931	8,726,643	19,198,614	23,998
2025	37,520	5,132,741	2,830,000	984,159	8,946,900	19,683,180	24,604
2026	38,193	5,228,397	2,830,000	995,982	9,054,379	19,919,633	24,900
2027	38,885	5,326,545	2,830,000	1,008,112	9,164,657	20,162,246	25,203
2028	39,594	5,427,250	2,830,000	1,020,559	9,277,809	20,411,179	25,514
2029	40,321	5,530,578	2,830,000	1,033,330	9,393,908	20,666,597	25,833

(1) DSL – Distribution System Leakage.
(2) Average Daily Demand.
(3) Maximum Daily Demand.
(4) Peak Hour Demand.

WATER RIGHTS

Table E-2 summarizes the City's future annual water rights analysis. Table E-3 shows the analysis of future instantaneous water rights. As the tables show, the City's has adequate water rights to sustain growth through the planning period.

Table E-2 Analysis of Future Annual Water Rights

Year/ Demand	Total Annual Water Right (acre-ft)	Annual Demand (acre-ft)	Water Right Surplus (+) or Deficit (-) (acre-ft)
2008	11,090	4,139	+6,951
2015	11,090	6,639	+4,451
2029	11,090	10,523	+567

Table E-3 Instantaneous Water Right and Source Analysis

Year	Total Instantaneous Water Right (gpm)	Maximum Day Demand (gpm)	Source Capacity Surplus (+) or Deficit (-) (gpm)
2008	12,475	5,378	+7,097
2015	12,475	9,054	+3,421
2029	12,475	14,174	-1,699

WATER SUPPLY STRATEGY

The City's strategy to meet supply needs in the future consists of determining a plan for the surface water sources, improving transmission from the Washougal Wellfield to the upper zones, working with the City of Washougal to develop Stiegerwald regional sources consistent with the Watershed Plan, and developing redundant sources at Camas Meadows Wells.

JONES AND BOULDER CREEK

At the present time, the Jones and Boulder Creeks supply a maximum of 1,080 gpm to the City's water system. Based on an agreement between the City and the Department of Ecology, surface water sources are only used between November 1 and May 14. Prior to construction of the filtration plant, these sources were able to provide the entire 1,570 gpm capacity. At that time, the City did not have the head losses due to filtration, and these sources supplied the 343 Zone, rather than the higher head conditions of the 455 Zone that these sources currently supply. The capacity limitations are the 10-inch steel main between the creek intakes and the filter plant, and the capacity of the filter plant. The capacity of the City's pressure filter plant is 1,200 gpm, and the City's combined water right for these two sources is 3.5 cfs, or 1,570 gpm. Any increase in

supply from the surface water sources will require replacement of at least 4.5 miles of the 10-inch transmission main with 16-inch-diameter pipe, or additional pumping.

The City is considering three long-term options for its surface water sources:

1. Continue to use Jones and Boulder Creek at its current capacity and seasonal usage from November 1 through May 14. This option is attractive because it avoids the capital costs associated with an upgrade of the filter plant and the 4.5 miles of 10-inch steel transmission main. This source is advantageous because it is one of the few sources that is not located at the Washougal Well Field, increasing the City's source reliability. This source also is fed by gravity directly into the 455 Zone, which means lower system pumping costs when compared with the City's groundwater wells.

2. Discontinue use of the surface water sources altogether and transfer all the water rights to existing groundwater sources and new groundwater sources. The City could work out a water rights transfer with Ecology to develop new well sources closer to the City in exchange for the relinquishment of the Jones and Boulder Creek sources. This would only be worthwhile to the City if it could obtain equivalent groundwater rights closer to the City.

3. Construct a new treatment facility at a new location. The treatment facility is nearing 50 years in age and is due for replacement of some of its major components. Construction of a new treatment plant at a new location could allow the City to increase the capacity to the maximum instantaneous water right. If the treatment plant were located upstream of its current location, a portion of the 10-inch steel main could be abandoned, and the reduction in main length could provide additional capacity. Further, if located properly, the new treatment plant could serve future growth in the NUGA. A new treatment method would need to be selected and pumping facilities would more than likely be required for this option.

A more in depth study will be done by the City in the next 6 years to determine the most cost effective and beneficial alternative.

TRANSMISSION IMPROVEMENTS

The City has a number of transmission mains that are vital to the daily operation of the City. The City will determine if an upgrade of the existing 10-inch steel transmission main is appropriate once a long-term plan for the Jones and Boulder Creek sources has been identified.

Transmission mains will need to be constructed with the Crown Road Booster Station to serve the 544 Zone. Approximately 5,400 feet of 24-inch DI transmission main is

required from the discharge of the booster station to the intersection of SE 283rd Avenue and NE Nourse Road.

Additionally, transmission mains must be constructed within the NUGA in the 544 Zone to connect the Gregg NUGA and the Green Mountain NUGA. Approximately 24,800 feet of 24-inch DI transmission main is required to directly connect these portions of the NUGA. It is recommended that this improvement be made within the 6-year planning period in order to meet maximum day demand projections within the 544 Zone.

If this improvement is not made, then growth in the 544 Zone will be limited by the Lacamas Booster Station. In order to meet demands, the suction side transmission main to the Lacamas Booster Station must be upgraded to increase the capacity of the booster station. While Lacamas Booster Station has source capacity as currently configured, suction side improvements will be required to serve NUGA growth if the transmission main around the north side of the lake is not installed. Approximately 5,000 feet of 20-inch DI transmission main must be replaced if the NUGA transmission main is not constructed.

The remaining portions of the NUGA will be served by approximately 32,500 feet of 16-inch DI transmission main. These improvements are dependent on growth within the NUGA and are placed in the 20-year planning period.

CAPITAL IMPROVEMENT PROGRAM AND FINANCING

A summary of the City's 6-year CIP is shown in Table E-4. Projects in the 6-year planning period are an estimated $14,044,800.

The financial analysis shows that increased rates and SDCs, plus adjustments for projected inflation should support the water utility and planned improvements through the end of 2015. Depending upon the financing available for water system repairs and improvements, rates will be adjusted accordingly.

Table E-4 6-year Capital Improvement Project Summary

No.	Title	Year	City Project Cost[1]
SR-1	Well 14 Development - Anderson Site	2010	$ 1,650,000
SR-2	Boulder Creek Fish Screen	2010	$ 35,000
C-1	Water Conservation Device Distribution Program	2010	$ 5,000
C-2	Leak Detection Study	2010	$ 6,000
C-3	Commercial/Industrial Water Audit Program	2010	$ 25,000
D-1	Pipeline Replacement	2010	$ 150,000
D-2	PRV Adjustments on NW 16th and NW McIntosh	2010	-
D-3	12-inch DI main on NW 38th Avenue	2010	$ 750,000
D-1	Pipeline Replacement	2011	$ 150,000
D-4	UPH PRV adjustments and looping around NW Astor	2011	$ 323,000
D-5	Butler Site PRV, 8-inch	2011	$ 89,000
T-1	Forest Home Booster Station Site Acquisition	2011	$ 50,000
C-2	Leak Detection Study	2011	$ 6,000
C-3	Commercial/Industrial Water Audit Program	2011	$ 25,000
C-4	Residential Water Audit Program	2011	$ 50,000
SR-3	Treatment Plant Facility Plan	2012	$ 60,000
D-1	Pipeline Replacement	2012	$ 150,000
D-6	Couch Street Booster Pump Station	2012	$ 120,000
D-7	UPH looping from NW 16th to NW 12th Avenue	2012	$ 78,000
T-2	Forest Home Booster Station Upgrade	2012	$ 464,800
T-3	Forest Home Transmission Upgrade	2012	$ 358,000
T-4	Crown Road 24-inch Transmission Main	2012	$ 1,508,000
T-5	Crown Road Booster Station	2012	$ 213,000

Table E-4 6-year Capital Improvement Project Summary (continued)

No.	Title	Year	City Project Cost[1]
T-6	Portable Booster Pump	2012	$ 15,000
C-2	Leak Detection Study	2012	$ 6,000
C-3	Commercial/Industrial Water Audit Program	2012	$ 25,000
C-4	Residential Water Audit Program	2012	$ 50,000
D-1	Pipeline Replacement	2013	$ 150,000
T-7	NUGA 544 Zone - 24 inch Transmission Main	2013	$ 2,300,000
C-2	Leak Detection Study	2013	$ 6,000
C-4	Residential Water Audit Program	2013	$ 50,000
D-1	Pipeline Replacement	2014	$ 150,000
S-1	Lower Prune Hill Reservoir Evaluation	2014	$ 80,000
T-7	NUGA 544 Zone - 24 inch Transmission Main	2014	$ 2,300,000
C-2	Leak Detection Study	2014	$ 6,000
SR-4	Well 17 Feasibility Study - Camas Meadows Site	2015	$ 50,000
D-1	Pipeline Replacement	2015	$ 150,000
T-7	NUGA 544 Zone - 24 inch Transmission Main	2015	$ 2,441,000
6-Year Capital Improvement Total			**$14,044,800[2]**

(1) CCI = 8,660.08 per ENR January 2010.
(2) CIP totals only include portion City will fund. Does not include NUGA (N) projects or developer (DE) projects.

Chapter 1
INTRODUCTION AND EXISTING WATER SYSTEM

INTRODUCTION

In accordance with Washington Administrative Code (WAC) 246-290-100 and the Washington State Department of Health (DOH), water system plans need to be updated every 6 years or more frequently, if necessary, to reflect the current conditions of the water system. The City of Camas (City) water system facilities identification number is 108002. A copy of the City's Water Facilities Inventory Form is provided in Appendix A. The DOH water system plan checklist, and DOH submittal form is provided in Appendix B. The City last completed a Water System Plan (Plan) in 2002.

PURPOSE

The purpose of this Plan is to assist the City in developing long term planning strategies for the City's water service area. This Plan will also evaluate the development of the area north of Lacamas Lake, the North Urban Growth Area (NUGA). The Plan evaluates the existing system and its ability to meet the anticipated State and Federal requirements for water source, quality, transmission, storage, and distribution across a 20-year planning horizon in accordance with the Growth Management Act (GMA). This Plan will evaluate the system capacity into the 6- and 20-year planning period, 2015 and 2029, respectively. This Plan will also analyze the strategic outlook for the system over the next 50 years. Water system improvement projects have been developed to meet

the changing demands of regulatory impacts, population growth and development, and infrastructure repair and replacement. The Plan also identifies the costs of the improvement projects and provides a financial plan for funding the projects.

PLAN SUMMARY

This Plan is presented in nine chapters. The contents of these chapters are summarized below:

- Chapter 1 provides an introduction, Plan summary, historical information about the water system, and a summary of existing facilities.
- Chapter 2 provides an overview of the regulatory requirements regarding legislation, regulatory agencies, system design standards, and water quality standards.
- Chapter 3 provides the basic planning data and water use projections used in developing the planning strategy for the next 20 years.
- Chapter 4 provides an analysis of the City's water quality, including Department of Health regulations, water treatment information, and recorded water quality information. This chapter also analyzes the water system components and their ability to meet the projected demands on the system.
- Chapter 5 provides the hydraulic analysis for the water system using H_2O Map modeling software. This chapter illustrates how the system responds to various modeling scenarios, including identifying available fire flows and system pressures.
- Chapter 6 outlines the City's water use efficiency program, including current conservation efforts, target water use reductions, and an investigation of the potential for water reuse as a component of the water use efficiency plan.
- Chapter 7 provides a summary of the operation and maintenance (O&M) program. This chapter summarizes water system management, system operations, emergency response planning, safety procedures, cross connection control, record keeping, and identifies O&M improvements.
- Chapter 8 presents the capital improvements, needed to address requirements identified by the analyses provided in Chapters 4 through 7.
- Chapter 9 presents the current financial status of the City, along with a discussion of funding for the identified capital improvement projects.

HISTORY OF THE CITY

The first known settler, David Parker, came to the City of Camas in 1845. In 1883 the La Camas Colony Company of Portland purchased 2,600 acres encompassing Lacamas, Round, and Dead Lakes, the stream connecting them to the Columbia River, and constructed dams for water power for new flour and paper mills, and a sawmill and furniture factory in the area. The City of Camas was incorporated in 1906. A vicinity

map showing the City limits is provided as Figure 1-1. Aerial photos were taken in 2006.

DEVELOPMENT OF THE WATER SYSTEM

The City's water system began operation in 1913 with the construction of the Jones Creek Intake and the Butler Reservoir. The City drilled Wells 1 and 2 in 1936. The City constructed the Chlorination Plant in 1952 and the Filter Plant in 1965, signifying the beginning of treatment of the City's water. Table 1-1 provides a timeline of events in the City's water system history.

Table 1-1 Water System Historical Timeline

Date	Event
1845	Camas first settled
1913	Jones Creek Intake constructed
1913	0.6 MG Butler Reservoir, South Half
1923	0.6 MG Butler Reservoir, North Half (1.2 MG total)
1931	Boulder Creek Intake constructed
1935	0.5 MG Lower Prune Hill Reservoir
1936	Wells 1 and 2 constructed
1945	Well 3 constructed
1948	Butler Booster Station - 800 gpm
1949	Forest Home Booster Station-450 gpm
1952	Chlorination Plant - injects chlorine into water from Jones Creek and Boulder Creek before it goes to the Filter Plant
1959	Well 4 constructed
1965	Filter Plant - 1,200 gpm - filters water from Jones Creek and Boulder Creek intakes
1965	10th Street Booster Station
1968	Well 5 constructed
1969	Well 6 constructed
1971	Well 7 constructed
1971	1.5 MG Lower Prune Hill Reservoir
1971	0.75 MG Upper Prune Hill Reservoir
1971	Lower Prune Hill Booster Station - 500 gpm, 500 gpm, 750 gpm
1977	Well 8 constructed 1,350 gpm
1978	0.1 MG Gregg Reservoir
1978	Old Gregg Booster Station - 500 gpm
1988	SCADA System installed
1993	2.0 MG Lacamas Reservoir
1993	Lacamas Booster Station - 500 gpm, 500 gpm, 1,500 gpm
1998	Forest Home Booster Station Upgrade – 1,000 gpm
1999	Butler Booster Station Upgrade
2000	Well No. 9 constructed – 650 gpm
2001	Angelo Booster Station constructed – 3,000 gpm capacity

Table 1-1 Water System Historical Timeline (Continued)

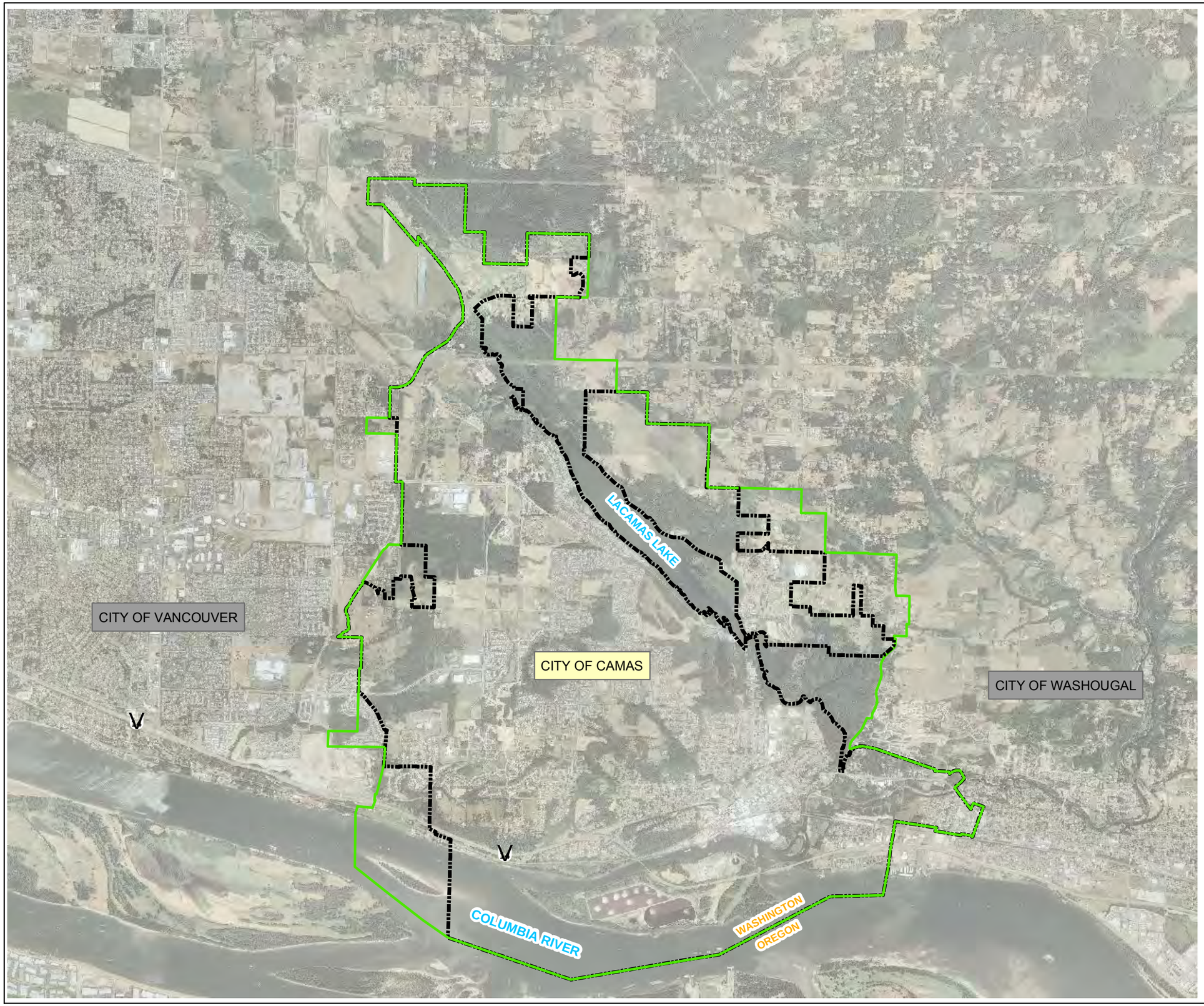
Date	Event
2001	Lower Prune Hill Booster Station Upgrade – 1,000 gpm replacement pump
2002	Upper Prune Hill Reservoir (2.4 MG) and Booster Station (2,900 gpm capacity) constructed
2002	New Gregg Zone Booster Station Constructed, 1,500 gpm
2002	Lower Prune Hill Upgrade, 2,000 gpm
2002	Jones and Boulder Creek intake metering
2002	Chlorine and CT improvements
2002	Well 1 & 2 abandoned
2003	Well 3 decommissioned
2003	Well 11, 1,200 gpm & 12 900 gpm constructed, Washougal Wellfield Chemical Feed Facility installed
2004	Well 10 constructed – 900 gpm
2007	Well 4 decommissioned
2008	Well 13 constructed, 1,325 gpm
2008	Washougal River 24-inch pipe crossing installed
2008	Ostenson Canyon Pipeline installed
2008	City and Department of Ecology sign agreement regarding use of surface water sources and increased water rights associated with groundwater.
2009	Well 14 constructed – 1,000 gpm
2009	Sodium hypochlorite disinfection system installed at Well 5 and 9

ORGANIZATION

The City's water system is owned and operated by the City of Camas. The City is governed by a mayor and seven council members, all of which are elected officials. The Public Works Director is appointed by the council and, as one of his duties, heads the City's water department. The water department is divided into two branches, engineering and operations.

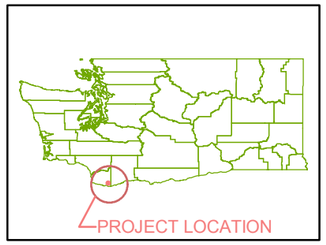
EXISTING WATER SYSTEM COMPONENTS

The City owns and operates a water source, treatment, transmission, distribution, and storage system. The system consists of 16 pressure zones ranging from a hydraulic grade of 852 feet in the Upper Prune Hill Zone to 343 feet in the downtown area in the Butler Zone. The City currently operates nine groundwater wells, one surface water treatment plant, over 130 miles of pipe, seven reservoirs, eight booster stations, and 48 PRV stations.



3

0 4,000 8,000 Feet



LEGEND:

City Limits

Urban Growth Boundary

SOURCE: CITY OF CAMAS

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 1-1
VICINITY MAP

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WATER RIGHTS

The City currently has municipal water rights issued by the Washington State Department of Ecology (DOE) for two surface water sources and nine groundwater sources. Additionally, the City holds groundwater permits to develop production wells at three new sites and to expand production from existing wells at their Lower Washougal River wellfield. The combined water right on instantaneous quantity basis (Q_i) from all of the City's sources is 14,045 gallons per minute (gpm). The annual withdrawal allocated to the City is 11,090 ac-ft/yr.

A summary of the City's water rights are presented below in Table 1-2. Four of the wells listed in Table 1-2 are no longer in use: Wells 1, 2, 3, and 4. Water rights from these wells have been transferred to other sources as indicated. Copies of water rights are located in Appendix C.

Table 1-2 Water Right Summary

Source	ID Number	Priority Date	Instantaneous Qi (gpm)	Annual Qa (acre-ft/year)
Claims				
Well 1	G2-CV1-2P159 121022	06/11/74	900	320[1]
Well 2	G2-CV1-2P160 121023	06/11/74	900	230[1]
Well 10	Claims transferred from Wells 1 and 2[6]			
Well 12	Claims transferred from Wells 1 and 2[6]			
Certificates				
Boulder Creek[7]	S 712 CS2-SWC 712	08/22/23	1,120 (2.5 cfs)	977[2] (P) 843 P (Instream Flow)
Jones Creek[7]	S 711 CS2-SWC 711	09/05/30	450 (1.0 cfs)	393[3] (P) 337 P (Instream Flow)
Well 3	G 85-A	07/21/45	1,200	118 (P)
Well 4	G 4072-A	02/12/59	1,325	1,208 (P)
Well 5	G 6636-A	03/22/68	600	920[4] (P)
Well 6	G 6635-A	03/22/68	1,500	2,400[4] (P)
Well 7	G2-00501	03/22/71	1,000	530[5] (P)
Well 8	G2-24400	02/04/77	900	530[5] (P)
Well 11	Water Right transferred from Well 3[5]			
Well 13	Water Right transferred from Well 4[5]			

Table 1-2 Water Right Summary (Continued)

Source	ID Number	Priority Date	Instantaneous Qi (gpm)	Annual Qa (acre-ft/year)
Permits				
Well 9	G2-27384	08/13/86	650	210 (S)
Expanded Wellfield Permit	G2-30144	08/13/86	500	2,150 (P)
Anderson Site	G2-30145	08/13/86	1,000	880 (P)
Parkers Landing	G2-30146	08/13/86	1,000	880 (P)
Treatment Plant Well	G2-30147	08/13/86	1,000	880 (P)
Total			**14,045**	**11,090 (P)** **210 (S)**

(1) Claims are considered valid until proven otherwise through an adjudication process.
(2) This source was formerly known as the Little Washougal River. The certificate refers to an instantaneous quantity (Qi) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights, including 1,820 ac-ft/yr for Boulder Creek (S 712), based on continuous withdrawal at the instantaneous right specified.
(3) The certificate refers to an instantaneous quantity (Qi) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights, including 730 ac-ft/yr. for Jones Creek (S 711), based on continuous withdrawal at the instantaneous right specified.
(4) The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 3,300 ac-ft/yr."
(5) The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 5,750 ac-ft/yr."
(6) Well 10, 11, and 12 were installed to replace Well 1, 2 and 3, which have failed due to collapsed well casings; see Pacific Groundwater Group report dated June 9, 2003. Well 13 replaced Well 4 after Well 4 was determined to be groundwater under the influence of surface water; see Pacific Groundwater Group report dated August 14, 2006.
(7) See Ecology agreement that limits withdrawal from May 15 through October 31.
(P) Primary water right, additive to other rights.
(S) Supplemental water right, not additive or considered when summing a cumulative total of all rights.

The surface water diversions for Jones Creek and Boulder Creek (formerly known as the Little Washougal River) are situated in Section 3, Township 2 North, Range 4 East, W.M. All of the wells, with the exception of Well 9, are located in Section 12, Township 1 North, Range 3 East, W.M. Well 9 is located in Section 4, Township 1 North, Range 3 East. The "place of use" specified by DOE on all certificates, permits, and claims is either "within the City limits of the City of Camas" or the "area served by the City of Camas." The purpose or "type of use" for certificates, permits, and claims is "municipal supply," except for Certificate S 711 (Jones Creek), which specifies a purpose of "domestic supplies."

Ecology and the City reached an agreement that eliminates the surface water withdrawals between May 15 and October 31, in exchange for additional groundwater rights. Diversions for the Boulder and Jones Creek sources are limited by the period of use agreed to between the City and Department of Ecology, and the rate of installed

capacity. Based on continuous operation between October 31 and May 15 the City is able to divert 1,370 ac-ft/yr from these combined sources. The remaining surface water rights (1,180 ac-ft/yr) have been placed in to a permanent seasonal trust through change applications CS2-SWC 712 and CS2-SWC 711.

The City has also submitted two water right applications for new wells in the Lacamas Creek basin. Application G2-30018 requests 350 gpm and 300 ac-ft/yr from a new well at Camas Fire Station 42. Application G2-30019 requests 1,000 gpm and 1,200 ac-ft/yr from two wells that will be installed at the Camas Meadows golf course. An additional application has been submitted for Stiegerwald rights in the 50-year planning period.

EXISTING WATER SYSTEM FACILITIES

The City's water system facilities are discussed in the following sections with respect to storage, transmission and distribution, and SCADA and control. The focus of these sections is to provide an overview of the City water system's identifying equipment and infrastructure.

SOURCE OF SUPPLY

The City currently obtains its water from nine groundwater wells and two surface water sources. Eight of the nine groundwater sources are located in the downtown area, in the Butler 343 Zone and Well 9 is located in the Lacamas 542 Zone. The City also chlorinates and filters surface water from Boulder and Jones Creeks. Well 14 is under construction and anticipated to be online in Spring 2010.

BOULDER CREEK AND JONES CREEK

Jones Creek has been providing the City of Camas with water since 1913. The Boulder Creek source was added in 1931. The intakes at Boulder and Jones Creeks consist of small settling basins and screens. Raw water from the Boulder and Jones Creek intakes is transmitted approximately 3.4 and 3.9 miles, respectively, to the chlorination plant where the water is pre-chlorinated. Water travels from the chlorination plant through over 6.5 miles of 10-inch steel pipe to the filter plant, where it receives further treatment. The water then flows by gravity to either the Lower Prune Hill Zone or the Butler Zone, depending upon the level in the Lower Prune Hill Reservoirs.

The City calls its groundwater sources only after demands cannot be met by production from the filter plant. The surface water sources have lower operating expenses because they can provide flow to two pressure zones without pumping, and have low silica content, which makes these sources more desirable to light industrial customers and their water quality sensitive industrial processes. However, these surface water sources are not available during peak water demand months.

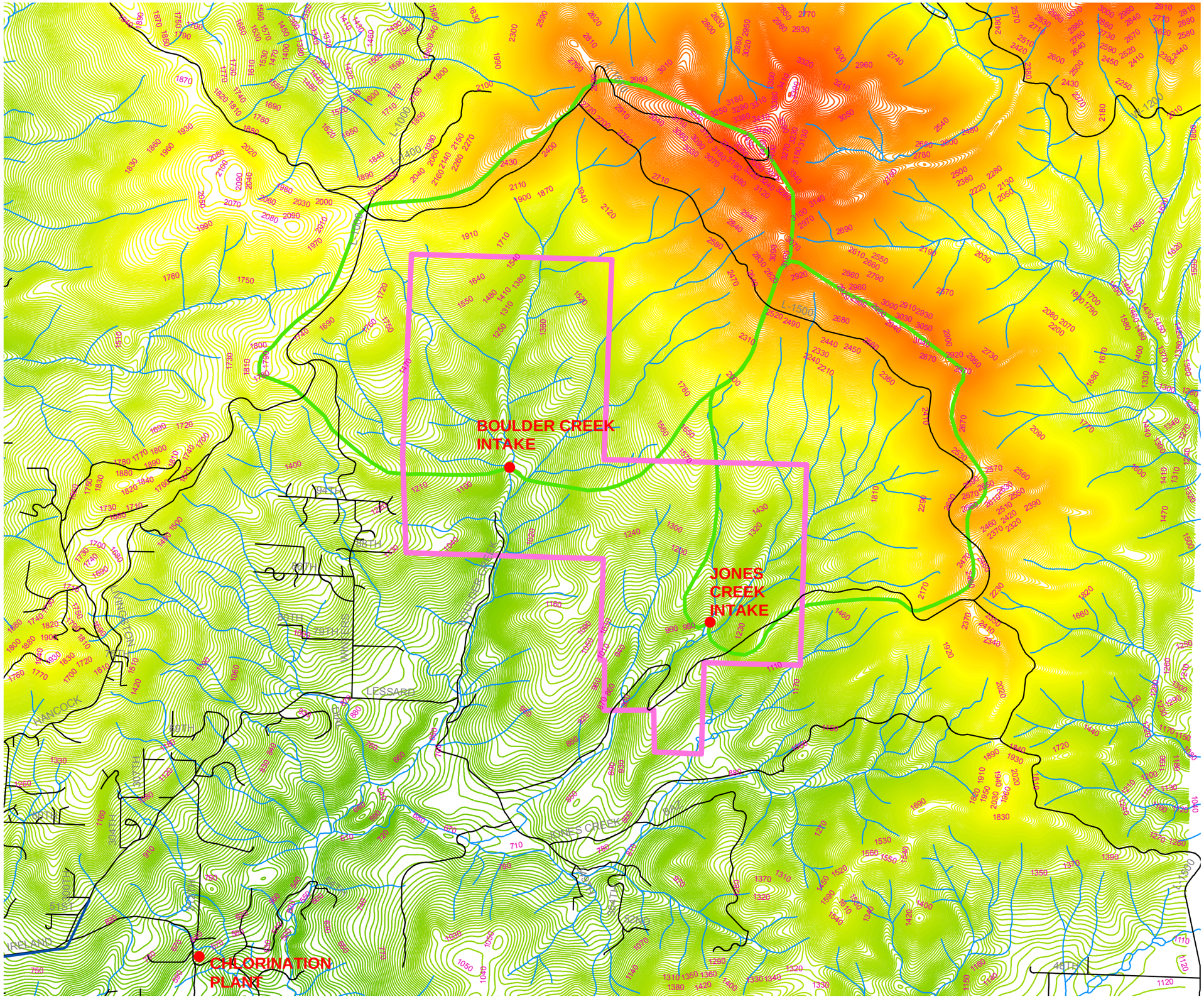
The Jones and Boulder Creek sources historically had a combined capacity of 1,570 gpm. This capacity occurred prior to the installation of the filter plant, at which time the source discharged directly to the lower head conditions of the 343 Zone. The higher discharge pressure of the 455 Zone and the losses through the filter plant have limited the capacity of these sources to 1,050 gpm. An upgrade of the existing filter plant and to portions of the 6.5 miles of 10-inch transmission main are required to overcome the hydraulic limitations of the Jones and Boulder Creek sources.

The chlorination plant is located at the intersection of NE 49th Street and NE 312th Avenue in Clark County. The facility is a pre-chlorination facility that utilizes approximately 6.5 miles of 10-inch steel pipeline as contact time prior to treatment at the filter plant. Chlorine levels are monitored at the filter plant, which are relayed to the City's telemetry system. Figure 1-2 shows the location of the City's chlorination plant, and the headworks for Jones and Boulder Creek intakes.

The City's filter plant has a rated capacity of 1,200 gpm. However, the total capacity of Jones and Boulder Creek is approximately 1,050 gpm under normal system operation, as described above. Under the City's new water rights, the surface water sources will be limited to 6.5 months seasonal usage to reduce the amount of water withdrawn from the streams during the warmest part of the year for fish stream flow augmentation. Aluminum sulfate coagulant, polymer, sodium fluoride, and sodium hydroxide are added at the filter plant. The filter plant is a pressure filter plant and the influent pressure is 130 psi, while the effluent pressure is a function of the head loss through the filter. Water to the system is delivered at approximately 120 psi. This allows the plant to supply the Lower Prune Hill Reservoirs by gravity. Once the Lower Prune Hill Reservoirs have reached capacity, a solenoid valve at the Butler Booster Station called the Butler Valve redirects flow from Lower Prune Hill to the Butler Reservoir.

GROUNDWATER SOURCES

The City currently operates nine groundwater wells. Wells 7, 8, 10, 11, and 12 are located on SE 6th Avenue, in the eastern downtown area, and are referred to as the Washougal Wellfield. Well 6 is located farther east along SE 6th Avenue near the Camas/Washougal border. The well water is conveyed across the Washougal River via a 14-inch steel line under the river and a 24-inch ductile iron pipe on a bridge over the river. The two pipes join and an 18-inch transmission line carries water from the Washougal Wellfield up toward the Angelo Booster Station. Well 5 is located south of Well 6 on SE 8th Street. All of these wells are located in the 343 Zone. Well 9 was completed in August 2000 at a capacity of 650 gpm. It is located in the 544 Zone on NW 38th Avenue near Parker Street. Well 10 was completed in September 2004. Well 11 was completed in July 2003. Well 12 was completed in October 2003. Well 13 was completed in June 2008. Table 1-3 lists the City's groundwater sources and their



3

0 2,500 5,000 Feet

LEGEND:

- Water Lines
- Roads
- City Property
- Creek Watershed
- Water
- Streams

Contours:

4000 ft

0 ft

SOURCE: CITY OF CAMAS

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 1-2
JONES AND BOULDER CREEK
HEADWORKS AND WATERSHED

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capacities. Well 14 is under construction and scheduled for completion in Spring 2010, and will add source capacity to the 343 Zone.

Table 1-3 Groundwater Sources

Source	Depth (feet)	Rated Capacity (gpm)	HP	Casing (inch)	Control Valve	Auxiliary Power
Well 5	71	500	75	8	3-inch	No
Well 6	85	1,450	150	16	6-inch	No
Well 7	84	950	100	14	3-inch	No
Well 8	87	1,350	150	14	4-inch	Yes
Well 9	253	650	100	16	6-inch	No
Well 10	92	900	200	16	8-inch	No
Well 11	105	1,200	200	16	8-inch	Yes
Well 12	106	900	200	16	8-inch	Yes
Well 13	102	1,325	200	20	8-inch	Yes
Well 14	-	1,000	200	20	8-inch	Yes
Total Source Capacity		**10,225 gpm**				

The City is currently investigating additional groundwater sources to continue to anticipate future demands. The City is continuing to pursue new sources of supply within its service area.

WATER TREATMENT

Surface Water

The City's surface water is chlorinated and filtered. Chlorination of the surface water occurs at the City's 12.5 percent liquid sodium hypochlorite plant, located several miles upstream of the filter plant. The distance between the Chlorination Plant and the Filter Plant provides 2.5 hours of prefiltration contact time.

The City operates two 750 gpm pressure filters (1,500 gpm total). The filters provide layers of media that vary from course to fine and provide the physical filtration required. Dechlorination is used for the filter backwash and bypass. The City also treats with sodium fluoride for dental benefits, alum and polymer for coagulation, and 25 percent caustic soda for pH adjustment at the filter plant. A photo of the filtration plant is shown below in Figure 1-3.

Figure 1-3 Filtration Plant

Groundwater

Treatment of the City's groundwater sources includes on-site chlorination, fluoridation, and caustic soda addition. A single chemical feed facility provides treatment for Wells 7, 8, 10, 11, and 12 due to their close proximity to one another. The remaining wells each have individual treatment facilities at the well locations. Fluoridation always occurs downstream of the well pump. Flourisilic acid is used at Wells 7, 8, 10, 11, and 12. Sodium fluoride is used at Wells 5, 6, 9 and 13. Caustic soda is added at each of the wells, with the exception of Well 9 due to natural pH, for corrosion control. The existing treatment facilities for the City's sources are shown in Table 1-4.

Table 1-4 Treatment Facilities

Source	Status	Filtration	Chlorination	Fluoridation	Corrosion Control
Boulder Creek	Active	Yes	Yes	Yes	Caustic Soda
Jones Creek	Active	Yes	Yes	Yes	Caustic Soda
Well 5	Active	No	Yes	Yes	Caustic Soda
Well 6	Active	No	Yes	Yes	Caustic Soda
Well 7	Active	No	Yes	Yes	Caustic Soda
Well 8	Active	No	Yes	Yes	Caustic Soda
Well 9(1)	Active	No	Yes	Yes	N/A
Well 10	Active	No	Yes	Yes	Caustic Soda
Well 11	Active	No	Yes	Yes	Caustic Soda
Well 12	Active	No	Yes	Yes	Caustic Soda
Well 13	Active	No	Yes	Yes	Caustic Soda
Well 14	Pre-Active	No	Yes	Yes	Caustic Soda

(1) Well pH above treatment limit.

Groundwater Under the Direct Influence of Surface Water

The federal definition of ground water under the direct influence of surface water (GWI) is a groundwater source located near a surface water such that it has significant occurrence of contamination from pathogens such as Giardia lamblia which is not normally found in groundwater. A GWI receives direct surface water recharge and is subject to rapid changes in water characteristics that correlate to surface water conditions. Sources determined as GWI are required to achieve 99.9 percent removal of Giardia lamblia and viruses by filtration and disinfection.

A hydraulic connection to nearby surface water is a potential GWI source. In order to determine if a hydraulic connection exists, a water system may conduct a hyrdogeologic investigation or use the water quality monitoring (WQM) method (WQM). The WQM method requires monitoring the groundwater and surface water source for 1 year for temperature and conductivity. If a significant correlation is determined from statistical analysis of the data, then the source is determined to be hydraulically connected to surface water. Less demanding requirements are required for hydraulically connected sources. These include eliminating the surface water influence, developing an alternate source, meet criteria to remain unfiltered, or install filtration.

A microscopic particulate analysis (MPA) is conducted in order to determine if a groundwater source is a GWI source. The City has completed MPA testing on Wells 6, 7, 10, 11, and 12 that indicate that these sources are hydraulically connected to surface water. Therefore, these sources are required by DOH to achieve a CT of 6. An

evaluation by Pacific Groundwater Group in 2006 states that Well 13 is not under the direct influence of surface water, but is hydraulically connected to surface water.

STORAGE FACILITIES

The City currently operates seven storage facilities with a combined total of 8.45 million gallons (MG). A discussion of each storage facility is provided in the following sections. A summary of the storage facilities is provided in Table 1-5. A map showing the location of the various water system facilities within the City is provided as Figure 1-4.

In the following discussion, 'normal operating conditions' describes the system operation during non-peak, winter months. During summer months, operations differ due to varied source operations, and higher water usage.

Butler Reservoir

The Butler Reservoir consists of two adjacent, partially buried concrete reservoirs. The two reservoirs share a common wall, with the north half being constructed in 1913, and the south half being completed in 1923. The reservoirs are covered and have a total storage capacity of 1.2 MG. The base elevation of the reservoir is approximately 328 feet and the overflow elevation is 343 feet. The entire capacity of the Butler Reservoir is usable storage.

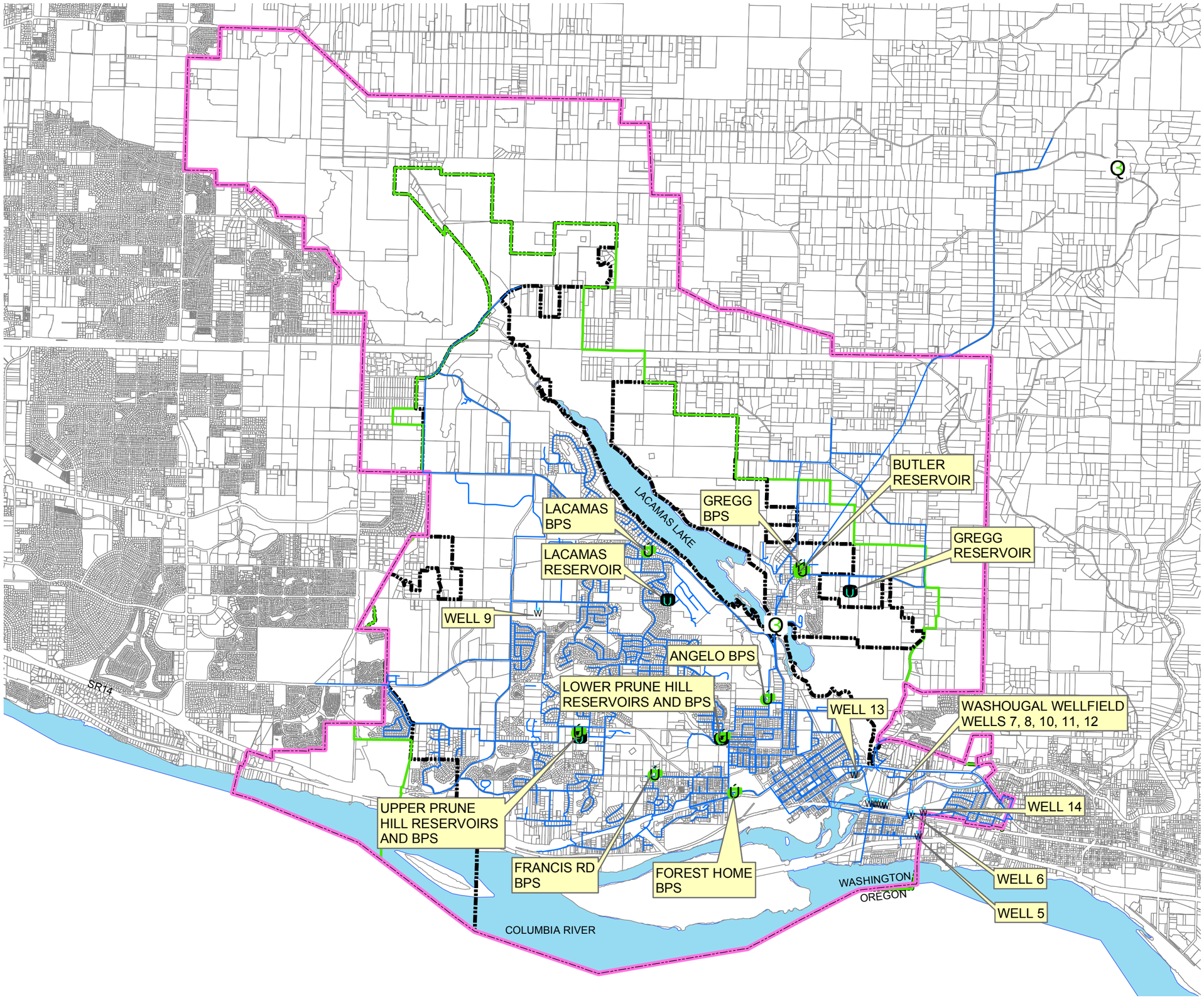
Under normal operating conditions, the Butler Reservoir is supplied through 6,420 lineal feet of 12-inch cast iron transmission main. This transmission main connects with the dedicated 18-inch transmission main from Wells 6, 7, 8, 10, 11, 12, and 13 at NE 22nd Ave. and NE Everett Street.

The filter plant, which supplies the 455 Zone under normal conditions, can also supply the Butler Reservoir. When the water level in the Lower Prune Hill Reservoirs come within one foot of the 455 foot overflow, a solenoid operated control valve, located at the filter plant, is activated via telemetry. This valve, known as the Butler Valve, diverts the treated water to the Butler Reservoir and the 343 Zone.

Lower Prune Hill Reservoir

Storage in the Lower Prune Hill Zone is provided by two concrete ground level reservoirs with overflow elevations of 455 feet. The first reservoir was constructed in 1935 and has a total capacity of 0.5 MG. A second, 1.5 MG reservoir was added to the same site in 1971. The reservoirs are plumbed together to act as one reservoir, and both have a base elevation of approximately 432 feet.

All of the storage in the Lower Prune Hill Reservoirs is usable, either via gravity to the 455 Zone, or if pumped to the Upper Prune Hill Zone through the Lower Prune Hill Booster Station. Under normal system operation, water from the filter plant supplies the



3

0 4,000 8,000 Feet

LEGEND:

- Reservoir
- Pump Station
- Water Treatment
- Wells
- Water Lines
- Water Service Boundary

Limits

- City Limits
- Urban Growth Boundary
- Clark Co. Parcels
- Water

SOURCE: CITY OF CAMAS

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 1-4
WATER SYSTEM FACILITIES

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455 Zone and the reservoirs. Once the Lower Prune Hill Reservoirs are full, flow from the filter plant is diverted to the 343 Zone. The 455 Zone can also be supplied through pumping from the 343 Zone via the Forest Home, Butler, and Angelo Booster Stations.

The Lower Prune Hill Reservoirs can also supply the 544 Zone through the Lacamas Booster Station.

Upper Prune Hill Standpipe and Reservoir

The Upper Prune Hill Standpipe and Reservoir, constructed in 1971 and 2001, respectively, currently provide all of the storage for the Upper Prune Hill Zones. The standpipe has an overflow elevation of 852 feet, stands 100-feet tall, and has a total capacity of 0.75 MG. The standpipe sets the hydraulic grade line for the pressure zone.

The Upper Prune Hill Reservoir is below the HGL of the 852 zone and serves the zone by pumping through the Upper Prune Hill BPS to the UPH Standpipe. It has an overflow elevation of 816 feet, stands 64-feet tall, and has a total capacity of 2.4 MG. The booster station has a total pumping capacity of 2,900 gpm. Including the standpipe and reservoir, the 852 zone is supplied by the Lower Prune Hill BPS, 12-inch transmission line, and 16-inch Ostenson Canyon transmission line.

Lacamas Reservoir

The Lacamas Reservoir, constructed in 1993, has a total capacity of 2.0 MG. It has a base elevation of approximately 504 feet, and an overflow elevation of 544 feet. The Lacamas Reservoir is a ground level reservoir, with a base elevation high enough to make all of the storage available for use. The Lacamas Reservoir is primarily supplied from the Lower Prune Hill Zone via the Lacamas Booster Station or from the newly constructed Well 9. PRV stations from the Upper Prune Hill zone can also provide fire flow to the Lacamas Zone.

Gregg Reservoir

The Gregg Reservoir, a 100,000 gallon capacity steel standpipe, was constructed in 1978. It has a base elevation of approximately 472 feet, an overflow elevation of 542 feet, and is the only storage facility for the Gregg Zone. The Gregg Reservoir is supplied by the Gregg Booster Stations.

Table 1-5 Existing Storage Facilities

Reservoir	Butler	Lower Prune Hill No. 1	Lower Prune Hill No. 2	Upper Prune Hill No. 1	Upper Prune Hill No. 2	Gregg	Lacamas
Capacity (MG)	1.2	0.5	1.5	0.75	2.4	0.10	2.0
Diameter (ft)	100x100	61	105	36	90	16	84
Base Elevation (ft)	328	432	432	752	748	472	496
Overflow Elevation (ft)	343	455	455	852	798	542	544
Year Constructed	1913	1935	1971	1971	2002	1978	1993
Construction Type	Concrete	Concrete	Concrete	Steel	Steel	Steel	Steel
Location	707 NE 43rd Ave.	600 NW 18th Loop	600 NW 18th Loop	2822 NW 18th Ave.	2822 NW 18th Ave.	1709 SE 270th Pl.	1520 NW 41st Cir.

TRANSMISSION AND DISTRIBUTION FACILITIES

Transmission and distribution facilities allow the water supply to reach the City's customers. These facilities include transmission and distribution mains, booster pump stations and pressure reducing stations that allow water to flow between pressure zones, from one hydraulic grade to another.

Water Mains

Transmission mains are primarily used to convey water from one area of the system to another and may or may not provide water service to customers. Distribution mains are generally classified as water pipes with diameters of 12 inches and smaller and maintain adequate pressures for serving the City's customers. Pipe materials within the City currently include the following:

- Cast Iron (CI) Pipe
- Polyvinyl chloride (PVC) Pipe
- Ductile Iron (DI) Pipe
- Steel (ST) Pipe
- Galvanized Steel
- Copper

Table 1-6 provides a list of pipe diameters, pipe materials and the total length of each within the water system.

Table 1-6 2008 Pipe Diameter and Type

Diameter	Ductile Iron (DI) (ft)	Cast Iron (CI) (ft)	Steel (ST) (ft)	Polyvinyl Chloride (PVC) (ft)	Unknown (ft)	Total (ft)	Percentage
6-inch	73,775	69,470	20,259	0	16,982	180,486	25.8%
8-inch	146,109	19,501	12,226	0	68,613	246,449	35.2%
10-inch	4,221	0	10,563	0	29,857	44,641	6.4%
12-inch	53,928	21,118	3,533	0	44,982	123,561	17.6%
14-inch	4,371	0	9,343	0	75	9,418	1.3%
16-inch	9,576	764	1,571	0	744	3,079	0.4%
18-inch	44,068	77	181	0	41,414	85,739	12.2%
20-inch	0	0	0	6,895	0	6,895	1.0%
24-inch	4,322*	0	0	0	9,099	0	0.0%
Total	336,046	110,930	57,675	6,895	211,766	700,268	100.0%
Percentage	48.0%	15.8%	8.2%	1.0%	30.2%	100.0%	

(1) Current as of July 2007. Obtained from Water System Hydraulic Model, GIS based.

Pressure Zones

The City has five main areas that serve as pressure zones in the system. These are the 343 Zone - Butler, the 455 Zone - Lower Prune Hill, the 852 Zone - Upper Prune Hill, the 544 Zone - Lacamas, and the 542 Zone - Gregg. These areas are named after the reservoirs located within the area. The City's water system contains 16 pressure zones in all. With the exception of the 852 Zone, each area is a single pressure zone, with a hydraulic grade controlled by the reservoir located in the zone. The 852 Zone contains eight separate pressure zones located adjacent to the Upper Prune Hill Reservoir. These zones are set by PRVs and exist as a buffer between the high elevation of the 852 Zone and the lower zones such as the 544 Zone and the 455 Zone. Table 1-7 lists the City's pressure zones and corresponding hydraulic grade control. The location and size of the various pressure zones is shown in Figure 1-5. A system schematic showing the transmission and distribution facilities and storage facilities is included as Figure 1-4.

Table 1-7 Pressure Zones

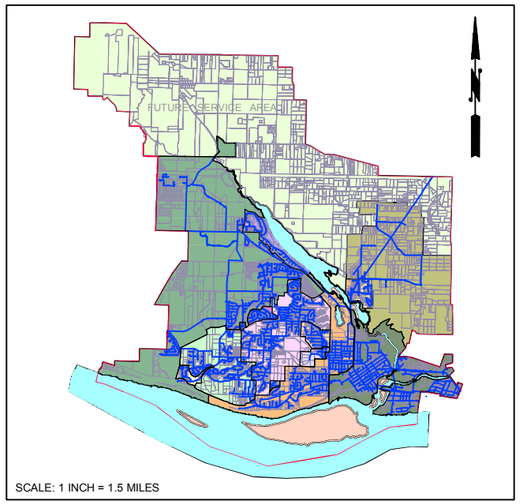
Pressure Zone	Hydraulic Grade Control
343	Butler Reservoir
428	PRV(1)
455	Lower Prune Hill Reservoirs
500	PRV(2)
542	Gregg Reservoir
544	Lacamas Reservoir
547	PRV(3)
650	PRV(3)
656	PRV(3)
680	PRV(3)
687	PRV(3)
697	PRV(3)
711	PRV(3)
760	PRV(3)
800	PRV(3)
852	Upper Prune Hill Reservoirs

(1) Dependent on the Lower Prune Hill Reservoirs.
(2) Dependent on the Lacamas Reservoir.
(3) Dependent on the Upper Prune Hill Reservoirs.

Pressure Reducing Stations

In order to operate on the sixteen pressure zones, the City maintains numerous pressure reducing stations as shown in Table 1-8. In most cases, there are two PRVs at each station. The smaller valve operates to provide the average daily demand to the zone that it serves. The larger valve, which is generally set five psi lower than the small valve, is primarily used for fire protection or large demand situations. The City's PRVs have pressure sustaining features, which are set to ensure that upstream pressures are maintained. Pressure relief valves have been installed at newer station to prevent over pressurizing the zone being fed.

The City has a contract with GC Systems to service the 68 PRVs located within the water system. This contract allows GC Systems to perform general maintenance and ensure that the valves are operating correctly, both on an individual and system-wide level.



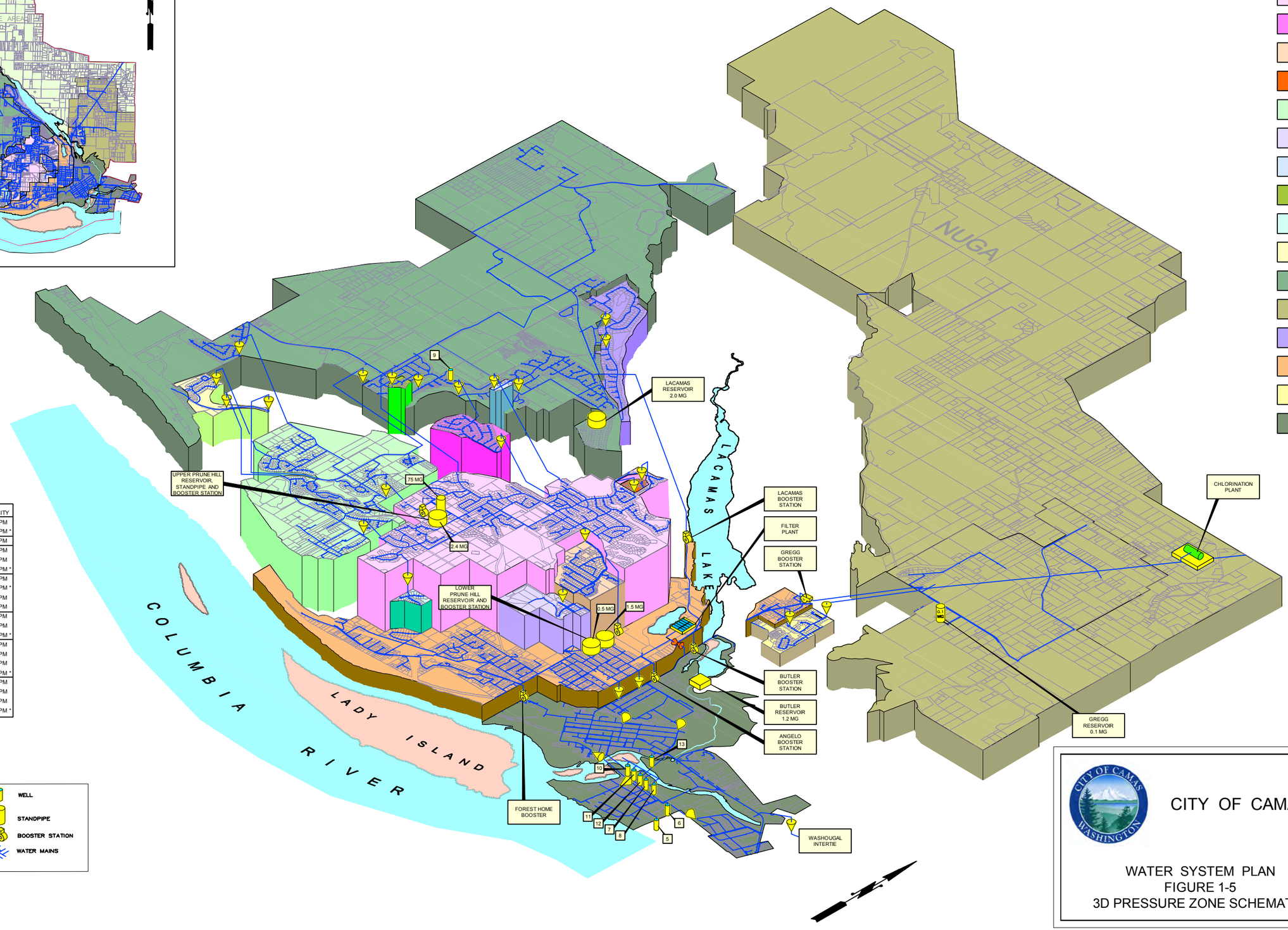
SOURCE	CAPACITY
FILTER PLANT NO.	1,100 GPM
WELL NO. 5	500 GPM
WELL NO. 6	1,450 GPM
WELL NO. 7	950 GPM
WELL NO. 8	1,350 GPM
WELL NO. 9	650 GPM
WELL NO. 10	1,000 GPM
WELL NO. 11	1,000 GPM
WELL NO. 12	1,200 GPM
WELL NO. 13	1,325 GPM

PUMP	PUMP	CAPACITY
BUTLER	NO. 1	800 GPM
	NO. 2	600 GPM *
FOREST HOME	NO. 1	1,000 GPM
LOWER PRUNE HILL	NO. 1	100 GPM
	NO. 2	1,000 GPM
	NO. 3	750 GPM *
GREGG**	NO. 1	500 GPM
	NO. 2	500 GPM *
	NO. 3	1,500 GPM
	NO. 4	1,500 GPM
LACAMAS	NO. 1	1,000 GPM
	NO. 2	500 GPM
	NO. 3	500 GPM *
ANGELO	NO. 1	1,000 GPM
	NO. 2	1,000 GPM
	NO. 3	1,000 GPM
	NO. 4	1,000 GPM *
UPPER PRUNE HILL	NO. 1	750 GPM
	NO. 2	750 GPM
	NO. 3	1,400 GPM
	NO. 4	1,400 GPM *

* STAND-BY PUMP

LEGEND:

- RESERVOIR
- CONCRETE RESERVOIR
- PRESSURE REDUCING VALVE (PRV)
- BUTLER VALVE
- WELL
- STANDPIPE
- BOOSTER STATION
- WATER MAINS



CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 1-5
3D PRESSURE ZONE SCHEMATIC

L:\CAMAS\08495 WSP\FIGURES\FIG1-5 PRESSURE_ZONES.DWG, FIGURE 1-5, 12/23/2009 2:05:24 PM, PDF-XCHANGE FOR ACROPLOT PRO, BY: P MARSHALL

Table 1-8 Pressure Reducing Valves

No	Location	Size (Inch)	Downstream Zone	Downstream Setting (psi)	Upstream Static Pressure (psi)
1	NW 22nd and Fargo	4	687	65	140
2	NW McIntosh	6	697	45	120
3	NW McIntosh	2	697	50	120
4	NW Payne Rd. and 18th	8	544	Closed	Closed
5	NW Payne Rd. and 18th	4	544	Closed	Closed
6	NW 16th Ave. and Klickitat	10	697	30	105
7	NW 16th Ave. and Klickitat	4	697	40	105
8	NW Ivy and Fargo	4	623	50	85
9	NW 23nd Ave. and Fargo St.	4	537	74	126
10	NW 19th Ave. and Fargo St.	4	687	75	150
11	NE 21st and Everett	8	343	55 back 40	110
12	NE 19th and Everett	6	343	55 back 40	110
13	NW 32nd Cir.	8	680	25	120
14	NW 32nd Cir.	2	680	30	120
15	NW Brady Rd. Deer Creek	8	517	25	105
16	NW Brady Rd. Deer Creek	3	517	30	105
17	NW Parker St. and Linear	8	518	30	135
18	NW Astor and 36th	8	544	50	120
19	NW Astor and 36th	2	544	65	120
20	NW 43rd and Sierra	8	544	30 back 55	190
21	SE 3rd and Whitney – Washougal Intertie	8	Washougal Water System	Closed	Closed
22	SE 3rd and Whitney – Washougal Intertie	11/2	Washougal Water System	Closed	Closed
23	NW Logan St. off NW 28th	6	760	45	90
24	NW Logan St. off NW 28th	2	760	50	90
25	NW 31st and NW Dahlia Dr.	6		Closed	Closed
26	NW 31st and NW Dahlia Dr.	2		Closed	Closed
27	NW 29th Ave. and NW Astor St.	2	800	58	90
28	NW 29th Ave. and NW Astor St.	6	800	53	90
29	NW Sierra Dr. and NW 38th Ave.	6	711	35	115
30	NW Sierra Dr. and NE 38th Ave.	2	711	40	115
31	Currawong Ct. and NW 40th Ave.	6	694	75	145
32	Currawong Ct. and NW 40th Ave.	2	694	80	145
33	NW 23rd Ave. and Icicle	8	685	58	130
34	NW 23rd Ave. and Icicle	2	685	63	130
35	NW Julia St.	8	544	Closed	Closed
36	NW Julia St.	2	544	Closed	Closed
37	SE Fern Ridge Dr.	2	499	40	110
38	SE Fern Ridge Dr.	8	499	35	110
39	NE Shepherd Road – Washougal Intertie	8	Washougal Water System	Closed	Closed
40	NE Shepherd Road – Washougal Intertie	11/2	Washougal Water System	Closed	Closed
41	NE 6th and Hayes	4	343	80	94
42	NE 6th and Hayes	12	343	70	94
43	SE 15th St. and Hayes – where?	6		Closed	Closed
44	SE 15th St. and Hayes – where?	2		Closed	Closed

Table 1-8 Pressure Reducing Valves (Continued)

No	Location	Size (Inch)	Downstream Zone	Downstream Setting (psi)	Upstream Static Pressure (psi)
45	East End Walden	2	423	32	84
46	East End Walden	6	423	22	84
47	West End Walden	11/2	423	72	118
48	West End Walden	6	423	65	118
49	NE 6th and Joy	6	343	64 back 74	92
50	Goot Park	3	343	115 back 123	138
51	Goot Park	10	343	110 back 123	138
	Well Field East	4	343	Closed	Closed
	Well Field East	12	343	Closed	Closed
52	Lake Ridge Lower	2	543	48	98
53	Lake Ridge Lower	6	543	43	98
54	Lake Ridge Middle	2	680	63	91
55	Lake Ridge Middle	6	680	58	91
56	Lake Ridge Upper	2	727	68	123
57	Lake Ridge Upper	6	727	63	123
58	Spyglass (Upper PRV in View Ridge)	2	686	30	100
59	Spyglass (Upper PRV in View Ridge)	6	686	25	100
60	Spyglass (Lower PRV in View Ridge)	2	505	35	110
61	Spyglass (Lower PRV in View Ridge)	6	505	40	110
62	Drewf's Farm Upper	2	691	50	63
63	Drewf's Farm Upper	6	691	45	63
64	Drewf's Farm Lower	2	669	50	130
65	Drewf's Farm Lower	6	669	45	130
66	NW Ivy and Ostenson Canyon	2	677	65	140
67	NW Ivy and Ostenson Canyon	6	677	60	140
68	Vista Del Rio	2	355	63	150

Booster Stations

The City currently operates nine booster stations. The Lower Prune Hill Booster Station is located at the Lower Prune Hill Reservoir site and pumps water from the 455 Zone to the 852 Zone. This pump station contains three pumps at a total rated capacity of 2,500 gpm, with the ability to add one additional pump. This station has the capacity for one additional pump. The Lower Prune Hill Booster Station is shown in Figure 1-6.

Figure 1-6 Lower Prune Hill Booster Station

The Forest Home Booster Station, located at 418 NW 10th Avenue, pumps from downtown in the 343 Zone to the 455 Zone. This station contains one pump at a rated capacity of 1,000 gpm. Figure 1-7 below, shows the Forest Home Booster Station.

Figure 1-7 Forest Home Booster Station

The Butler Booster Station is located at the Butler Reservoir site and also pumps from the 343 Zone to the 455 Zone. This station contains two pumps at a rated capacity of 700 gpm each, for a total rated capacity of 1,400 gpm. This station has the capacity for one additional pump. Figure 1-8 below, shows the Butler Booster Station.

Figure 1-8 Butler Booster Station

The Angelo Booster Station is located at Fallen Leaf Park and is the primary booster station that pumps from the 18-inch transmission main in the 343 Zone to serve the 455 Zone; it also feeds the suction side of the Lacamas Booster Station. This station contained four pumps at a rated capacity of 4,000 gpm. The Angelo Booster Station is shown below in Figure 1-9.

Figure 1-9 Angelo Booster Station

The Lacamas Booster Station, located at 4620 NW Sierra Street, pumps water from the 455 Zone to the 544 Zone. This station contains three pumps at a rated capacity of 2,500 gpm. Figure 1-10 below shows the Lacamas Booster Station.

Figure 1-10 Lacamas Booster Station

The Old and New Gregg Booster Stations are also located at the Butler Reservoir site and pump water from the 455 Zone to the 542 Zone. The Old Gregg Booster Station contains two pumps at a rated capacity of 500 gpm each. The New Gregg Booster Station contains two pumps at a rated capacity of 1,500 gpm each. Figure 1-11 below shows the Gregg Booster Station.

Figure 1-11 Gregg Booster Station

The ninth booster station, known as the 10th Avenue booster station, provides service pressures to only five connections located on the south east side of Prune Hill.

Table 1-9 Booster Stations

Booster Pump Station	No. of Pumps	Rated Capacity (gpm)	Year Constructed	Location
Butler	2	1,400	1948(1)	Butler Reservoir Site
Forest Home	1	1,000	1949(2)	418 NW 6th Ave.
Old Gregg	2	1,000	1978	Butler Reservoir Site
New Gregg	2	3,000	2003	Butler Reservoir Site
Lower Prune Hill	3	2,500	1971(3)	Lower Prune Hill Reservoir Site
Lacamas	3	2,500	1993	4620 NW Sierra St.
Angelo	4	4,000	2001	Fallen Leaf Park
Upper Prune Hill	4	2,900	2002	Upper Prune Hill Reservoir Site

(1) Pump replaced in 1998.
(2) Upgraded in 1999.
(3) Upgraded in 2002 and 2004.

A schematic of the City's existing water system is shown in Figure 1-12. This figure is a simplified hydraulic representation of how supply is transferred between the various zones.

INTERTIES

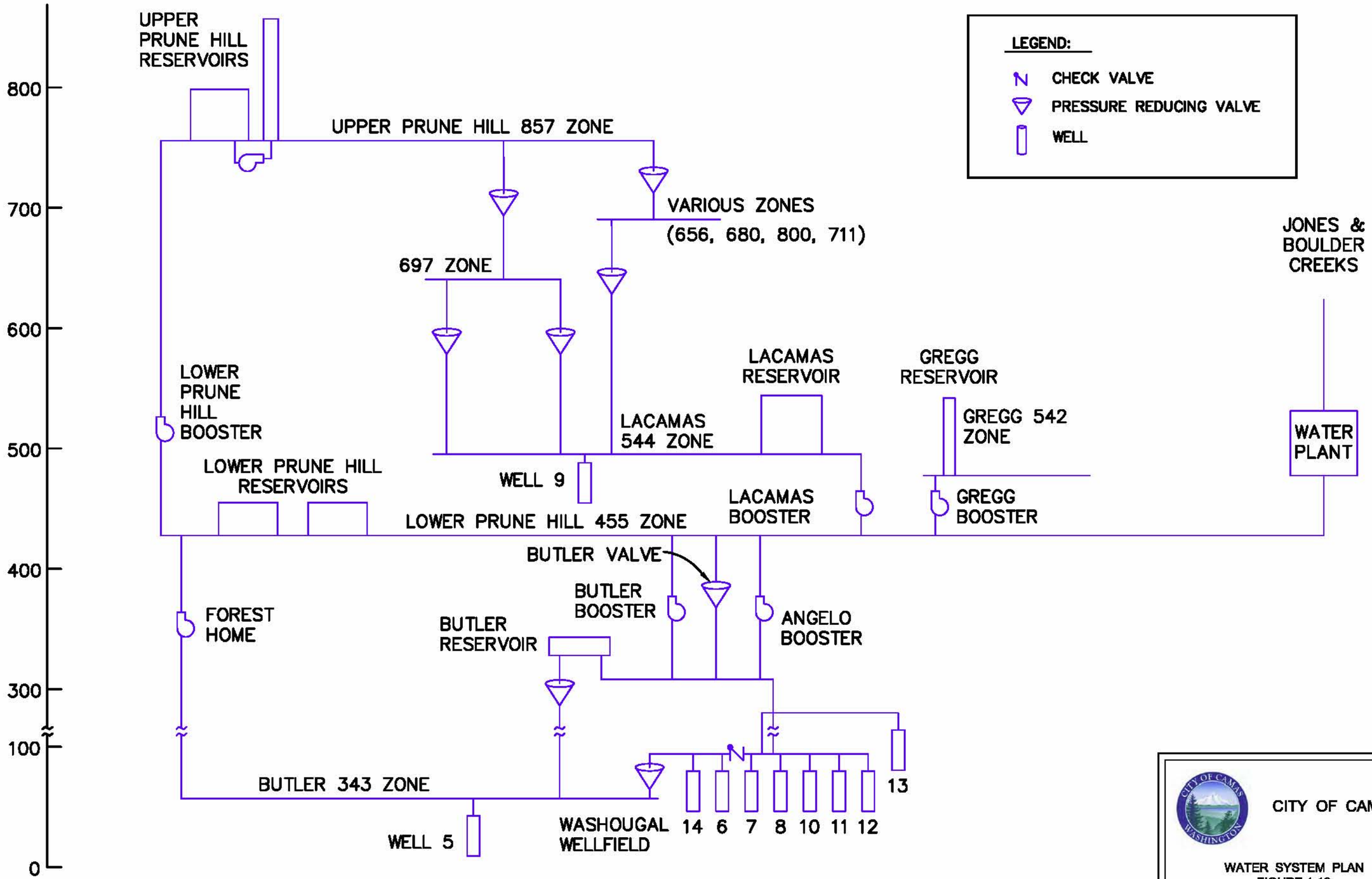
The City currently has an emergency intertie agreement with the City of Washougal to the east and the City of Vancouver to the west. A physical intertie does not exist with Vancouver, but the City has emergency access to two fire hydrants located at SE 1st and Friberg. The City has two one-way PRV interties with Washougal, located on SE Shepherd Road and at the intersection of SE 3rd Street and Whitney Street. These interties provide water from the City of Camas to the City of Washougal under low pressure conditions. The City does not have any other intertie agreements at the present time.

SCADA

The City has a Supervisory Control and Data Acquisition (SCADA) system with master control located at the City Operations Center. The system uses programmable control software, which can be controlled by a personal computer at the operations center, or from remote by a modem connected to a remote computer. The system monitors reservoir levels, well status, well flow rate, booster pump flow rates, pump status, run time, power usage, and alarm conditions. The system is able to record and display trending data for everything the City monitors. Table 1-10 indicates all of the data acquisition and control features of the SCADA system. The pump calls listed in Table 1-10 are typical, but not necessarily current. The City continually rotates well and booster pump calls to exercise the pumps and to evenly distribute wear on the pumps.

Table 1-10 SCADA System Control Setpoints

Pump	Capacity (gpm)	Called By	Winter Settings		Summer Settings	
			On Elevation (ft)	Off Elevation (ft)	On Elevation (ft)	Off Elevation (ft)
Well 5[1]	500	Butler Reservoir	17.0	18.0	18.5	20.0
Well 6	1,450	Butler Reservoir				
Well 7	950	Butler Reservoir	12.8	13.2		
Well 8	1,350	Butler Reservoir	13.8	14.1		
Well 9	650	Lacamas Reservoir	36.0	40.0		
Well 10	900	Butler Reservoir	13.6	13.9		
Well 11	1,000	Butler Reservoir	13.4	13.7		
Well 12	1,000	Butler Reservoir	14.0	14.3		
Well 13	1,325	Butler Reservoir	8.5	9.0		
Old Gregg Booster Station	500	Gregg Reservoir	58.0	65.0	58.0	65.0
New Gregg Booster Station	1,700	Gregg Reservoir	58.0	65.0	58.0	65.0
Forest Home Booster Station	1,000	Well 5	-	-	-	-
Butler Booster Station						
Pump No. 1	800	Lower Prune Hill Reservoir	15.5	16.0	15.5	16.0
Pump No. 2	600	Lower Prune Hill Reservoir	15.0	15.5	15.0	15.5
Angelo Booster Station						
Lead Pump	1,000	Lower Prune Hill Reservoir	20.0	21.5	21.0	22.0
Lag No. 1	1,000	Lower Prune Hill Reservoir	19.5	20.5	20.5	21.5
Lag No. 2	1,000	Lower Prune Hill Reservoir	18.5	19.5	19.5	20.5
Lag No. 3	1,000	Lower Prune Hill Reservoir	17.0	18.0	18.0	19.0
Lower Prune Hill Booster Station						
Lead Pump	850	Upper Prune Hill Reservoir	56.0	95.0	58.0	95.0
Lag No. 1	850	Upper Prune Hill Reservoir	54.0	94.0	56.0	95.0
Lag No. 2	850	Upper Prune Hill Reservoir	52.0	93.0	54.0	95.0
Upper Prune Hill Booster Station						
Lead Pump	730	Upper Prune Hill Standpipe	88.0	95.0	88.0	95.0



CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 1-12
WATER SYSTEM SCHEMATIC

Table 1-10 SCADA System Control Setpoints (Continued)

Pump	Capacity (gpm)	Called By	Winter Settings		Summer Settings	
			On Elevation (ft)	Off Elevation (ft)	On Elevation (ft)	Off Elevation (ft)
Lag No. 1	730	Upper Prune Hill Standpipe	86.0	93.0	86.0	93.0
Lag No. 2	1,200	Upper Prune Hill Standpipe	84.0	92.0	84.0	92.0
Lag No. 3	1,200	Upper Prune Hill Standpipe	80.0	88.0	80.0	88.0
Lacamas Booster Station						
Lead Pump	500	Lacamas Reservoir	40.0	44.0	42.0	44.0
Lag No. 1	500	Lacamas Reservoir	36.0	41.0	40.0	42.0
Lag No. 2	1,500	N/A	Manual	Manual		
Butler Valve(2) (Filter Plant)	1,050 gpm (Typical)	Lower Prune Hill Reservoirs	22.5	22.0	22.5	22.0

N/A – Not Applicable

(1) Wells 6, 8, 10, 11, 12, and 13 are rotated monthly as the lead well.

(2) The Butler Valve is a solenoid activated valve that diverts filter plant flow from the 455 Zone to the 343 Zone, when the Lower Prune Hill Reservoirs are full.

Chapter 2
REGULATORY REQUIREMENTS

INTRODUCTION
Water system planning is based on a careful analysis of a water utility's responsibility to comply with applicable regulatory requirements while providing service to existing and future customers. These regulatory requirements are the result of a number of state and federal laws. These laws are monitored and enforced by a number of federal, state and local agencies.

APPLICABLE LEGISLATION, REGULATIONS AND PERMITS
In this section, the various state and federal legislation that may affect City operations are discussed, as well as other relevant permits, programs, and regulations.

FEDERAL CLEAN WATER ACT
The Federal Water Pollution Control Act is the principal law regulating the water quality of the nation's waterways. Although originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was given the common title of the "Clean Water Act." The Clean Water Act has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the State Revolving Fund (SRF) which provides low-cost financing for a range of water quality infrastructure projects.

A Clean Water Act (CWA) Section 401 Water Quality Certification is required for any activity that may result in discharge to surface waters including excavation activities that occur in streams, wetlands, or other Waters of the United States. In Washington State, CWA Section 401 responsibility has been assumed by the Department of Ecology, and is required for projects with CWA Section 404 Permits.

Section 404 of the Clean Water Act regulates discharges of fill or dredged materials in wetlands, including any related draining, flooding and excavation. Pipeline and pump station projects in wetlands will require a Section 404 permit, in addition to any related local permits. CWA Section 404 Permits require Endangered Species Act (ESA) Section 7 consultation with the US Fish and Wildlife Service and the National Marine Fisheries Service as a result of recent listings of salmonids. Biological Assessments, Biological Opinions and their review have significantly lengthened the time required for issuance of CWA Section 404 Permits.

SAFE DRINKING WATER ACT

The Federal Safe Drinking Water Act (SDWA) was passed in 1974 and amended in 1986 and 1996. The Washington State Department of Health (DOH) adopted the federal standards under WAC 246-290, which became effective April 27, 2003. All public water systems as defined by the Environmental Protection Agency (EPA) are affected by the SDWA. A public water system is defined as one that serves piped water to at least 25 people, or 15 connections for at least 60 days per year. The SDWA contains regulations regarding water quality, sampling, treatment, and public notification requirements that are applicable to the City.

ENDANGERED SPECIES ACT

The Table 2-1 lists the Evolutionarily Significant Units (ESUs) of salmonid species present in the Camas area listed, or proposed for listing, under the authority of the Endangered Species Act:

Table 2-1 Relevant ESA Listings

Columbia River Species (ESU)	Status	Habitat
Columbia River Bull trout	Listed Threatened – 6-10-98	Critical Habitat – 9-25-05
Lower Columbia River Steelhead	Listed Threatened – 1-5-06	Critical Habitat – 9-2-05
Lower Columbia River Chinook	Listed Threatened – 6-28-05	Critical Habitat – 9-2-05
Columbia River Chum	Listed Threatened – 6-28-05	Critical Habitat – 9-2-05
Columbia River Cutthroat Trout	De-listed – 4-5-99	Not Applicable
Lower Columbia River Coho	Listed Threatened – 6-28-05	Critical Habitat – Under Development
Green Sturgeon	Listed Threatened - 2007	Critical Habitat – Under Development

The purpose of the 1972 ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved...." In pursuit of this goal, the ESA authorizes USFWS and NMFS to list species as endangered or threatened, and to identify and protect the critical habitat of listed species. USFWS has jurisdiction over terrestrial and freshwater plants and animals such as bull trout and cutthroat trout, while NMFS is responsible for protection of marine species including anadromous salmon. Under the ESA, endangered status is conferred upon "any species that is in danger of extinction throughout all or a significant portion of its range…," while threatened status is conferred upon "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The ESA defines critical habitat as the "geographical area containing physical and biological features essential to the conservation of the species."

Once a species is listed as endangered or threatened, the ESA makes it illegal for the government or individuals to "take" a listed species. "Take" has been interpreted by the federal courts to include "significant modification or degradation of critical habitat" that impairs essential behavior patterns. For species listed as endangered, the blanket prohibitions against "take" are immediate. However, threatened species may be protected through a more flexible Section 4(d) rule describing specific activities that are likely to result in a "take."

RECLAIMED WATER STANDARDS

The standards for the use of reclaimed water are outlined in the Revised Code of Washington (RCW) Section 90.46 and in a separate document published by the Washington State Departments of Health and Ecology entitled "Water Reclamation and Reuse Standards." Reclaimed water is the effluent derived in any part from wastewater from a wastewater treatment system that has been adequately and reliably treated, such that it is no longer considered wastewater and is suitable for a beneficial use or a controlled use that would not otherwise occur. The legislature has declared that "the utilization of reclaimed water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife habitat creation and enhancement purposes (including wetland enhancement) will contribute to the peace, health, safety, and welfare of the people of the State of Washington."

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act was established in 1969 and requires federal agencies to conduct environmental review or assessments of projects to determine environmental impacts on all projects requiring federal permits or funding. If the project is determined to be environmentally insignificant a Finding of No Significant Impact (FONSI) is issued, otherwise an Environmental Impact Statement (EIS) is required. City activities requiring CWA Section 404 permits fall under the jurisdiction of NEPA.

The National Historic Preservation Act regulates federal activities with the potential to impact materials of historic, cultural or archaeological significance under Section 106, which requires consultation with affected Native American Tribes and the Washington State Department of Archaeology and Historic Preservation. Documentation of this consultation is included in National Environmental Policy Act (NEPA) Environmental Reports and Assessments. Recent decisions by the US Army Corps of Engineers require an independent NHPA Section 106 consultation process for projects permitted by the Corps, which can result in significant delays to project implementation.

The State of Washington regulates state funded projects with the potential to impact materials of historic, cultural or archaeological significance under Governor's Executive Order 05-05, which requires consultation with the Department of Archaeology and Historic Preservation and affected Tribes similar to the NHPA Section 106 process.

STATE ENVIRONMENTAL POLICY ACT

The State Environmental Policy Act (SEPA) ensures that environmental issues are taken into consideration during the planning process for Non-Federal projects. An Environmental Impact Statement (EIS) is required if a project will have a significant adverse environmental impact. The EIS looks at potential environmental problems that would be caused by the project, ways the project could be changed to minimize the

impact, and mitigation options. The City is currently pursuing alternate sources of supply, which may require an EIS depending on the type of projects that are involved. Most projects including water right applications and transfers, typically do not require an EIS. A SEPA checklist is prepared and a Determination of Non-significance is issued instead. This Plan will fall under the SEPA Checklist Non-Project Action requirement. The water system projects listed in the capital improvement plan will each be completed under a separate SEPA checklist. A SEPA checklist and Determination of Nonsignificance for the Plan is included in the Appendix D.

GROWTH MANAGEMENT ACT

The Washington State Growth Management Act (GMA) was enacted in 1990 and requires certain local governments to plan for the population growth that will occur over the next twenty years within an established Urban Growth Area (UGA). The GMA also requires cities to classify critical areas (wetlands, aquifer recharge areas, fish and wildlife habitat areas, geologically hazardous areas, and frequently flooded areas) and to establish development regulations to protect these areas. The City of Camas, in conjunction with the planning efforts of Clark County, is currently in the process of updating its City Comprehensive Plan, in compliance with the GMA. Minor changes to the UGA are anticipated during this update.

SHORELINE MANAGEMENT ACT PERMIT

A Shoreline Permit is required on all projects of $2,500 or more that are located on the water or shoreline area. Shorelines are lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cubic feet per second or greater, marine waters, and an area within 200 feet of the ordinary high water mark. Areas within the City that are classified as shoreline are those areas along Lake Lacamas, the Washougal River, Little Washougal River, and the Columbia River.

FLOODPLAIN DEVELOPMENT PERMIT

Local governments that are participating in the National Flood Insurance Program are required to review projects (including water system facilities) in a mapped flood plain and impose conditions to reduce potential damage from flood water. A Floodplain Development Permit is required prior to construction. Areas where a Floodplain Development Permit may be required include the flood hazard areas which are discussed in further detail in Chapter 3.

HYDRAULIC PROJECT APPROVAL

Under Washington Administrative Code (WAC) 220-110, the Washington State Department of Fish and Wildlife requires a hydraulic project approval (HPA) for activities that will “use, divert, obstruct, or change the natural flow or bed” of any waters of the state. For City activities such as pipeline crossings of streams or outfall and intake improvements, an HPA will be required, and must include provisions necessary to minimize project specific and cumulative impacts to fish.

Because of ESA listings throughout Washington, the Washington State Department of Fish and Wildlife and NMFS are in the process of revising the Hydraulic Code to protect species listed as threatened or endangered. If NMFS determines that the revisions are sufficient to protect listed species, the State hopes the revised Code will constitute an acceptable Habitat Conservation Plan under Section 10 of the ESA. If the Habitat Conservation Plan is approved, NMFS may issue an Incidental Take Permit allowing incidental take of a listed species if the permittee has complied with the Habitat Conservation Plan. This Incidental Take Permit expires after an agreed upon period of time, and may then be revised by NMFS.

LOCAL PERMITS

The City has agreements with Clark County for the construction and maintenance of facilities in their respective rights-of-way. Under these agreements, a Right-of-Use permit is issued that specifies construction standards such as traffic control, work hours, and safety issues, as well as design and restoration standards.

WATER RIGHTS

A water right is the legal authorization to use a specified amount of public water for a certain beneficial purpose. Washington State law requires that permission in the form of a water right permit or certificate be granted for most appropriations of public water. Water rights are required to ensure proper allocation and management of water resources. Water rights are issued by the Washington State Department of Ecology (Ecology). The following sections provide definitions of key terms with regards to water rights.

Water Right Claim

A water right claim is a statement of claim to water use that began before the State Water Codes were adopted and is not covered by a permit or certificate. A claim may represent a valid water right if it describes the use of a surface water source that began before 1917 or the use of groundwater source that began before 1945. It can also represent a water right claim that was filed with the State during an open filing period designated under RCW 90.14, or is covered by the groundwater exemption.

Water Right Permit

A water right permit is issued by the state to water right applicants to begin developing their water right. A water right is developed when the applicant follows the provisions outlined in their permit such as using the water for the purposes and limits stated in the permit. A water right permit will remain in effect until the water right certificate is issued, if all terms of the permit are met, or the permit is canceled.

Water Right Certificate
A water right certificate is issued by Ecology to certify that the water user has the authority to withdraw a specific amount of water under certain conditions. The conditions are based on the beneficial use of water under the water right permit. The water right certificate is a legal document recorded at the county auditor's office. Issuance of the water right certificate is the final step in obtaining a water right.

REGULATORY AGENCIES

The above regulations, permits, and programs are administered by various local, state, and federal agencies. The history, purpose, and authority of these agencies are discussed below.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

The stated mission of the EPA is to protect human health and to safeguard the natural environment upon which life depends. The EPA's purpose includes protecting all Americans from significant human health risks, ensuring that national environmental efforts are based on the best available scientific information, ensuring that federal laws are enforced fairly, and that environmental protection contributes to making our communities and ecosystems diverse, sustainable, and economically productive. Ecology currently administers the State Revolving Fund (SRF) loans for the EPA.

UNITED STATES FISH AND WILDLIFE SERVICE (USFWS)

Under the ESA, USFWS is responsible for the protection of all non-marine life including birds, mammals, and non-anadomous fish, including bull trout and sea-run cutthroat. Although USFWS may choose to invoke the blanket prohibitions of Section 9, the "threatened" status of Bull Trout allows more flexibility to establish regulations designed to protect these species. These regulations, known collectively as a Section 4(d) rule, outline activities likely to result in a "take" of a threatened species, as well as exempted activities.

THE NATIONAL MARINE FISHERIES SERVICE (NMFS)

Under the ESA, NMFS is responsible for the protection of marine life, including anadromous salmon such as the Columbia River Chinook, Chum, and Steelhead. When a species is listed as "endangered" the prohibitions against "take" of the species are immediate under Section 9 of the ESA of the Act. Although NMFS may choose to invoke the blanket prohibitions of Section 9, the "threatened" status of the Columbia River Chinook, Coho, Chum, and Steelhead allows more flexibility to establish regulations designed to protect these species. These regulations, known collectively as a Section 4(d) rule, outline activities likely to result in a "take" of a threatened species, as well as exempted activities. The final 4(d) Rule was adopted on June 20, 2000.

UNITED STATES ARMY CORPS OF ENGINEERS

Under Section 404 of the Clean Water Act, the US Army Corps of Engineers (Corps) is authorized to regulate discharge of fill and dredged material to waters of the United States, including wetlands. A similar review process is employed for projects with the potential to impact navigable waters, including the Columbia River, under Section 10 of the Rivers and Harbors Act of 1899. This process applies to any work on outfalls to the Columbia River. The Corps employs a system of General or Nationwide Permits for blanket authorization of activities such as utility lines that have minimal adverse impact on the environment. In situations where projects are large and complex, or adverse impact is probable, the Corps may issue an Individual Permit after reviewing an alternatives analysis. Enforcement actions may be brought by the Corps or the EPA. Activities subject to Corps jurisdiction require NEPA and ESA review and consultation.

WASHINGTON STATE DEPARTMENT OF HEALTH

The Washington State Department of Health (DOH) has three primary functions: to regularly assess the State's health needs and resources; to develop and implement sound public policy; and to ensure the capacity of public health agencies to manage daily operations and respond to public health emergencies. The Department of Health was granted full authority and responsibility for the regulation and enforcement of the SDWA by the federal government in 1976. DOH also publishes guidelines for the preparation of water system plans, water conservation programs, design and drinking water quality standards, and watershed control programs. Water system comprehensive plans must be reviewed and approved by DOH. Construction plans and specifications must also be reviewed by DOH unless they are transmission or distribution improvements included in the Water System Comprehensive Plan Capital Improvement Program.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

The mission of Ecology's Water Quality Program is to protect, preserve and enhance the state surface and ground water quality and to promote the wise management of water for the benefit of current and future generations. Ecology performs various functions under state and federal authority and has both local and regional offices. Ecology oversees the allocation of water rights.

WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE

Under WAC 220-110 and RCW 75.20, any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water of the state requires hydraulic project approval from the Department of Fish and Wildlife. Approval would be required for all City construction projects that cross or otherwise take place in streams or shorelines.

WATERSHED RESOURCE INVENTORY AREA (WRIA)

Under WAC 173-500-040, Washington State was divided into 62 geographic areas, defined on the basis of surface water resources. These 62 geographic areas are defined as Water Resource Inventory Areas (WRIAs). The purpose of WRIAs is to implement effective planning involving all jurisdictions that fall within WRIA, including county, city, and other local, state, and national agencies.

The City of Camas and the Jones and Boulder Creek watersheds reside within WRIA 28. The City owns and controls a majority of the Jones and Boulder Creek watersheds, Figure 1-2, which are both tributaries of the Washougal River. The City is an active participant in regional watershed planning efforts.

LOCAL HEALTH DEPARTMENTS

The Clark County Department of Health is the local health department governing the City. In general, local health departments may adopt and enforce local regulations when they are consistent with and more stringent than state regulations.

COUNTY PLANNING POLICIES

City planning policies should be consistent with those of Clark County. Accordingly, this Plan will require approval by Clark County.

CITY POLICIES

Planning policies are important in guiding the development of a water system. The City has adopted many resolutions regarding water system planning that are included in the City Code. Table 2-2 lists various City policies and references where the policy is stated.

Table 2-2 City Policies

Policy Name	City of Camas Policy	Reference
Cross-Connection Control	A cross-connection control policy has been adopted by the City that provides written procedures for the abatement of cross connections and backflow prevention devices.	Chapter 13.32 of the City of Camas Municipal Code
Late-comer Agreements	Late-comer agreements may be granted when the cost of constructing water main extensions identified in the Comprehensive Plan exceeds the System Development Charges (SDC) to be collected from a plat.	Chapter 13.52 of the City of Camas Municipal Code
Developer Extensions/ Minimum Standards	Standards have been adopted which provide the minimum general standards required by the City for developer constructed water main extensions and improvements to be acquired by the City.	Chapter 13.48 of the City of Camas Municipal Code
Utility Rates and Charges	Utility service rates and charges have been adopted by the City which outline the service rates and charges, billing, connection fees, and miscellaneous charges.	Chapter 13.36 of the City of Camas Municipal Code
Watershed Management	City ordinances have been created establishing the boundaries of the City's watershed, the activities prohibited within the watershed, and the penalties for violating the provisions of these ordinances.	Chapter 13.56 of the City of Camas Municipal Code
City Service Water Supply	City ordinances have been created to establish a level of service to customers at the point of delivery.	Chapter 13.16.010 of the City of Camas Municipal Code
Conservation	The City utilizes SEPA and UPC provisions to promote beneficial reuse, recycling and conservation among industrial and residential customers.	15.08 UPC 16.28 SEPA

Table 2-2 City Policies (Continued)

Policy Name	City of Camas Policy	Reference
Water Shortage	City ordinances have been created that allow the City to impose restrictions during a water shortage.	Chapter 13.12.060 of the City of Camas Municipal Code
Design Standards	The City shall adhere to design standards and regulations established in the Clark County Coordinated Water System Plan (CWSP)	Clark County CWSP
Providing water service outside of City UGA Boundary	The City has a Water Service Area Boundary established by Clark County prior to GMA. The City will continue to provide water service to customers outside of the City's UGA Boundary but within the established Water Service Area. The City is not required to provide fire flow to such customers.	City of Camas 2010 Water System Comprehensive Plan
Developer Extensions outside of City UGA Boundary	The City will provide water service to developer extensions outside the City's existing UGA but within the established Water Service Boundary whenever reasonably possible. Developer extensions shall adhere to the established SDC.	City of Camas 2010 Water System Comprehensive Plan
New Water Service to Customers with Existing Wells	Developer extensions shall adhere to the established SDC and shall abandon all private wells and relinquish associated water rights to the City as a provision of the SDC. Water rights procured in this manner will be used to accommodate growth in the Water Service Area.	City of Camas 2010 Water System Comprehensive Plan
Fire Flow Analysis	Available fire flow shall be determined by an analysis using the city's hydraulic model or some other appropriate analytical tool. Available fire flow shall be based on 20 year, peak day conditions.	City of Camas 2010 Water System Comprehensive Plan

SYSTEM DESIGN STANDARDS

Performance and design criteria typically address the sizing and reliability requirements for source, storage, distribution, fire flow and water quality. The Department of Health has developed minimum standards pertaining to the performance and design of Group A Public Water Systems. The following sections describe the DOH standards that will later be used to evaluate the City's system in Chapter 4, System Analysis.

CLARK COUNTY COORDINATED WATER SYSTEM PLAN

The City conforms to all standards set forth in the Clark County Coordinated Water System Plan (CWSP). Clark County must approve the City's Water System Comprehensive Plan prior to DOH approval.

MINIMUM DEPARTMENT OF HEALTH DESIGN STANDARDS

DOH relies on various publications, agencies and the utility itself to develop and establish design criteria. WAC 246-290-200, Design Standards, lists the various criteria allowed by the DOH. This Plan will use the Department of Health's *Water System Design Manual (June 1999)* as the criteria for assessing the City's standards. This Design Manual serves as a guideline for the evaluation of existing facilities and in the preparation of plans and specifications for all Group A public water systems in compliance with WAC 246-290, which includes the City's water utility.

Level of Service

Water systems should be designed to maintain a certain level of service for their customers. This includes maintaining a minimum of 30 pounds per square inch (PSI) in the distribution system under peak hour demand and 20 PSI under fire flow conditions. On-site back-up power equipment or gravity standby storage is necessary to maintain service during power outages unless the power grid meets the DOH minimum reliability criteria. The system should also be designed such that sufficient valving is in place to keep a minimum number of customers out of service when water is turned off for maintenance or repair. The City's water system meets or exceeds the minimum pressure requirements, maintains auxiliary power for its pumped storage, and provides sufficient valving.

Minimum Pipe Sizes

The DOH Design Manual states that the minimum size distribution line shall not be less than 8 inches in diameter. Hydraulically justified smaller lines may be used on short line extensions. The City standards require that a minimum of 8-inch lines be installed except on short, dead-end lines into cul-de-sacs and fire lines.

Storage

Several components are considered when determining the amount of storage required for the operation of a water system. The following sections describe these storage components. The formulas presented in these sections will later be used to evaluate the City's existing storage facilities in Chapter 4, System Analysis.

Operational Storage

Operational storage is the volume of water in the reservoirs that, under normal operating conditions, supplies water to the system while the sources are not in operation. Operational storage for the City can be controlled by adjusting the reservoir levels with the City's Supervisory Control and Data Acquisition (SCADA) system.

Equalizing Storage

Equalizing storage must be provided as part of the total storage for the system to provide water during periods of peak demand that cannot be met by the source production capacity. The amount of equalizing storage required is calculated using the following equation:

$V_{ES} = (Q_{PH} - Q_S)*150$ minutes

V_{ES}= Equalizing storage

Q_{PH}= Peak hour demand

Q_S= Sum of all source capacities (except emergency sources)

Emergency (Standby) Storage

Emergency storage provides reliability for the system should sources fail or unusual conditions create higher than anticipated system demands. The DOH Design Manual requires a minimum of 2.0 times the average day demand volume. The amount of standby storage required is calculated using the following equation:

$V_{SB} = 2 \text{ Days}*((ADD) - (Q_T-Q_L))$

V_{SB} = Standby storage

ADD = Average day demand

Q_T = Total Supply Flow

Q_L = Largest Supply Flow

The City is supplied from nine independent wells and from two surface water sources (Jones Creek and Boulder Creek). Having such a large number of independent sources reduces the amount of standby storage required for the City. This is illustrated in Chapter 4, System Analysis.

Fire Suppression Storage
Water systems must be capable of delivering pressurized flows in accordance with the adopted fire flow requirements. The required fire suppression storage is the product of the fire flow rate and duration. The amount of fire suppression storage required is calculated using the following equation:

V_{FSS} = NFF*T
V_{FSS} = Fire suppression storage
NFF = Needed fire flow
T = Time(minutes)

There are various fire flow requirements within the City depending on the type of building. The fire suppression storage component, however, just considers the maximum fire flow requirement. The maximum adopted fire flow requirement for the City is equal to 5,000 gallons per minute (gpm) for 4 hours.

Dead Storage
Dead storage is the amount of storage in a reservoir that is considered unusable because the hydraulic grade of the system cannot be maintained once the water level drops below a certain point.

DOH requires that all water systems have sufficient source capacity and water rights to meet the annual average day demand and peak day demand requirements on a reliable basis. The City has redundancy of source in its nine independent wells and two surface water sources. The City has a policy for imposing emergency water use restrictions and has an active emergency response program as a means of ensuring system reliability.

Fire Flow
Fire flow rate and duration requirement is as required by the local fire authority and/or the Public Water System Coordination Act. The City has an adopted minimum residential fire flow requirement of 1,000 gpm, and a minimum commercial and industrial fire flow requirement of 1,500 gpm. The City's maximum adopted fire flow requirement is 5,000 gpm for 4 hours.

Construction Standards
Construction standards set forth the actual materials and construction methods that contractors, developers, and the City must follow when constructing water system facility improvements.

City Design Standards
The City has adopted standard specifications for the design and construction of water system facilities. These standards identify the criteria for both the materials and the

methods of construction for the City's water system. A copy the City's design standards are included in the Appendix E.

WATER QUALITY STANDARDS

The 1974 SDWA, and its 1986 and 1996 amendments, established specific legislation for regulation of public water systems by federal and state governments. The federal government, specifically the EPA, is authorized to develop national drinking water regulations and oversee the implementation of the SDWA. Once federal regulations become effective or promulgated, the states may adopt the federal law as state law and accept the primary responsibility for implementation and enforcement of the law.

The State of Washington has adopted as state law all of the SDWA regulations promulgated by the EPA. The EPA has delegated the authority to oversee drinking water regulations to the State DOH. State drinking water regulations are published in WAC 246-290 and establish monitoring requirements, maximum contaminant levels, and requirements for follow-up actions. WAC 246-290 establishes the water quality standards that must be followed for Group A Public Water Systems. Group A Public Water Systems are defined as all systems serving 15 or more connections or 25 or more people per day for 60 or more days per year.

Minimum standards for water quality are often specified in terms of maximum contaminant levels (MCLs). Primary MCLs are based on chronic and/or acute human health effects. Secondary MCLs are based on factors other than health effects, such as the aesthetic quality of the water. Public water purveyors have the responsibility of meeting the requirements of the regulations on a day-to-day basis. Monitoring requirements are often established for regulated contaminants to ensure that water systems demonstrate compliance with MCLs or treatment technique requirements. Public water suppliers are also required to retain certain records and submit reports to the State DOH.

On August 6, 1996, additional amendments to the SDWA were signed into law as Public Law 104-182. The 1996 amendments updated the development of regulations concerning arsenic, radon, groundwater disinfection and filtration.

CURRENT DRINKING WATER STANDARDS

Current state law contains regulations of bacteriological contaminants, inorganic chemicals and inorganic physical parameters (IOCs), volatile organic chemicals (VOCs), synthetic organic chemicals (SOCs), radionuclides and trihalomethanes (THMs). The current drinking water standards are described below.

Bacteriological
Many serious diseases are caused by bacteria, a class of single celled organisms. Indicator organisms are often used in monitoring of bacterial contamination of drinking water. Typical indicator organisms are total coliform, fecal coliform, and *E. coli*. Coliforms are naturally occurring in the digestive systems of animals. Violations of bacteriological MCLs are as follows (WAC 246-290):

- During routine sampling, coliform is detected in more than one sample in a single month (for systems taking less than 40 samples per month)
- Fecal coliform present in a repeat sample, which is a sample collected to confirm the presence of fecal coliform detected in a previous analysis
- *E. coli* present in a repeat sample
- Coliform present in a set of repeat samples collected as a follow-up to a sample with fecal coliform or *E. coli* present

Disinfection By-products
WAC 246-290-300(7) requires purveyors of public water systems that provide water treated with chemical disinfectants to monitor for disinfectants and disinfection byproducts. The Disinfection/Disinfectants Byproduct Rule (D/DBP Rule) establishes residual disinfectant concentrations and maximum contaminant levels for disinfection byproducts.

Trihalomethanes (THMs) and five haloacetic acids (HAA5) are a group of organic compounds that can be formed as a result of drinking water disinfection by chlorine and are; therefore, often referred to as disinfection byproducts. Total trihalomethanes (TTHMs) include the sum of the concentrations of four disinfection byproducts: chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

Stage 1 of the D/DBP Rule was published in November 1998 and became effective in 2000. Under Stage 1 of the D/DBP Rule, the MCLs for TTHM and HAA5 is 80 micrograms per liter (µg/L) and 60 µg/L, respectively, and is based on the running annual average of two annual samples. Systems are required to prepare and implement a disinfection byproducts monitoring plan. The Stage 1 D/DBP Rule will remain in effect for compliance until October 1, 2013.

Stage 2 of the D/DBP Rule was published in January 2006 and compliance with the new regulations begins on October 1, 2013. Under Stage 2 of the D/DBP Rule, the MCLs for TTHM and HAA5 remain 80 µg/L and 60 µg/L, respectively; however, compliance with the MCL is based on the running annual average of each individual sample instead of the running annual average of all samples combined. The number of samples taken is

dependent on the population served. Systems serving between 500 and 9,999 people must collect two samples per year and systems serving between 10,000 and 99,999 people must collect four samples per quarter.

Qualifying systems may be eligible for a 40/30 Certification Waiver. Systems granted a 40/30 Certification by EPA do not have to comply with the Stage 2 D/DBP requirements. In order to qualify, a system must not have any Stage 1 D/DBP TTHM or HAA5 violations, and samples taken during an eight-consecutive-quarter period for TTHM and HAA5's must be below 40µg/L and 30 µg/L, respectively.

Residual Disinfectant

According to WAC 246-290-300, systems providing disinfectant treatment shall measure residual disinfectant concentration within the distribution system when taking routine or repeat coliform samples. Water entering the distribution system must contain a residual disinfectant concentration of total free chlorine of at least 0.2 mg/L. Distribution system residual disinfectant concentrations measured as free chlorine must be detectable in at least 95 percent of the samples taken each calendar month. Residual disinfectant concentration within the distribution system is generally measured at the same time and location that routine bacteriological samples are collected.

Lead and Copper

The EPA published the final regulations for the Lead and Copper Rule (LCR) in 1991 as part of the 1986 SDWA Amendments. LCR is intended to reduce tap water concentrations of lead and copper. LCR requires an initial monitoring phase in which two rounds of water sampling for lead and copper are conducted. Lead samples collected according to Section 40 of the Code of Federal Regulations (CFR), must have concentrations below the "Action Level" of 0.015 mg/L in the 90th percentile. Similarly, copper samples must have concentrations less than 1.3 mg/L in the 90th percentile. Systems exceeding the action levels are required to provide public notification and implement a program for reducing lead and copper levels.

Based on the requirements of the EPA Lead and Copper Rule (40 CFR 141), lead and copper monitoring must be completed for two consecutive 6-month monitoring periods. If lead and copper action levels are not exceeded, then the number of samples may be reduced to one-half the original number for three consecutive annual periods. Assuming compliance with the action level is maintained, reduced sampling may continue once every 3 years thereafter.

IOCs, VOCs and SOCs

The State of Washington has adopted Federal MCLs and monitoring regulations for inorganic chemicals and physical parameters (IOCs), volatile organic compounds (VOCs), and synthetic organic compounds (SOCs). The Federal standards were

originally promulgated in the Phase I Rule and updated in the Phase II and Phase V rules. Monitoring for these chemicals is conducted at the source of the water supply.

Consumer Confidence Reports

Every July, water utilities must provide annual reports to their customers on the quality of their drinking water. These "consumer confidence" reports will tell customers whether their water meets state and federal drinking water standards, and if not, why not. The reports include information on the water source, the regulated and unregulated contaminants that have been detected in the water during the year and their concentration, disinfection byproducts or microbial contaminants in the water and their concentration, descriptions of possible health effects of contaminants present at concentrations greater than the MCL, identification of the likely source of any contamination, and a summary of any violations in monitoring, reporting or record keeping. The City provided information regarding water quality to its customers in their consumer confidence report entitled *City of Camas Annual Drinking Water Quality Report* which was published in May 2008. A copy of this Report is provided in the Appendix F.

Surface Water Treatment Rule

The Surface Water Treatment Rule (SWTR) was incorporated into the WAC in April 1993. This Rule established water quality requirements for surface water sources and groundwater sources that are under the direct influence of surface water (i.e., GWI sources). The purpose of the SWTR is to protect against acute health risks from waterborne microbiological contaminants. Requirements for adequate disinfection and contact time are established. Filtration may be required in order to meet water quality standards and source requirements. Treatment technique requirements are established, instead of MCLs, for Giardia lamblia, viruses, heterotrophic plate count bacteria, Legionella and turbidity. Disinfection with or without filtration must achieve at least 99.9 percent removal and/or inactivation of Giardia lamblia cysts and 99.99 percent removal and/or inactivation of viruses.

Radionuclides and Radon Rule

Radionuclides include radioactive substances occurring naturally in subsurface waters. Regulated substances include radium-226, radium-228, uranium, and gross alpha and beta particles. Table 2-3 summarizes radionuclide MCLs as defined by EPA's Radionuclide Rule, WAC 246-290-310(7), and 40 CFR 141.66.

Table 2-3 Radionuclide MCLs

Radionuclide	MCL
Combined Radium -226 and -228	5 pCi/L
Uranium	30 μg/L
Gross Alpha (excluding uranium and radon)	15 pCi/L
Gross Beta	4 millirem/year

WAC 246-290-300(10) and 40 CFR 141.26 require radionuclide samples once every 4 years. A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis provided that the measured gross alpha particle activity does not exceed 5 pCi/L at a confidence level of 95 percent.

Though a radon MCL was included in the originally proposed Radionuclide Rule, it was determined that a radon MCL will now be issued as a separate rule. In November of 1999, EPA proposed a preliminary radon MCL of 300 pCi/L. EPA is considering an alternative MCL of 4,000 pCi/L if states or water purveyors implement a multimedia mitigation program aimed at reducing household indoor-air health risks from radon gas from soil as well as tap water. The date for publication of the final Radon Rule is unknown at this time.

Arsenic Rule

Arsenic is an inorganic chemical that has received significant attention due to recent rule revisions. Long-term exposure to low concentrations of arsenic in drinking water can lead to skin, bladder, lung, or prostate cancer. Non-cancer effects of ingesting arsenic at low levels include cardiovascular disease, diabetes, and anemia, as well as reproductive, developmental, immunological, and neurological effects.

After several proposals and revisions by EPA, a new arsenic standard was published in February 2001, and was to become effective in 2004, replacing the previous standard of 0.05 mg/L. Changes in EPA's new administration resulted in a set aside of the new standard. However, the MCL of 0.01 mg/L was reaffirmed in October 2001 and the law became effective in February 2002. Compliance with the new MCL standard of 0.01 mg/L is required for all systems by January 23, 2006.

The Arsenic Rule makes monitoring requirements consistent with monitoring for other IOCs. Groundwater sampling for arsenic is required once every 3 years. Any system that has a sampling point monitoring result exceed the MCL must increase the frequency of monitoring at that sampling point to quarterly sampling. Compliance with the MCL would be based on the running annual average of the samples. Systems triggered into increased monitoring would not be considered in violation of the MCL until they have completed one year of quarterly sampling. However, if any sample result will

cause the running annual average to exceed the MCL at any sampling point, the system is out of compliance with the MCL immediately.

Groundwater Rule

The Groundwater Rule is one of the 1986 amendments to the SDWA. This rule establishes a method for determining if disinfection of a groundwater source is required, and it establishes disinfection standards for those sources where disinfection is required.

Municipal Water Law: Water Use Efficiency

The Washington Legislature passed the Water Use Efficiency Act of 1989 (43.20.230 RCW), which directs DOH to develop procedures and guidelines relating to water use efficiency. In response to this mandate, Ecology, the Washington Water Utilities Council, and DOH jointly published a document titled *Conservation Planning Requirements* (1994). Water conservation measures for medium systems include water use data collection, water demand forecasts, public education, technical assistance, water metering, conservation incentives, and a water conservation plan.

In 2003, the Municipal Water Supply – Efficiency Requirements Act (Municipal Water Law) was passed and amended RCW 90.46 to require additional conservation measures. The Municipal Water Law (MWL), among other things, directed DOH to develop the Water Use Efficiency (WUE) requirements, which was adopted in October 2006.

The WUE requirements are an extension to the *Conservation Planning Requirements* and sets more stringent requirements for public water purveyors. The WUE requirements are comprised of four sections:

1. Planning requirements
2. Distribution leakage standard
3. Metering requirements
4. Goal setting and performance reporting requirements

The City's Water Use Efficiency Program will be discussed in further detail later in this Plan.

A summary of the existing and anticipated drinking water requirements are provided in Table 2-4.

Table 2-4 Summary of Existing and Anticipated Drinking Water Requirements

Rule	Monitored by the City	Contaminants Affected	Publication Date of Final Rule
Existing WAC 246-290 (includes Lead/Copper Rule and Phase II/V Rule)	Yes	Bacteriological, IOC, VOC, SOC, THM, Radionuclides	In Effect
Residual Disinfectant	Yes	Chlorine Residual	In Effect
Stage I/II Disinfectants /Disinfection By-Products Rule	Yes	THMs, HAA5, Chlorite, Bromate	In Effect
Radon	Yes	Radon	In Effect
Radionuclides	Yes	Radionuclides	In Effect
Long Term 1 Enhanced Surface Water Treatment Rule	Yes	Bacteriological	In Effect
Ground Water Rule	Yes	Bacteriological	In Effect
Arsenic Rule	Yes	Arsenic	In Effect
Long Term 2 Enhanced Surface Water Treatment Rule	Yes	Bacteriological	In Effect
Sulfate	Yes	Sulfate	In Effect
Information Collection Rule	Yes	Large Surface Water Systems: Bacteriological, DBP, IOCs	In Effect
Interim Enhanced Surface Water Treatment Rule	Yes	Large Surface Water Systems: Bacteriological	In Effect
GWI Portion of Existing WAC 246-290	Yes	Evaluation of Wells for Surface Water Influence	In Effect
MWL Water Use Efficiency	Yes	Water Conservation Requirements	In Effect

Chapter 3
BASIC PLANNING DATA AND WATER USE FORECASTING

INTRODUCTION

Planning is an important component for effective water utility management. Water system planning is essential for providing reliable, high quality water service, ensuring efficient use of the utility's water resources, complying with State and Federal requirements, assuring orderly growth of the system, and maintaining consistency with regional planning efforts. A well developed comprehensive plan is necessary to provide planning for the existing water service area as well as for future development within the planning area. Planning criteria that is essential for the evaluation of the City's water system is presented in this Chapter. This planning criteria includes growth management, elements of the study area, land use planning, intergovernmental coordination, and population projections for the planning period.

GROWTH MANAGEMENT

The Growth Management Act (GMA) was enacted by the Washington State Legislature in 1990 to address the population growth that occurred in areas of Washington State during the 1980s. To ensure a continuation of Washington's high quality of life, officials across the state have addressed growth management within various levels of government. The basic objective of the GMA is to encourage local county and city governments to develop and implement a 20-year comprehensive plan that incorporates their vision of the future, within the framework of the broader needs of the state.

Under the GMA, municipalities must complete their own planning and coordinate these planning efforts with those of the county and surrounding municipalities. The planning effort of a municipality includes the establishment of a future service area. Municipalities are to provide water service to areas within their established planning boundary.

STUDY AREA

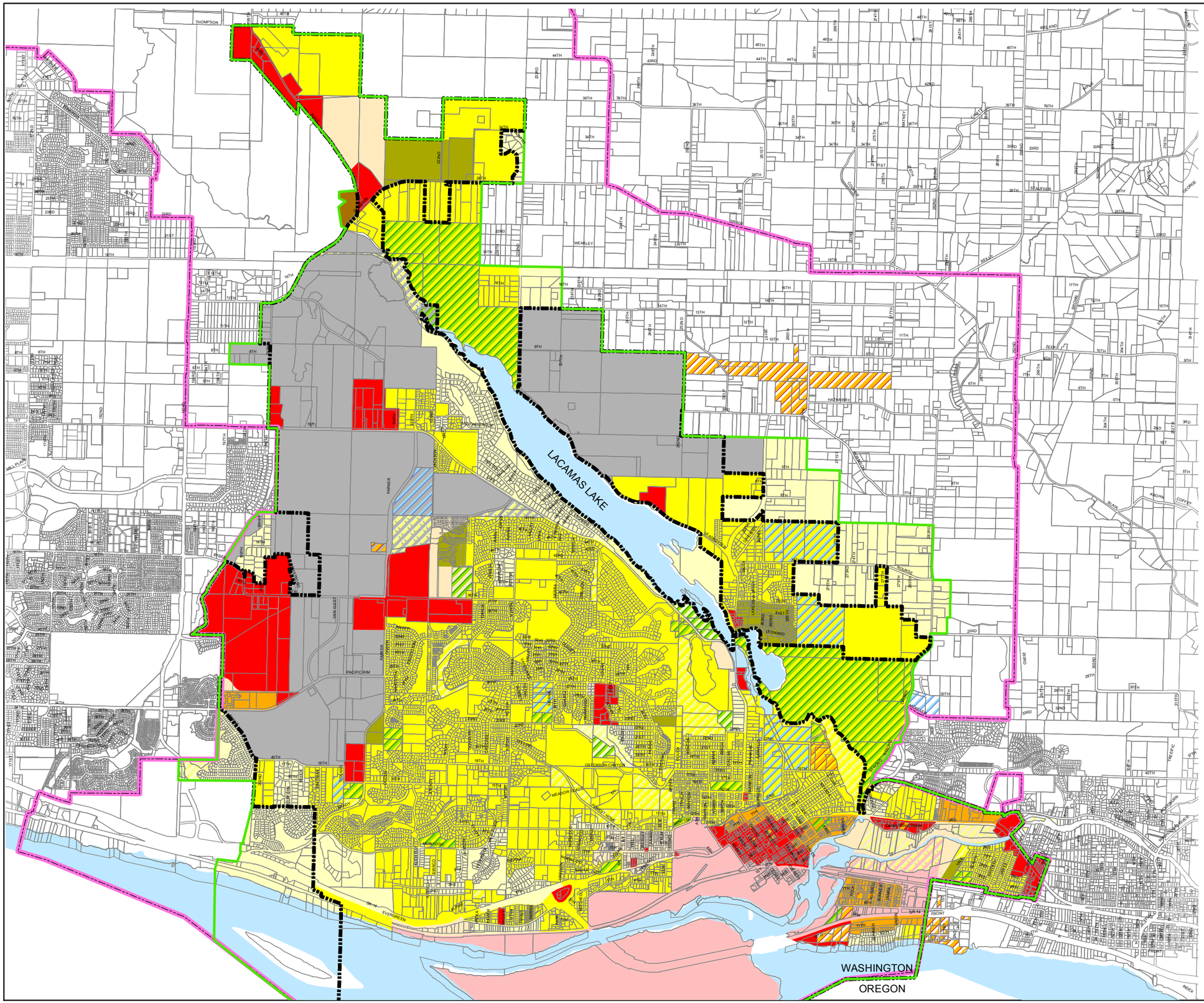
The Urban Growth Area (UGA) boundary for the City of Camas is located in Southwestern Washington and lies entirely within Clark County. The UGA boundary of the City is bordered by the Columbia River and the Washington/Oregon State line to the South, City of Vancouver UGA boundary to the West, and the City of Washougal UGA boundary to the East. An additional area north of Lacamas Lake is also included, and is referred to as the North Urban Growth Area (NUGA). Figure 3-1 shows the elements of the study area.

Before the adoption of the GMA, Clark County developed a coordinated regional plan for water service within Clark County. The purpose of this plan was to define water service areas for the water suppliers within Clark County, and to establish a hierarchy for water providers within the water service area. As a result of this plan, the City of Camas has inherited a water service area that is larger than the UGA. The City currently serves customers outside of its UGA boundary, the majority of who reside in the 542 Zone.

The study area includes those properties within the current City water service area boundary. This area, known as the Water Service Area, was defined as part of a coordinated county effort before the GMA was passed. The current City limits comprise of approximately 7,522 acres, while the NUGA is approximately 2,350 acres, as shown in Figure 3-1. The City also supplies water to Hewlett Packard, which resides within the City of Vancouver's UGA.

The Municipal Water Supply – Efficiency Requirements Act, Chapter 5, Laws of 2003 (MWL), amended several provisions of the State Water Code (RCW Chapters 90.03, 90.46, etc.) to provide municipal water systems more flexibility in managing their systems and greater certainty regarding the legal status of their water rights. In addition to providing these benefits, the MWL imposes new conservation and water use efficiency requirements. The Water Use Efficiency Rule was adopted under WAC 246-290 in September 2006.

Under the MWL, DOH was expressly charged with ensuring that new services described in water system plans are consistent with adopted local comprehensive plans and development regulations of the country or other general purpose government(s) where a municipal system may serve. To this end, DOH has developed a Consistency



3

0 3,000 6,000 Feet

Note:
The Landuse shown was used in the analysis of this document. However, land use & zoning has been modified in recent months and may be modified through legislative action throughout the life of the plan.

LEGEND:

- City Limits
- Urban Growth Boundary
- Water Service Boundary
- Clark Co. Parcels
- Water
- School Property
- Municipal Features
- Park
- Green Space

City Of Camas Landuse:

- Single-Family - Low
- Single-Family - Medium
- Single-Family - High
- Multi-Family - Low
- Multi-Family - High
- Commercial
- Light Industrial / Business Park
- Industrial
- Mixed Use

SOURCE: CITY OF CAMAS 2008

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 3-1
STUDY AREA AND ZONING

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Statement to be signed by utility officials and attached to water system plans (and updates) for review and concurrence by county officials. Municipal water systems must also delineate where appropriate, retail, future, and wholesale service areas in their water system plan (updates). Rules and guidelines relating to issues of plan consistency were adopted by DOH in 2008 under the MWL.

SERVICE AREA

In accordance with the Municipal Water Law (MWL), the City is required to designate a retail service area within which it has a duty to serve all customers, and if appropriate, also designate a future service area and wholesale service area. At this time, the City provides only retail service within the service area established in Figure 3-2.

RETAIL SERVICE AREA

The City acknowledges that it has a duty to serve within its retail service area, which is co-extensive with the service area boundary. The City's retail service area is located entirely within Clark County. Figure 3-2 depicts the City's current and future retail service area. The existing service area included areas within the City limits, and all UGA areas. The future retail service area includes all areas outside of the NUGA, but inside the Coordinated Water System Plan Water Service Area.

For purposes of this plan, retail water service is generally defined as the provision of a direct service connection to a customer falling within the City's retail service area.

PHYSICAL ENVIRONMENT

The physical environment within the City and surrounding areas plays a key role in planning for the future water service of the City's population. The relevant components of the physical environment include topography, groundwater, climate, surface water, site sensitive areas, and geology and soils.

Topography

The ground slope and natural drainage features within the City play a significant role in the planning and design of the water distribution and storage facilities. The elevation within the City ranges from about 20 feet above sea level along the shores of the Columbia and Washougal Rivers, to approximately 752 feet (NGVD 29) at the Upper Prune Hill Standpipe located at the top of Prune Hill. The terrain in the City includes a flat plateau centered in the core of the City. The topography of the City and surrounding areas is shown in Figure 3-3.

Groundwater

The City currently uses groundwater as its primary water supply. The City has developed eight wells in the downtown area, located in the southeastern portion of the City. The City also has a well in the Grass Valley area, located in the northwest portion

of the City. The City is continuing to develop and establish new groundwater sources to accommodate residential and industrial growth.

Climate

The City receives an average of 59 inches of rain per year according to the National Oceanic and Atmospheric Administration data. December is historically the wettest month, and July the driest, with normal precipitation varying from 0.82 to 6.82 inches per month.

The average annual temperature is about 51 degrees Fahrenheit (°F). August is the warmest month with an average temperature of about 61°F and December is the coolest with an average temperature of about 41°F.

Surface Water

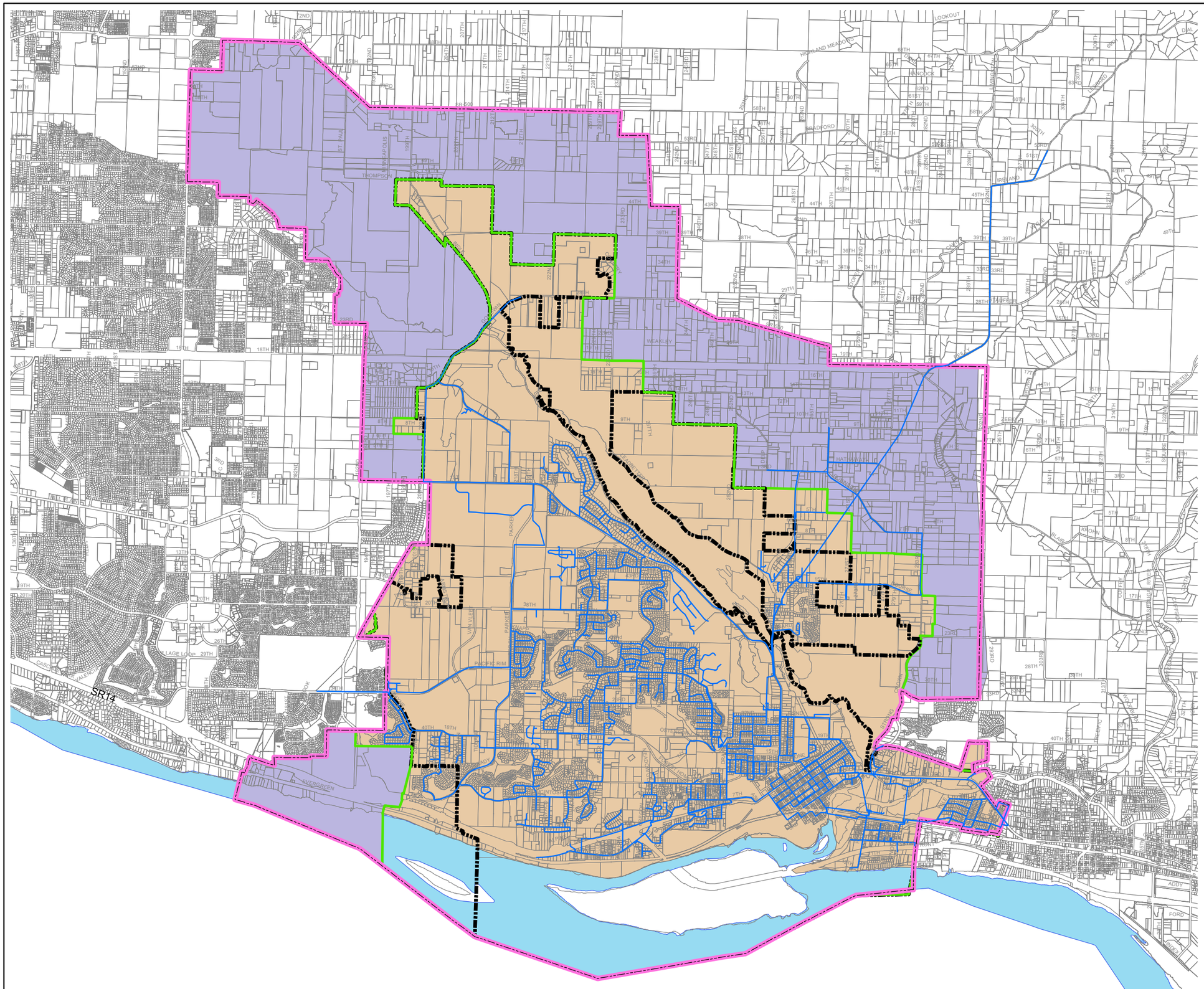
The surface water features within the City UGA boundary include Lacamas Lake, the Columbia River, the Washougal River, Lacamas Creek, Fallen Leaf Lake, and Round Lake. The City also owns the majority of the watershed for the Jones and Boulder Creeks north of the City's intakes for these sources. Jones and Boulder Creek are tributaries of the Little Washougal River, which is a tributary of the Washougal River. The basin characteristics for the creeks, streams, and rivers discussed below were obtained from stream gauging published by the U.S. Geological Survey.

The Columbia River begins in Canada, enters the United States in northeastern Washington, continues traveling southwest through eastern Washington, where it travels over a series of dams until it empties into the Pacific Ocean. The Columbia River forms the border between the states of Washington and Oregon from the point where it crosses the 46th Parallel until it empties into the Pacific Ocean. The Columbia River drainage area is approximately 241,000 square miles, with an average flow of 603,000 cubic feet per second (cfs).

Lacamas Lake is over 60 feet deep in places. It receives flow from Lacamas Creek and Dwyer Creek. The Lake then discharges into Lacamas Creek, which flows into the Washougal River. The water level is controlled by dam located at the south end of the lake. Fallen Leaf Lake and Round Lake are man-made lakes and are smaller parts of Lacamas Lake, separated from Lacamas Lake by Everett Street.

The Washougal River flows southwest from the Cascade Mountains to the City of Camas, where it empties into the Columbia River. The Washougal River drainage basin is approximately 108 square miles in size and historical records report average flows at approximately 9,000 cfs.

The Little Washougal River, of which Jones and Boulder Creeks are tributaries, flows to the southwest out of the Cascade Mountains. The Little Washougal turns to the



3

0 4,000 8,000 Feet

LEGEND:

- Future Retail Service Area
- Retail Service Area
- Water Lines
- Water Service Boundary
- City Limits
- Urban Growth Boundary
- Clark Co. Parcels
- Water

SOURCE: CITY OF CAMAS

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 3-2
RETAIL SERVICE AREA

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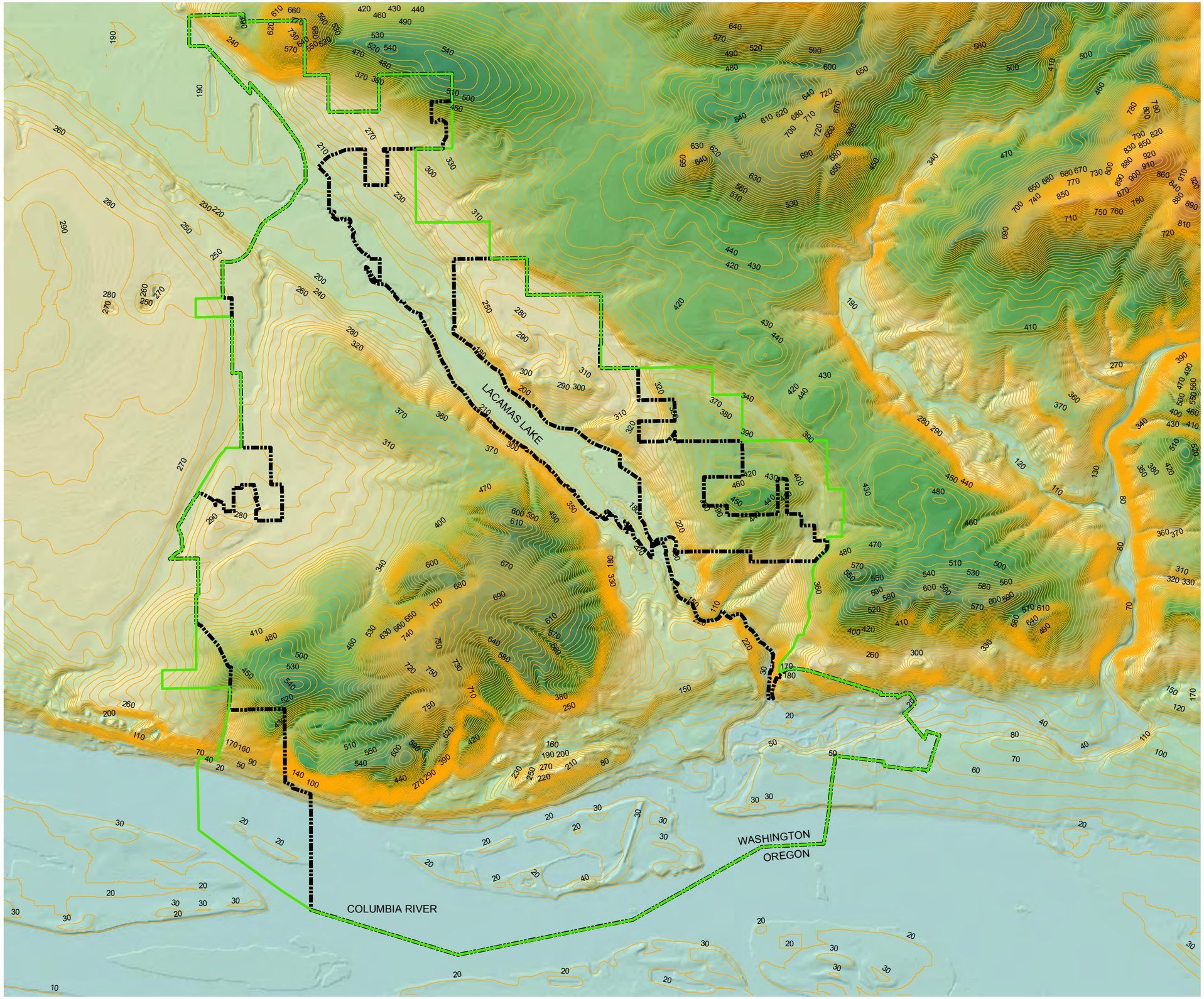

3

0 4,000 8,000 Feet

LEGEND:

- City Limits
- Urban Growth Boundary
- 10' Contours

SOURCE: CITY OF CAMAS & USGS

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 3-3
TOPOGRAPHY MAP

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southeast before it crosses into the City of Camas UGA and empties into the greater Washougal River. The Little Washougal drainage basin covers approximately 23 square miles with historical average daily peak flows of approximately 1,317 cfs.

Site Sensitive Areas

Site sensitive areas within the City include those classified as wetlands, slide hazard areas, and water bodies. The wetland and floodplain areas within the City are shown in Figure 3-4 and 3-5, respectively. Information in this section was supplied by the City and Clark County GIS and Planning Departments.

Wetlands

There are approximately 835 acres within the City that are classified as wetlands. Wetlands are defined by the EPA as areas that are inundated for at least part of the year. Wetlands support valuable and complex ecosystems and consequently development is severely restricted if not prohibited in most wetlands. Wetlands within the City of Camas are shown in Figure 3-4.

Steep and Unstable Slopes

There are approximately 891 acres within the City that are classified as steep and unstable slopes. These areas are those that are prone to unstable behavior due to steep slopes, lack of vegetation, or unconsolidated soils.

Water Bodies

Lakes and streams are classified as sensitive areas due to the wide variety of plants and animals that they support. It should be noted that a majority of the regulations discussed in Chapter 2 are designed to protect natural water bodies and their associated ecosystems.

Flood Plains

Flood hazard areas are areas adjacent to lakes, rivers, and streams that are prone to flooding during peak runoff periods. Construction of buildings and other development in these areas is regulated in accordance with flood hazard construction standards. The Camas 100-year flood plain map (land that has a 1 percent chance of flooding each year) is depicted in Figure 3-5. Proposed development projects within 300 feet of a frequently flooded area are required by municipal code 16.80 to provide a critical area report.

Geology

The Clark County area exhibits traces of its geologic history including repeated inundation by fluctuating sea levels during glacial epochs, the sedimentary processes of the Columbia River, volcanic activity, periodic earthquakes, and other tectonic activity. The geologic units in Clark County reflect this varied history and can be placed into two general categories: older consolidated and volcanic rocks. These include Columbia River Basalts and Skamania and Goble volcanic series, and sedimentary rocks

incorporating unconsolidated gravels, silts, sands, and clays created by glacial and alluvial processes. There is an active fault in the region that runs under Lacamas Lake.

Soils

The majority of the soils within the City are classified as Hillsboro-Dollar-Cove Association by the NRCS. This soil class is defined as deep, dominantly level to sloping, well-drained to very poorly drained, medium textured terrace soil. The area near Lacamas Lake and portions of land that fall within the City's service area are classified as Hesson Olympic Association. This soil class is deep, nearly level to steep, moderately fine textured soils.

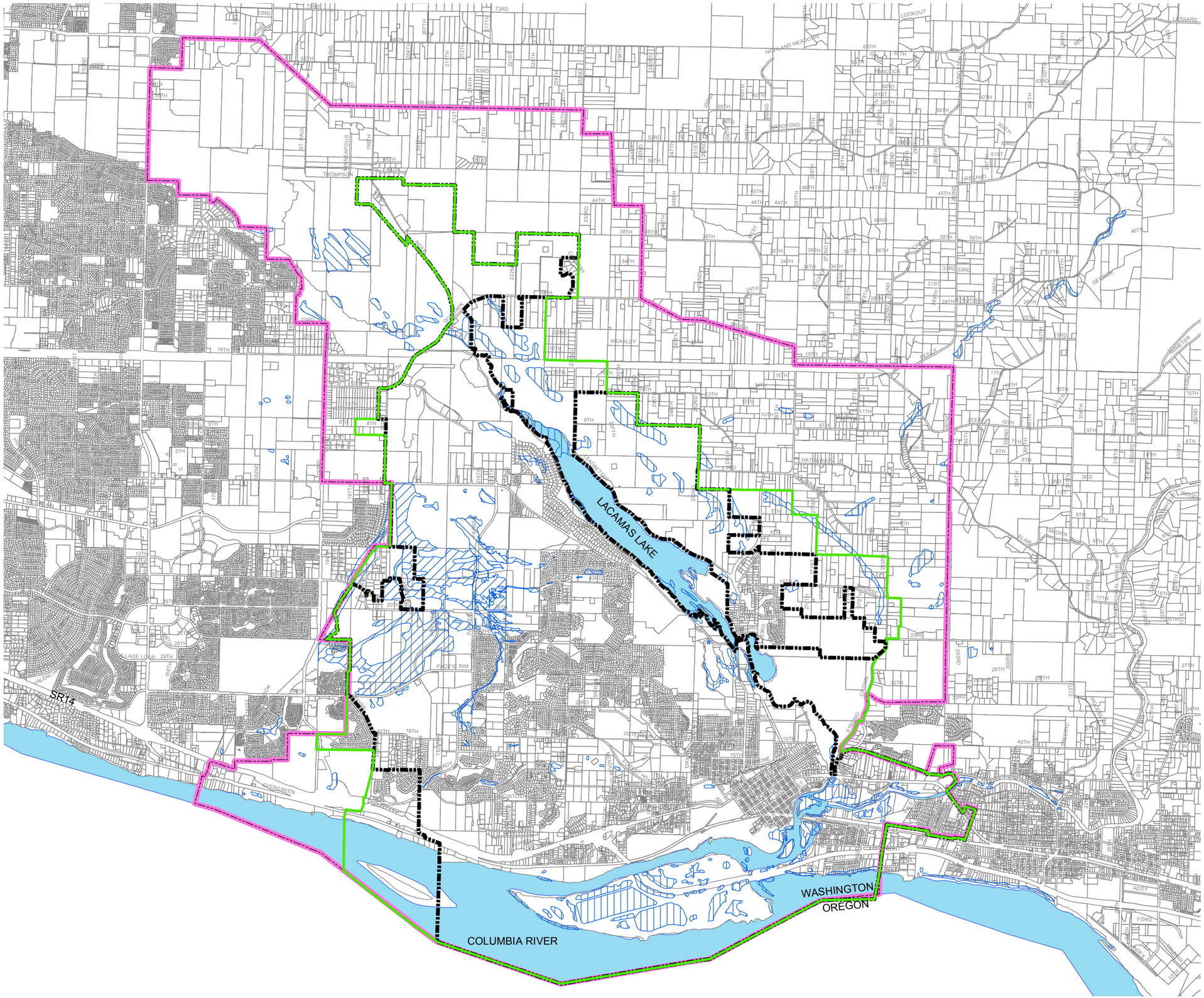
Endangered Species

As indicated in Chapter 2, the Columbia Bull trout, Coho, Green Sturgeon, Chinook, Chum, and Steelhead are listed as "threatened" under the ESA. Under the ESA, governments and individuals are prohibited from taking species, or degrading critical habitat of the species.

According to the National Marine Fisheries Service, critical habitat types necessary to support the chinook life cycle include juvenile rearing areas, juvenile migration corridors, areas for growth and development, adult migration corridors, and spawning areas. Essential features of critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover and shelter, food, riparian vegetation, space, and safe passage conditions. Compliance with the Section 4(d) rule finalized in June 2000 by the National Marine Fisheries Service will reduce the possibility of City activities such as stream crossings or other construction adjacent to streams that may adversely impact any of these critical habitat features.

The U.S. Fish and Wildlife Service have proposed listing the resident cutthroat and bull trout as threatened under the ESA. The U.S. Fish and Wildlife Service considers these sub-populations to be "depressed," with an estimated population of less than 5,000 and fewer than 500 spawners. Bull trout habitat requirements are similar to the chinook in many respects. However, spawning bull trout are often associated with colder water than the chinook. Bull trout may seek out groundwater seepages along the bottom of small tributary streams in the upper elevations of the watershed.

Table 3-1 lists the priority species present in the Washougal River Basin.



3

0 4,000 8,000 Feet

LEGEND:

- City Limits
- Urban Growth Boundary
- Water Service Boundary

Wetlands:

- 1988 NWI
- PMX
- Delineated
- Parcels
- Water

SOURCE: CITY OF CAMAS

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 3-4
WETLANDS MAP

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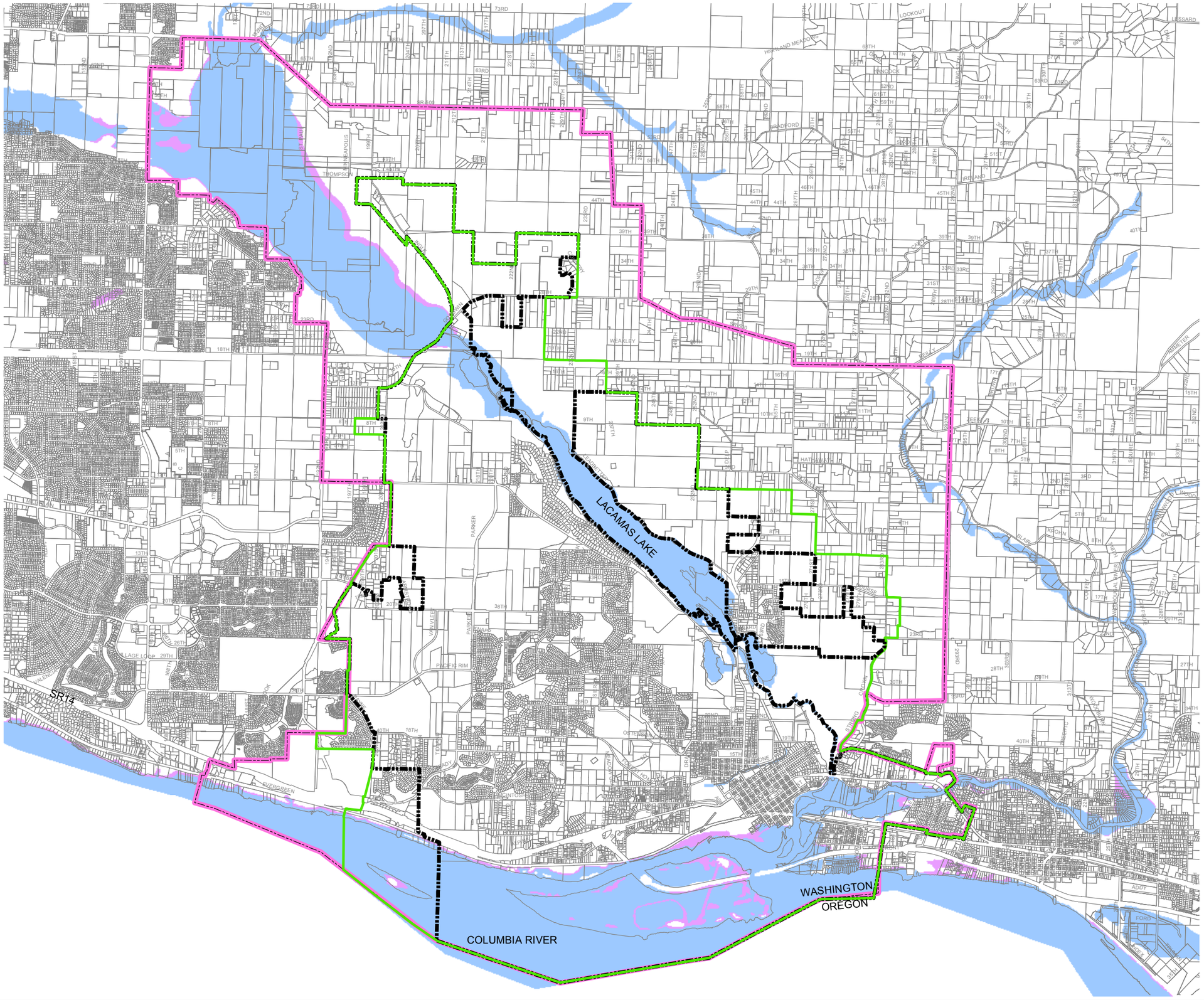

3

0 4,000 8,000 Feet

LEGEND:

- City Limits
- Urban Growth Boundary
- Water Service Boundary
- Parcels

FEMA FLOOD ZONES:

A - AN AREA INUNDATED BY 100 YEAR FLOODING, FOR WHICH NO BFE'S HAVE BEEN ESTABLISHED

X500 - AN AREA INUNDATED BY 500 YEAR FLOODING; AN AREA INUNDATED BY 100-YEAR FLOODING WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; OR AN AREA PROTECTED BY LEVEES FROM 100 YEAR FLOODING

SOURCE: CITY OF CAMAS & NATIONAL WETLANDS INVENTORY

CITY OF CAMAS

WATER SYSTEM PLAN
FIGURE 3-5
FLOODPLAIN MAP

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Table 3-1 Priority Anadromous and Resident Fish Presence

Species	Columbia River	Washougal River	Little Washougal River	Boulder Creek	Jones Creek
Chinook Salmon	X	X	X		
Coho Salmon	X	X	X	X	X
Chum Salmon	X	X	X		
Sockeye Salmon	X				
Steelhead	X	X	X	X	X
Bull Trout	X				
Green Sturgeon	X	X			

Source: Salmon and Steelhead Stock Inventory for Salmon (Department of Fish and Wildlife) and Salmonid Stock Inventory for Bull Trout (Department of Fish and Wildlife)

LAND USE PLANNING

The current and future land use for the City is shown in Figure 3-1. The various land use classifications for the City are shown in Table 3-2. The total area of each land use designation as defined in Figure 3-1 is also given in Table 3-2. These zoning designations were utilized to develop build-out population estimates later in this chapter.

Table 3-2 Land Use Designation for the UGA

Land Use Designation	City Without North UGA (acres)	North UGA Expansion (acres)	Total within UGA (acres)	Percent of Total
Single-Family	3,281	965	4,247	43.0 %
Multi-Family	358	97	455	4.6 %
Commercial	6018	89	690	7.0 %
Industrial	979	0	979	9.9 %
Light Industrial/Business Park	1,473	551	2,024	20.5 %
Parks	146	646	792	8.0 %
Green Space	416	0	416	4.2 %
Municipal Facilities	36	0	36	0.4 %
Schools	233	0	233	2.4 %
Total	**7,523**	**2,349**	**9,872**	**100.0 %**

WASTEWATER SYSTEM

The City also owns and operates a wastewater collection system consisting of collection sewers, trunk sewers, lift stations, force mains, and a wastewater treatment facility.

INTERGOVERNMENTAL COORDINATION

Regional coordination is an important component of water system planning. The City currently provides water to areas outside of the UGA, including customers in Clark County to the Northeast of the City, and customers within the City of Vancouver's UGA. Adjacent purveyors to the City include the City of Vancouver to the west, the City of Washougal to the East, and the Clark County PUD to the north. The City maintains two interties with the City of Washougal.

CITY OF VANCOUVER

The City of Vancouver lies within Clark County and borders Camas to the west. The City of Vancouver was incorporated in 1857. Vancouver's population was 143,560 as of the 2000 Census. The City of Camas currently provides water service to a small area within Vancouver's UGA along Pacific Rim Blvd. Among these customers, Hewlett Packard is a significant water user that purchases water from both the City of Camas and the City of Vancouver. An emergency intertie exists between the City of Vancouver and the City of Camas via two fire hydrants.

CITY OF WASHOUGAL

The City of Washougal lies within Clark County and borders Camas to the east. Washougal was incorporated in 1908. As of the 2000 Census, Washougal has a population of 8,595. Camas currently has two one way PRV interties with the City of Washougal, which are located in the eastern part of downtown Camas. Washougal's primary water supply is a well field that pumps from the same aquifer as Camas' Well 5. A copy of the City's intertie agreement with the City of Washougal is located in Appendix G.

CLARK PUBLIC UTILITIES

Clark Public Utilities (CPU) serves areas to the north and west of the City's UGA. CPU serves more than 30,000 water customers within Clark County. Its service area covers approximately 200 square miles and includes the communities of Hazel Dell, Salmon Creek, Lakeshore, Felida, Mt. Vista, La Center, Brush Prairie, Hockinson, Venersborg, Heisson, Meadow Glade, Dollars Corner, Duluth, Pioneer, Manor, Amboy, and Yacolt. The utility also operates a number of satellite water systems for small residential developments throughout the County. Two such satellite systems reside within the City UGA.

CPU obtains its water from groundwater sources. The utility maintains 34 wells with a pumping capacity of 33 million gallons per day. Water is stored in 25 reservoirs with a

combined capacity of 11.7 million gallons. CPU is currently investigating alternative water sources for the future. The most feasible option appears to be the development of a wellfield southeast of Vancouver Lake. This development would yield approximately 36 mgd. CPU currently has two satellite systems located within the City of Camas Water Service Area Boundary. There are currently no interties or written agreements with CPU, with the exception of the Coordinated Water Plan.

RELATED PLANNING DOCUMENTS

The related planning documents listed in the following sections were utilized in the preparation of this document.

COMPREHENSIVE PLANS

- *Clark County Growth Management Plan, 2007*
- *2004 City of Camas Comprehensive Plan*
- *1996 City of Camas Water System Master Plan*
- *Clark County Coordinated Water System Plan (CWSP), 1999*
- *City of Camas WSP, 2001*
- *Watershed Plan*

OTHER PLANS AND REPORTS

- *NUGA Expansion Water and Sewer Infrastructure Evaluation, September 2007*
- *City of Camas Westside Test Well Drilling Program, Pacific Groundwater Group, March 2001*
- *2000 City of Camas Water/Sewer Utility Rate Study*
- *1999 City of Camas Water Utility System Development Charge*
- *2007 Metropolitan Transportation Plan for Clark County*
- *Washougal Wellfield Hydrogeologic Study*
- *General Sewer/Waste Water Facility Plan Update (Draft), 2007*
- *2009 Rate Study*

PLANNING PERIOD

Due to the City's growth history and the need to provide water services for future growth, the City's water system is in need of continuous evaluation and improvement. A planning period for the evaluation of the water utility should be long enough to be useful for an extended period of time, but not so long as to be impractical. The planning period for this plan is through 2029, coinciding with a 20-year planning interval. In general, it is assumed that mechanical and electrical equipment, such as pumps and controls, have a useful life of 20 years, while structures such as reservoirs and piping have a useful life of 50 to 75 years. This Plan will also provide and evaluation of the water system at buildout, when the City has grown to its full capacity.

POPULATION

To evaluate the operation of the existing facilities and to estimate the facilities required for future water service within the study area, the City's existing and projected populations are established based on historical data provided by the Washington State Office of Financial Management (OFM), input from City staff, and land use designations. In an effort to maintain consistency with the City's *General Sewer/Wastewater Facility Plan*, similar projections are used.

CURRENT AND PROJECTED CITY POPULATION

The current and future residential population of the City is listed in Table 3-3. Population projections between 2008 and 2029 are based upon a linear growth rate from the previous 4 years of growth within the City. This growth rate is based on the average from 2005 to 2007, 2.61 percent. The NUGA population projections are based on projections developed for the update to the *General Sewer/Wastewater Facility Plan.* These projections assume that ultimate buildout of the NUGA will occur by 2025, and that growth will not begin until 2011. The total projected population served by the City is estimated at 40,321 in 2029.

Table 3-3 Historical and Projected UGA Population

Year	City Population	NUGA Population Served by the City	Total
2005	15,460	-	15,460
2006	15,880	-	15,880
2007	16,280	-	16,280
2008	16,700	-	16,700
2009	17,135	-	17,135
2010	17,581	-	17,581
2011	18,039	777	18,817
2012	18,509	1,555	20,064
2013	18,992	2,332	21,324
2014	19,486	3,110	22,596
2015	19,994	3,887	23,881
2016	20,515	4,665	25,180
2017	21,049	5,442	26,492
2018	21,598	6,220	27,817
2019	22,160	6,997	29,158
2020	22,738	7,775	30,512
2021	23,330	8,552	31,882
2022	23,938	9,330	33,267
2023	24,561	10,107	34,668
2024	25,201	10,885	36,086
2025	25,858	11,662	37,520
2026	26,531	11,662	38,193
2027	27,223	11,662	38,885
2028	27,932	11,662	39,594
2029	28,695	11,662	40,321

*Population data is linked to the Land Use Map dated June 25, 2008, and is shown in Figure 3-1.

Water Service Area Build-out Population

Build-out population is based upon the maximum density and acreage of each land use classification. Table 3-4 shows the City's build-out population for the water service area based upon land use. Build-out for the City water service area is estimated to occur by 2038.

Table 3-4 Build-out Population for the Water Service Area Based on Land Use

Classification	Density (Dwelling Units per Acre)	Total Acreage	Residential Units	Population
Single-Family Low	2.6	1,612	4,191	10,058
Single-Family Medium	4.0	2,216	8,864	21,274
Multi-Family Low	12.0	147	1,764	4,233
Multi-Family High	36.0	94	3,384	8,122
Non-Residential	0	2,091	0	0
Unclassified*	0.2	7,666	1,533	3,679
Total	**1.4**	**13,826**	**19,736**	**47,366**

*No zoning classification is available for services outside of the UGA. A build-out density of 0.2 Dwelling Units per Acre was assumed.

Population projections should be revisited and reevaluated concurrently with any anticipated change to the City's UGA to ensure the City's ability to provide water service to areas outside the City's current UGA.

WATER USE CHARACTERIZATION

Water use characterization is an important aspect of water system planning. By evaluating the historical trends in the amount of water purchased and consumed, peaking factors, and the customer population, it is possible to provide forecasts of future demands on the water system. This is necessary in order to assess the capacity of the City's existing facilities and design future water system facilities.

The City's customer base is comprised of residential, commercial, and industrial connections. Approximately 51 percent of the City's total water use is from single-family residential customers, and approximately 35 percent industrial water use in 2007.

WATER SERVICE CONNECTIONS

The total number of water service connections within the City at the end of 2007 was 7,095.

Service Connections by Customer Class

The City classifies its customers based on various rate codes. For the purposes of this document, water usage has been divided into the following customer types: single family residential, multi-family residential, commercial, industrial, combined residential /commercial, and city services. These connections have meter sizes ranging from 5/8-inch to 6-inches.

Table 3-5 provides a summary of the connections for each type of customer class as of 2007. The difference between the number of units billed may vary from the number of connections due to either multiple units per meter or inactive connections. The raw connection data represented the number of connections at the end of each year. To provide a more accurate view of the connections throughout a given year, the end of year data was averaged from the given year, and the previous year.

Table 3-5 Service Connections by Customer Class

Customer Class	2003	2004	2005	2006	2007
Residential	3,948	4,543	5,192	5,909	6,435
Commercial	184	192	205	217	219
Industrial	29	29	29	29	29
City	34	34	34	34	35
Irrigation	122	133	142	148	159
Firelines	41	41	42	42	43
Total	**4,357**	**4,971**	**5,642**	**6,379**	**6,919**
Growth		**14.11%**	**13.50%**	**13.05%**	**8.47%**

WATER USE

Water use in the City can be broken down into three main components: Source production, customer consumption, and distribution system leakage. These three elements are discussed in the following sections.

Source Production

The City currently supplies water to its customers through production wells and two surface water sources. The surface water sources are combined and treated at the City's filter plant. Production is metered at the filter plant and at each individual well. Table 3-6 provides the water production from 2002 through 2007 for the filter plant and the wells. These totals are based upon daily meter reading at the respective sources.

Table 3-6 2002 – 2007 Production: Average Day Production

Source	2002 (gpd)	2003 (gpd)	2004 (gpd)	2005 (gpd)	2006 (gpd)	2007 (gpd)
Filter Plant	1,221,359	1,035,296	1,061,567	750,293	782,337	782,992
Well 3	480,981	-	-	-	-	-
Well 5	256,989	197,564	257,888	257,888	177,381	52,608
Well 6	846,304	982,553	137,921	137,921	243,648	468,838
Well 7	244,666	549,268	165,546	165,546	375,452	198,742
Well 8	860,260	844,759	386,488	386,488	669,963	667,542
Well 9	31,117	190,759	122,104	122,104	128,471	52,984
Well 10	-	-	537,388	537,388	257,867	205,348
Well 11	-	152,997	688,656	688,656	639,014	763,673
Well 12	-	36,242	567,595	567,595	866,531	570,274
Total	**3,941,676**	**3,989,438**	**3,925,152**	**3,613,878**	**4,140,664**	**3,763,001**

Table 3-7 provides a summary of the historical per capita production.

Table 3-7 2005 – 2007 Per Capita Production

Year	Water Service Area Population	ADD (gpd)	Production per Capita (gpcd)
2005	15,460	3,613,878	234
2006	15,880	4,140,664	261
2007	16,280	3,763,001	231
Average	**15,873**	**3,839,181**	**242**

Based on the average production from the City's sources over the last three years the per capita production 242 gallons per capita per day (gpcd). This value accounts for the possibility of fluctuations in water use, residential irrigation demands, and distribution system leakage. The average production per capita value is less than the previous Plan, 274 gpcd.

However, the industrial water use in the City is significantly high. To provide a more accurate view of the water use per capita, only water use for residential customers is considered. For 2007, the ADD for residential customers is 2,212,000 gpd. This water use includes distribution system leakage, but does not include industrial or commercial water use. With a population of 16,280, the per capita production for residential

customers is **136 gpcd**. This value will be used to calculate the demand projections discussed in subsequent sections.

Maximum Day Water Demand

Peak day demand is the maximum amount of water used in a 24-hour period for the year. Peak hour demand, or maximum instantaneous demand, is the largest amount of water used in a one-hour period for the year. Maximum day and peak hour demands usually occur during the summer months due to the added demands of irrigation. Table 3-8 presents the historical maximum day demand for each of the City's sources.

Table 3-8 2005 – 2007 Maximum Day Source Demand

Source	2005 (gpd)	2006 (gpd)	2007 (gpd)
Filter Plant	1,027,000	1,182,000	1,314,000
Well 5	476,000	504,000	301,000
Well 6	-	-	1,879,000
Well 7	707,000	2,083,000	871,000
Well 8	59,000	1,424,000	1,355,000
Well 9	752,000	695,000	269,000
Well 10	1,217,000	-	-
Well 11	1,520,000	-	1,454,000
Well 12	2,747,000	2,770,000	-
Total	**8,505,000**	**8,658,000**	**6,999,000**
Date	**August 27**	**July 15**	**July 10**

The City's telemetry records were used to determine the historical maximum day demands (MDD) on the system. Daily meter readings on the City's supply wells and surface water sources were used to determine the City's maximum production day. Table 3-9 presents the historical maximum day demands to average day peaking factors.

Table 3-9 2002 – 2007 Maximum Day Demand

Year	ADD (gpd)	MDD (gpd)	Peaking Factor
2002	3,941,676	9,585,000	2.43
2003	3,989,438	8,166,000	2.05
2004	3,648,184	8,837,000	2.42
2005	3,613,878	8,505,000	2.35
2006	4,134,317	8,658,000	2.09
2007	3,763,001	6,999,000	1.86
2008(1)	3,695,479	7,745,003	2.09
Average	**3,848,416**	**8,458,333**	**2.20**

(1) 2008 data is actual data, but this information was not available at the time this analysis was conducted, and therefore, is not included in the average calculation.

Based on the average peaking factor shown in Table 3-9, a conservative peak day to average day peaking factor of 2.2 will be used to project peak day demands on the system discussed in subsequent sections. The peak day to average day peaking factor was 1.9 in the City's previous WSP.

The maximum quantity of water produced in a 1-hour period during a maximum day demand is the peak hour demand. If precise records of peak hour demand are not available, peak hour is often expressed in terms of a peaking factor. A peaking factor is defined as the ratio of peak hour to the maximum day demand. It is generally accepted that peak hour factors range from 1.5 to 2.5. The DOH Water System Design Manual, August 2001, provides a methodology for calculating peak hour demand (PHD). The generalized equation is as follows:

$$PHD = (MDD/1440)[(C)(N) + F] + 18$$

Where:
PHD = Peak Hourly Demand, (gpm)
C = Coefficient Associated with Range of ERUs
N = Number of Service Connections, ERUs
F = Factor Associated with Ranges of ERUs
MDD = Maximum Day Demand, (gpd/ERU)

For the City, an ERU is equal to 296 gpd, as shown in subsequent sections and in Table 3-13. The number of service connections, N, is equal to the maximum day production divided by the maximum day demand per ERU. The result is a total system ERU value of 12,989.

The values for C and F of the peak hour demand formula are taken from the DOH Water System Design Manual, Table 5-1, page 5-8. C is equal to 1.6 and F is equal to 225. The MDD is estimated as MDD = 296 gpd/ERU * 2.2 = 651 gpd/ERU

By substituting these values into the equation above, the PHD is calculated to be 9,518 gallons per minute (gpm). Thus, the calculated peaking factor between peak hour demand and maximum day demand for the entire system is 1.62 (9,518/(8,458,333/1440) = 1.62). (See DOH comment/response matrix for further explanation of this calculation.)

A conservative peak hour to peak day peaking factor of **1.8** will be used to project peak hour demands on the system discussed in subsequent sections.

Consumption History

City water consumption is measured at individual service meters. Residential customers are billed for water service every two months, while commercial and municipal customers are billed monthly. The City's water connections and consumption, as it is related to customer class, is presented in Table 3-10 and Figures 3-6 and 3-7.

Table 3-10 2007 Customer Consumption

Customer Type	Annual Consumption (gallons)	Number of Connections	Percent of Total Connections	Percent of Total Consumption
Single-Family	631,634,388	6102	87.2%	46.0%
Multi-Family	24,167,880	405	5.9%	1.8%
Commercial	54,723,680	219	3.1%	4.0%
Industrial	429,112,640	29	0.4%	31.2%
City	6,456,736	35	0.5%	0.5%
Irrigation	70,828,120	158.5	2.3%	5.2%
Hydrants	3,716,064	43	0.6%	0.3%
NA	1,282,072	0	0.0%	0.1%
DSL	151,573,946	0	0.0%	11.0%
Total	**1,373,495,526**	**6,997**	**100.0%**	**100.0%**

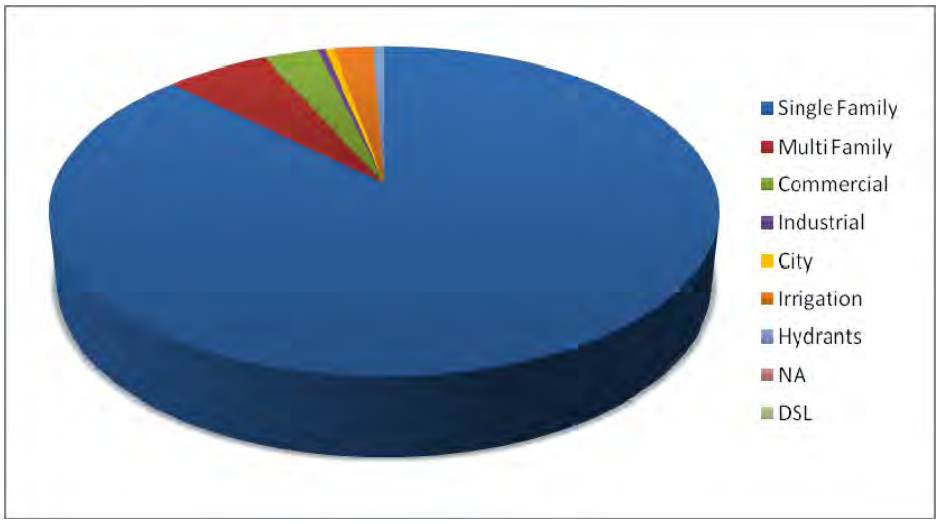


Figure 3-6 Connections by Customer Class

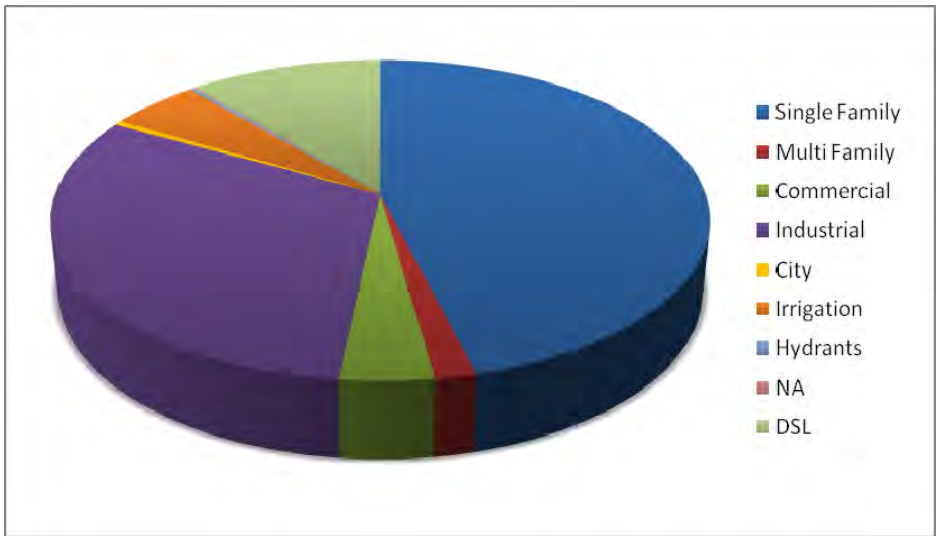


Figure 3-7 Consumption by Customer Class

Table 3-11 shows the City's highest water users. The majority of these users are from the industrial customer class that accounts for over 35 percent of the City's water usage. Note that Camas School District #117 has a number of different accounts, but is included as a single account.

Table 3-11 Highest Water Users

Customer	2005 ADD (gpd)	2006 ADD (gpd)	2007 ADD (gpd)
Wafertech Industries	570,385	625,521	597,593
Linear Technology	233,870	171,406	257,783
Georgia Pacific Mill	238,567	253,700	261,624
Camas School District #117	38,198	55,009	41,559
Sharp Electronics Corp	17,470	15,494	14,488
Hewlett-Packard	40,647	29,633	21,329
Green Mountain Golf Course	0	20,146	0
Heraeus Shin-estu	12,657	14,543	12,789
Underwriters Laboratory	20,222	24,751	22,558
Camas Washington Associates	8,499	8,641	9,143
Bodycote	7,030	6,640	8,122

DISTRIBUTION SYSTEM LEAKAGE

Distribution system leakage (DSL) is defined as the difference between metered source production and all accounted for sources of water usage. Prior to DOH instituting the new Water Use Efficiency requirements, all non-revenue water was called "lost and unaccounted for water." However under the new rules, all non-revenue water is simply considered DSL, whether it is resulting from actual leakage in the distribution system or is caused by some other factor such as unmetered usage, unaccounted for hydrant flushing, or inaccurate meters. Table 3-12 provides the historical distribution system leakage for water from 2002 through 2007.

Table 3-12 Distribution System Leakage

Year	Production (gallons)	Consumption (gallons)	DSL (gallons)	Percent DSL	3-year Rolling Average
2002	1,438,711,600	1,093,178,064	345,533,536	24.0%	-
2003	1,456,144,700	1,163,908,194	292,236,506	20.1%	-
2004	1,460,213,119	1,211,462,296	248,750,823	17.0%	20.4%
2005	1,319,065,600	1,235,318,260	83,747,340	6.3%	14.5%
2006	1,509,025,682	1,265,488,092	243,537,590	16.1%	13.2%
2007	1,373,495,526	1,221,921,580	151,573,946	11.0%	11.2%
Average	**1,426,109,371**	**1,198,546,081**	**227,563,290**	**15.8%**	

The City has a relatively high distribution system leakage percentage. Water systems with high pressures (greater than 120 psi), like those found in the 343 Zone, typically show large quantities of DSL. Fire flow requirements and existing sprinkler systems may prevent the City from adjusting and re-aligning the existing 343 Zone to reduce pressures. The feasibility of adjusting pressures in the 343 Zone will be analyzed due to its potential for conservation and reduction of distribution system leakage. This analysis is included as part of the hydraulic analysis, located in Chapter 5. As part of the Municipal Water Law, the City's goal is to reduce DSL to an average of 10 percent using a 3-year rolling average. As of 2007, the City is very close to meeting this goal, with an average of 11.2 percent DSL.

EQUIVALENT RESIDENTIAL UNITS

The conversion of total water use to equivalent residential units (ERUs) provides a way to express water use by non-residential customers as an equivalent number of single family residential customers. The average volume of water used per residential connection is calculated by dividing the total volume of water used in the single family residential customer class by the total number of single family residential connections. This number defines the average single family residential water use per connection. The volume of water used by the other customer classes can then be converted to an equivalent number of single family residential services. ERUs for other customer classes are calculated by dividing the number of connections by the average single family residential water use per connection. The average volume of water used per single family residential connection in 2007 was approximately **284 gallons per day** (gpd). Table 3-13 provides the number of water service connections by customer class, the average daily consumption per customer class for 2007, the ERUs, and the average ERUs per connection.

Table 3-13 2007 Equivalent Residential Units

Customer Type	Total Demand (gpd)	Number of Connections(1)	Equivalent Residential Units(2)	ERUs per Unit
Single-Family	1,730,505	6102	6,102	1.00
Multi-Family	66,213	405	233	0.58
Commercial	149,928	219	529	2.41
Industrial	1,175,651	29	4,146	142.95
City	17,690	35	62	1.78
Irrigation	194,050	159	684	4.32
Hydrants	10,181	43	36	0.83
NA	3,513	0	12	-
DSL	415,271	0	1,464	-
Total	**3,763,001**	**6,992**	**13,269**	

(1) Number of connections for each customer class is equal to the average end of year connection values from 2006 and 2007.

(2) ERUs = Total Demand / 283.6 gpd per ERU

Figure 3-8 is a graph that shows the normalized City growth from 2002 through 2007 based on water service connections and average day production. This graph shows that while the number of connections has steadily increased since 2002, production has remained relatively flat.

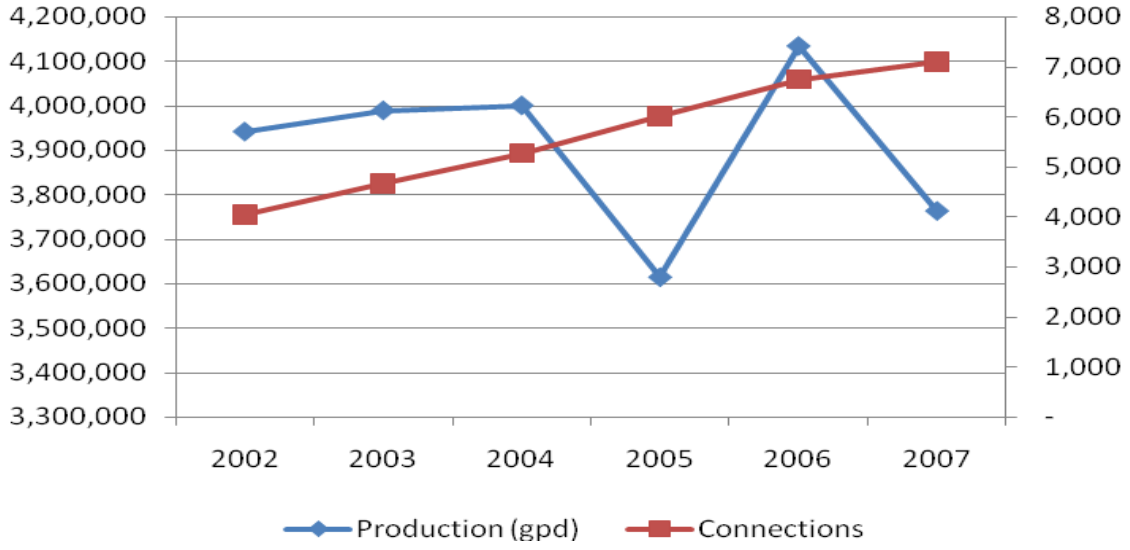


Figure 3-8 Historical Growth

City Water Use Efficiency Program

The City's water use efficiency (WUE) program includes conservation information on their web site, leak detection surveys, a water main replacement program, and a meter replacement program. More information regarding the City's WUE program, including recommended improvements, is provided in Chapter 6.

WATER USE FORECASTING

Water use forecasting uses the population projections presented in Table 3-4 along with per capita water usage to project the water demands that the system must support as its population increases. The demand forecasts will be used in the system analysis and to develop demand sets for the hydraulic analysis.

PROJECTED WATER USE

Water use projections have been made based on the City's population within the water service area boundary. The water use projections were calculated assuming an average water use of 142 gpcd for non-industrial water users. This value was calculated using 2005 through 2007 water production less industrial demand and DSL, divided by the population data.

Because industrial water use comprises such a large percentage of the City's water use and can grow independently from City population growth, industrial water use has been projected separately. Over the past 6 years, the number of industrial connections has not increased; it has remained constant at a value of 26 connections. The peak day to average day peaking factor is 2.2, and the peak hour to peak day peaking factor of 1.8 will be used. In order to make the system analysis more conservative, water conservation was not included. However, water use projections incorporating conservation are provided in Chapter 6. The projected average day and peak day water demands for the water service area were shown in Table 3-11, and peak hour water demands were presented in Table 3-12.

Industrial use was projected assuming a consumption factor of 3,000 gallons per day per acre of light industrial land. Assuming a buildout year of 2025, the water use projections for the light industrial land use classification were extrapolated from existing water consumption to simulate industrial growth over the next 20 years. All land zoned as light industrial was considered developable to complete these projections. Wetland areas and other areas unsuitable for development were removed from the water use projections, since these lands are not developable. The City does not want to understate the potential for light industrial growth within the urban growth boundary.

Wafertech, the City's largest individual water user, is in the planning stages of expanding its current manufacturing plant. Wafertech used approximately 0.60 mgd in 2007, and it is anticipated that Wafertech will require as much as 0.70 mgd at its current capacity.

Table 3-14 summarizes the different values calculated in this chapter, and how these values are used to analyze the City's water usage.

Table 3-14 Summary of Planning Data Values

Value	Unit	Description
242	gpcd	Average day production per capita for all uses. Three-year average. See Table 3-7.
142	gpcd	Average day production per capita less industrial use and DSL (includes all residential and commercial). Three-year average. Used for Non-NUGA demand projections.
136	gpcd	2007 residential average day demand per capita. Includes residential consumption only.
116	gpcd	Residential average day demand per capita. Based on single and multifamily consumption data. Three-year average. Used for NUGA residential projections.
2.20	-	Historical average maximum day demand peaking factor. See Table 3-9. Used to convert ADD to MDD in projections.
1.80	-	2007 peaking factor to convert MDD to PHD. Used for projections.
284	gpd	2007 ERU value. The average single family residential consumption.
296	gpd	2004-2007 average ERU value. Used to convert demand projections to ERUs.

Table 3-15 Non-NUGA Water Demand Projections

Year	Non-NUGA Population	Residential, Commercial, and City Demand(1) (gpd)	Industrial Demand(2) (gpd)	DSL @ 11%(3) (gpd)	Total ADD(4) (gpd)	MDD(5) (gpd)	PHD(6) (gpm)
2008(7)	16,700	2,371,400	1,267,559	449,759	4,088,718	8,995,180	11,244
2009	17,135	2,433,178	1,364,874	469,422	4,267,475	9,388,444	11,736
2010	17,581	2,496,566	1,462,189	489,284	4,448,039	9,785,686	12,232
2011	18,039	2,561,605	1,559,503	509,351	4,630,459	10,187,010	12,734
2012	18,509	2,628,339	1,656,818	529,626	4,814,783	10,592,522	13,241
2013	18,992	2,696,811	1,754,133	550,117	5,001,060	11,002,332	13,753
2014	19,486	2,767,067	1,851,447	570,828	5,189,341	11,416,551	14,271
2015	19,994	2,839,153	1,948,762	591,765	5,379,679	11,835,295	14,794
2016	20,515	2,913,117	2,046,076	612,934	5,572,127	12,258,680	15,323
2017	21,049	2,989,008	2,143,391	634,341	5,766,740	12,686,828	15,859
2018	21,598	3,066,876	2,240,706	655,993	5,963,575	13,119,864	16,400
2019	22,160	3,146,772	2,338,020	677,896	6,162,688	13,557,914	16,947
2020	22,738	3,228,750	2,435,335	700,055	6,364,141	14,001,109	17,501
2021	23,330	3,312,864	2,532,650	722,479	6,567,993	14,449,584	18,062
2022	23,938	3,399,169	2,629,964	745,174	6,774,307	14,903,475	18,629
2023	24,561	3,487,722	2,727,279	768,146	6,983,147	15,362,923	19,204
2024	25,201	3,578,582	2,824,594	791,404	7,194,579	15,828,075	19,785
2025	25,858	3,671,809	2,830,000	803,594	7,305,404	16,071,888	20,090
2026	26,531	3,767,465	2,830,000	815,417	7,412,882	16,308,341	20,385
2027	27,223	3,865,613	2,830,000	827,548	7,523,161	16,550,954	20,689
2028	27,932	3,966,318	2,830,000	839,994	7,636,312	16,799,887	21,000
2029	28,659	4,069,646	2,830,000	852,765	7,752,411	17,055,305	21,319

(1) Non-NUGA Population * 142 gpcd, 142 gpcd is equal to the average of total production from 2005 to 2007 less industrial demand and DSL, divided by the population. Spread linearly based on buildout by 2025. Total of 710 acres, and 3,000 gallons per day per acre, plus 700,000 gpd for Wafertech.

(2) Spread linearly based on buildout by 2025. Total of 710 acres, and 3,000 gallons per day per acre, plus 700,000 for Wafertech.

(3) DSL = Total ADD * 0.11

(4) Total ADD = Sum(Residential, Commercial, City, and Industrial Demand) / 0.89

(5) MDD = ADD * 2.2

(6) PHD = MDD * 1.8 / (24 * 60)

(7) 2008 is actual data from OFM and is not projected, 2009 OFM data shows a population of 16,950. Methodology for population projection is described on page 3-10.

Table 3-16 NUGA Water Demand Projections

Year	NUGA Population	Residential Demand(1) (gpd)	LI/BP Demand(2) (gpd)	Commercial Demand(3) (gpd)	DSL @ 11%(4) (gpd)	Total ADD(5) (gpd)	MDD(6) (gpd)	PHD(7) (gpm)
2008	-	-	-	-	-	-	-	-
2009	-	-	-	-	-	-	-	-
2010	-	-	-	-	-	-	-	-
2011	777	90,186	4,286	2,923	12,038	109,433	240,753	301
2012	1,555	180,372	8,573	5,846	24,075	218,866	481,506	602
2013	2,332	270,558	12,859	8,769	36,113	328,299	722,258	903
2014	3,110	360,745	17,146	11,692	48,151	437,732	963,011	1,204
2015	3,887	450,931	21,432	14,615	60,188	547,165	1,203,764	1,505
2016	4,665	541,117	25,718	17,538	72,226	656,599	1,444,517	1,806
2017	5,442	631,303	30,005	20,460	84,263	766,032	1,685,270	2,107
2018	6,220	721,489	34,291	23,383	96,301	875,465	1,926,022	2,408
2019	6,997	811,675	38,578	26,306	108,339	984,898	2,166,775	2,708
2020	7,775	901,861	42,864	29,229	120,376	1,094,331	2,407,528	3,009
2021	8,552	992,047	47,150	32,152	132,414	1,203,764	2,648,281	3,310
2022	9,330	1,082,234	51,437	35,075	144,452	1,313,197	2,889,034	3,611
2023	10,107	1,172,420	55,723	37,998	156,489	1,422,630	3,129,786	3,912
2024	10,885	1,262,606	60,010	40,921	168,527	1,532,063	3,370,539	4,213
2025	11,662	1,352,792	64,296	43,844	180,565	1,641,496	3,611,292	4,514
2026	11,662	1,352,792	64,296	43,844	180,565	1,641,496	3,611,292	4,514
2027	11,662	1,352,792	64,296	43,844	180,565	1,641,496	3,611,292	4,514
2028	11,662	1,352,792	64,296	43,844	180,565	1,641,496	3,611,292	4,514
2029	11,662	1,352,792	64,296	43,844	180,565	1,641,496	3,611,292	4,514

(1) Linearly distributed based on a total buildout population of 11,662 (determined from the City and in the *North UGA Expansion Water and Sewer Infrastructure Analysis* by Gray & Osborne in September 2007) and 116 gpcd. 116 gpcd is equal to the average residential consumption from 2005 to 2007, divided by the population.

(2) Linearly distributed based on total employees on the developable acreage, 2,819 (determined from the City and in the *North UGA Expansion Water and Sewer Infrastructure Analysis* by Gray & Osborne in September 2007) and 18 gpd/employee from the *Washington DOH Water System Design Manual*.

(3) Linearly distributed based on the developable acreage, 66.4 (determined from the City and in the *North UGA Expansion Water and Sewer Infrastructure Analysis* by Gray & Osborne in September 2007) and 660 gpd/acre for commercial use. This value was determined based on the average commercial water use in 2007, 150,000 gpd, over the existing 227 commercial acres in the City (150,000 / 227 = 660 gpd/acre).

(4) DSL = Total ADD * 0.11

(5) NUGA Total ADD = Sum(Residential , LI/BP, and Commercial Consumption) / 0.89

(6) NUGA MDD = NUGA ADD * 2.2

(7) NUGA PHD = NUGA MDD * 1.8 / (24 * 60)

Table 3-17 Total City and NUGA Water Demand Projections

Year	Total Population	Total Residential, Commercial, LI, and BP Demand (gpd)	Total Industrial Demand (gpd)	Total DSL @ 11% (gpd)	Total ADD (gpd)	Total MDD (gpd)	Total PHD (gpm)
2008	16,700	2,371,400	1,267,559	449,759	4,088,718	8,995,180	11,244
2009	17,135	2,433,178	1,364,874	469,422	4,267,475	9,388,444	11,736
2010	17,581	2,496,566	1,462,189	489,284	4,448,039	9,785,686	12,232
2011	18,817	2,659,001	1,559,503	521,388	4,739,892	10,427,763	13,035
2012	20,064	2,823,130	1,656,818	553,701	5,033,649	11,074,028	13,843
2013	21,324	2,988,997	1,754,133	586,230	5,329,359	11,724,590	14,656
2014	22,596	3,156,648	1,851,447	618,978	5,627,074	12,379,562	15,474
2015	23,881	3,326,130	1,948,762	651,953	5,926,845	13,039,059	16,299
2016	25,180	3,497,490	2,046,076	685,160	6,228,726	13,703,197	17,129
2017	26,492	3,670,776	2,143,391	718,605	6,532,772	14,372,098	17,965
2018	27,817	3,846,039	2,240,706	752,294	6,839,039	15,045,887	18,807
2019	29,158	4,023,331	2,338,020	786,234	7,147,586	15,724,689	19,656
2020	30,512	4,202,705	2,435,335	820,432	7,458,472	16,408,637	20,511
2021	31,882	4,384,214	2,532,650	854,893	7,771,757	17,097,865	21,372
2022	33,267	4,567,914	2,629,964	889,625	8,087,504	17,792,508	22,241
2023	34,668	4,753,863	2,727,279	924,635	8,405,777	18,492,710	23,116
2024	36,086	4,942,118	2,824,594	959,931	8,726,643	19,198,614	23,998
2025	37,520	5,132,741	2,830,000	984,159	8,946,900	19,683,180	24,604
2026	38,193	5,228,397	2,830,000	995,982	9,054,379	19,919,633	24,900
2027	38,885	5,326,545	2,830,000	1,008,112	9,164,657	20,162,246	25,203
2028	39,594	5,427,250	2,830,000	1,020,559	9,277,809	20,411,179	25,514
2029	40,321	5,530,578	2,830,000	1,033,330	9,393,908	20,666,597	25,833

(1) The sum of Non-NUGA Demands from Table 3-15, and NUGA Demands from Table 3-16.

For comparison purposes, Table 3-18 shows the breakdown of ERUs for the total production in 2007. The total number of ERUs in 2007 was 13,269.

Table 3-18 2007 ERU Distribution

Customer Type	Total Demand (gpd)	Number of Connections(1)	Equivalent Residential Units(2)	ERUs per Unit
Single-Family	1,730,505	6102	6,102	1.00
Multi-Family	66,213	405	233	0.58
Commercial	149,928	219	529	2.41
Industrial	1,175,651	29	4,146	142.95
City	17,690	35	62	1.78
Irrigation	194,050	158.5	684	4.32
Hydrants	10,181	43	36	0.83
NA	3,513	0	12	-
DSL	415,271	0	1,464	-
Total	**3,763,001**	**6,992**	**13,269**	

(1) Number of connections for each customer class is equal to the average end of year connection values from 2006 and 2007.

(2) ERUs = Total Demand / 283.6 gpd per ERU

The 2007 ERU value is based on actual data single family data from 2007. The ERU value for 2007 is 283.6 gpd/ERU.

The following table represents the 2007 ERU distribution without industrial demand or DSL. This data is used to separate the non-NUGA demand projections from Table 3-15, Column 3 by customer type.

Table 3-19 2007 ERU Distribution (less Industrial and DSL)

Customer Type	Demand (gpd)	Equivalent Residential Units(1)	Percentage of Total ERUs (2)
Single-Family	1,730,505	6,102	0.80
Multi-Family	66,213	233	0.03
Commercial	149,928	529	0.07
City	17,690	62	0.01
Irrigation	194,050	684	0.09
Hydrants	10,181	36	0.00
NA	3,513	12	0.00
Total	**2,172,079**	**7,659**	**1.0**

(1) Equal to the annual consumption divided by 283.6 gpd/ERU

(2) Equal to the number of ERUs for each customer class divided by 7,659

The following tables project ERUs for the City through the 20-year planning period. These projections are based on an average ERU value from 2004 to 2007. The following projections use a value of 296 gpd/ERU.

Table 3-20 Non-NUGA ERU Projections

Year	Residential(1)	Commercial(2)	City(3)	Irrigation(4)	Industrial(5)	DSL @11%(6)	Total ERUs(7)
2008	6,650	561	80	721	4,282	1,519	13,813
2009	6,823	575	82	740	4,611	1,586	14,417
2010	7,001	590	84	759	4,940	1,653	15,027
2011	7,183	606	87	779	5,269	1,721	15,643
2012	7,370	622	89	799	5,597	1,789	16,266
2013	7,562	638	91	820	5,926	1,859	16,895
2014	7,759	654	93	841	6,255	1,928	17,532
2015	7,961	671	96	863	6,584	1,999	18,175
2016	8,169	689	98	886	6,912	2,071	18,825
2017	8,381	707	101	909	7,241	2,143	19,482
2018	8,600	725	104	932	7,570	2,216	20,147
2019	8,824	744	106	957	7,899	2,290	20,820
2020	9,054	764	109	982	8,227	2,365	21,500
2021	9,289	783	112	1,007	8,556	2,441	22,189
2022	9,531	804	115	1,034	8,885	2,517	22,886
2023	9,780	825	118	1,060	9,214	2,595	23,592
2024	10,035	846	121	1,088	9,543	2,674	24,306
2025	10,296	868	124	1,116	9,561	2,715	24,680
2026	10,564	891	127	1,146	9,561	2,755	25,044
2027	10,839	914	131	1,175	9,561	2,796	25,416
2028	11,122	938	134	1,206	9,561	2,838	25,798
2029	11,412	962	137	1,237	9,561	2,881	26,191

(1) Residential ERUs = SF + MF ERU percentage from Table 3-17 (0.83)* third column in Table 3-15.
(2) Commercial ERUs = Commercial ERU percentage from Table 3-19 (0.07) * third column in Table 3-15.
(3) City ERUs = City ERU percentage from Table 3-19 (0.01) * third column in Table 3-15.
(4) Irrigation ERUs = Irrigation ERU percentage from Table 3-19 (0.09) * third column in Table 3-15.
(5) Industrial ERUs = Industrial Demand from Table 3-15, Column 4 / 296 gpd per ERU.
(6) DSL ERUs = DSL Demand from Table 3-15, Column 5 / 296 gpd per ERU.
(7) Total ERUs = sum of Residential, Commercial, City, Irrigation, Industrial, and DSL ERUs.

Table 3-21 NUGA ERU Projections

Year	Residential(1)	LI/BP(2)	Commercial(3)	DSL @ 11%(4)	Total ERUs(5)
2008	-	-	-		-
2009	-	-	-		-
2010	-	-	-		-
2011	305	14	10	41	370
2012	609	29	20	81	739
2013	914	43	30	122	1,109
2014	1,219	58	39	163	1,479
2015	1,523	72	49	203	1,849
2016	1,828	87	59	244	2,218
2017	2,133	101	69	285	2,588
2018	2,437	116	79	325	2,958
2019	2,742	130	89	366	3,327
2020	3,047	145	99	407	3,697
2021	3,352	159	109	447	4,067
2022	3,656	174	118	488	4,436
2023	3,961	188	128	529	4,806
2024	4,266	203	138	569	5,176
2025	4,570	217	148	610	5,546
2026	4,570	217	148	610	5,546
2027	4,570	217	148	610	5,546
2028	4,570	217	148	610	5,546
2029	4,570	217	148	610	5,546

(1) Residential ERUs = Residential Demand from Table 3-16, Column 3 / 296 gpd per ERU.
(2) LI/BP ERUs = LI/BP Demand from Table 3-16, Column 4 / 296 gpd per ERU.
(3) Commercial ERUs = Commercial Demand from Table 3-16, Column 5 / 296 gpd per ERU.
(4) DSL ERUs = DSL Demand from Table 3-16, Column 6 / 296 gpd per ERU.
(5) Total ERUs = Sum of Residential, LI/BP, Commercial, and DSL ERUs.

Table 3-22 Total ERU Projections(1)

Year	Residential	Commercial	Industrial, LI, and BP	City	Irrigation	DSL	Total ERUs
2008	6,650	561	4,282	80	721	1,519	13,813
2009	6,823	575	4,611	82	740	1,586	14,417
2010	7,001	590	4,940	84	759	1,653	15,027
2011	7,488	616	5,283	87	779	1,761	16,013
2012	7,979	641	5,626	89	799	1,871	17,006
2013	8,476	667	5,970	91	820	1,981	18,005
2014	8,978	694	6,313	93	841	2,091	19,010
2015	9,485	721	6,656	96	863	2,203	20,023
2016	9,997	748	6,999	98	886	2,315	21,043
2017	10,514	776	7,343	101	909	2,428	22,070
2018	11,037	804	7,686	104	932	2,542	23,105
2019	11,566	833	8,029	106	957	2,656	24,147
2020	12,100	862	8,372	109	982	2,772	25,198
2021	12,641	892	8,716	112	1,007	2,888	26,256
2022	13,188	922	9,059	115	1,034	3,005	27,323
2023	13,741	953	9,402	118	1,060	3,124	28,398
2024	14,300	985	9,745	121	1,088	3,243	29,482
2025	14,866	1,016	9,778	124	1,116	3,325	30,226
2026	15,134	1,039	9,778	127	1,146	3,365	30,589
2027	15,410	1,062	9,778	131	1,175	3,406	30,962
2028	15,692	1,086	9,778	134	1,206	3,448	31,344
2029	15,982	1,180	9,778	137	1,237	3,491	31,805

(1) The sum of Non-NUGA ERU projection from Table 3-20 and NUGA ERU projections from Table 3-21.

BUILDOUT PROJECTIONS

Buildout projections have been developed using the assumptions described in previous sections for areas within the City limits and the Urban Growth Area (UGA). Ultimate buildout is estimated to occur by 2038. The average daily demand within the city limits and UGA includes Phase I of Waftertech and is 10.58 million gallons per day (mgd), or 11,856 acre-feet per year (ac-ft/yr).

The ultimate water uses for the City include Phases II and III of the Waftertech expansion and buildout within the City's water service boundary (WSB) as defined in the Coordinated Water System Plan (CWSP), which includes areas outside of the city limits and UGA. The acreage within the WSB that was not included in the original analysis is 3,151 acres. Using an estimate of three dwelling units per acre, an additional

9,454 equivalent residential units (ERUs) are estimated within the WSB and outside of the city limits and UGA. Based on the ERU value of 296 gpd/ERU, an additional 2.79 mgd, or 3,134 ac-ft/yr, are anticipated within the WSB.

The ultimate expansion of Waftertech Phase III has a demand of 3.50 mgd. Phase I includes 0.70 mgd for Waftertech. Therefore, an additional 2.80 mgd, or 3,136 ac-ft/yr, from Wafertech must be accounted for at ultimate buildout for the City. The following table summarizes the demands that can be expected for the City at buildout.

Table 3-23 Total Buildout Demands

Demand Source	ADD (mgd)	Annual Demand (acre-ft)
WSP – City Limits, UGA, Wafertech Phase I	10.58	11,856
WSB	2.79	3,136
Wafertech Phase II and III	2.80	3,136
Total Buildout Demands	16.17	18,126

Chapter 4
SYSTEM ANALYSIS

INTRODUCTION

The purpose of this chapter is to determine if the existing water system facilities are able to supply sufficient quality and quantity of water to meet existing and projected demands. In this section, three major planning components will be analyzed in detail:

- Water Quality Analysis
- System Component Analysis
- Summary of Deficiencies

The design and construction standards identify the standards that apply to the City's water system facilities. The system component analyses compare the various design standards to the City's existing facilities. Based on these analyses, a summary of deficiencies is provided. Recommended improvements, project costs, and prioritization of recommended improvements are presented in Chapter 8 of this report.

WATER SYSTEM STANDARDS

The City complies with water quality standards established by the Washington State Department of Health.

Design standards established by the Washington State Department of Health are used to evaluate the City's water system in this Chapter.

The City has updated construction standards in May 2007. The water details can be found in Appendix E.

WATER QUALITY ANALYSIS

The City obtains its water from both surface water and groundwater sources. All of the City's sources are treated with chlorine and fluoride. Surface water is also treated via a rapid sand pressure filter plant. The City began corrosion control in April, 2000, consisting of soda ash addition at the filter plant and caustic soda addition at the groundwater sources.

The following sections provide a discussion of the water quality monitoring conducted by the City as well as the coordination with SPU for regional water quality monitoring programs.

A detailed review of the City's water quality is included in the *City of Camas Annual Drinking Water Quality Report*, located in the Appendix F. The City monitors for over 150 compounds, including turbidity, lead and copper, bacteriological contaminants, and disinfection by-products. Table 4-1 lists the City's regular water quality testing schedule. In addition to the items listed in Table 4-1, the City tests for Synthetic Organic Compounds (SOCs), radionuclides, lead and copper, and all other water quality testing required to meet DOH and EPA regulatory compliance.

Table 4-1 Water Quality Testing

Water Quality Parameter	Source(s)	Testing Frequency
Water Turbidity	Filter Plant	Continuous and daily
Coliform	Boulder Creek, Jones Creek, Distribution System	One combined monthly sample for surface water, Five weekly in distribution system
Volatile Organic Chemicals (VOCs)	Boulder Creek, Jones Creek, Wells	Every 36 months
Inorganics	Boulder Creek and Jones Creek, Wells	One combined annual sample for surface water, every 36 months for wells
Fluoride	Filter Plant Wells Distribution System	Daily Daily Four Weekly Samples
Temperature	Filter Plant	Daily
pH	Filter Plant Distribution System	Daily Continuous at Angelo and Upper Prune Hill Booster Stations Four Weekly Samples
Chlorine Residual	Filter Plant Wells Distribution System	Continuous and Daily Daily Five Weekly Samples

BACTERIOLOGICAL

All bacteriological sampling is conducted by the City at the sampling locations listed in Table 4-2. The City monitors for bacteriological contaminants in accordance with its Water Quality Monitoring Plan. The number of required monthly samples is provided annually from DOH on the Water Quality Monitoring Report. The City is required to collect 20 samples per month per WAC 246-290-300. The number of required samples is based on the population served by the water system.

The City has been in compliance with WAC regulations for sampling and follow-up actions. The City had a sample test positive for total coliform in 2007 with E. coli absent. Follow-up testing revealed that sample was negative for coliform. The coliform monitoring plan is located in Appendix H of this plan. The follow up monitoring locations are not listed in the following table, but are included in the appendix.

Table 4-2 Water Quality Monitoring Stations*

Service Area	Location
Surface Water Sources	Influent of Chlorine Plant
852 Zone - Upper Prune Hill	NW 24th and Elgin
852 Zone - Upper Prune Hill	NW 24th and Maryland
852 Zone - Upper Prune Hill	Lower Prune Hill Booster
852 Zone - Upper Prune Hill	Upper Prune Hill Booster
852 Zone - Upper Prune Hill	NW 9th and Hoquiam
852 Zone - Upper Prune Hill	SE Grandridge Drive
455 Zone - Lower Prune Hill	Forest Home Booster
455 Zone - Lower Prune Hill	Angelo Booster Station
455 Zone - Lower Prune Hill	Crown Park – NE 17th and Dallas
343 Zone - Butler	1707 NE Ione St.
343 Zone - Butler	616 NE 4th Ave.
343 Zone - Butler	NE 2nd and Yale
343 Zone - Butler	Butler Booster
343 Zone - Butler	SE 11th and Polk
542 Zone - Gregg	27200 SE Robinson Road
542 Zone - Gregg	Gregg Booster
544 Zone - Lacamas	Underwriters Lab
544 Zone - Lacamas	4302 NW Dahlia
544 Zone - Lacamas	Lacamas Booster Station
544 Zone - Lacamas	3263 NW 45th Court
544 Zone - Lacamas	Fire Station #42 (Parker Street)

*Only 20 samples are taken each month. Sample sites are rotated between locations listed.

DISINFECTION BYPRODUCTS

The Disinfection/Disinfection Byproducts (D/DBP) Rule establishes residual disinfectant concentrations and maximum contaminant levels for disinfection byproducts. The rule was implemented in two stages. Stage 1 was published in the November 1998 and became effective in December 2001. Stage 2 was published in January 2006 and compliance begins on October 1, 2013. Under Stage 2 of the D/DBP Rule, the MCLs for TTHM and HAA5 remain 80 µg/L and 60 µg/L, respectively; however, compliance with the MCL is based on the running annual average of each individual sample instead of the running annual average of all samples combined. The number of samples taken is dependent on the population served. Table 4-3 summarizes the D/DBP Rule standards.

Table 4-3 D/DBP Standards

Parameter	MCL (Final)
TTHM (Total Trihalomethanes)	80 µg/L
HAA5 (Sum of five Haloacetic Acids)	60 µg/L
Bromate	10 µg/L
Chlorite	1.0 mg/L
Residual Chlorine	4.0 mg/L

The City currently tests quarterly for disinfection byproducts and is in full compliance with the Stage 1 requirements. The City has been approved for a 40/30 certification waiver because all of their Stage 1 D/DBP sample results are below 40 µg/L for TTHM and 30 µg/L for HAA5 and they have no monitoring violations. The City received a 40/30 certification waiver for Stage 2 of the D/DBP Rule in a letter from DOH dated April 21, 2006. The City's reduced monitoring requirement is to collect a total of five TTHM and five HAA5 samples per quarter. Table 4-4 shows the results of the City's 2007 disinfection by-product testing. All results meet the EPA standards for disinfection byproducts.

Table 4-4 2007 D/DBP Test Results

Date	Test Location	HAA (5) (µg/L)	Total Trihalomethanes (µg/L)
6/13/2007	SE 8th and Polk	0.9	1.1
6/13/2007	NW 9th and Hoquam	4.3	5.6
6/13/2007	NW 18th and Beech	2.9	6.6
6/13/2007	Underwriter Lab - Camas	9.0	9.2
6/13/2007	Green Mnt. Golf Course	18.1	14.9
3/29/2007	1620 SE 8th Avenue	ND	1.5
3/29/2007	NW Maryland and 24th	6.3	6.9
3/29/2007	616 NE 4th	ND	1.0
3/29/2007	Fire Station 42	17.7	11.6
3/29/2007	27224 SE Robinson Road	6.2	8.0
8/29/2007	West End Macintosh	2.2	5.8
8/29/2007	NW 9th and Hoquam	1.7	5.9
8/29/2007	SW 6th - END	1.3	5.6
8/29/2007	616 NE 4th	ND	0.9
8/29/2007	NE 2nd and Yale	ND	2.0
12/5/2007	NE 2nd and Yale	2.7	4.3
12/5/2007	1620 SE 8th Avenue	2.0	3.1
12/5/2007	27224 SE Robinsen	9.9	12.3
12/5/2007	Underwriters Lab - Camas	2.3	2.0
12/5/2007	616 NE 4th	2.1	1.6

RESIDUAL DISINFECTANT

According to WAC 246-290-300, systems providing disinfection treatment shall measure residual disinfectant concentration within the distribution system when taking routine or repeat coliform samples. The City is required to maintain a minimum chlorine residual of 0.2 mg/L throughout its distribution system. To ensure adequate chlorine residual, the City monitors the filter plant effluent continuously, and takes daily samples of the filter plant influent and at each of the groundwater wells. The City also tests five distribution samples each week for chlorine residual, to ensure adequate levels are being maintained throughout the distribution system. City records indicate that chlorine residual in the distribution system typically ranges between 0.5 and 1.2 mg/L.

VOLATILE ORGANIC CHEMICALS

The City tests for VOCs every three years, in accordance with WAC 246-290-300. The City's last testing period occurred in September 2007 and 2006. Results indicated no detection of VOCs at the wells. The City's next round of VOC sampling is scheduled for 2009, during which time the City will test all existing wells. The City's latest VOC results are located in Appendix I.

SYNTHETIC ORGANIC CHEMICALS

The City tests for SOCs every 3 years, in accordance with WAC 246-290-300. The City's last testing period occurred in April 2007, and results indicated no detection of SOCs at the Filter plant or any of the wells. The City's next round of SOC testing is scheduled for 2010.

LEAD AND COPPER

After the Lead and Copper Rule (LCR) was adopted in 1991, the City performed a corrosion control study to determine methods to bring the water system into compliance. As a result of the study, the City has provided pH treatment to its surface water sources and groundwater sources with caustic soda. This treatment method provides the least impact on the City's customers, while raising the City's groundwater to acceptable pH levels. The City began corrosion control of its groundwater sources in April 2000. Lead and copper testing indicates that the corrosion control measures are effective. The latest lead and copper testing results are located in Appendix J.

RADIONUCLIDES

WAC 246-290-300(10) and 40 CFR 141.26 require radionuclide samples once every 4 years. A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis provided that the measured gross alpha particle activity does not exceed 5 pCi/L at a confidence level of 95 percent.

Though a radon MCL was included in the originally proposed Radionuclide Rule, it is determined that a radon MCL will now be issued as a separate rule. In November of 1999, EPA proposed a preliminary radon MCL of 300 pCi/L. EPA is considering an alternative MCL of 4,000 pCi/L if states or water purveyors implement a multimedia mitigation program aimed at reducing household indoor-air health risks from radon gas from soil as well as tap water. The date for publication of the final Radon Rule is unknown at this time.

The City began testing for radionuclides in 1995. Since that time, the City has been in compliance with all adopted radionuclide regulations. The City collected radionuclide samples for radium in 2004 and 2008. In all of the samples the result was below the detection level. The next round of radionuclide testing will be in 2012.

INORGANIC COMPOUNDS

The City tests annually for Inorganic Compounds (IOCs) in accordance with WAC 246-290-300. The City's most recent IOCs were taken in 2007, these results can be found in Appendix K. Results indicated that the City does not have any MCL violations.

GROUNDWATER UNDER THE INFLUENCE OF SURFACE WATER (GWI)

None of the City's sources are GWI. Well 4 was determined as a GWI source, but has since been abandoned. The Washougal Wellfield wells are designated as hydraulically connected to surface water. These wells, Wells 6, 7, 8, 10, 11, 12, and 13, are required to meet a CT of 6. In addition, any other sources developed within the wellfield must also meet a CT of 6. This includes Well 14, which is currently under construction, and the remaining two wells that have yet to be designed.

WATER RIGHTS ANALYSIS

A summary of the City's existing water rights is provided in Table 1-3 of Chapter 1. Both the maximum instantaneous and the annual withdrawals from surface water and groundwater sources must comply with the limitations of these water rights. A comparison of instantaneous water rights for each of the City's sources to current source pumping capacity is presented in Table 4-5.

Table 4-5 Instantaneous Water Right versus Source Capacity

Source	Instantaneous Diversion or Withdrawal (gpm)	Nominal Pumping Capacity (gpm)(1)	Water Right Surplus (+) or Deficit (-) (gpm)
Boulder Creek	1,120 [2.5 cfs]	590(2)	+530
Jones Creek	450 [1.0 cfs]	450(2)	0
Well 5	600	500	+100
Well 6	1,500	1,450	+50
Well 7	1,000	950	+50
Well 8	900	1,350	-450
Well 9	650	650	0
Well 10	900	900	0
Well 11	1,200	1,200	0
Well 12	900	900	0
Well 13	1,325	1,325	0
Wellfield Water Right(3)	500	0	+500
Future Anderson Site Well 14	1,000	0	+1,000
Future Parkers Landing	1,000	0	+1,000
Future Treatment Plant Well	1,000	0	+1,000
2008 Total	**14,045(4)**	**10,265**	**+3,780**

Table 4-5 Instantaneous Water Right versus Source Capacity (continued)

Source	Instantaneous Diversion or Withdrawal (gpm)	Nominal Pumping Capacity (gpm)(1)	Water Right Surplus (+) or Deficit (-) (gpm)
Pending Applications			
Fire Station	350	0	0
Camas Meadows	1,000	0	0

(1) Hydraulic pumping capability may vary depending on which sources are running.
(2) For the two surface water sources, pumping capacity is considered to be the maximum flow rate through the gravity pipeline system. These sources are seasonal sources which are available between November 1 and May 14, and are not available during May 15 through October 31. Surface water capacity is approximately 1,040 gpm based on meter data. This is the hydraulic limitation of the existing transmission pipeline.
(3) This is a floating water right for the Washougal Wellfield that may be used on Wells 5, 6, 7, 8, 10, 11, 12, or 13.
(4) Total does not include pending applications. All water rights are not available for use at the same time.

As demonstrated by this comparison of instantaneous water rights to source diversion and pumping capacity, a surplus water rights capacity of 3,780 gpm exists. The majority of the surplus of water rights over pumping capacity is due to the recently approved ecology applications for three future well sites. Additional capacity is due to an inability to completely utilize the Jones and Boulder Creek instantaneous water right capacity due to transmission and filter plant limitations. The City prefers to transfer surface water rights rather than upgrade the existing facilities. Currently, Jones and Boulder Creek are used as a seasonal source, and are not available between May 15 and October 31.

INSTANTANEOUS WATER RIGHTS ANALYSIS

An analysis of the ability of the City's total instantaneous water rights and pumping capacity to meet current and future water system production needs is presented in Table 4-6.

Table 4-6 Instantaneous Water Right Analysis

Year	Total Instantaneous Water Right(1) (gpm)	Maximum Day Demand (2) (gpm)	Source Capacity Surplus (+) or Deficit (-) (gpm)
2008	12,475	5,378	+7,097
2015	12,475	9,054	+3,421
2029	12,475	14,174	-1,699

(1) Jones and Boulder Creek are not available as source water during maximum day demand usage. Total instantaneous water right does not include these surface water rights.

(2) The MDD is from Table 3-17, converted from gpd to gpm.

This table demonstrates that at this time, instantaneous water rights are sufficient to meet maximum day demands for the water system. Assuming that the City develops the three wells for which they have water rights, instantaneous water rights will meet the demands in the 6-year planning period. A minimal deficiency is shown in the 20-year planning period. This deficiency can be addressed through conservation, approval of pending water right applications at the Fire Station and Camas Meadows, or other source options provided for in the WIRA Plan or allowed by Ecology. Once the pending water right applications are approved by Ecology, the City will have a deficiency of water rights in the 20-year planning period of 349 gpm.

ANNUAL WATER RIGHTS ANALYSIS

With respect to annual water withdrawal requirements, Table 4-7 provides an analysis of the City's ability to meet existing and future demands.

Table 4-7 Annual Water Right Analysis

Source	Annual Water Right (acre-feet)		Annual Source Production-2008 (acre-feet)(1)	Surplus (+) or Deficit (-) (acre-feet)
Boulder Creek	1,820 (P)		679(2)	+2,288
Jones Creek	730 (P)			
Well No. 5	920 (P)	Capped at 5,900 acre-ft per year	3,333	
Well No. 6	2,400 (P)			
Well No. 7	530 (P)			
Well No. 8	530 (P)			
Well No. 10	320 (P)			
Well No. 11	118 (P)			
Well No. 12	230 (P)			
Well No. 13	1,208 (P)			
Well No. 9	210 (S)		127	+83
Anderson Site	880 (P)		0	+880
Parkers Landing	880 (P)		0	+880
Treatment Plant Well	880 (P)		0	+880
2008 Total	**11,090 (P)** **210 (S)**		**3,460**	**+7,630 (P)(3)** **+83 (S)**

(1) Annual production values from Table 3-6, converted to acre-feet.
(2) Individual surface water source data unavailable. Annual production reflects the total source production from Boulder and Jones Creek.
(3) The surplus annual water rights shown for individual sources do not add to the total shown due to the fact that some are categorized as supplementary rights and there is a limitation to the total annual right based on conditions in Permits and Reports of Examination.
(P) Primary water right, additive to other rights.
(S) Supplemental water right, not additive or considered when summing a cumulative total of all rights.

As shown in Table 4-7, the City has sufficient annual water rights to meet existing average day demands. Based on 2008 production records, there is a surplus of 4,928 acre-feet per year.

An analysis of the ability of the City's annual water rights to meet future water system production needs is presented in Table 4-8.

Table 4-8 Analysis of Future Annual Water Rights

Year/ Demand	Total Annual Water Right (acre-ft)	Annual Demand (acre-ft)(1)	Water Right Surplus (+) or Deficit (-) (acre-ft)
2008	11,090	4,139	+6,951
2015	11,090	6,639	+4,451
2029	11,090	10,523	+567

(1) Projected water demands from Table 3-15, converted to acre-feet. Conservation is not included in Table 3-15.

Review of Table 4-8 indicates that the City has sufficient annual water rights to meet demand through the end of the 6-year planning period. If growth occurs as projected in Chapter 3, the City will need to acquire additional annual water rights to meet the demands in the 20-year planning period.

Total buildout demands were described in Chapter 3, Table 3-22. These demands include Wafertech Phase II and III, and buildout of the City's entire water system boundary. Total demands equal 18,126 acre-feet, which results in a water right deficit of 7,036 acre-feet.

FACILITY ANALYSIS

The following sections provide a facility analysis based on the ability of the system to meet the existing and projected water system demands.

SOURCE OF SUPPLY

As discussed in Chapter One, the City supplies water to its customers via two surface water sources and nine groundwater wells. The following sections describe the ability of each source to meet system demands and identify deficiencies at the sources.

Surface Water - Jones and Boulder Creeks

At the present time, the Jones and Boulder Creeks supply a maximum of 1,080 gpm to the City's water system. Based on an agreement between the City and the Department of Ecology, surface water sources are only used between November 1 and May 14. Prior to construction of the filtration plant, these sources were able to provide the entire 1,570 gpm capacity. At that time, the City did not have the head losses due to filtration, and these sources supplied the 343 Zone, rather than the higher head conditions of the 455 Zone that these sources currently supply. The capacity limitations are the 10-inch steel main between the creek intakes and the filter plant, and the capacity of the filter plant. The capacity of the City's pressure filter plant is 1,200 gpm, and the City's combined water right for these two sources is 3.5 cfs, or 1,570 gpm. Any increase in

supply from the surface water sources will require replacement of at least 4.5 miles of the 10-inch transmission main with 16-inch diameter pipe, or additional pumping.

The City is considering three long-term options for its surface water sources:

1. Continue to use Jones and Boulder Creek at its current capacity and seasonal usage from November 1 through May 14. This option is attractive because it avoids the capital costs associated with an upgrade of the filter plant and the 4.5 miles of 10-inch steel transmission main. This source is advantageous because it is one of the few sources that is not located at the Washougal Well Field, increasing the City's source reliability. This source also is fed by gravity directly into the 455 Zone, which means lower system pumping costs when compared with the City's groundwater wells.

2. Discontinue use of the surface water sources altogether and transfer all the water rights to existing groundwater sources and new groundwater sources. The City could work out a water rights transfer with Ecology to develop new well sources closer to the City in exchange for the relinquishment of the Jones and Boulder Creek sources. This would only be worthwhile to the City if it could obtain equivalent groundwater rights closer to the City.

3. Construct a new treatment facility at a new location. The treatment facility is nearing 50 years in age and is due for replacement of some of its major components. Construction of a new treatment plant at a new location could allow the City to increase the capacity to the maximum instantaneous water right. If the treatment plant were located upstream of its current location, a portion of the 10-inch steel main could be abandoned, and the reduction in main length could provide additional capacity. Further, if located properly, the new treatment plant could serve future growth in the NUGA. A new treatment method would need to be selected and pumping facilities would more than likely be required for this option.

A more in depth study will be conducted by the City in the next 6 years to determine the most cost effective and beneficial alternative.

Washougal Wellfield

The City's groundwater sources, with the exception of Well 9, are located near the Washougal River. These wells make up the Washougal Wellfield. These wells have the capacity to produce 8,575 gpm, but currently can only produce approximately

5,750 gpm. This is due to transmission deficiencies out of the 343 Zone. Specific transmission problems and solutions will be discussed in Chapter 5.

Well 6

Well 6 has a capacity of 1,450 gpm and is required to meet a CT of 6. To meet CT requirements, the City has restricted flow at Goot Park to 800 gpm from Well 6 into the downtown grid. The City also installed a check valve at the intersection of SE 6th Street and SE Polk Avenue, to allow flow from Well 6 into the Washougal Well Field, across the Washougal River and through the 18-inch transmission main to maximize the capacity of the well. As part of the Well 14 construction, a new treatment facility with on-site chlorine generation, fluoridation, caustic addition, and CT piping is being installed at the Well 6 site. The improvements will serve Well 6 and the construction of Well 14, and will maximize the wells' operational flexibility by enabling them to pump directly into the One-stop shopping area and the 343 Zone distribution grid without any flow restrictions. This project is scheduled for completion in 2009.

Well 14 – Anderson Site

Well 14 is a new well scheduled for construction in Spring 2010 and will have a capacity of 1,000 gpm. A treatment facility will be installed that will serve Well 14 and Well 6. CT will be achieved at this site, which will improve flow to the distribution system for Well 6.

SOURCE ANALYSIS

The following analysis demonstrates the sources ability to meet current and future maximum day demands. Table 4-9 assumes a 24-hour pumping period during the maximum day, and the current pumping and transmission configuration. Table 4-10 also assumes a 24-hour pumping period and current system configurations, but includes reliability by taking the largest source out of service. Well 6 is the largest source in this scenario. The surface water sources are not available during this period.

Table 4-9 Source Analysis

Year	Nominal Pumping Capacity (gpd)	MDD(1) (gpd)	Surplus/Deficit (gpd)
2008(2)	10,000,000	7,745,003	+2,254,997
2015	10,000,000	13,039,059	-3,039,059
2029	10,000,000	20,666,597	-10,666,597

(1) From projections presented in Table 3-17.

(2) Flow tests by Gray & Osborne on January 22, 2009 show that Wells 7, 8, 10, 11, 12, and 13 can produce 5,250 gpm. Assumes Well 5 operates at 500 gpm, Well 6 can produce at least 545 gpm, and Well 9 operates at 650 gpm. Total = (5,250+500+545+650)*60*24 = 10,000,000 gpd

Table 4-10 Source Analysis with Largest Source Out of Service

Year	Nominal Pumping Capacity (gpd)	MDD(1) (gpd)	Surplus/Deficit (gpd)
2008(2)	9,216,000	7,745,003	+1,470,997
2015	9,216,000	13,039,059	-3,823,059
2029	9,216,000	20,666,597	-11,450,597

(1) From projections presented in Table 3-15.

(2) Flow tests by Gray & Osborne on January 22, 2009 show that Wells 7, 8, 10, 11, 12, and 13 can produce 5,250 gpm. Assumes Well 5 operates at 500 gpm, and Well 9 operates at 650 gpm. Well 6 is the largest source when operating by itself, and is assumed out of service for reliability. Total = (5,250+500+650)*60*24 = 9,216,000 gallons

Each source analysis scenario shows a significant source deficit in the 6 and 20-year planning periods. The wells are not capable of pumping to their full capacities due to transmission issues. If the existing wells were utilized to their full pumping capacity, the City would have a maximum day pumping capacity of 13,664,000 gallons. This would sustain the City through the 6-year planning period.

With the addition of the three 1,000 gpm wells, the City would have a maximum day pumping capacity of 17,964,000 gallons, assuming full transmission capability. This volume would require approximately 2.7 MG of additional capacity to support the City through the 20-year planning period.

NUGA ZONE

Initial development within the NUGA is anticipated to occur within two areas. The first area is within the southeast portion in and around the Gregg Annexation area, while the second is within the northwest portion in and around Green Mountain. Subsequent growth is expected to occur in the area between the southeast and northwest. For the purpose of this analysis, the southeast portion of the NUGA will be referred to as NUGA (Gregg), and the northwest portion of the NUGA will be referred to as NUGA (Green Mountain).

The pressure zones for the NUGA are based on existing hydraulic gradients within the City's water system. The NUGA (Green Mountain) is proposed to be part of the City's existing 544 Zone, which is served by the Lacamas Reservoir. As the NUGA (Gregg) develops, it will be part of the 542 Zone, and served by the Gregg Reservoir. However, as development continues, it is expected that the 542 Zone and the 544 Zone will eventually merge and become a single 544 Zone, with the installation of an altitude valve on the Gregg Reservoir.

DEMAND DISTRIBUTION BY ZONE

To accurately distribute demand requirements throughout the City's facilities, 2008 demands are divided amongst the five major service regions (Butler, Lower Prune Hill, Upper Prune Hill, Lacamas, and Gregg) and assigned to the storage facility that serves that region. Demands are established based on the wells and booster stations that serve each zone. Projections are based on the total demands established in Chapter 3. A modest growth rate of one percent is assumed for the Butler Reservoir; Lower Prune Hill Reservoirs, and existing Gregg Reservoir service areas. NUGA demands have been established separately in Chapter 3. The Upper Prune Hill projections are based on a technical memo titled *Upper Prune Hill Buildout Potential* (Gray and Osborne, June 2008). The remaining demands are assigned to the Lacamas Reservoir service area. Table 4-11 below summarizes the projection demands by reservoir service area used throughout the Plan.

Table 4-11 Demand Distribution by Zone

Zone	2008(1)			2015		2029	
	ADD (gpd)	MDD (gpd)	Peaking Factor	ADD (gpd)	MDD (gpd)	ADD (gpd)	MDD (gpd)
343 - Butler	839,693	1,437,128	1.71	900,265	1,540,796	1,034,831	1,771,105
455 - LPH	439,898	778,086	1.77	471,630	834,213	542,127	958,907
542 - Gregg	106,928	294,382	2.75	114,641	315,617	131,777	362,794
542 – NUGA Gregg	0	0	0	273,586	601,882	820,748	1,805,646
542 - Total	106,928	294,382	2.75	388,227	917,499	952,525	2,168,440
544 - Lacamas	1,066,043	2,390,433	2.24	2,255,820	5,396,916	3,617,539	8,409,190
544 – NUGA Green Mtn.	0	0	0	273,586	601,882	820,748	1,805,646
544 - Total	1,066,043	2,390,433	2.24	2,529,406	5,998,798	4,438,287	10,214,836
852 - UPH	1,242,917	2,844,974	2.29	1,637,324	3,747,752	2,426,138	5,553,309
TOTAL	**3,695,479**	**7,745,003**	**2.15**	**5,926,845**	**13,039,059**	**9,393,908**	**20,666,597**

(1) 2008 values based on actual data.

A summary of the pumping capacity for each zone is presented in Table 4-12.

Table 4-12 Available Pumping Capacity by Zone

Source	Nominal Pumping Capacity (gpm)
Zone 343 - Butler	
Well 5	500
Well 6	545(1)
Well 7	5,250(2)
Well 8	
Well 10	
Well 11	
Well 12	
Well 13	
343 Total	6,295
Zone 455 - LPH	
Forest Home	1,000
Butler	1,400
Angelo	3,500
455 Total	5,900
Zone 542 - Gregg	
Old Gregg	500
New Gregg	1,500
542 Total	2,000
Zone 544 - Lacamas	
Lacamas	1,200
Well 9	650
544 Total	1,850
Zone 852 - UPH	
LPH	2,500
852 Total	2,500

(1) Well 6 is assumed to be capable of supplying at least 545 gpm with the rest of the wells in service.

(2) Pump tests performed on January 22, 2009 indicate that these wells are capable of pumping 5,250 gpm.

PUMPING ANALYSIS

The pumping analysis shown below in Table 4-13 is based on the demand distributions presented in Table 4-11, and the existing pumping capacities of each zone presented in Table 4-12.

Table 4-13 Maximum Day Pumping Capacity (MGD)

Zone	Nominal 24-hour Pumping Capacity(1)	2008		2015		2029	
		MDD	Surplus/ Deficit	MDD	Surplus/ Deficit	MDD	Surplus/ Deficit
343 – Butler(2)	9.06	6.81	2.26	12.10	(3.04)	19.73	(10.67)
455 – LPH(3)	8.50	5.37	3.12	10.56	(2.07)	17.96	(9.46)
542 – Gregg(4)	2.88	0.29	2.59	0.32	2.56	0.36	2.52
542 – NUGA Gregg(4)	-	-	-	0.60	(0.60)(5)	1.81	(1.81)
542 - Total	2.88	0.29	2.59	0.92	1.96	2.17	0.71
544 – Lacamas(4)	2.66	2.39	0.27	5.40	(2.73)	8.41	(5.75)
544 – NUGA Green Mtn.	-	-	-	0.60	(0.60)	1.81	(1.81)
544 - Total	2.66	2.39	0.27	6.00	(3.33)	10.22	(7.56)
852 – UPH(4)	3.60	2.84	0.76	3.75	(0.15)	5.55	(1.95)

(1) Pumping capacity from Table 4-12, and converted mgd.
(2) The 343 Zone maximum day demands include the demands for all of the zones, less the supply from Well 9, because all zones rely on water from the Butler zone for supply.
(3) The 455 Zone maximum day demands include demands from the 542, 544, and 852 zones, less the supply from Well 9. Water supply for these zones must pass through the Lower Prune Hill zone.
(4) The maximum day demands for these zones only include the volume required to meet each zones demand. No water leaves these zones to supply other areas of the system.
(5) The existing Gregg booster stations are capable of supplying the NUGA Gregg through 2029; however, deficits in the 343 and 455 Zone require additional pumping capacity.

With the development of the NUGA, 544, and 852 Zones, pumping and/or source facilities must be developed in order to serve these areas within the 20-year planning period. The existing facilities that currently serve the 542 Gregg zone will be sufficient to serve the NUGA Gregg through the 20-year planning period. The deficiencies in the 343 Zone will be improved by increasing transmission from the Washougal Wellfield to the distribution system. These improvements will be discussed in detail in Chapter 5.

The Crown Road Booster Pump Station is a project planned for construction and has already been designed. The station will pump from the Washougal Wellfield to the 544 zone. As the NUGA begins to develop, the City will eventually combine the 542 and

544 zones in order to better serve the area. Initially, the capacity of the station will be 3,200 gpm, with the potential to expand to 4,800 gpm. Table 4-14 shows the pumping analysis with the Crown Road Booster Station operating at 3,200 gpm into the 544 zone.

Table 4-14 Future Maximum Day Pumping Capacity (MGD)

Zone	Nominal 24-hour Pumping Capacity(1)	2008		2015		2029	
		MDD	Surplus/ Deficit	MDD	Surplus/ Deficit	MDD	Surplus/ Deficit
343 – Butler(2)	11.06	6.81	2.26	12.10	(1.04)(3)	19.73	(8.67)
455 – LPH(4)	8.50	2.98	5.52	5.95	2.55	13.35	(4.85)
544 – Gregg, NUGA, Lacamas(5)	10.15	2.68	7.47	6.92	3.24	12.38	(2.23)
852 – UPH(6)	3.60	2.84	0.76	3.75	(0.15)(7)	5.55	(1.95)

(1) Pumping capacity from Table 4-12, and converted mgd. 544 Zone includes 3,200 gpm from Crown Road Booster Station. 343 Zone includes an estimated 2.0 mgd of increased pumping capacity due to transmission improvements associated with Crown Road Booster Station.

(2) The 343 Zone maximum day demands include the demands for all of the zones, less the supply from Well 9, because all zones rely on water from the Butler zone for supply. The addition of Crown Road Booster Station will increase the pumping capacity of the Washougal Wellfield, and the deficit will be reduced.

(3) The construction of Well 14 will produce an additional 1.44 mgd to the 343 Zone and eliminate this deficiency.

(4) The 455 Zone maximum day demands include demands from the 542, 544, and 852 zones, less the supply from Well 9 and the supply from Crown Road Booster Station. Water supply for these zones must pass through the Lower Prune Hill zone.

(5) Maximum day demand for this zone is the addition of the demands from the Gregg, NUGA, and Lacamas zones.

(6) The maximum day demand for this zone only includes the volume required to meet demands within UPH.

(7) This deficit will be eliminated with a temporary portable 125 gpm booster pump.

Additional pumping improvements needed within the 6 and 20-year planning period will be discussed later in this chapter.

STORAGE ANALYSIS

The City currently has seven reservoirs with a combined storage capacity totaling 8.45 MG. A storage analysis was completed for the City's water service area. In order to determine whether or not the existing storage facilities operated by the City are adequate to meet existing and future demands on the system, the required volumes of the following five storage components need to be calculated.

- Operational Storage
- Equalizing Storage
- Standby Storage
- Fire Suppression Storage
- Dead Storage

The formulas for calculating these components of the storage requirements are provided in the DOH 2001 Water System Design Manual.

OPERATIONAL STORAGE

Operational storage is the volume of water that is used under normal operating circumstances. Water level sensors installed at storage facilities are used to control pump operations, and the volume of water used between the "on" and "off" set-points is the operational storage volume. In the case of Butler Reservoir, if the reservoir water level drops 3 feet, a well is called which will pump until the Butler Reservoir is full again. The 3 feet of storage comprises the operational storage of the Butler Reservoir. Table 4-15 shows the operational storage requirements for the City.

Table 4-15 Operational Storage

Reservoir	Volume/Height (gallon/ft.)	Pump Call Level (ft.)	Operational Storage (Gal.)
343 - Butler	80,000	3	240,000
455 - Lower Prune Hill No. 1	21,740	2.5	54,400
455 - Lower Prune Hill No. 2	65,217	2.5	163,000
542 - Gregg	1,430	10	14,300
544 - Lacamas	44,444	6	266,700
852 - Upper Prune Hill Standpipe	7,500	10	75,000
852 - Upper Prune Hill Reservoir	37,500	5	187,500
Total			**1,000,900**

EQUALIZING STORAGE

Equalizing storage must be provided as part of the total storage for the system to provide water during periods of peak demand that cannot be met by the source production capacity. In order to determine the amount of equalizing storage required by the City, the following equation was used from the DOH Design Manual:

$ES = (PHD - Q_s)(150 \text{ min.})$

Where: ES = Equalizing storage, in gallons

PHD = Peak hourly demand, in gpm

Q_s = Sum of all active sources of supply, in gpm

The amount of equalizing storage required in each reservoir is calculated based on the percentage of the total demand that is used in each pressure zone, and applied to the total equalizing storage required. Table 4-16 provides the projected equalizing storage distribution required through build-out. The demands for the 343 and 455 Zones are based on the peak hour demand for the zone, plus the pumping capacity from the zone to the upper zones.

Table 4-16 Equalizing Storage Distribution

Zone	2008			2015		2029	
	Peak Hour Demand (gpm)(1)	Qs (gpm)(2)	ES (gallons)	Peak Hour Demand (gpm)(1)	ES (gallons)	Peak Hour Demand (gpm)(1)	ES (gallons)
343 - Butler	7,696	6,295	210,212	7,826	229,652	8,114	272,832
455 - LPH	4,823	5,900	-	4,893	-	5,049	-
542 - Gregg	325	2,000	-	395	-	453	-
542 – NUGA Gregg	-	-	-	723	112,854	2,257	338,559
542 - Total	-	-	-	1,148	112,854	2,710	338,559
544 - Lacamas	2,988	1,850	170,706	6,746	734,433	10,511	1,299,223
544 – NUGA Green Mtn.	-	-	-	723	112,854	2,257	338,559
544- Total	2,988	1,850	170,706	7,469	847,287	12,768	1,637,782
852 - UPH	3,556	2,500	158,433	4,685	327,711	6,942	666,245

(1) Based on the total peak hour demand for the system, presented in Table 3-16, and distributed based on the percentage of total ADD for each Zone, as presented in Table 4-11. PHD for the 343 includes the demand for the 343 Zone and 5,900 gpm, the maximum pumping capacity out of the 343 Zone. PHD for the 455 Zone includes the demand for the 455 Zone and 3,850 gpm, the maximum pumping capacity out of the 455 Zone.

(2) From Table 4-12.

FIRE SUPPRESSION STORAGE

Water systems must be capable of delivering fire flows in accordance with the adopted fire flow requirements. The maximum adopted fire flow requirement for the City is equal to 5,000 gpm for 4 hours. The required fire suppression storage is the product of the fire flow rate and duration, or 1.20 MG. Minimum residential fire flow requirements are 1,000 gpm, and minimum commercial and industrial fire flow requirements are 1,500 gpm. Table 4-17 shows the maximum fire flow requirements for each of the City's storage facilities.

Table 4-17 Fire Suppression Storage

Reservoir	Greatest Fire Flow Requirement (gpm)	Time Requirement (Hrs)	Storage Requirement (MG)	Location
343 - Butler	4,000	4	0.96	Camas High School, Businesses-4th and Franklin
455 - LPH	4,000	4	0.96	Georgia Pacific -10th and Benton
542 - Gregg	2,000	2	0.24	Camas High School
542/544 - NUGA	1,500	2	0.18	Single family home
544 - Lacamas	5,000	4	1.20	Wafertech Industries
852 - UPH	2,000	2	0.24	Dorothy Fox Elementary

STANDBY STORAGE

Standby storage provides reliability for the system should sources fail or unusual conditions create higher than anticipated system demands. Standby storage is defined in the DOH manual as two times the average day demand with the largest source out of service, or 200 gallons per ERU.

For each service area, points of supply are considered, and the largest source taken out of service. For some pressure zones, such as the zones served by the Upper Prune Hill Standpipe, the largest source of supply is a booster pump.

Table 4-18 Standby Storage

Zone	2008 ERUs	2015 ERUs	2029 ERUs	2008 SBS (gallons)	2015 SBS (gallons)	2029 SBS (gallons)
343 - Butler	2,837	3,041	3,496	567,360	608,287	699,210
455 - LPH	1,486	1,593	1,832	297,228	318,669	366,302
542 - Gregg	361	387	445	72,248	77,460	89,038
542 – NUGA Gregg	-	925	2,773	-	184,853	554,560
542 - Total	361	1,312	3,218	72,248	262,313	643,598
544 - Lacamas	3,601	7,621	12,221	720,300	1,524,203	2,444,283
544 – NUGA Green Mtn.	-	925	2,773	-	184,853	554,560
544 - Total	3,601	8,546	14,994	720,300	1,709,056	2,988,843
852 - UPH	4,199	5,531	8,196	839,808	1,106,300	1,639,282
Total	**12,485**	**20,023**	**31,736**	**2,496,945**	**4,004,625**	**6,347,235**

NESTING STORAGE

Due to the large emergency storage requirements, the City has elected to nest its standby and fire suppression storage. Nesting allows the City to consolidate standby and fire suppression storage for the purpose of the storage analysis. DOH allows nesting of standby and fire suppression storage per WAC 246-290-235 (4), provided the local fire protection authority does not require them to be additive. The City Fire Marshall has indicated that nesting fire suppression and standby storage is acceptable.

DEAD STORAGE

Dead storage is the volume of unusable water stored in the reservoirs because it is not available to all customers at a minimum pressure of 30 psi. The base elevation of the Butler, Lower Prune Hill, and Lacamas Reservoirs are such that the full capacity of the reservoir can be used to supply all of its customers while maintaining 30 psi. The Gregg Reservoir and Upper Prune Hill Standpipe have dead storage levels of 32 and 67 feet, respectively. The Upper Prune Hill Reservoir has a booster station that makes all of its 2.4 MG of storage usable; however, the City does not fully deplete the reservoir, and maintains a minimum of 5 feet of storage. Table 4-19 provides a summary of the dead storage analysis.

Table 4-19 Dead Storage

Reservoir	Base Elevation (ft.)	Highest Service Elevation (ft.)	Minimum Hydraulic Grade (ft.)	Dead Storage Level (ft.)	Dead Storage (MG)
343 -Butler	328	220	289	0	-
455 - Lower Prune Hill 1	432	362	432	0	-
455 - Lower Prune Hill 2	432	362	432	0	-
542 - Gregg	472	435	504	32	0.05
544 - Lacamas	504	410	479	0	-
852 - Upper Prune Hill Standpipe	752	750	819	67	0.51
852 - Upper Prune Hill Reservoir	752	750	819	5	0.19
Total					**0.75**

TOTAL STORAGE

Tables 4-20 through 4-22 show the total storage requirements for the 6-year and 20-year planning periods. Currently, the City has a surplus of storage in the Lower Prune Hill, Lacamas, and Upper Prune Hill reservoirs, and deficiencies in the Butler and Gregg reservoirs. Transferring storage, via pumping and PRVs, from reservoirs with a surplus

of storage, alleviates current storage deficits in the Butler and Gregg and reservoirs. Additional storage for each zone, except the 852 zone, is required between the 6 and 20-year planning period. As development is expected to occur within the NUGA, an additional reservoir on Green Mountain, in the 544 zone, is an option that the City is considering.

The deficits shown in Tables 4-20 and 4-21 are for a single zone analysis. Excess storage is available in other zones to eliminate any single zone deficiencies. The City has adequate total system storage through the 6-year planning period.

The total storage analysis assumes that the existing pumping capacity of the system is constant through the 20-year planning period. The addition of source and pumping capacity reduces the required storage volume significantly, and may provide a less costly alternative to the construction of new reservoirs.

Table 4-20 2008 Storage Requirements

Zone	OS	ES	FSS	SBS	DS	Total Required	Available	Difference
	(MG)					(MG)		
343 - Butler	0.24	0.21	0.96	0.57	-	1.41	1.2	(0.21)(1)
455 - LPH	0.22	-	0.96	0.30	-	1.18	2	0.82
542 - Gregg	0.01	-	0.24	0.07	0.05	0.30	0.1	(0.20)(2)
544 - Lacamas	0.27	0.17	1.2	0.72	-	1.64	2	0.36
852 - UPH	0.26	0.16	0.24	0.84	0.70	1.96	3.15	1.19
Total System	**1.00**	**0.54**	**3.60**	**2.50**	**0.75**	**6.49**	**8.45**	**1.96**

(1) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 343 Butler Zone.
(2) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 542 Gregg Zone.

Table 4-21 2015 Storage Requirements

Zone	OS	ES	FSS	SBS	DS	Total Required	Available	Difference
	(MG)					(MG)		
343 -Butler	0.24	0.23	0.96	0.61	-	1.43	1.2	(0.23)(1)
455 - LPH	0.22	-	0.96	0.32	-	1.18	2.0	0.82
542 -Gregg	0.01	-	0.24	0.08	0.05	0.30	0.1	(0.20)(2)
542 –NUGA Gregg	0.08	0.11	0.09	0.18	-	0.37	0.0	(0.37)(3)
542 - Total	0.09	0.11	0.24	0.26	0.05	0.51	0.10	(0.41)
544 -Lacamas	0.27	0.73	1.20	1.52	-	2.53	2.00	(0.53)(4)
544 – NUGA Green Mtn.	0.08	0.11	0.09	0.18	-	0.37	-	(0.37)(3)
544 - Total	0.34	0.85	1.20	1.71	-	2.90	2.00	(0.90)
852 - UPH	0.26	0.33	0.24	1.11	0.70	2.39	3.15	0.76
Total	**1.15**	**1.52**	**3.60**	**4.00**	**0.75**	**8.41**	**8.45**	**0.04**

(1) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 343 Butler Zone.
(2) Excess storage in the 455 LPH Zone eliminates the deficit shown in the 542 Gregg Zone.
(3) NUGA growth is dependent on the construction of additional storage by developers.
(4) Excess storage in the 852 UPH Zone eliminates the deficit shown in the 544 Lacamas Zone.

Table 4-22 2029 Storage Requirements

Zone	OS	ES	FSS	SBS	DS	Total Required	Available	Difference
	(MG)					(MG)		
343 -Butler	0.24	0.27	0.96	0.70	-	1.47	1.2	(0.27)
455 - LPH	0.22	-	0.96	0.37	-	1.18	2.0	0.82
542 -Gregg	0.01	-	0.24	0.09	0.05	0.30	0.1	(0.20)
542 –NUGA Gregg	0.08	0.34	0.09	0.55	-	0.97	-	(0.97)
542 - Total	0.09	0.34	0.24	0.64	0.05	1.27	0.10	(1.02)
544 -Lacamas	0.27	1.30	1.20	2.44	-	4.01	2.00	(2.01)
544 – NUGA Green Mtn.	0.08	0.34	0.09	0.55	-	0.97	-	(0.97)
544 - Total	0.34	1.64	1.20	3.00	-	4.98	2.00	(2.98)
852 - UPH	0.26	0.67	0.24	1.64	0.70	3.27	3.15	(0.12)
Total	**1.15**	**2.92**	**3.60**	**6.35**	**0.75**	**12.02**	**8.45**	**(3.57)**

RECOMMENDATIONS

A summary of recommendations for the water system facilities, based on findings in the system analysis, is as follows.

Source

To maximize the City's water rights and accommodate growth, the City will make the modifications necessary to utilize all existing groundwater water rights. The primary modifications necessary to utilize the water rights within the Washougal Wellfield, are transmission improvements. Moving source water from the 343 zone to upper zones is the primary deficiency. Transmission and distribution improvements will be discussed in detail in Chapter 5, hydraulic analysis.

Additional source capacity will be provided by the three approved water right applications, totaling 3,000 gpm. Well 14, the Anderson Site Well is currently under construction. Assuming the full capacity of Well 14 can be utilized, Well 15 must be developed when an additional 9,350 ERUs are added to the system. If the Well 17 water right, the Camas Meadows Well, is approved in the 6-year planning period, it will be developed first to meet demands in the 544 Zone. The next well, Well 16 or 17, must be developed when an additional 11,475 ERUs are added to the system. This is when the MDD will exceed the City's source capacity.

The pending Camas Meadows water right application for 1,000 gpm, will be located within the NUGA once it is approved by Ecology, and developed by the City. By developing a source within the 544 Zone, pumping requirements of the 343 Zone will be reduced. The City also has a 350 gpm pending water right at the Fire Station in the 544 Zone. Both of these sources are valuable to meet increasing demands in this area. These sources shall take priority for development when approved.

The City is searching for additional sources within the NUGA and the Steigerwald area. Additional demand may be required due to unforeseen industrial growth within the area. The City will continue to search for additional sources in these areas.

A fish screen has already been installed at the headworks to Jones Creek. A screen will also be installed at the Boulder Creek headworks to improve fish passage.

Booster Stations

Lacamas

The Lacamas Booster Station, constructed in 1993, has a 2,500 gpm rated capacity, but is only able to supply 1,200 gpm at this time. The Lacamas Booster Station consists of two 500 gpm pumps, and one 1,500 gpm pump outfitted with a VFD. Flow tests with the 1,500 gpm pump have indicated that the booster station is suction side-limited by the 7,000 lineal feet of 14-inch transmission main that supplies the booster station. There is an empty port available in the booster station to install a fourth pump.

The 544 Zone will require additional pumping capacity if transmission improvements are not developed within the NUGA. The current pumping capacity of the Lacamas Booster

Station is 1.73 mgd, or 2,692 maximum day ERUs, based on a 24-hour pumping period. Well 9 supplies the 544 Zone with 0.94 mgd, or 1,458 maximum day ERUs, for a total supply of 2.66 mgd or 4,149 ERUs to the 544 Zone. The Lacamas Booster Station can support approximately 426 additional ERUs to the 544 Zone before improvements are required.

According to the WAC, transmission mains are required to maintain a minimum of 5 psi, as opposed to distribution mains which must maintain a minimum pressure of 30 psi. By reclassifying the 14-inch suction side main to the Lacamas Booster Station as a transmission main and allowing lower suction side pressure, the capacity is increased to 1,800 gpm or 2.6 mgd. This improvement increases the total pumping capacity to the 544 Zone to 3.53 mgd. Using 2008 MDD data in Table 4-13, a total of 1,750 ERUs are added to the 544 Zone once this improvement is made ([3.53 mgd – 2.39 mgd] / [296 gpd/ERU * 2.2]).

An upgrade of the Lacamas Booster Station to 2.6 mgd increases the total flow into the 544 Zone to 3.53 mgd but this will not provide enough flow to meet demands in the zone through the 6-year planning period. Significant industrial growth is anticipated within the zone, and approximately ten percent of the total 6-year demand is generated from growth within the NUGA. Options to meet the 6-year demand of 6.0 mgd in the 544 Zone include development of sources within the NUGA, replacement of the 14-inch transmission main on the suction side of the Lacamas Booster Station, or completing the NUGA transmission main along the north side of the lake to connect the 542 and 544 Zone. An upgrade to the 14-inch transmission main also requires an upgrade to the Lacamas Booster Station. Completing the NUGA transmission main along the north side of the lake requires the completion of the Crown Road Booster Station. The City will pursue the later option and limit growth within the NUGA until improvements are made.

Forest Home

The Forest Home Booster Station has a current capacity of 1,000 gpm. A pumping deficit is projected to the 455 Zone in the six year planning period. In order to meet these demands, this station shall be upgraded to 2,500 gpm, and will increase the total pumping capacity to the 455 Zone to 10.6 mgd. This will meet demands in the Zone through the 6-year planning period.

Crown Road

The Crown Road Booster Station has already been designed, and will provide 3,200 gpm, or 4.61 mgd, from the 343 Zone to the 542 Zone. This provides an additional 15,574 ERUs to the 542 Zone.

This improvement will be made within the 6-year planning period in order to increase transmission out of the 343 Zone, and to meet maximum day demands projected in the 542 Zone in 2015. When the transmission line around the north side of Lacamas Lake is completed to connect the 542 and 544 Zone, this upgrade will provide enough flow to the 544 Zone to meet maximum day demands through the 6-year planning period.

Lower Prune Hill
The Lower Prune Hill Booster Station has a rated capacity of 2,750 gpm, but can only currently supply 2,500 gpm to the 852 Zone. The City shall upgrade this station to increase the capacity to a total of 4,000 gpm, or 5.76 mgd. This will sustain the maximum day demands in the 852 Zone through the 6- and 20-year planning period.

10th Ave/Francis Booster Station
The 10th Avenue Booster Station serves approximately ten connections on the south east side of Upper Prune Hill. The City has indicated that they would like to eliminate this station by serving these connections from the 852 Zone. This improvement is scheduled for the 6-year planning period.

Upper Green Mountain
A portion of the NUGA around the Green Mountain area is above the 544 Zone and must be served by individual booster stations on an as needed basis. The timing of this project is dependent on the rate of growth within the NUGA. This project is placed in the 20-year planning period.

Transmission and Distribution
The City has a number of transmission mains that are vital to the daily operation of the City. The City will determine if an upgrade of the existing 10-inch steel transmission main is appropriate once a long-term plan for the Jones and Boulder Creek sources has been identified.

Transmission mains will need to be constructed with the Crown Road Booster Station to serve the 544 Zone. Approximately 5,400 feet of 24-inch DI transmission main is required from the discharge of the booster station to the intersection of SE 283rd Avenue and NE Nourse Road.

Additionally, transmission mains must be constructed within the NUGA in the 544 Zone to connect the Gregg NUGA and the Green Mountain NUGA. Approximately 24,800 feet of 24-inch DI transmission main is required to directly connect these portions of the NUGA. This improvement will be made within the 6-year planning period in order to meet maximum day demand projections within the 544 Zone.

If this improvement is not made, then growth in the 544 Zone will be limited by the Lacamas Booster Station. In order to meet demands, the suction side transmission

main to the Lacamas Booster Station must be upgraded to increase the capacity of the booster station. Approximately 5,000 feet of 20-inch DI transmission main must be replaced if the NUGA transmission main is not constructed.

The remaining portions of the NUGA will be served by approximately 32,500 feet of 12-inch DI transmission main. These improvements are dependent on growth within the NUGA and are placed in the 20-year planning period.

Additional analysis of the City's transmission and distribution mains will occur during the hydraulic analysis, presented in Chapter 5.

Storage

The City currently has sufficient storage to accommodate existing demands. A storage deficiency is anticipated within the 6- and 20-year planning period.

Although Table 4-20 shows a deficit in the 343 and 542 Zone, excess storage in the upper zones currently supplement the deficient zones.

In Table 4-21, excess storage in the 455 Zone will supplement the 343 Zone. Excess storage in the 852 Zone will supplement the 544 Lacamas Zone. Growth within the NUGA will be dependent on the construction of additional storage in the 544 NUGA and 542 NUGA Zones by developers. There is currently a City policy that limits growth within the 542 Gregg Zone based on available storage. These restrictions result in adequate storage through the 6-year planning horizon.

The existing Butler Reservoir was constructed more than 80 years ago and must be replaced. A leak detection test has been performed on the Butler Reservoir and revealed significant leakage. A reservoir and booster pump station at the cemetery site is scheduled as a replacement. This reservoir will provide an additional 2.0 MG of storage. It will serve the 343 Zone and a new 290 pressure zone downtown, and the booster pump will pump from the reservoir to the 455 Zone. This improvement is placed in the 20-year planning period.

The City will build a new storage facility within the existing 542 Zone. The 542 and 544 Zone each have a projected storage deficit in the 20-year planning period. The site should be large enough to accommodate at least 2.0 MG of storage, and be at an elevation suitable to serve the 544 Zone. This improvement is placed in the 20-year planning period.

The City will require an additional reservoir in the Green Mountain NUGA within 20-year planning period. This reservoir will be at an elevation of 489 feet with an overflow at 544 feet to serve the NUGA. At 75 feet in diameter, this reservoir will add

approximately 2.0 MG of storage to the zone. The following table shows the required growth in areas of the City to trigger the recommended improvement projects.

Table 4-23 Capital Improvement ERU Triggers

Project	Trigger
Source Improvements	
Well 14 – Anderson Site	Currently under construction
Well 17 – Camas Meadows Site	9,350(1) additional ERUs system wide
Well 15 – Parkers Landing Site	11,475(2) additional ERUs system wide
Well 16 – Wastewater Treatment Plant Site	13,772(3) additional ERUs system wide
Well 18 – Fire Station Well	15,984(4) additional ERUs system wide
Steigerwald Source Development	Future Demand beyond 20-year planning period
NUGA Source Development	NUGA Growth and Demand
Storage Improvements	
Cemetery Reservoir	343 Zone currently deficient, Butler Reservoir requires replacement
Gregg Reservoir	542 Zone currently deficient
Green Mountain Reservoir	1,600 additional ERUs in the NUGA 544 Zone
Booster Station Improvements	
Forest Home BS Upgrade	4,556 additional ERUs in all zones less 343
Crown Road BS	180 additional ERUs within the 542 Zone
Cemetery BS	8,120(5) additional ERUs in all zones less 343
LPH BS Upgrade	1,167 additional ERUs within the 852 Zone
Lacamas BS Upgrade	2,922(6) additional ERUs within the 544 Zone
Crown Road BS Upgrade	7,373 additional ERUs within the 542/544 Zone
Transmission Improvements	
24-inch NUGA Transmission	2,922(6) additional ERUs in the 544 Zone

(1) Assumes full water rights from Well 14 are pumped into the system. Relies on transmission improvements.
(2) Assumes full water rights from Well 14 and 17 are pumped into the system. Relies on transmission improvements.
(3) Assumes full water rights from Well 14, 17, and 15 are pumped into the system. Relies on transmission improvements.
(4) Assumes full water rights from Well 14, 17, 15, and 16 are pumped into the system. Relies on transmission improvements.
(5) Assumes upgrade of Forest Home Booster Station has been completed.
(6) The Lacamas BS Upgrade or the 24-inch NUGA transmission improvement must be made. Both not required.

Chapter 5
WATER SYSTEM HYDRAULIC ANALYSIS

INTRODUCTION

The operation of the City's municipal water system involves a variety of interactions among various water system components, including source, storage, transmission, and distribution system facilities. These interactions and their effect on the level of service provided to the City's customers are dependent on the distribution and magnitude of water demands within the system and the performance characteristics of the water system. In addition to normal diurnal demands, infrequent demand events, such as fires, can create significant stress on the water system. Such factors must be considered in analyzing the ability of the water system to meet future demands while maintaining an adequate level of customer service.

The development of a computer hydraulic model, which can simulate the response of a water system under a variety of conditions, has become an increasingly important element in the planning, design, and analysis of municipal water systems. The Washington State Department of Health's WAC 246-290 requires hydraulic modeling as a component of water system comprehensive plans. This Chapter presents the development and use of a computer hydraulic model for the City's water system.

HYDRAULIC MODELING PROGRAM

The hydraulic model of the City's water system was constructed using MWSoft's H_2O Map hydraulic modeling software that operates in a GIS environment. The H_2O Map model is configured with a graphical user interface. Each model element, including pipes, valves, pumps, and reservoirs, is assigned a unique graphical representation within the program. Each element is also assigned a number of attributes specific to its function and representation. Element attributes include spatial coordinates, elevation, water demand, pipe length, diameter, and pipe status, as well as pump and reservoir characteristics. Model input is accomplished through the creation and manipulation of these objects and their attributes. The H_2O Map modeling package also includes a number of tools, which facilitate the presentation of model results. The results for a given simulation can be presented either graphically or in a tabular report format to indicate flow, demand, pressure, headloss, and hydraulic grade for various system elements.

A steady state analysis can be used to evaluate the conditions in the system at an instantaneous moment in time or an extended period analysis can be run to simulate the changing conditions of the system over time. The steady state analysis determines pipe flows and system pressures according to a specified system demand, configuration, and operational conditions. The steady state analysis is a useful tool for looking at how the system responds to high demand events, such as analyzing the available fire flow in the system. For the purpose of the Plan, only steady state analyses are applied.

HYDRAULIC MODEL DEVELOPMENT

One of the primary goals in the development of the City's hydraulic model is to create a model that realistically represents the current water system. The hydraulic model includes elements representing reservoirs, pipes, pumps, valves, master meter connections and junction nodes, which establish points of connections between pipes. Input information for each of these elements must be as accurate as possible in order to develop a realistic representation of the water system as a whole. A node map is provided at the end of the Plan.

MODEL LAYOUT AND CONSTRUCTION

The City's model is constructed using information from City's water system base maps. Meetings with City staff regarding the operation of various components of the system were also a crucial element in developing an accurate model. Model element elevations are based on ten foot contour maps and spot elevations provided by the City.

Model Labeling

A system of labeling is applied to the model in order to group model elements. Junctions and pipes are assigned a number that corresponds to one of the five major regions of the water system: Butler, Lower Prune Hill, Upper Prune Hill, Lacamas, and Gregg. These regions correspond to water system pressure zones, except for the Upper Prune Hill Region, which consists of several smaller pressure zones. These numbers are the prefixes for the pipe and node numbers, and are shown in Table 5-1.

Table 5-1 Element Labeling

Region	Model Pipe Designation	Model Node Designation
343 - Butler	P1-XXX	J1-XXX
455 - Lower Prune Hill	P2-XXX	J2-XXX
852 - Upper Prune Hill	P3-XXX	J3-XXX
544 - Lacamas	P4-XXX	J4-XXX
542 - Gregg	P5-XXX	J5-XXX
542/544 - NUGA	P6-XXX	J6-XXX

Pipes and nodes in the system are grouped and labeled using the region number that corresponds to their location. Reservoirs in the system are labeled as they are named by the City. For example, the Lacamas Reservoir is labeled in the model as "LACAMAS." Booster Stations are labeled similarly. For example, the Lacamas Booster Station Pump No. 1 is labeled "LACAMAS-1." The City's sources of supply wells are labeled according to the well number, and the City's surface water sources are labeled according to their creek name. Table 5-2 illustrates typical labeling for the various elements.

Table 5-2 Examples of Labeling Standards for Model Elements

Element Type	Element Label	Region	Region Number	Description
Junction (Node)	J1-118	Butler	1	Prefix indicates Region
Pipe	P4-693	Lacamas	4	Prefix indicates region.
Valve	PRV-12	Upper Prune Hill	3	PRVs labeled by City number. Flow-control valves labeled by well number.
Pump	Gregg-1	Gregg	5	Name indicates booster station and pump number.
Reservoir	Lacamas	Lacamas	4	Reservoirs labeled by name.
Well	Well-8	Butler	1	Wells labeled by name.
Surface Water Source	Jones	Raw Water	R	Jones and Boulder Creek are labeled by name. "R" signifies raw water transmission main.

Water Supply

The City's surface water sources and groundwater wells are modeled using reservoirs with constant hydraulic grade lines and flow control valves. The fixed hydraulic grade line allows the well or surface water sources to deliver water at a set pressure, while the flow control valve allows the user to control the capacity of the source at any given time. For the City's model, groundwater wells are set to deliver water at a pressure of 150 psi, with the exception of Well 6, which delivers at 170 psi. Well delivery pressures are based upon information from City staff and on-site pump tests. Capacities are based upon the rated capacities of the well pumps.

Reservoirs

In H_2O Map, reservoirs are modeled as "tanks" with finite size, using actual reservoir dimensions and elevations. The model includes all of the City's existing reservoirs.

Pressure Reducing Valves

In H_2O Map, pressure reducing valves (PRVs) are modeled as pipes that require a pressure setting. City Staff provided settings for PRVs in the model, as shown in Table 1-8. Many of the City's PRV stations have two or more PRVs in parallel. The smaller diameter PRVs are set to provide flow under normal operating conditions and the larger PRVs are set to open during high demand scenarios such as a fire, when the smaller PRV can no longer maintain the necessary hydraulic grade. In order to simplify the model, parallel PRVs are modeled as a single PRV, using the larger diameter PRV and setting.

Booster Stations

All of the City's existing booster stations are included in the hydraulic model. Manufacturers' pump curves are entered into the model to simulate head and flow conditions at the Lower Prune Hill, Angelo, Lacamas, New Gregg, and Upper Prune Hill Booster Stations. If pump curves are not available, design points have been entered into the model using known pump capacities and head conditions. Pump curves are not available for the Butler, Old Gregg, and Forest Home Booster Stations. The software extrapolates pump curves from the design points if the pumps are active during model runs.

SYSTEM DEMANDS

The distribution of system demands is very important in creating an accurate model. City water production data from 2008 is used to identify the total demand of each pressure zone. System demands are spread evenly across each reservoir service area.

The modeling software allows numerous modeling scenarios to be loaded into the model. The DOH Water System Design Manual states that water system comprehensive plans should evaluate the 6- and 20-year planning periods. For the purposes of this Plan, the following scenarios have been analyzed.

- 2008 Average Daily, Peak Daily, and Peak Hourly Demand
- 2015 Average Daily, Peak Daily, and Peak Hourly Demand
- 2029 Average Daily, Peak Daily, and Peak Hourly Demand

Demand conditions are based upon current and projected water use, as defined in Chapter 3, and distributed by zone in Table 4-11. The 2015 modeling scenarios will assist in identifying and scheduling projects in the six-year capital improvement plan. The 2029 modeling scenarios will be utilized to develop a more conceptual approach to water system planning and improvements due to the unpredictability of population growth and water demands within these longer planning periods.

Existing System

The average daily demands for the 2008 system are entered into the model using water consumption data. Consumption records for the ten highest water users are entered into the model at their exact address.

The production data was compiled for January and July of 2008 for each pressure zone based on the volume of water pumped into each zone. The ADD for 2008 was determined by calculating the percentage of demand pumped into each pressure zone compared to the total pumped. An average percent distribution is calculated based on the January and July production records. The following table shows the weighted distribution of production demand.

Table 5-3 2008 Production Distribution by Zone

Region	January		July		Average Percentage of Total
	Volume Pumped (gpd)	Percent of Total	Volume Pumped (gpd)	Percent of Total	
343 – Butler(1)	781,200	26.9%	1,202,400	18.6%	**22.7%**
455 – LPH(2)	399,800	13.8%	651,000	10.0%	**11.9%**
542 – Gregg(3)	57,700	2.0%	246,300	3.8%	**2.9%**
544 – Lacamas(4)	779,500	26.8%	2,000,000	30.9%	**28.8%**
852 – UPH(5)	887,100	30.5%	2,380,300	36.7%	**33.6%**
Total	2,905,300	100.0%	6,480,000	100.0%	**100.0%**

(1) Equals the volume pumped into the 343 Zone (Wells 5-8, 10-13), less the volume pumped out of the 343 Zone (Forest Home BS, Butler BS, and Angelo BS).
(2) Equals the volume pumped into 455 Zone (Jones and Boulder Creek, Forest Home BS, Butler BS, and Angelo BS), less the volume pumped out (LPH BS, Lacamas BS, and Old and New Gregg BS).
(3) Equals the volume pumped into 542 Zone (Old and New Gregg BS).
(4) Equals the volume pumped into 544 Zone (Lacamas BS).
(5) Equals the volume pumped into 852 Zone (LPH BS).

The weighted average percentages from January and July of 2008, shown in Table 5-3, are used to distribute the production data from 2008 to obtain the ADD. The July peak month weighted percentages are used to obtain the MDD for 2008. Table 5-4 shows the distribution of demands by zone for 2008.

Table 5-4 2008 Demand Distribution by Zone

Region	ADD(1) (gpd)	MDD(2) (gpd)	PHD(3) (gpm)
343 – Butler	839,693	1,437,128	1,796
455 – LPH	439,898	778,086	973
542 – Gregg	106,928	294,382	368
544 – Lacamas	1,066,043	2,390,433	2,988
852 – UPH	1,242,917	2,844,974	3,556
Total	**3,695,479**	**7,745,003**	**9,681**

(1) Equal to the total average day production from 2008, shown in Table 3-9, multiplied by column 6 in Table 5-3.
(2) Equal to the total maximum day production from 2008, shown in Table 3-9, multiplied by column 5 in Table 5-3.
(3) Equal to the MDD in column 3 of this table, multiplied by the peaking factor of 1.8, as defined in Chapter 3 of the Plan.

Future Growth

For future growth, the water service area demand projections described in Chapter 3 are used to calculate growth factors. The 20-year demands for the City and the NUGA are presented in Table 3-14 and 3-15, respectively. The 343, 455, and 542 Zones are assumed to grow at a rate of one percent due to the limited available land for expansion. The ultimate build out of the 852 Zone is based on available land use outlined in the *Upper Prune Hill Build-Out Memo* by Gray & Osborne. The 544 Zone is based on the 6- and 20-year demands from Chapter 3, less the demands from the other zones.

Table 5-5 2015 and 2029 Demand Distribution by Zone

Region	2015			2029		
	ADD (gpd)	MDD (gpd)	PHD (gpm)	ADD (gpd)	MDD (gpd)	PHD (gpm)
343 – Butler	900,265(1)	1,540,796(6)	1,926(7)	1,034,831(1)	1,771,105(6)	2,214(7)
455 – LPH	471,630(1)	834,213(6)	1,043(7)	542,127(1)	958,907(6)	1,199(7))
542 – Gregg	114,641(1)	315,617(6)	395(7)	131,777(1)	362,794(6)	453(7)
542/544 – NUGA	547,165(2)	1,203,764(2)	1,505(2)	1,641,496(2)	3,611,292(2)	4,514(2)
544 – Lacamas	2,255,820(3)	5,396,916(3)	6,746(7)	3,617,539(3)	8,409,190(3)	10,511(7)
852 – UPH	1,637,324(4)	3,747,752(6)	4,685(7)	2,426,138(4)	5,553,309(6)	6,942(7)
Total(5)	**5,926,845**	**13,039,059**	**16,299**	**9,393,908**	**20,666,597**	**25,833**

(1) ADD equal to the 2008 ADD increased by 1 percent each year.
(2) ADD, MDD, and PHD projections defined in Chapter 3, Table 3-15.
(3) Equal to the total, defined in Chapter 3, less demands from 343, 455,542/544, and 852 Zones.
(4) ADD based on land use in the *Upper Prune Hill Build Out* memo by Gray & Osborne.
(5) From Chapter 3, Table 3-16.
(6) MDD equal to the ADD multiplied by the peaking factor for each zone according to 2008 demand distribution in Table 5-4.
(7) PHD equal to the MDD multiplied by the peaking factor of 1.8.

MODEL CALIBRATION

The final step in the development of the City's water system hydraulic model is calibration. As shown in Table 5-3, the model is calibrated according to the results of ten hydrant flow tests conducted on May 13, 2009, by City Operations staff and Gray & Osborne. The model calibration simulations were conducted under 2008 average daily demand conditions. Flow into the system from the City's wells, surface water sources, and the reservoir levels, as shown on the telemetry system at the beginning of the hydrant flow tests, are shown in Table 5-6.

Table 5-6 Model Calibration Conditions

Parameter	Condition
Butler Reservoir	13.7-foot water level
Lower Prune Hill Reservoir	19.3-foot water level
Upper Prune Hill Reservoir	56.7-foot water level
Upper Prune Hill Standpipe	91.9-foot water level
Lacamas Reservoir	40.5-foot water level
Gregg Reservoir	58.0-foot water level
Lacamas Booster Station	567-gpm production
Angelo Booster Station	1,070-gpm production
Upper Prune Hill Booster Station	1,325-gpm production
Filter Plant	920-gpm production
Well 10	900-gpm production
Well 13	1,325-gpm production

The locations of the hydrant flow tests along with a comparison of the field and model results are provided in Table 5-7.

Table 5-7 Model Calibration Results

Location	Flow (gpm)	Field Results (psi)			Model Results (psi)			Δ between Field and Model
		Static	Residual	Δ	Static	Residual	Δ	
NW Lacamas Dr. and NW Valley Ct.	920	86.5	70	16.5	87	70.3	16.7	**0.2**
NW Leadbetter Blvd. and NW Fremont St.	1,350	96	92	4	96	90	6	**2**
NW Pacific Rim Dr. and NW Julia St.	1,500	98	92	6	98	93.8	4.2	**1.8**
NW 47th Ave. and NW Trout St.	1,300	80	78	2	79	77.5	1.5	**0.5**
NW Sierra Dr and NW 28th Ave.	1,240	71	65	6	71	66.2	4.8	**1.2**
NW 26th Ave. and NW Quartz St.	1,190	76	65	11	76	57	19	**8**

Table 5-7 Model Calibration Results (continued)

Location	Flow (gpm)	Field Results (psi)			Model Results (psi)			Δ between Field and Model
		Static	Residual	Δ	Static	Residual	Δ	
NW 44th Ave. and NW Oregon St.	1,270	76	64	12	76	63	13	**1**
NE Ione St. and NE 38th Ave.	1,150	86	64	22	86	69	17	**5**
19400 SE 42nd Cr.	1,380	94	83	11	93	80.5	12.5	**1.5**
5299 NW 17th Cr.	1,280	94	78	16	94	75.8	18.2	**2.2**

Δ: Change in pressure

As indicated in Table 5-7, all but one of the ten model results are within 5 psi of field tests. The location with the higher differential is NW 26th Avenue and NW Quartz Street with an 8 psi differential. This location is supplied directly from the 852 Zone. The 8 psi discrepancy is believed to be caused by an incorrect gage reading during the field test. The model results are conservative for calibration and show a greater residual drop in pressure than those measured in the field. The calibration is considered to be acceptable due to the conservative model result, and the accuracy of the other nine calibration points.

MODEL SIMULATIONS AND RESULTS

Hydraulic model analyses have been conducted to simulate the response of the City's water system under a variety of conditions to include peak hour and fire flow demands. The hydraulic model is also used to develop and assess a variety of potential system improvement projects. Piping improvement projects are divided into three groups:

- Transmission Improvements
- Fire Flow Improvements
- Peak Hour Demand Pressure Improvements

Repair and replacement projects are included to upgrade dead end and undersized lines and to provide looping to improve fire flow, peak hour pressures, and water quality. Fire flow improvement projects are those identified and developed through fire flow modeling to improve flow availability at locations where potential deficiencies are indicated. Transmission improvements are established to support anticipated future growth and demands.

MODEL SIMULATIONS

Reservoir levels are calculated using the depleted fire suppression storage, equalization storage, and operational storage outlined in the Chapter 4 Storage Analysis. For 2008 levels, the Gregg Reservoir levels only account for operational storage, because it has no equalizing storage, and fire suppression storage was transferred to the Lower Prune Hill Reservoirs. Fire suppression storage for the Butler Reservoir is applied to the Lower Prune Hill Reservoirs, the Lacamas Reservoir, and the Upper Prune Hill Reservoir. Table 5-8 shows the reservoir levels for both the peak hour and fire flow analyses for each planning period.

Table 5-8 Reservoir Levels

Reservoir	Overflow Height (ft)	Volume (MG)	Volume/ Height	PHD Levels (ft)			Fire Flow Levels (ft)		
				2008	2015	2029	2008	2015	2029
Butler	15	1.2	80,000	9.4	9.1	-	9.4	5.1	-
Cemetery Reservoir	70	2.0	28,571	-	-	58.0	-	-	24.4
Lower Prune Hill – 1	23	0.5	21,740	20.5	20.5	20.5	6.0	6.0	6.0
Lower Prune Hill - 2	23	1.5	65,217	20.5	20.5	20.5	6.0	6.0	6.0
Gregg	70	0.1	1,429	60.0	60.0	60.0	60.0	60.0	60.0
New Gregg NUGA	70	2.0	28,571	-	-	55.6	-	-	44.0
Lacamas	45	2	44,444	35.2	22.5	9.7	8.2	3.5	9.7
Green Mountain NUGA	70	2.0	28,571	-	-	55.6	-	-	10.45
Upper Prune Hill Reservoir	50	2.4	375,000	40.8	36.3	27.1	8.8	3.3	20.7
Upper Prune Hill Standpipe	100	0.75	7,500	90.0	90.0	90.0	90.0	90.0	90.0

Model Results

Results from the previously described scenarios, under the previously defined system conditions, are included in the Appendix L. Modeling results revealed the following system deficiencies, listed as transmission, level of service, and available fire flow deficiencies.

Transmission Improvements

In order to meet 2015 and 2029 pumping requirements for the 544 Zone, the 14-inch suction side transmission main from Everett Street to the Lacamas Booster Station must be upgraded to support the higher pumping capacities required. Otherwise, the NUGA

transmission main must be completed. The transmission improvements for the Lacamas Booster Station assume that the City will not be able to develop new sources in the 544 Zone during the 20-year planning period. Additional source capacity in the 544 Zone reduces the pumping needs at the Lacamas Booster Station. Table 5-9 list the required transmission improvements.

Table 5-9 Required Transmission Improvements

Diameter (inches)	Quantity (LF)	Improvement
12	1,400	Replace existing 6-inch main with 12-inch main to minimize headloss from Well 6 and 14 to the upgraded Forest Home Booster Station.
24	19,650	24-inch transmission main within NUGA to connect the 542 Zone to the 544 Zone.
20	5,000	Suction-side 20-inch transmission main parallel to existing 14 inch between Lacamas Booster Station and Everett St. *Required only if 544 Zone demands exceed the transmission capabilities of the 14-inch main before the NUGA transmission main is completed.*
24	7,800	24-inch Crown Road Booster Station suction and discharge transmission main to connect to the 542 Zone, from SE Crown Road and SE V Street to SE 283rd Ave and SE 7th Street.
12	2,300	Replace existing 6 and 8-inch main with 12-inch transmission main along SE Polk St. for increased transmission from the proposed WWTP Well. To connect to existing transmission main at SE 6th and Polk.
16	4,200	Transmission main along 22nd to connect Cemetery BS to the 455 Zone, connection at Division and 22nd.
12	2,300	Transmission main from Cemetery Reservoir to new 260 Zone, connection at 6th and Oak.

Table 5-10 shows the additional transmission improvements that are required to move supply from the proposed wells to the upper zones, and within the NUGA.

Table 5-10 Developer Funded NUGA Transmission Improvements

Diameter (inches)	Quantity (LF)	Improvement
12	15,600	12-inch transmission main within the NUGA for added transmission within the 544 Zone from the Green Mountain Reservoir.
12	5,300	12-inch transmission main from SE 283rd Ave. and Hathaway Rd. from SE 7th St. to connect to existing main.
12	1,900	Replace existing 6-inch main with 12-inch transmission main for additional transmission within the NUGA.
12	11,200	12-inch transmission main within the NUGA for added transmission along the north side of Lacamas Lake.
12	2,600	12-inch transmission main within the NUGA for added transmission from the Crown Rd Booster Station, from the north side of the lake to connect to existing transmission along NE Everett St.
12	7,900	12-inch transmission main to increase transmission within the NUGA.
12	5,700	12-inch transmission main to increase transmission within the NUGA.

Level of Service

In order to evaluate the water system's ability to meet future demands, the existing system is modeled under the projected peak hour demand conditions for 2015 and 2029. WAC 246-290-230 (5) requires that public water systems be designed to deliver peak hour demand while maintaining minimum system-wide pressures of 30 psi, with equalizing storage depleted from the City's reservoirs. The storage analysis, which provides a breakdown of the storage components, is presented in Chapter 4.

To accurately simulate the system's distribution and transmission capacity, pumping, transmission, and storage improvements associated with the development of the NUGA is assumed to have been completed for the 2015 and 2029 model runs.

Results that display the system-wide pressure distribution for the peak hour demand conditions with depleted equalization storage for 2015 and 2029 scenarios are provided in the Appendix L. Capital improvement projects have been identified in Chapter 8 that correct each peak hour deficiency.

Available Fire Flows

The hydraulic model was also used to assess the availability of fire flows throughout the City. WAC 246-290-230 (6) requires systems providing fire flow to be designed to provide peak daily demand plus the required fire flow, while maintaining minimum system-wide pressures of 20 psi. In addition, fire suppression storage and all equalizing storage are depleted from the City's reservoirs for the analysis. Transmission, pumping, and storage improvements recommended in Chapter 4 were included in all fire flow modeling.

Figure 5-1 gives a color-coded node map of available fire flow for 2008. Figure 5-2 shows the available fire flow in 2008 after the recommended 6-year improvements have been completed. Figure 5-3 shows the peak hour demand pressures in the City after the recommended 6-year improvements have been completed. Figure 5-4 shows the available fire flow in 2015 after the recommended 6-year improvements have been completed. Complete fire flow modeling results are available in the Appendix L.

Future Available Fire Flows

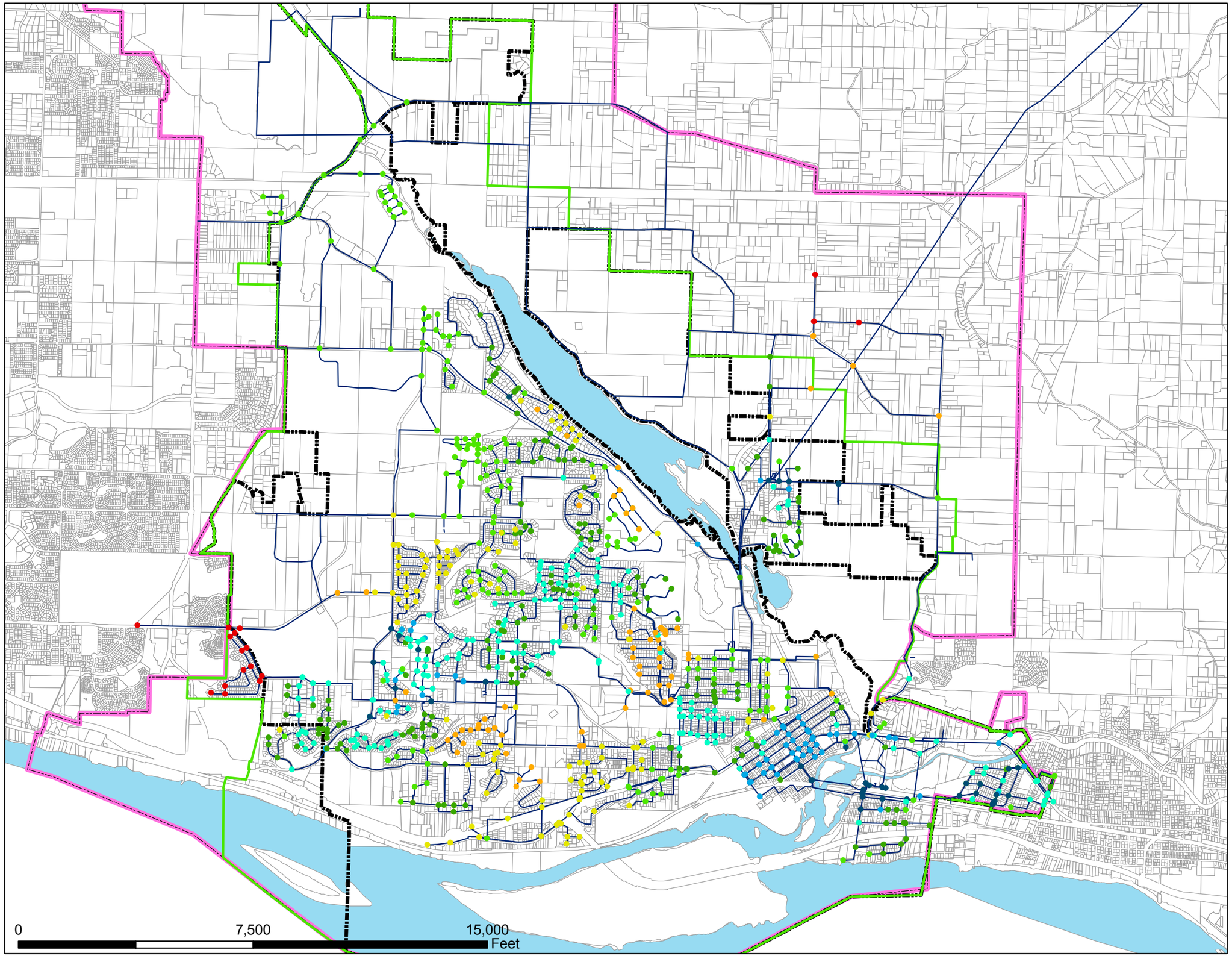
Complete fire flow results are located in the Appendix L. A minimum residential fire flow requirement of 1,000 gpm was used to determine deficiencies, and at specific locations where fire flow requirements are higher. Available fire flow deficiencies are identified as specific projects in the capital improvement plan, located in Chapter 8.

CONCLUSIONS

The City's hydraulic model shows that the City has a very strong system capable of meeting DOH pressure and fire flow regulations through 2029, provided storage and pumping deficiencies discussed in Chapter 4 are addressed. Results from the hydraulic modeling analysis revealed the following improvements, identified in Table 5-11. Cost estimates for projects identified in Table 5-11 shall be included in the capital improvement program, located in Chapter 8.

Table 5-11 Recommended Improvements

System Deficiency	Recommended Improvement
Fire Flow Deficiency along SE Payne Rd, NW Astor St, and NW 12th Lane	Open the PRV station located on NW 18th Avenue, close the valve along NW 9th Avenue, south of Hoquiam Court, and adjust PRV settings at NW Astor and 36th. Construct 1,600 LF of 8-inch main from NW Eagle Street to NW 15th Circle and from NW 12th Circle to NW Astor to increase looping.
Peak Hour Pressure Deficiency on Couch St.	Install 50 gpm booster station to provide service pressures on Couch Street between NW 21st Avenue and NW 22nd Avenue. Include check features to allow 455 Zone to provide fire flow.
Low Peak Hour Pressure on Hathaway Road	2,000 LF of 12-inch main on NE Everett Road and NE 3rd Street to increase looping
Low Peak Hour Pressure on NW 14th Ave.	Raise hydraulic grade of 697 Zone to 710 feet by adjusting PRVs on NW 16th Avenue and NW McIntosh Road.
Peak Hour Pressure Deficiencies on UPH	Upgrade 320 LF of outlet piping from UPH Standpipe to 12 inches.
Peak Hour Pressure Deficiencies on UPH	1,300 LF of 12-inch main from NW Hood and 16th to NW Cascade Street and 16th to increase looping.
Peak Hour Pressure Deficiencies on UPH	300 LF of 12-inch main from NW 9th Avenue to NW 12th Avenue to increase looping.



3

Legend

- Urban Growth Boundary
- City Limits
- Water Service Boundary
- Pipe Lines

2008 Fire Flow

- 0 - 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000
- 2001 - 3000
- 3001 - 4000
- 4001 - 5000
- < 5000

SOURCE: CITY OF CAMAS

CITY OF CAMAS WASHINGTON

FIGURE 5-1

2008 AVAILABLE FIRE FLOW

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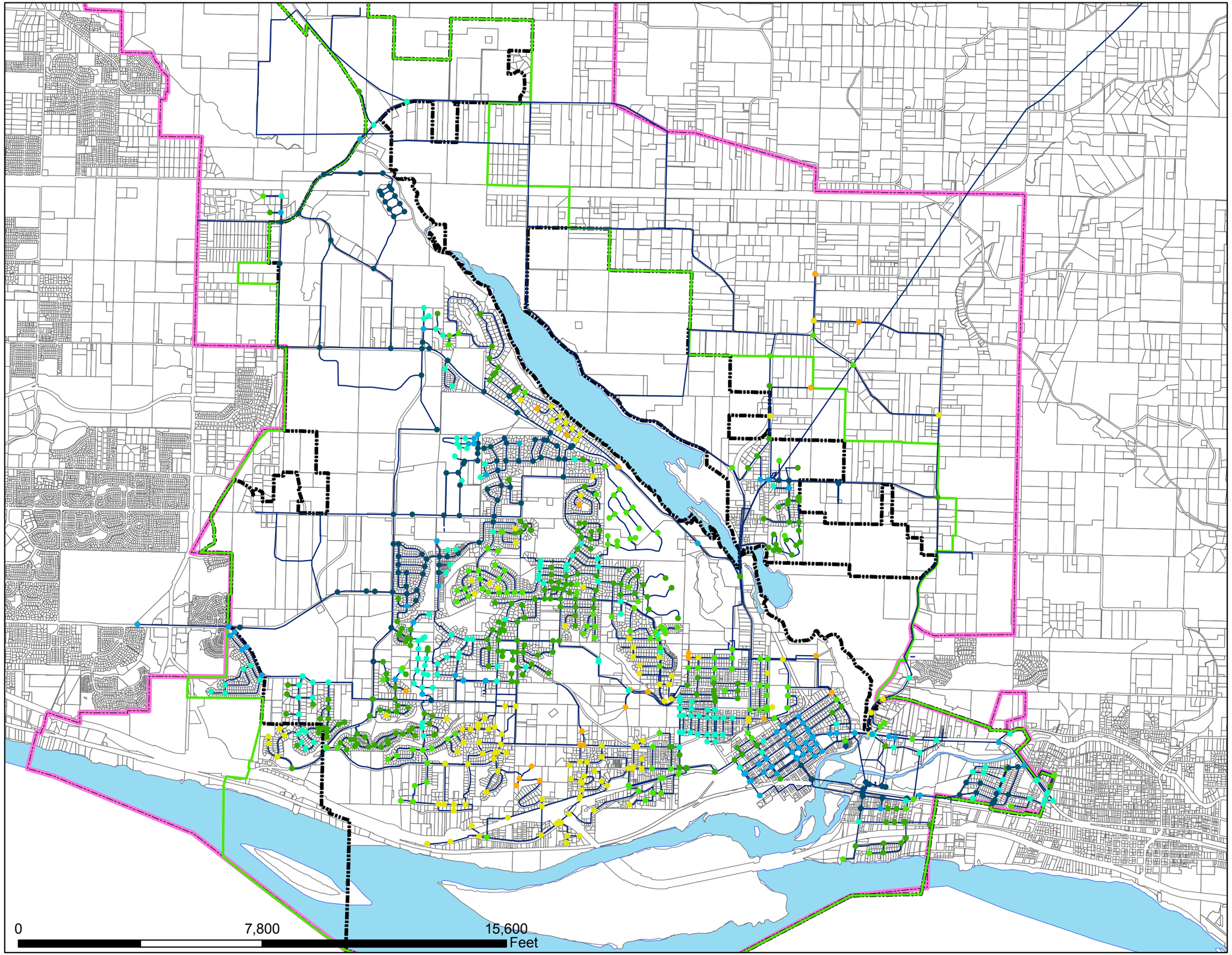


3

Legend

- Urban Growth Boundary
- City Limits
- Water Service Boundary
- Pipe Lines

2008 Fire Flow

- 0 - 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000
- 2001 - 3000
- 3001 - 4000
- 4001 - 5000
- < 5000

SOURCE: CITY OF CAMAS

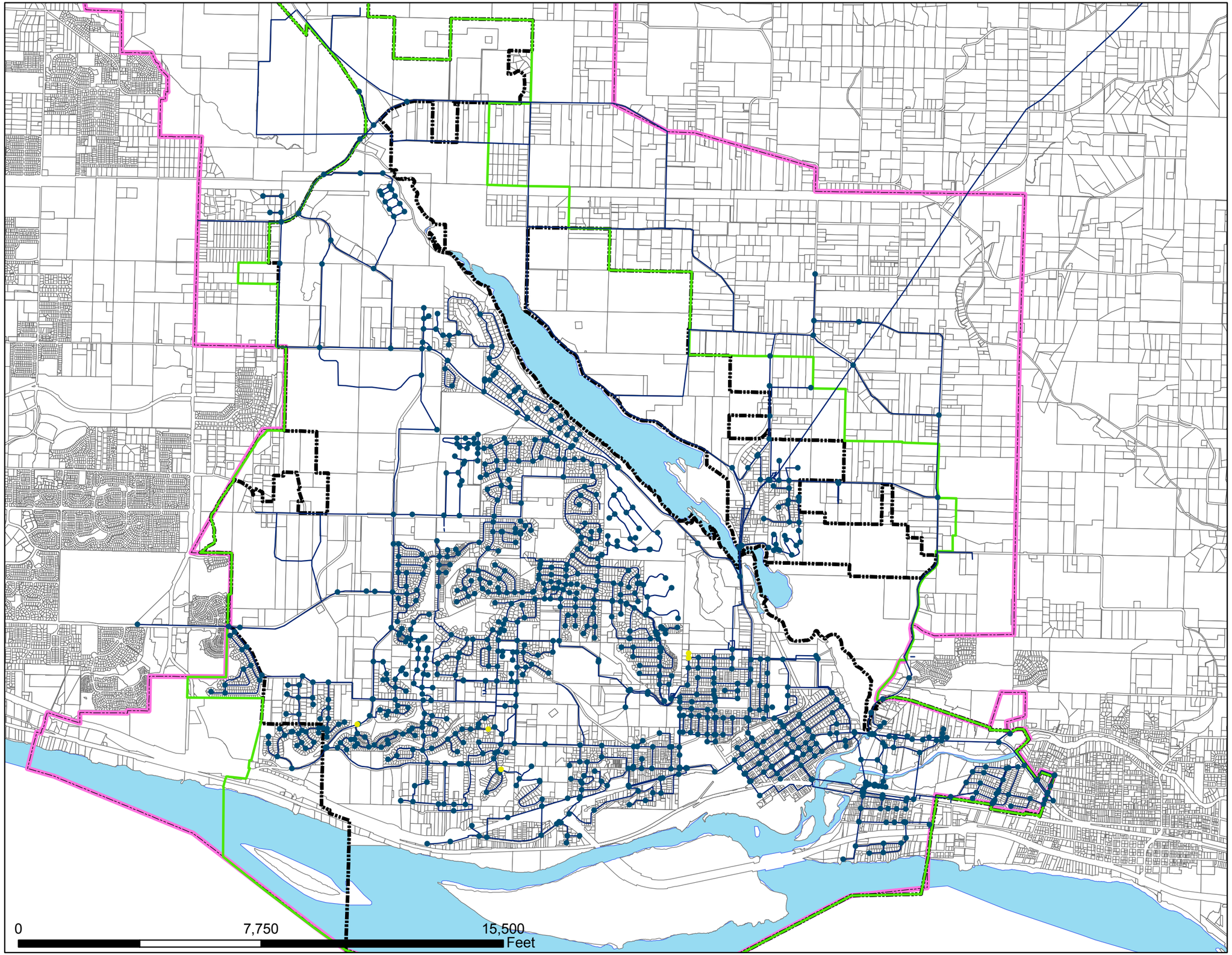
CITY OF CAMAS WASHINGTON

FIGURE 5 - 2

2008 FIRE FLOW WITH IMPROVEMENTS

L:\CAMAS\08495 WSP\Fig5-2.mxd

3



Legend

Pressure (PSI)

- > 20
- > 30
- Urban Growth Boundary
- City Limits
- Water Service Boundary
- Pipe Lines

SOURCE: CITY OF CAMAS

FIGURE 5 - 3

2008 PHD PRESSURE WITH IMPROVEMENTS

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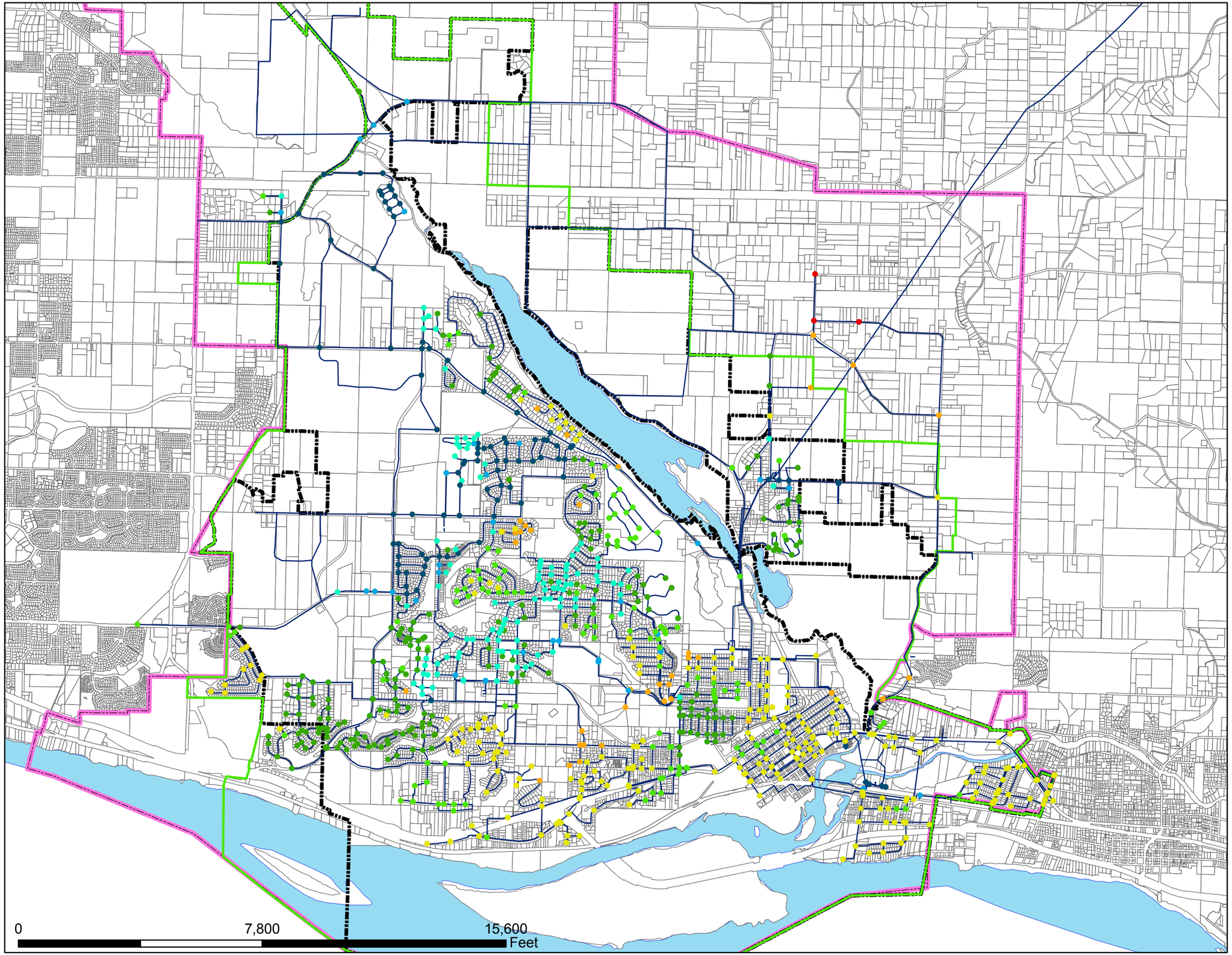

3

Legend

- Urban Growth Boundary
- City Limits
- Water Service Boundary
- Pipe Lines

2015 Fire Flow

- 0 - 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000
- 2001 - 3000
- 3001 - 4000
- 4001 - 5000
- < 5000

SOURCE: CITY OF CAMAS

CITY OF CAMAS WASHINGTON

FIGURE 5 - 4

2015 FIRE FLOW WITH IMPROVEMENTS

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Chapter 6
WATER USE EFFICIENCY PROGRAM

The objectives of this chapter are to identify the conservation and water use efficiency requirements pertaining to the City of Camas, evaluate past conservation efforts, and describe the City's water use efficiency program.

WATER USE EFFICIENCY RULE BACKGROUND

The Washington Legislature passed the Water Use Efficiency Act of 1989 (43.20.230 RCW), which directs Department of Health (DOH) to develop procedures and guidelines relating to water use efficiency. In response to this mandate, Department of Ecology (Ecology), the Washington Water Utilities Council, and DOH jointly published a document titled *Conservation Planning Requirements* (1994). In 2003, the Municipal Water Supply - Efficiency Requirements Act (Municipal Water Law) was passed and amended RCW 90.46 to require additional conservation measures. The Municipal Water Law, among other things, directed DOH to develop the Water Use Efficiency Rule (WUE Rule), which is outlined in the *Water Use Efficiency Guidebook* and became effective January 22, 2007. These documents provide guidelines and requirements regarding the development and implementation of conservation and efficiency programs for public water systems. Conservation and efficiency programs developed in compliance with these documents are required by DOH as part of water system planning documents and by Ecology as part of a public water system water right application. Conservation must be evaluated and implemented as an alternate source of supply before state agencies approve applications for new or expanded water rights.

As an extension to the *Conservation Planning Requirements*, the WUE Rule sets more stringent requirements for public water purveyors. The WUE Rule is comprised of eight chapters:

1. Introduction to Water Use Efficiency Requirements
2. Water Meters
3. Data Collection
4. Demand Forecasting
5. Water Use Efficiency Program
6. Distribution System Leakage
7. Goal Setting and the Public Forum
8. Annual Performance Report

This chapter provides a discussion of the chapters, requirements, and the impact the WUE Rule has on the City.

WATER USE EFFICIENCY REQUIREMENTS

The *Water Use Efficiency Guidebook* establishes varying implementation and evaluation requirements for municipal water suppliers (MWS). The new requirements focus on the importance of measuring water usage and evaluating the effectiveness of the WUE program. There are three fundamental elements to the Rule, including planning, distribution leakage standards, and goal setting and performance reporting.

Table 6-1 provides a summary of the WUE Rule requirements applicable to the City.

Table 6-1 Summary of WUE Requirements

Requirement	Deadline for MWS with 1,000 or more connections
Begin collecting production and consumption data	January 1, 2007
Include WUE program in planning documents	January 22, 2008
Set WUE goals	January 22, 2008
Submit service meter installation schedule	July 1, 2008
Submit first annual performance report	July 1, 2008
Meet distribution leakage standard (based on 3-year rolling average)	July 1, 2010, or 3 years after installing all service meters
Complete installation of all service meters	January 22, 2017

WATER METERS

Metering all water production and consumption is critical for determining system wide and individual water use efficiency. The Rule has set deadlines for meter installation and data collection, which are shown in Table 6-2.

Table 6-2 Meter and Data Collection Deadlines

Requirement	Deadline for MWS with 1,000 or more connections
Install production meter(s)	January 22, 2007
Begin collecting production and consumption data	January 1, 2007
Submit service meter installation schedule	July 1, 2008
Complete installation of all service and intertie meters	January 22, 2017

As Table 6-2 indicates, the WUE Rule currently requires production meters on all existing and new water sources, and requires consumption meters on all customer connections by 2017.

The City meters all existing customer connections and will continue to meter all new connections. All sources are metered as well. The City is in full compliance with metering requirements.

The City has one emergency intertie with the City of Washougal, which is normally closed. As described in WAC 246-290-132(4), emergency interties are exempt from metering requirements.

DATA COLLECTING

The WUE Rule requires regular collection of production and consumption data. Data must be reported in the City's planning documents and annual performance report to DOH. Water use data will be used for the following:

- Calculating leakage;
- Forecasting demand for future water needs;
- Identifying areas for more efficient water use;
- Evaluating the success of your WUE program;
- Describing water supply characteristics;
- Aiding in decision-making about water management.

The City submitted their first annual report on July 1, 2008. The next report is due July 1, 2010.

The Rule also sets requirements for collecting source and service data. Source meters must be read monthly and reported as monthly and annual totals. Service meter totals only have to be reported in annual amounts, although it is recommended to read all service meters every one to two months. The City currently reads source meters daily and service meters bimonthly. They will report monthly and annual water produced, annual water consumed, annual totals for each customer class, and customer class seasonal variations.

The City has established six customer classes: single-family residential, multi-family residential, commercial, irrigation, industrial and fire lines. By separating customers into different categories, the City can track the effects of their WUE program more accurately.

SOURCE OF SUPPLY ANALYSIS

A source of supply analysis was presented in Chapter 3.

DISTRIBUTION SYSTEM LEAKAGE

The 1994 *Conservation Planning Requirements* set the maximum allowable rate of distribution system leakage, at 20 percent of total source production. The WUE Rule now requires that water distribution systems have a leakage rate of less than 10 percent of finished water production based on a three year rolling average. The City must meet the three-year rolling average requirement by July 1, 2010.

Distribution system leakage (DSL) is defined as the difference between total water produced or purchase and all authorized water consumed. Known or credibly estimated losses can be excluded from the leakage calculation and may include uses such as construction, fire fighting, and flushing. The City is currently developing a tracking system to more accurately account for these uses. The leakage totals in Table 6-3 are a combination of leakage and unauthorized use.

Distribution system leakage (DSL) for the City equals the difference between the treated supply volume and volume measured at the customers' meters plus any other credibly estimated usage. Since 2002, distribution system leakage has ranged from 83.7 to 345.5 MG, and has had a rate between 6.3 percent and 24.0 percent of total treated supply. Table 6-3 provides annual data of distribution system leakage from 2002 to 2007.

Table 6-3 Historic Distribution System Leakage

Year	Production (gallons)	Authorized Consumption (gallons)	DSL (gallons)	Percent DSL	3-year Rolling Average
2002	1,438,711,600	1,093,178,064	345,533,536	24.0%	-
2003	1,456,144,700	1,163,908,194	292,236,506	20.1%	-
2004	1,460,213,119	1,211,462,296	248,750,823	17.0%	20.4%
2005	1,319,065,600	1,235,318,260	83,747,340	6.3%	14.5%
2006	1,509,025,682	1,265,488,092	243,537,590	16.1%	13.2%
2007	1,373,495,526	1,221,921,580	151,573,946	11.0%	11.2%
Average	**1,426,109,371**	**1,198,546,081**	**227,563,290**	**15.8%**	

The DSL rate fluctuates significantly between the years 2004 through 2007. This may be due to new construction, main leaks and two leaking reservoirs. The City's 3-year rolling average in 2007 is 11 percent. The City will improve record keeping on authorized consumption to help determine actual leakage loss. If the City does not meet the new DSL requirement by 2010, they will include a water loss control action plan in the next planning document.

PREVIOUS WATER USE EFFICIENCY PROGRAM

The following section describes the City's current water use efficiency goals taken from Chapter 6 of the 2002 Water System Comprehensive Plan (WSP) and specific tasks or items that the City is conducting.

CONSERVATION MEASURES

The following conservation measures were included in the City's Capital Improvement Program (CIP) for the development of the City's Water Conservation Program.

- Include consumption history on utility billing forms.
- Conduct a water system leak detection survey in 2002.
- Update City Sprinkling Ordinance to include water conservation measures and inclined block rate structure.
- Obtain and distribute Department of Health water conservation brochure and update website with enhanced conservation measures.
- Continue to supply and distribute water conservation kits.
- Install central control irrigation system and weather station for City parks, playfields, and schools, and make data and control features available to large irrigation customers.
- Institute water audit program for commercial, industrial, municipal, residential, and irrigation customers.

- Institute residential landscape management program by offering water savings devices such as rain barrels and soaker hoses at at-cost or subsidized rates. Make this program a cooperative effort with nurseries or other jurisdictions.
- Consider offering rebates on water and energy-efficient appliances.
- Examine feasibility of inclined block rate structure during the City's next rate study.

UNACCOUNTED FOR WATER/LEAK DETECTION

Since 2002, the City has contracted for three to five days of leak detection services per year. Each year this allow for testing of approximately 25 to 30 percent of the distribution system. In 2007, the contractor detected leaks totaling 10 MG measured on an annualized basis. Nearly 44 MG in leaks have been detected and repaired as a result of these surveys over the past five years. In March of 2007, the City performed a leak analysis on Lower Prune Hill Reservoir. The test revealed a water loss of 4,608 gpd at this site. The City contracted with Hydro Tech International to perform repairs on this tank. In June 2007 the City performed a leak analysis on this tank and showed no loss. Butler Reservoir was also surveyed for leaks in April 2007. Leaks totaling 3,500 gpd were detected. Hydro Tech performed some point repairs at this time. Visual leaks are still evident at this site. This problem will be addressed in Chapter 8 of this plan.

PROGRAM PROMOTION AND CUSTOMER EDUCATION

The water conservation brochures (Irrigation Tips & Regulations, and Leaks), and the City's annual Water Quality Report provide water conservation tips, and are available to the public at the City's Water Utility Billing Department, and Water Department, and website at www.ci.camas.wa.us. Also, information is available at an information booth during Camas Days (held once a year). The City's local newspaper is also used to inform the public of any voluntary or required odd/even days when water usage during the summer is at its highest.

CONSTRUCTION REQUIREMENTS

The City building code requires new construction to install low flow toilets and showerheads. Low flow toilet tanks are rated at 1.6 gallons and showerheads are rated at 2.5 gallons per minute. These requirements apply to both new residential and commercial construction.

CUSTOMER LEAK DETECTION

Springbrook and Neptune software (City software for billing and meter use) have parameters for flagging overuse or under use water consumption. When a customer's usage changes significantly from the previous year, the utility notifies customers of possible leaks on the residential side of the meter. The utility offers a billing adjustment when the customer provides proof of repair to the billing department.

Bills Showing Consumption History

The City's water bills indicate water consumption history. By allowing customers to track and compare their usage, they can monitor their water use more closely, increasing conservation and also awareness of potential leaks.

IRRIGATION MANAGEMENT

The City has employed several rules and restrictions for lawn sprinkler systems to reduce improper use. Installation of a residential lawn sprinkler system requires a plumbing permit issued by the City of Camas. All underground lawn sprinkler systems are required to have a backflow prevention assembly installed on the sprinkler system. An annual test must be performed by a certified tester and submitted to the City. All testing is the responsibility of the property owner. Reminder notices are mailed each year regarding annual testing of the backflow prevention assembly. The City requires that all non-residential water services must have a backflow prevention assembly installed at the water meter or elsewhere as required by the City. Failure to comply with irrigation regulations may result in severing the connection to the backflow assembly or discontinuation of City water service.

The City has started a pilot project with Deer Creek Homeowner Associations (HOA) providing a free evaluation of their existing system. The evaluation showed considerable room for improvement. The City is currently working to develop a rebate or incentive program to encourage the HOA to make the recommended upgrades to their system. The goal is to demonstrate that significant savings can be gained with proper maintenance, hardware and technology including smart controllers, head and nozzle changes, and repair of damaged heads. These improvements will reduce customer billing and reduce water use. The City is contemplating additional design and performance standards for new irrigation system installations.

LANDSCAPE MANAGEMENT

The City encourages the following landscape management ideas:

- Set sprinkler system timers to irrigate only when needed.
- Water lawns and plants in the early morning or late evening to limit water loss due to evaporation.
- Place a layer of mulch around plants and trees to avoid excessive evaporation.
- Monitor irrigation so to water only as rapidly as the soil can absorb the water.
- Install drip irrigation systems for a slow, steady supply of water to the plant roots.
- Position sprinklers or drip irrigation systems to water only the root areas of plants and not sidewalks, gutters, or streets.
- Consider native plants when landscaping.

CONSERVATION RATE STRUCTURE

Historically the City has charged a discounted rate for irrigation. In 2003, the City conducted a rate study and implemented a structure that removed the discount for irrigation over time and provided a true cost rate. The rate was gradually increased to ease the burden on major irrigators like the school district who are tied to an annual budget. Historic water rates are shown in Table 6-4. The City has contemplated an inclined block rate during the rate study but has chosen to remain with a uniform rate structure for this rate horizon. Future rate studies will reevaluate the rate structure.

Table 6-4 Historic Customer Water Rates Inside City Limits

Customer Class	2003 ($/ccf)	2004 ($/ccf)	2005 ($/ccf)	2006 ($/ccf)	2007 ($/ccf)	2008 ($/ccf)
Residential	$1.26	$1.16	$1.20	$1.22	$1.24	$1.24
Commercial	$1.68	$1.35	$1.40	$1.45	$1.50	$1.50
Industrial	$1.08	$1.12	$1.16	$1.20	$1.25	$1.25
Cemetery	$0.56	$0.56	$0.56	$0.56	$0.56	$0.56
Irrigation	$0.76	$0.76	$0.95	$1.10	$1.25	$1.40

CONSERVATION KITS

The City has purchased conservation kits over that last 5 years for distribution to the public. A main focus has been at Camas Days, an annual community event that draws large crowds. The City also participates at HP earth day where kits are distributed to HP employees many of which live in Camas.

WATER AUDIT PROGRAM/ REBATE PROGRAM

As described above, the City is currently working to develop a rebate or incentive program to encourage the HOA to make the recommended upgrades to their system and provide a model to establish a working audit and rebate program for other customers in our system. The City continues to offer industrial customers the opportunity to develop an audit program specific to their needs. Georgia Pacific has shown some interest in doing an evaluation of water use within their facility but has not committed at this time.

EFFECTS OF PAST MEASURES

Since the City laid out their last conservation plan in 2002, there has been significant reduction in distribution system leakage (from 27 percent in 2000 to 11 percent in 2007) and much lower water usage during irrigation periods. The City attributes this to increased customer education on conservation due to the establishment of conservation ordinances, media press releases and billing inserts.

NEW WATER USE EFFICIENCY PROGRAM

Under the WUE Rule, the City must set water use efficiency goals and measures progress each year toward meeting these goals. Goals must include a measurable outcome, address water supply or demand characteristics, and include an implementation schedule. The City must also evaluate or implement efficiency measures to help meet these goals.

GOALS

The City plans to reduce its total water use in several ways. The City's primary goal will be to reduce DSL to meet WUE requirements of less than 10 percent. Second, the City will promote conservation by its customers to reduce overall water demand.

Goal No. 1 of the water use efficiency program is to continue to reduce distribution system leakage. In 2008, the City lost nine percent of the water produced from leaks and unaccounted for water losses. However, the average distribution system leakage rate for 2006 through 2008 is 12.1 percent.

The City will increase efforts to minimize the amount of leakage and unaccounted for water and accurately track all water used including estimating the amount of unmetered water used. In order to have a 3-year rolling average of less than 10 percent by July 1, 2010, the City must continue to reduce annual DSL through 2010. Table 6-5 summarizes the target DSL reductions through 2015. The City will continue to be aggressive in leak detection and repair, accurate accounting for authorized consumption and continue with meter replacement and maintenance program.

Table 6-5 Summary of DSL Reduction Goals

Year	Distribution System Leakage (%)	3-yr Rolling Average
2007	Actual - 11%	11.2%
2008	Actual – 9.2%	12.1%
2009	At or Below 9%	9.7%
2010	At or Below 9%	9.1%
2011	At or Below 9%	9%
2012	At or Below 9%	9%
2013	At or Below 9%	9%
2014	At or Below 9%	9%
2015	At or Below 9%	9%

Goal No. 2 of the WUE program is to reduce the customer consumption per Equivalent Residential Unit (ERU) by 1 percent or approximately 2 gpd per year over the six-year

planning period. An ERU is equal to annual single-family residential consumption divided by the number of single-family residential connections.

Table 6-6 ERU Reduction Goal Summary

Year	ERU Value (gpd/ERU)
2008	283.6
2009	231
2010	228
2011	226
2012	224
2013	222
2014	219
2015	217

WATER USE EFFICIENCY MEASURES

The WUE Rule states several measures that must be implemented or evaluated and provides a list of measures you can count as additional measures in the WUE Program. WAC 246-290-810 identifies the minimum number of water use efficiency measures that must be evaluated based on system size. The City serves 7,095 connections, and therefore must evaluate or implement six supplementary water use efficiency measures in addition to the mandatory measures. The following sections describe both the mandatory and supplementary water use efficiency measures evaluated and indicate which have been or will be implemented by the City.

Mandatory Implementation - Source and Service Metering and Meter Calibration

As stated previously, the City currently meters all customers and sources. The City meters all new customers and sources as well. The City currently tests and calibrates all industrial meters annually and replaces approximately 500 residential meters per year, or as budget allows.

Mandatory Implementation - Leak Detection and Water Accounting

The City will continue their current leak detection and water accounting program in an effort to reduce distribution system leakage. The City will increase their efforts to reduce leakage and increase documentation of authorized consumption.

If the City cannot reduce DSL to have a three-year rolling average of 10 percent or less by July 1, 2010, the City must develop a Water Loss Control Action Plan (WLCAP). If by this date they do not meet the DSL requirement but are implementing a WLCAP, they will be in compliance with the WUE Rule. Chapter 6 of the *WUE Guidebook* provides more information on WLCAP.

Mandatory Implementation - Customer Education
As described above, the City provides information and tips for efficient water use for customers on their web page and in brochures available at several City offices. The City will continue to make educational resources available to the public.

Mandatory Evaluation – Rates that Encourage Efficiency
The City contemplated an inclined block rate during their last rate study but chose to remain with a uniform rate structure for this rate horizon. A rate study is scheduled in 2010 and will reevaluate the rate structure in accordance with the regulations.

Mandatory Evaluation – Reclaimed Water Opportunities
The City has been active in using treated wastewater for wash down and process use at the wastewater treatment plant (WWTP). Treated sewage effluent is used in many non-potable water applications such as landscape irrigation at the WWTP. Treatment plant hoses are also plumbed so that staff can wash down facilities at the plant.

The City will also provide a comprehensive look at reuse in their next Wastewater Facility Plan, which was submitted to Ecology as a first draft in November 2009.

Supplementary Measures
The City will continue implementing all of their current measures described above as part of their new Water Use Efficiency Program. Table 6-7 summarizes these measures.

Table 6-7 City WUE Program Measures

Implemented Measure	Applicable Customer Classes
Program Promotion and Customer Education	5
Conservation Kits	2
Construction Requirements	3
Customer Leak Detection	5
Bills Showing Consumption History	5
Irrigation Management	3
Landscape Management	4
Water Audits	5
Rebate Program	3
Total Measures Counted	**35**

EVALUATION OF MEASURES
Many of the measures selected for continued implementation require little funding, such as including consumption history in bills and notifying customers of potential leaks. The City will track the finances associated with each measure and compare it to water saved

to evaluate the effectiveness of each measure. If measures do not provide enough savings to meet their goals, additional measures will be considered.

TARGET WATER SAVINGS PROJECTIONS

If these goals are realized, the City will see significant savings in water use and distribution system leakage.

Table 6-8 compares the average day demand with and without water use efficiency savings. The water use efficiency savings projections include a decrease in the ERU value of 1 percent per year until 2015 and a constant rate of distribution system leakage of 11 percent. At the end of the 6-year planning period (2015), these water use efficiency measures will account for a total savings of 686,985 gpd.

Table 6-8 Projected Water Use Efficiency Savings

Year	Number of ERUs	ADD w/o WUE (gpd)	ADD w/WUE (gpd)	WUE Savings (gpd)
2008	13,813	4,088,718	3,878,260	210,458
2009	14,417	4,267,475	4,007,337	260,138
2010	15,027	4,448,039	4,135,126	312,914
2011	16,013	4,739,892	4,362,383	377,510
2012	17,006	5,033,649	4,586,416	447,233
2013	18,005	5,329,359	4,807,294	522,065
2014	19,010	5,627,074	5,025,086	601,988
2015	20,023	5,926,845	5,239,859	686,985

DEMAND FORECASTING

The WUE Rule has added new criteria to consider when preparing demand forecasts. It is now required to project demands both with and without anticipated savings from the water use efficiency program. This additional forecast can help determine whether capital improvements can be delayed or eliminated, and how much additional growth may be permitted. It also provides a basis to measure actual water use data against to monitor conservation success.

Complete demand forecasts are provided in Chapter 3 of this plan. A summary is included in Table 6-9. These forecasts do not include anticipated reductions in use from conservation and efficient water use efforts.

Table 6-9 Demand Forecast without WUE Savings

Year	Projected Service Area Population	Projected Average Day Production (gpd)	Projected Max Day Production (gpd)	Projected Peak Hour Production (gpm)
2009	17,135	4,267,475	9,388,444	11,736
2015	23,881	5,926,845	13,039,059	16,299
2029	40,321	9,393,809	20,666,597	25,833

Table 6-10 Demand Forecast with WUE Savings

Year	Projected Service Area Population	Projected Average Day Production (gpd)	Projected Max. Day Production (gpd)	Projected Peak Hour Production (gpm)
2009	17,135	4,007,337	8,816,141	11,020
2015	23,881	5,239,859	11,527,690	14,410
2029	40,321	8,323,183	18,311,003	22,889

ANNUAL PERFORMANCE REPORTING

The City must submit a performance report to the Department of Health by July 1, 2010, and each year thereafter. DOH has developed a standard reporting form to help summarize the City's progress toward meeting their goals. The annual report must include:

- Total source production and system wide consumption
- Distribution system leakage in percentage and volume
- Goal description, schedule, and progress toward meeting goals

DOH has developed a report form to make the process easier. The final report will also be made available to the public when it is submitted to DOH.

SUMMARY

To comply with the new requirements set forth in the Water Use Efficiency Rule and to reduce overall water use, the District has set a goal to reduce approximately two gpd per ERU per year and to reduce DSL through 2010 to meet requirements.

The City will employ several measures to accomplish these goals, which are as follows:

- Bills showing consumption history
- Conservation Kits
- Construction requirements

- Customer education
- Customer leak detection
- Irrigation management
- Landscape management
- Leak detection surveys
- Program promotion
- Rebate Program
- Water Audits

If the City's goals cannot be met with the implemented measures, the City will consider additional measures to help them do so. However, the City expects that their new WUE program will be more than adequate to accomplish their goals and increase water use efficiency and conservation.

Chapter 7
OPERATIONS AND MAINTENANCE

INTRODUCTION

The objective of this chapter is to present the City's operation and maintenance (O&M) program to assure satisfactory management of the water system operations in accordance with WAC 246-290.

The O&M Program includes the following elements:

- Water System Management and Personnel
- Operator Certification
- System Operation and Control
- Preventive Maintenance Program
- Coliform Monitoring Plan
- Emergency Response Program
- Cross-Connection Control Program
- Record Keeping and Reporting
- O&M Improvements

WATER SYSTEM MANAGEMENT AND PERSONNEL

The City of Camas water system is owned and operated by the City of Camas. The City is governed by a mayor and seven council members, all of which are elected officials. Figure 7-1 provides the organization of the water system.

OPERATOR CERTIFICATION

Department of Health (DOH) requires all Group A water systems to have at least one certified Water Distribution Manager (WDM) under WAC 246-292-050. The WDM must further be certified at a level equal to or higher than the water system's classification rating as described in Table 7-1 and in accordance with WAC 246-292-040.

Table 7-1 Water System Group Classification

Classification	Population Served
Group 1	Less than 1,500
Group 2	1,501 to 15,000
Group 3	15,001 to 50,000
Group 4	Greater than 50,000

The City is currently classified as a Group 3 system, which also corresponds to the level of certification required. Under the current certification requirements, the one mandatory certified position that the City must have on staff is a Water Distribution Manager (WDM) Level 3 and CCS. It is also required that personnel with supporting certifications be available as back-up for the mandatory certified position. These supporting certifications may be one grade lower than the required Level 3.

Table 7-2 provides the name and certifications of the City personnel. In addition to the mandatory certification, the City maintains additional certifications held by supporting personnel. Many of the employees hold multiple levels of certification. The City must notify the Water Works Certification Board in the event of any changes in the mandatory or supporting certification personnel. All of the required certifications are current with respect to continuing education unit (CEU) requirements.

CITY OF CAMAS
WATER SYSTEM ORGANIZATION CHART

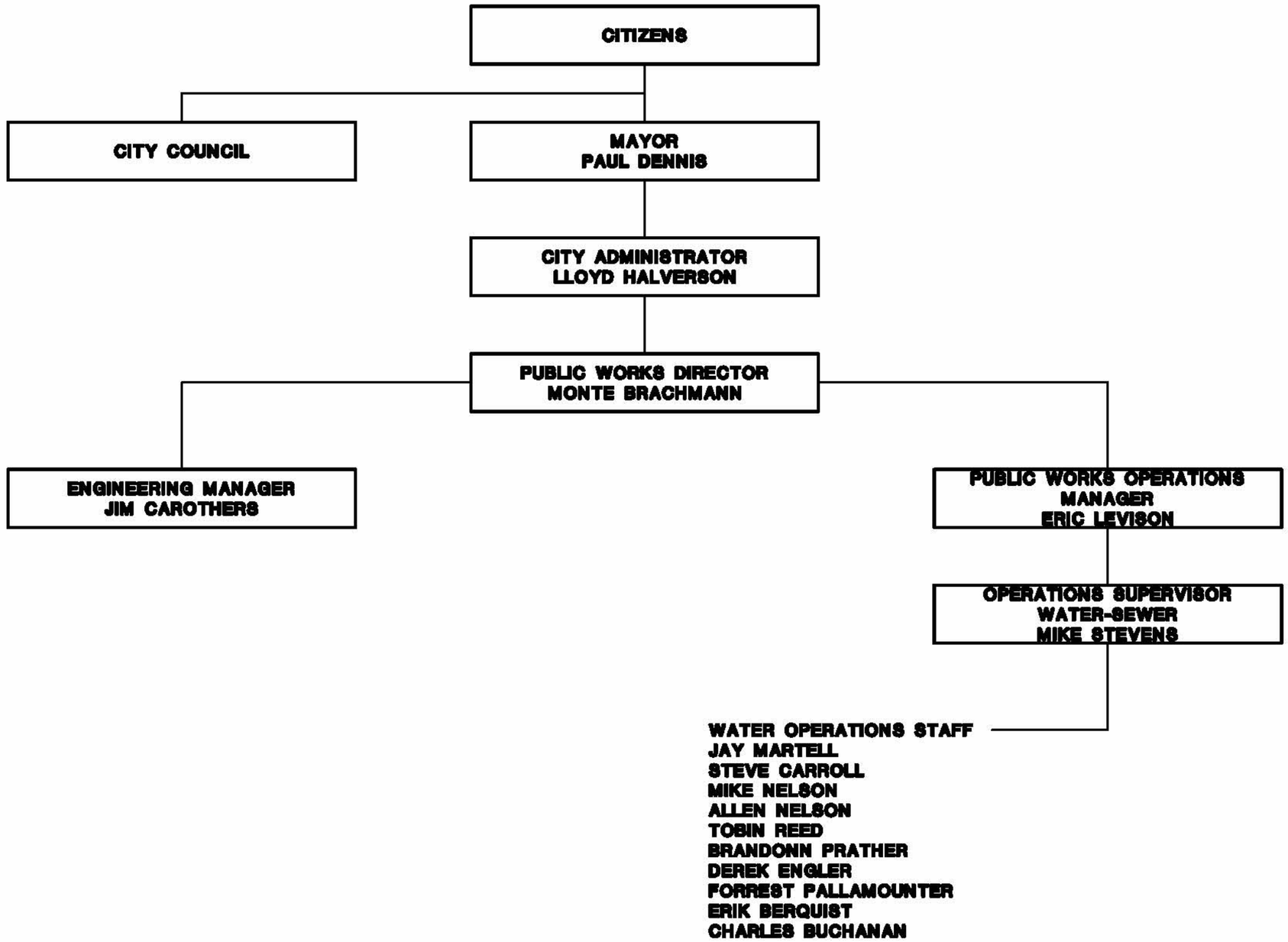


FIGURE 7-1

WATER SYSTEM
ORGANIZATION CHART

Table 7-2 Water System Operator Certifications

City Personnel	Water System Certifications	Certification Number
Monte Brachmann	WDM 4, WDS 2, WTPO 2,	751
Mike Stevens	WDM 3, WTPO 3, CCS	4946
Mike Nelson	WDM 2, WTPO 3, CCS	7509
Tobin Reed	WDM 2, WTPO 1, CCS	10297
Brandon Prather	WDM 2,	
Derek Engler	WDM 2	
Allen Nelson	WDM3, CCS	
Steve Carroll	WTPO 1, WDM 1	
Charles Buchanan	WDM 1	

PROFESSIONAL GROWTH

In order to promote and maintain expertise for the various grades of operator certification, Washington State requires that all certified operators meet professional growth requirements by completing no less than three CEUs within each three year period. Programs sponsored by both Washington Environmental Training Resources Center (WETRC) and the American Water Works Association (AWWA) Pacific Northwest Subsection are the most popular source of CEUs for certified operators in Washington State. The professional growth requirement may also be met by advancement by examination or certification by examination in a different classification. The City's Water Utility staff and personnel have traditionally been active in operator training programs. The City includes approximately 25 hours per year for each employee of the water department.

ROUTINE SYSTEM OPERATION AND PREVENTATIVE MAINTENANCE

The City's staff is responsible for the daily operation of its surface water sources, wells, treatment facilities, booster stations, PRVs, storage facilities, and distribution system. In addition to daily operation they also perform preventative maintenance on the system. The following sections describe the basic operation of the City's facilities. The preventative maintenance schedule and activities are listed in Appendix M.

WATER SOURCES

The City has two surface water sources and nine groundwater sources.

Surface Water Sources

Jones Creek has been providing the City of Camas with water since 1913. The intake consists of a dam, a small settling basin and dual coarse screens. A covered facility,

which used to house a fine screen, is located downstream of the uncovered coarse screen. To shut off flow from this source into the transmission main, a valve located downstream of the coarse screen and immediately inside the screen house is manually closed. This source is metered using an 8-inch Sparling propeller flow meter located inside the screen house immediately downstream of the shut off valve.

The Boulder Creek source was added in 1931. The intake consists of a dam, a small settling basin and screen. A covered facility housing a fine screen is located downstream of the uncovered coarse screen. To shut off flow from this source into the transmission main, a valve located downstream of the coarse screen and upstream of the screen house is manually closed. This source is metered using a 10-inch Sparling propeller flow meter in a vault located approximately 20 feet south of the screen house.

When flow from the two surface water sources is discontinued during the period May 15 to October 31 the transmission line is drained into Lacamas Lake by opening the bypass valve at the Surface Water Filtration Plant.

Groundwater Sources

The City operates nine groundwater sources. The City operates its well facilities by rotating sources. Generally the City will operate at least three wells with operational settings as summarized in Table 7-3.

Table 7-3 Well Operation Settings

Well Designation	Butler Reservoir Level			
	Summer On	Summer Off	Winter On	Winter Off
Lead(1)	14.3	14.6	13.8	14.2
First Lag(1) (2)	14.1	14.3	13.5	14
Second Lag(1)	13.8	14.1	13	13.5
Lower Prune Hill Reservoir Level				
Well No. 5(3)	18.5	20	17	18
Lacamas Reservoir Level				
Well No. 9	36	40	n/a	n/a

(1) Designation applies to Wells 6, 7, 8, 10, 11, 12 and 13.
(2) This well is tied to maintaining suction side pressure at Angelo Booster Station.
(3) This well operates in conjunction with Forest Home Booster Station.

Well No. 5 operates off of the Lower Prune Hill reservoir level in conjunction with the Forest Home Booster Station to meet demands in the Lower Prune Hill (455) Zone.

Well No. 9 is a seasonal supplemental source well that operates based on the level in the Lacamas Reservoir when needed to meet seasonal demands in the Lacamas (544) Zone.

The remaining wells (Nos. 6, 7, 8, 10, 11, 12 and 13) are rotated monthly and operated based on the level in the Butler Reservoir as shown in Table 7-3. If more than three wells are needed to meet demand, additional wells will be operated on an as-needed basis.

TREATMENT FACILITIES

The City operates and maintains their treatment facilities which include the surface water chlorination plant, surface water filtration plant, and treatment at the wells.

Surface Water Chlorination Plant

The Surface Water Chlorination Plant consists of chlorine addition to inactivate pathogenic organisms. Liquid sodium hypochlorite (12.5 percent) is injected directly into the surface water transmission main conveying the two surface water sources to a target dose of approximately 2 mg/L. Dose varies seasonally due to temperature fluctuations.

The liquid sodium hypochlorite is pumped directly into the 10-inch transmission main using a diaphragm metering pump. This metering pump is manually set. On-line chlorine residual monitoring occurs at the surface water filtration plant and the metering pump is adjusted when the on-line monitoring indicates this is needed.

Chlorinated water travels from the surface water chlorination plant through over 6.5 miles of 10-inch steel pipe to the filter plant, where it receives additional treatment. This treatment facility has an auxiliary power system that is powered by propane.

Surface Water Filtration Plant

The filtration plant consists of the following basic components:

Filtration – Consists of alum coagulant addition, polymer filter aid addition, two multimedia pressure filters and a backwash system that includes a dechlorination chemical addition step prior to discharging the backwash water to a settling lagoon that discharges to Lacamas Lake. Typical alum dose is 7 – 8 mg/L. Typical polymer dose is 0.055 mg/L. A streaming current monitor is available to control chemical dosing.

Fluoridation – Consists of fluoride addition for the purpose of preventing dental decay. A sodium fluoride saturator and metering pump is used to inject fluoride into the filtered water to a target dose of 0.8 – 1.3 mg/L.

Disinfection – No disinfection occurs at the surface water filtration plant. Residual chlorine is monitored in the finished water to ensure the chlorine

residual of water reaching the Surface Water Chlorination Plant is adequate (1.0 mg/L or higher).

Corrosion Control – Consists of sodium hydroxide addition for pH adjustment to a target level of 7.5. This typically requires a dose of 5 to 6 mg/L NaOH, which is injected into the filtered water before exiting the treatment facility.

Backwash Disposal – Consists of a backwash collection system that operates by reversing flow through the filters and collection of backwash water in a waste pipe that discharges by gravity to two backwash basins north of the plant. A thiosulfate feed system is used to dechlorinate the water prior to discharge to the backwash basins. Suspended solids settle out in the backwash basins and backwash water flows by gravity to Lacamas Lake.

Finished water from the Surface Water Filtration Plant feeds directly into an adjacent 12-inch main to feed the 14-inch line in NE Everett Street that serves as the backbone of the Lower Prune Hill (455) Pressure Zone. The surface water plant feeds the 455 Zone along with the Lacamas and Gregg Booster Stations. The Surface Water Filtration Plant operates on gravity flow. When the plant is in operation there is always flow through the plant based on system demand in the 455 Zone. Flow through the plant will vary depending on system demand.

Backwash occurs automatically either by a headloss or effluent turbidity setting. The operator selects these settings at the main filter control panel. Prior to initiating backwash, a surface wash of the top of the pressure filter media occurs using a pump that delivers water from the finished water line. Once the surface wash is complete, backwash is initiated by shutting off the influent valve to the pressure filter to be backwashed, causing the direction of flow through the filter to reverse and back up into the influent line. A pressure relief valve opens at 150 psi and raw water is taken to the lagoons.

A backwash valve that connects the influent line to the waste line opens and directs backwash water into the waste line that goes to the backwash basins north of the filter building. The backwash basins consist of two shallow earthen basins with a bentonite liner. Backwash water enters the basins via an inlet structure equipped with gate valves that allows each basin to be isolated. A wood screen downstream of the inlet keeps large debris from entering the outlets that collect the supernatant from the basins and allow it to flow to Lacamas Lake. The outlet from each basin is also equipped with a valve to prevent the basins from draining into Lacamas Lake if necessary. Normally all inlet and outlet valves are left open.

When the surface water treatment facility is taken offline, the two filtration systems are backwashed every 2 weeks to keep the media from getting compacted due to lack of

use. Water in the distribution system is used for backwashing since the transmission line is drained.

BOOSTER STATIONS

The City of Camas operates nine booster stations within its water system, as summarized in Table 7-4.

Table 7-4 Booster Stations

Booster Pump Station	Year Built	No. of Pumps	Pump horse power	Pump Capacity (gpm)	Total Pump Station Capacity (gpm)	Auxiliary Power
Old Gregg	1978	2	40	500	500	None
			40	500		
New Gregg	2003	2	100	1,500	1,500	300 kW
			100	1,500		
Butler	1948(1)	2	40	600	1,400	None
			50	800		
Forest Home	1949(2)	1	50	1,000	1,000	None
Angelo	2001	4	75	1,000	3,500	200 kW
			75	1,000		
			75	1,000		
			75	1,000		
Lacamas	1993	3	25	500	1,500	60 kW
			25	500		
			100	1,500		
Lower Prune Hill	1971(3)	3	150	1,000	2,245	300 kW
			150	1,000		
			100	750		
Upper Prune Hill	2002	4	20	750	4,300	Portable Generator
			20	750		
			40	1,400		
			40	1.400		
Francis Road	Unknown	1	7.5	80	80	None

(1) Pump replaced in 1998.
(2) Pump replaced in 1999.
(3) Upgraded in 2002 and 2004.

Table 7-5 shows the winter and summer settings for each booster station.

Table 7-5 Booster Station Settings

Booster Station	Capacity (gpm)	Called By	Winter On	Winter Off	Summer On	Summer Off
Old Gregg	500	Gregg Reservoir	58.0	65.0	58.0	65.0
New Gregg	1,500		58.0	65.0	58.0	65.0
Forest Home	1,000	Well 5	-	-	-	-
Francis Road	80	-	-	-	-	-
Butler Booster Station						
Pump No. 1	800	LPH Reservoirs	15.5	16.0	15.5	16.0
Pump No. 2	600		15.0	15.5	15.0	15.5
Butler Valve	1,050 (Typical)		22.5	22.0	22.5	22.0
Angelo Booster Station						
Pump No. 1	1,000	LPH Reservoirs	20.0	21.5	21.0	22.0
Pump No. 2	1,000		19.5	20.5	20.5	21.5
Pump No. 3	1,000		18.5	19.5	19.5	20.5
Pump No. 4	1,000		17.0	18.0	18.0	19.0
Lower Prune Hill (LPH) Booster Station (UPH Standpipe Open)						
Pump No. 1	1,000	ON - UPH Reservoir OFF-UPH Standpipe	56.0	95.0	58.0	95.0
Pump No. 2	1,000		54.0	94.0	56.0	95.0
Pump No. 3	750		52.0	93.0	54.0	95.0
Upper Prune Hill (UPH) Booster Station (UPH Standpipe Open)						
Pump No. 1	750	UPH Standpipe	88.0	95.0	88.0	95.0
Pump No. 2	750		86.0	93.0	86.0	93.0
Pump No. 3	1,400		84.0	92.0	84.0	92.0
Pump No. 4	1,400		80.0	88.0	80.0	88.0
Lacamas Booster Station						
Pump No. 1	500	Lacamas Reservoir	40.0	44.0	42.0	44.0
Pump No. 2	500		36.0	41.0	40.0	42.0
Pump No. 3	1,500	N/A	Manual	Manual	-	-

PRVS

Most of the City's PRV stations contain two parallel PRVs. The first PRV is the smaller of the two valves, has a lower allowable capacity, and provides flow for normal or low demands in the downstream pressure zone. The second PRV is the larger of the two valves and opens under higher demand conditions, such as a fire flow. The larger PRVs are not capable of providing low flows that occur during low demand. The larger PRV is usually set approximately 5 psi lower than the smaller PRV. As flow and head losses through the smaller valve increase, the larger valve will open to provide additional flow.

This arrangement allows each valve to operate within its optimal range of flow, which will require less maintenance and increase the life of the PRV. This differs from a single

PRV that is required to operate over the entire range of minimum and maximum flows. The City's PRVs do not have pressure sustaining features.

The City has a contract with GC Systems to service PRVs located within the water system. This contract allows GC Systems to perform general maintenance and ensure that the valves are operating correctly, both on an individual and system-wide level.

STORAGE FACILITIES

The City currently operates seven storage facilities with a combined total of 8.45 MG. A discussion of each storage facility and its basic operation was described in Chapter 1.

COLIFORM MONITORING PLAN

As required by DOH the City has a regular coliform monitoring plan in place to check for bacterial contamination of the distribution system. Samples are taken monthly at various locations which rotate throughout the year. A map of coliform sampling locations and the plan are located in Appendix H.

EMERGENCY RESPONSE PROGRAM

Water utilities have the responsibility to provide an adequate quantity and quality of water in a reliable manner at all times. To do this, utilities must reduce or eliminate the effects of natural disasters, accidents and intentional acts. Most utilities routinely deal with small scale emergency situations. Large scale emergency situations occur far less frequently, but may manifest themselves in the same way as the routine emergencies. If a utility is well prepared to handle routine emergencies, then they will also be better prepared to handle more disastrous ones as well. The complete emergency response program is located in Appendix N.

CROSS CONNECTION CONTROL PROGRAM

As required by WAC 246-290-490, Cross Connection Control, utilities have the responsibility to protect customers from water contamination due to cross connections. A cross connection control program is required to be included in the Water System Comprehensive Plan under WAC 246-290-100.

A cross connection is any physical arrangement where the potable water supply is connected, directly or indirectly, to any liquid of unknown or unsafe quality that may contaminate the public water supply through backflow. The regulation also requires utilities to develop and implement a comprehensive program to control cross connections within the system. An acceptable cross connection control program must address the following elements:

- Establishment of legal authority and program policies;
- Evaluation of premises for cross-connection hazards;

- Elimination and/or control of cross connections;
- Provision of qualified personnel;
- Inspection and testing of backflow prevention assemblies;
- Quality control of testing process;
- Response to backflow incidents;
- Public education for consumers;
- Record keeping for CCC program.

CITY OF CAMAS CCC PROGRAM

City ordinance 1504 addresses cross connections and their prevention. The ordinance is in the Camas Municipal Code under Water Use Regulations, Chapter 13.32.

This ordinance and corresponding Municipal Code provide the City's water department the ability to protect the water supply from contamination by prohibiting cross connections, requiring backflow prevention devices, declaring prohibited cross connections to be unlawful, establishing fees for the inspection of cross connection assemblies, and adopting State standards for cross connection regulations. The ordinance and corresponding Municipal Code provides procedures for the abatement of cross connections and the installation of backflow prevention devices.

The City has four employees certifies as cross-connection control specialists. The City's cross-connection control program and records are continually updated and files of each cross-connection device are on file with the City. The Public Works Department and the Building Department coordinate notification to customers who have devices that need to be tested. The city has the following information on file:

- Date of last inspection
- Results of inspection
- Recommended protection
- List of approved assemblies
- Test and maintenance reports
- List of certified testers
- Customer account number, billing address, service address, phone numbers, device history and maintenance records.

The City's Cross-Connection Control Program requires the inspection of backflow prevention devices at the time of installation. These devices are also scheduled to be inspected annually after installation, after the device is repaired, after the device is relocated or reinstated, and as necessary if tests indicate repeated failure. Owners of backflow prevention devices are notified by mail that their devices are due for inspection. However, it is the responsibility of the customer to see that their device is

tested. Failure to provide the city with a backflow prevention device inspection report from a certified cross connection control specialist will result in the customer's water service being terminated. This termination is then reported to the Department of Health.

A copy of the City's Cross-Connection Control Ordinance and Plan can be found in Appendix O.

RECORDKEEPING AND REPORTING

Records of various operational and maintenance parameters of the system are maintained by the City.

O&M DEFICIENCIES

There are no operation and maintenance deficiencies at the City.

Chapter 8
CAPITAL IMPROVEMENTS

INTRODUCTION

This Chapter presents the elements and proposed schedule of the 6-year Capital Improvement Plan (CIP) in accordance with the requirements of WAC 246-290. Water system capital improvements have been scheduled and prioritized on the basis of water quality concerns, growth, regulatory requirements, component reliability, system benefit, and financial priority. Additional projects for the 20-year planning period have also been identified. When the Water System Plan is updated at the end of the 6-year planning period, the projects presented for the 20-year planning period should be reevaluated and scheduled for the subsequent 6-year planning period if necessary. A City water system base map indicating proposed improvement projects is included at the end of this document.

In the future, other projects may arise which are not identified as part of the City's CIP. Such projects may be deemed necessary for ensuring water quality, preserving emergency water supply, addressing unforeseen problems with the City's water system, or accommodating transportation improvements proposed by other agencies. The City retains the flexibility to reschedule proposed projects and to expand or reduce the scope of proposed projects, as best determined by the City's Staff and as new information becomes available for evaluation. Each capital improvement project should be reevaluated to consider the most recent planning efforts as the proposed completion date for the project approaches. Detailed cost estimates for these projects are located in Appendix S.

SOURCE AND WATER RIGHTS

Based upon future water use projections shown in Chapter 3, and the water rights analysis shown in Chapter 4, the City will need to maximize their current sources and acquire new water rights in order to meet growth in the next 20 years. The following projects will address the deficiencies outlined in Chapter 4.

WELL 14 – ANDERSON SITE (SR-1)

This project is currently under construction and will have a capacity of 1,000 gpm. A treatment facility and CT piping will also be included in this project and will also serve Well 6. This project is listed as SR-1 in Table 8-1, is scheduled for completion in 2010, and has an estimated cost of $1,650,000.

BOULDER CREEK FISH SCREENS (SR-2)

The installation of a fish screen at the intake of Boulder Creek to minimize fish impacts is planned in 2010, and has an estimated cost of $35,000.

FILTRATION PLANT ALTERNATIVES ANALYSIS AND PREDESIGN REPORT (SR-3)

An analysis of the surface water filtration plant is required to determine necessary upgrades. This improvement is scheduled for 2012, and has an estimated cost of $60,000.

WELL 17 – CAMAS MEADOWS SITE (SR-4) (SR-6)

The City has applied for a 1,000 gpm water right for an additional well in the 544 Zone at Camas Meadows Golf Course. The application is currently pending. Once approved, site acquisition will be required as a portion of the well development. The City prefers to develop this well prior to Well 15 and 16 due to its location in the 544 Zone where demand is needed. This improvement is scheduled for 2018, when the maximum day demand will exceed the City's developed water rights. However, it is recommended that this improvement be made as soon as the application is approved due to the high demands expected in this zone within the 6-year planning period. The feasibility assessment is scheduled for 2015 at an estimated cost of $50,000. This project is listed as SR-4 in Table 8-1. The development of Well 17 is scheduled for 2018 and is listed as SR-6 in Table 8-1 and has an estimated cost of $1,650,000.

FILTRATION PLANT UPGRADES (SR-5)

An upgrade to the current filtration plant to a 1,000 gpm membrane filtration plant is scheduled for 2017, and has an estimated cost of $6,000,000. This project is contingent on the results of the Filtration Plant Analysis (SR-3).

WELL 15 – PARKERS LANDING SITE (SR-7)

Water rights have already been obtained for this project from Ecology. The capacity of this well will be 1,000 gpm. The Well 15 site is located approximately 700 feet southwest of Well 5. The maximum day demand, as shown in Table 3-16, will exceed

the City's existing developed water rights in 2022. This project is scheduled for completion in 2022, and has an estimated cost of $1,650,000.

NUGA Source Development (SR-8)

The City will pursue potential source development within the NUGA to support anticipated growth. It is recommended that the City continue to pursue additional source development in this area, and apply for water rights accordingly.

It is recommended that the City budget approximately $500,000 for continued source development. This project includes purchase and administrative costs for obtaining existing water rights from owners in this part of the service area. This project is listed as SR-8 in Table 8-1.

Well 16 – Wastewater Treatment Plant Site (SR-9)

Water rights have already been obtained for this project from Ecology. The capacity of this well will be 1,000 gpm. The Well 16 site is located at the City's Wastewater Treatment Plant. According to the maximum day demand projections provided in Table 3-16, after Well 15 is developed, additional water rights will be required in 2024. This project is scheduled for completion in 2024, and has an estimated cost of $1,650,000.

Well 18 – Fire Station Site (SR-10)

The City has applied for a 350 gpm water right for an additional well in the 544 Zone located at the Fire Station. The application is currently pending. Once approved, site acquisition will be required as a portion of the well development. This improvement is anticipated in 2026, and has an estimated cost of $1,000,000.

A summary of the source of supply capital improvements are shown in Table 8-1. All costs are in 2010 dollars.

Steigerwald Source Development (SR-11)

The City will actively pursuing potential source development in the Steigerwald area to support anticipated growth. The City will budge approximately $500,000 for source development in this area. This project is listed as SR-10 in Table 8-1.

A summary of the source of supply capital improvements are shown in Table 8-1. All costs are in 2010 dollars.

Table 8-1 Source of Supply Capital Improvement Projects

Project No.	Year	Description	Cost(1)
SR-1	2010	Well 14 Development – Anderson Site	$1,650,000
SR-2	2010	Boulder Creek Fish Screens	$35,000
SR-3	2012	Filtration Plant Facility Plan	$60,000
SR-4	2015	Well 17 Feasibility Study – Camas Meadows Site	$50,000
SR-5(2)	2017	Filtration Plant Upgrades	$6,000,000
SR-6	2018	Well 17 Development – Camas Meadows Site	$1,650,000
SR-7	2022	Well 15 Development – Parkers Landing Site	$1,650,000
SR-8	2022	NUGA Source development	$500,000
SR-9	2024	Well 16 Development – WW Treatment Plant Site	$1,650,000
SR-10	2026	Well 18 Development – Fire Station Site	$1,000,000
SR-11	2026	Steigerwald Source Development	$500,000

(1) CCI = 8,660.08 per ENR January 2010.
(2) This project is a place holder and depends on the evaluation, listed as project SR-3.

STORAGE FACILITIES

LOWER PRUNE HILL RESERVOIR EVALUATION AND REPLACEMENT (S-1) (S-5)

Due to the age and condition of the Lower Prune Hill Reservoirs, continued leak detection and a structural evaluation is planned within the 6 year planning period. This project will include a feasibility assessment that evaluates leakage, structural integrity, and short term rehabilitation options. This project is scheduled for completion in 2014 and is listed as project S-1 in Table 8-2 at an estimated cost of $80,000. The smaller of the two reservoirs will be decommissioned and demolished, and a new 0.5 MG steel welded tank will be constructed in its place. This improvement includes significant site and foundation work. This project is listed as project S-5 and is scheduled for completion in 2020 at an estimated cost of $1,539,000.

CEMETERY RESERVOIR (S-2)

A new 2.0 MG reservoir will be constructed to serve a new 290 Zone downtown, and the existing 343 Zone. The reservoir will set the hydraulic grade for the 290 Zone, and a booster station will also be constructed to supply the 455 Zone. The Cemetery Reservoir is identified as project S-2 and is scheduled for completion by 2016 at an estimated cost of $2,188,000.

DECOMMISSION AND DEMOLITION BUTLER RESERVOIR (S-3)

Due to the age and condition of the Butler Reservoir, it shall be decommissioned and replaced by the new Cemetery Reservoir. This project is identified as project S-3 and is scheduled for 2016 at an estimated cost of $40,000.

ADDITIONAL GREGG RESERVOIR (S-4)

As shown in the storage analysis in Chapter 4, additional storage is required in the 542 Zone as the NUGA develops. The additional Gregg Reservoir is scheduled for completion by 2018, and is estimated at $2,188,000.

GREEN MOUNTAIN RESERVOIR (S-6)

Based upon the storage analysis presented in Chapter 4, the City will require a new 2.0-MG reservoir within the 20-year planning period with development occurring within the NUGA. The Green Mountain Reservoir is scheduled for completion by 2024, and is estimated at $2,188,000. These projects are summarized in Table 8-2.

Table 8-2 Reservoir Capital Improvements

Project No.	Year	Description	Cost(1)
S-1	2014	Lower Prune Hill Reservoir Evaluation	$80,000
S-2	2016	Cemetery Reservoir, 2.0 MG	$2,188,000
S-3	2016	Decommissioning and Demolition of Butler Reservoir	$40,000
S-4	2018	Gregg Reservoir, 2.0 MG	$2,188,000
S-5	2020	Lower Prune Hill Reservoir Replacement	$1,539,000
S-6	2024	Green Mountain Reservoir, 2.0 MG	$2,188,000

(1) CCI = 8,660.08 per ENR January 2010.

TRANSMISSION AND BOOSTER STATION

The City's pumping and transmission requirements will depend upon the extent and rate of growth within the NUGA. The following is a description of the recommended transmission and booster station projects.

FOREST HOME BOOSTER STATION UPGRADE AND TRANSMISSION (T-1, T-2, T-3)

As demands on the 455 Zone increase and the Cemetery Reservoir and Booster Station are being constructed, an interim upgrade is planned at the Forest Home Booster Station to accommodate growth. The station will be upgraded from 1,000 gpm to 2,500 gpm to meet growth through the 6-year planning period, as shown in Chapter 4. The completion of this project will increase the total pumping capacity to the 455 Zone to 10.6 mgd. The upgrade will include a new building, pumps, and auxiliary generator. This is improvement requires site acquisition, listed as project T-1 in Table 8-3. The booster station upgrades are listed as project T-2. With the upgrade to the booster station, transmission improvements are required to minimize head losses from Well 6 and 14 to the 455 Zone. Approximately, 1,400 LF of 6-inch pipe must be replaced with 12-inch pipe. This is listed as project T-2 in Table 8-3 and is scheduled for completion by 2012.

CROWN ROAD TRANSMISSION, BOOSTER STATION, AND EXPANSION (T-4, T-5, T-15)

The Crown Road Booster Station has already been designed, and will provide 3,200 gpm from the 343 Zone to the 542 Zone and the NUGA, with the potential to expand to 4,800 gpm. It is recommended that this improvement be made in the 6-year planning period in order to increase transmission out of the Washougal Wellfield, and meet maximum day demands in the 544 Zone in 2015. As part of this project, 7,800 LF of 24-inch transmission main must be installed to connect the 343 Zone to the 542 Zone. This project will ultimately serve the NUGA, and the expansion of the booster station will be dependent on the rate of growth within the NUGA. Because this project is driven by growth, developers will fund the equivalent of an 8-inch transmission main, and 70 percent of the booster station. The transmission main and booster station are scheduled for completion by 2012, and are listed as projects T-4 and T-5, respectively, in Table 8-3. The expansion of the booster station is scheduled for completion by 2024 and is listed as project T-15 in Table 8-3.

PORTABLE BOOSTER STATION (T-6)

In order to meet maximum day demands in the 6-year planning period, a 125 gpm package booster pump station is required at the LPH Booster Station. This is an interim project to meet 6-year demands before the LPH Booster Station upgrade takes place to meet 20-year demands. This improvement is listed as project T-6 and is scheduled for 2012.

NUGA TRANSMISSION MAINS (T-7, N-1 THROUGH N-7)

In order to serve the anticipated development within the NUGA, a network of transmission mains must be constructed. See Figure 8-1 for the layout of recommended transmission mains within the NUGA. If growth occurs as projected, the 24-inch main that connects the 542 and 544 Zone must be constructed to meet demands. This project totals 19,650 LF, is scheduled for completion by 2015, and is listed as project T-7 in Table 8-3. An additional network of transmission mains within the NUGA will be developer funded. These projects are listed in Table 8-4 as projects N-1 through N-7, and are scheduled for construction in the 20-year planning period.

CEMETERY BOOSTER STATION AND TRANSMISSION MAINS (T-8, T-9, T-10, T-11)

As part of decommissioning the Butler Reservoir, and constructing the new Cemetery Reservoir, an additional 2,300 LF of 12-inch transmission main is required to connect the Cemetery Reservoir inlet to the 290 Zone at 6th and Oak. This is listed as project T-8 and is scheduled for completion by 2016. A new booster station will be constructed to provide 4,000 gpm from the new 290 Zone to the 455 Zone; this is listed as project T-9. As part of this improvement, 4,200 LF of 16-inch transmission main is required to connect the Cemetery Booster Station with the 455 Zone. This is listed as project T-10. Once the Crown Road Booster Station and Cemetery Reservoir are constructed, the existing 12-inch CI pipe may be converted to serve the 455 Zone. This is listed as

project T-11. The booster station and associated transmission projects are scheduled for completion by 2016.

LOWER PRUNE HILL BOOSTER STATION UPGRADE (T-12)

In order to meet maximum day demands through the 6-year planning period in the 852 Zone, the Lower Prune Hill Booster Station must be upgraded from its current capacity of 2,500 gpm to 4,000 gpm to meet 20 year demands. This project is listed as T-12 in Table 8-3.

LACAMAS BOOSTER STATION UPGRADE AND TRANSMISSION (T-13, T-14)

If the NUGA transmission main is not constructed, then growth in the 544 Zone must be served through the Lacamas Booster Station. This will require an upgrade of the Lacamas Booster Station and the 12-inch suction-side transmission main. The phasing and capacity requirements vary, depending upon the rate of growth within the zone. These improvements are listed as projects T-13 and T-14 in Table 8-3.

14-INCH STEEL REPLACEMENT (T-15)

6,000 LF of 14-inch steel main provides transmission to the 455 Zone. This must be replaced within the 20-year planning period and is listed as project T-15 in Table 8-3.

WELL 16 TRANSMISSION (T-17)

Transmission improvements are required once Well 16 is developed. Approximately 2,300 LF of 6-inch main will be replaced with 12-inch main along Polk Street. This project is included in the 20-year planning period and is listed as project T-17 in Table 8-3.

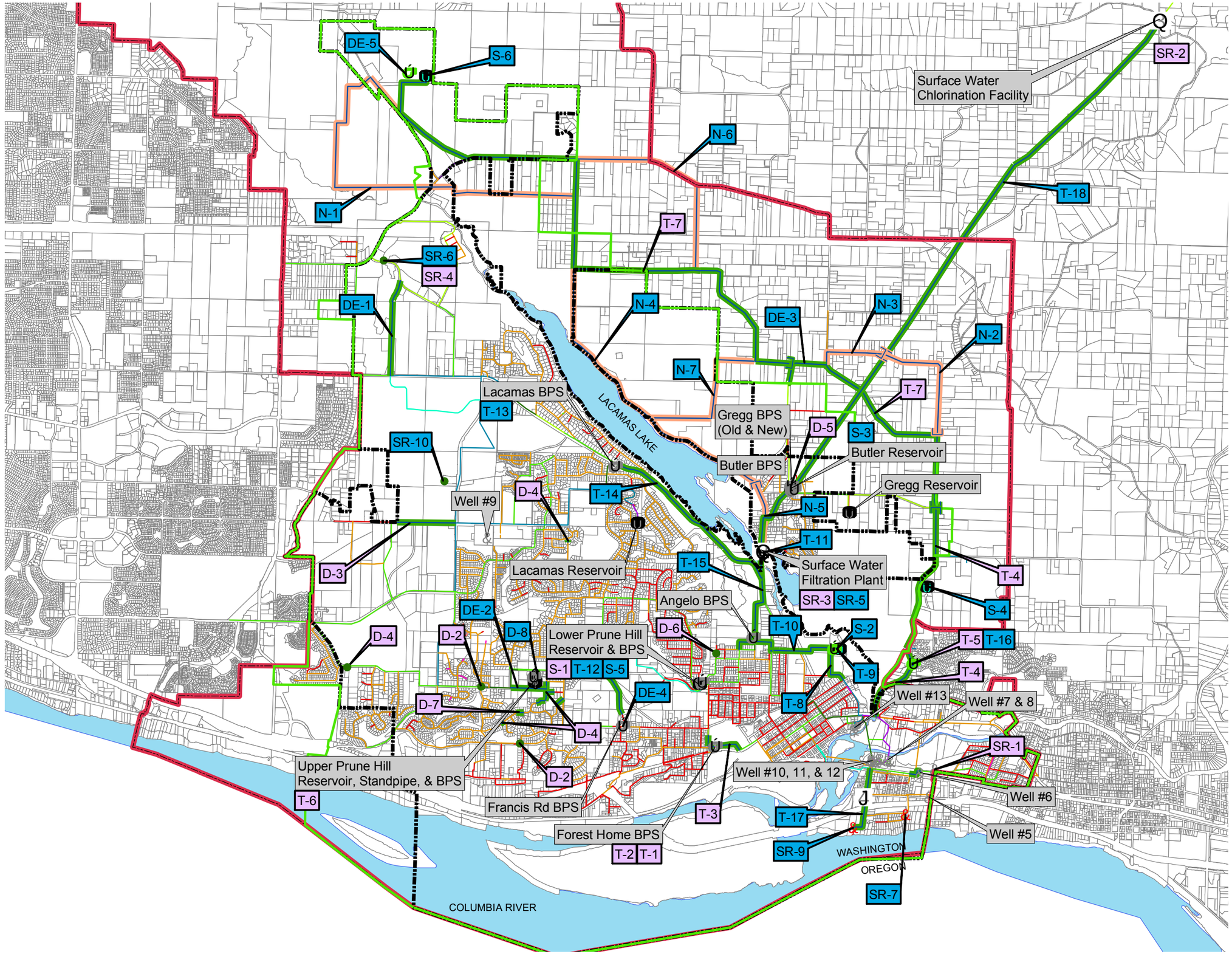
JONES AND BOULDER CREEK TRANSMISSION IMPROVEMENTS (T-18)

If Jones and Boulder Creek continue as a surface water source for the City, a new transmission main from the creeks to the filtration plant must be constructed. This project is a placeholder and is dependent on the findings of the Filtration Plant Facility Plan (SR-3). If needed, construction will include approximately 48,000 LF of 10-inch transmission main. This project is included in the 20-year planning period and is listed as project T-18 in Table 8-3.

Table 8-3 Transmission and Booster Station Improvements

Project No.	Year	Description	Capacity/ Length	Cost(1)
T-1	2010	Forest Home Booster Station Site Acquisition	-	$50,000
T-2	2012	Forest Home Booster Station Upgrade	2,500 gpm	$464,800
T-3	2012	Forest Home Transmission Upgrade	1,400 LF	$358,000
T-4(2)	2012	24-inch Crown Road BS suction and discharge transmission main from 3rd to 15th.	7,800 LF	$2,973,000
T-5(3)	2012	Crown Road Booster Station	3,200 gpm	$713,000
T-6	2012	Upper Prune Hill Portable Booster Pump	125 gpm	$15,000
T-7	2015	24-inch transmission main within the NUGA to connect the 542 Zone to the 544 Zone and the proposed Green Mountain Reservoir	19,650 LF	$7,041,000
T-8	2016	12-inch transmission main from Cemetery Reservoir inlet to 6th and Oak	2,300 LF	$514,000
T-9	2016	Cemetery Booster Station	4,000 gpm	$784,300
T-10	2016	16-inch transmission main to connect Cemetery BS with 455 Zone at 22nd and Division	4,200 LF	$1,275,000
T-11	2016	Convert existing 12-inch CI pipe to supply 455 Zone	-	$50,000
T-12	2018	Lower Prune Hill Booster Station Upgrade	4,000 gpm	$483,000
T-13	2020	Lacamas Booster Station Upgrade	3,500 gpm	$177,000
T-14	2020	20-inch suction-side transmission main to Lacamas Booster Station	5,000 LF	$1,731,000
T-15(2)	2023	Replace 14-inch steel transmission main from Butler Site to 455 Zone	6,000 LF	$1,563,000
T-16	2024	Crown Road Booster Station Upgrade	4,800 gpm	$80,300
T-17	2024	12-inch main along SE Polk St. for increased transmission from proposed Well 16	2,300 LF	$514,000
T-18	2025	Jones and Boulder Creek Transmission Improvements	48,000 LF	$6,974,000

(1) CCI = 8,660.08 per ENR January 2010.
(2) Developers will pay for approximately $1,465,000 of this project.
(3) Developers will pay for approximately $500,000 of this project.



3

0 4,000 8,000 Feet

LEGEND:

- City Limits
- Urban Growth Boundary
- Water Service Boundary

Water Lines

- 1
- 4
- 6
- 8
- 10
- 12
- 14
- 16
- 18
- 20
- 24
- 36

- New Well
- Existing Well
- New Pump Station
- New Reservoir
- Existing Operations Center
- Existing Pump Station
- Existing Reservoir
- Existing Standpipe
- Existing Water Treatment
- NUGA Improvements
- Distribution Improvements
- 6-year Improvement Projects
- 20-year Improvement Projects
- Existing Facilities

SOURCE: CITY OF CAMAS

CITY OF CAMAS WASHINGTON

FIGURE 8-1
CAPITAL IMPROVEMENT PROJECTS

L:\CAMAS\08495 WSP\FIG7-1 CIP.mxd

Table 8-4 NUGA Transmission Improvements

Project No.	Year	Improvement	Cost(1)
N-1	2017	12-inch transmission main within the NUGA for added transmission within the 544 Zone from the Green Mountain Reservoir, 15,600 LF 12 inch.	$3,434,000
N-2	2018	12-inch transmission main along SE 283rd Avenue and Hathaway Road, 5,300 LF 12 inch.	$1,292,000
N-3	2019	Replace existing 6-inch main with 12-inch transmission main for additional transmission within the NUGA, 1,900 LF 12 inch.	$590,000
N-4	2020	12-inch transmission main within the NUGA for added transmission along the north side of Lacamas Lake, 11,200 LF 12 inch.	$2,519,000
N-5	2021	12-inch transmission main within the NUGA for added transmission from the north side of the lake to connect to existing transmission along NE Everett Street, 2,600 LF 12 inch.	$735,000
N-6	2022	12-inch transmission main to increase transmission within the NUGA, 7,900 LF 12 inch.	$1,835,000
N-7	2023	12-inch transmission main to increase transmission within the NUGA, 5,700 LF 12 inch.	$1,379,000

(1) CCI = 8,660.08 per ENR January 2010.

DISTRIBUTION SYSTEM

Approximately 62 percent of the City's distribution system consists of ductile iron pipe. City staff has indicated that ductile iron became the City's standard pipe material in the late 1970s. Other materials within the water system include cast iron and steel. The cast iron pipe located within the distribution system requires relatively infrequent repairs and appears to be serviceable for some time to come. The steel pipe was installed in the 1940s. The City has a policy of replacing old steel pipe coinciding with road and developer projects, and shall continue to do so as part of the capital improvement program.

Additional hydraulic improvements were selected in order to improve system pressures, improve fire flows, and improve water quality by the looping of dead end lines.

Table 8-5 shows the City's distribution system improvements scheduled through the 20-year planning period. These new main locations were selected to increase system looping in order to improve water quality and fire flow, and were identified as deficiencies in the hydraulic analysis in Chapter 5. The cost estimates operate under the assumption that water lines will be placed in existing right-of-way or be placed in

future right-of-way as a result of developer extensions. These projects are identified as project numbers D-1 through D-8 in Table 8-5.

Table 8-5 Distribution System Improvements

Project No.	Year	Project Description	Purpose	Cost(1)
D-1	Annual	Pipeline Replacement	Level of Service	$150,000/year
D-2	2010	PRV adjustment on NW 16th and NW McIntosh, raise 697 Zone to 710 Zone	Peak Hour Deficiencies	-
D-3	2010	12-inch DI main on NW 38th Ave. from NW Parker St. to Water Service Area Boundary, 5,800 LF	Extension project	$750,000
D-4	2011	UPH PRV adjustments and looping around NW Astor, 1,600 LF of 8 inch	Fire Flow Deficiencies	$323,000
D-5	2011	Butler Site PRV Station, 8 inch	With Crown Road BPS, allow flow to 455 Zone, utilize existing 14-inch	$89,000
D-6	2012	Couch Street BS, 50 gpm	Peak Hour Deficiencies	$120,000
D-7	2012	UPH looping from NW 9th Avenue to NW 12th Avenue, 300 LF of 12 inch	Peak Hour Deficiencies	$78,000
D-8	2020	UPH Standpipe outlet piping upgrade, 320 LF of 24 inch	Peak Hour Deficiencies	$151,000

(1) CCI = 8,660.08 per ENR January 2010.

Table 8-6 presents projects that will be developer driven, will only be completed when demand is present, and will only be partially funded by the City. These projects are identified as project numbers DE-1 through DE-5 in the following table.

Table 8-6 Developer Extension Improvements

Project No.	Year	Project Description	Cost(1)
DE-1	2016	DI main between NW Camas Meadows Dr. to NW Lake Road, 4,000 LF of 12 inch	$985,000
DE-2	2017	UPH looping along NW 16th Avenue, 1,300 LF of 12 inch	$323,000
DE-3	2018	542 Zone looping along NE Everett Road and NE 3rd Street, 2,000 LF of 12 inch	$494,000
DE-4	2019	Decommission 10th Ave./Francis Booster Station, area served by UPH	$471,000
DE-5	2024	Upper Green Mountain Booster Station, 1,500 gpm	$419,200

(1) CCI = 8,660.08 per ENR January 2010.

WATER USE EFFICIENCY PROGRAM

The state's *Water Use Efficiency Rule* includes the development of a conservation program as a requirement for approval of water comprehensive plans and water rights. Components of a conservation program that include associated capital costs are typically measures that include ongoing programs for device distribution, irrigation central control, water audits, and leak detection.

WATER CONSERVATION DEVICES

As part of the Capital Improvement Program, the City will distribute water conservation devices. The devices can be distributed as kits or individual components and can be distributed over a number of years to existing customers. The requirement for installation of the kit components could be included in the City's plumbing code for new connections. New connections would be charged and supplied with a kit at the time of hookup. If the City maintained a supply of individual components, the kits could be detailed specifically for the new customer. Typical conservation kits consist of low-flow showerheads, shower timers, kitchen and bathroom aerators, toilet tank bags, toilet dye capsules, and instructions for use and installation. If a quantity of 1,000 kits was purchased, the above kit would cost approximately $4.00 per unit (bulk prices would be lower). Estimated water use savings of approximately 30 gallons per person per day have been attributed to water conservation devices.

WATER AUDITS

An ongoing water audit program is recommended to provide assistance to residential, commercial, and industrial customers. Under this program, trained personnel will visit a home or facility and make recommendations as to adjustments for water saving. The service could be provided free and on a voluntary basis for existing customers. The City is considering offering such a program to new and existing customers, particularly large industrial and commercial customers.

LEAK DETECTION STUDY

Leak detection is an integral element of a Water Use Efficiency Program. The City's three-year average for lost and unaccounted for water is equivalent to 11.2 percent. The City anticipates performing a leak detection survey during 2010.

A summary of the capital improvements relating to conservation and their anticipated costs are presented in Table 8-7.

Table 8-7 Conservation Capital Improvements

Project No.(1)	Year	Description	Cost
C-1	2010	Water Conservation Device Distribution Program	$5,000
C-2	2010-2014	Leak Detection Study	$6,000/year
C-3	2010-2012	Commercial/Industrial Water Audit Program	$25,000/year
C-4	2011-2013	HOA Water Audit Program	$50,000/year

(1) CCI = 8,660.08 per ENR January 2010.

CAPITAL IMPROVEMENT SUMMARY

Table 8-8 summarizes the system deficiencies from Chapters 4 and 5 and how the CIP project will remedy each deficiency.

Table 8-9 provides a summary of the system improvements for the City for the 6-year capital improvement program. Table 8-10 provides the improvements for the 20-year planning period. All cost estimates are based on 2010 dollars and are not adjusted for inflation. These improvements and their approximate locations are shown on the map provided at the end of this document.

Table 8-8 Summary of System Deficiencies

Deficiency	CIP Project
Existing and 6-year Deficiencies	
Source Capacity, 6-year deficit (page 4-13)	The City will increase the nominal pumping capacity (Table 4-12) with the construction of Forest Home Booster Station, Crown Road Booster Station, and Crown Road transmission mains to meet 6-year maximum day demands. By using the City's existing wells at their full capacity the pumping capacity is 13.66 MGD. This meets the City's 6-year MDD. Additional source capacity will come from Well 14. CIP Projects: SR-1, T-1, T-2, T-3, T-4, T-5
343 Zone MDD 6-year pumping deficiency (page 4-17)	The pumping deficiency is eliminated with Forest Home Booster Station, Crown Road Booster Station, Crown Road transmission mains, and connection of the 542 and 544 Zones through the NUGA. Well 14 also provided additional pumping capacity. CIP Projects: SR-1, T-1, T-2, T-3, T-4, T-5, T-7
455 Zone MDD 6-year pumping deficiency (page 4-17)	The pumping deficiency is eliminated with Crown Road Booster Station, and Crown Road transmission mains. CIP Projects: T-4, T-5
544 Lacamas and NUGA Zone 6-year MDD pumping deficiency (page 4-17)	The pumping deficiency is eliminated with Forest Home Booster Station, Crown Road Booster Station, Crown Road transmission mains, and connection of the 542 and 544 Zones through the NUGA. Well 14 also provided additional pumping capacity. CIP Projects: SR-1, SR-4, T-1, T-2, T-3, T-4, T-5, T-7, D-5

Table 8-8 Summary of System Deficiencies (Continued)

Deficiency	CIP Project
852 UPH Zone 6-year MDD pumping deficiency (page 4-17)	The pumping deficiency is eliminated with Forest Home Booster Station, Crown Road Booster Station, Crown Road transmission mains, and a portable booster pump. Well 14 also provided additional pumping capacity. CIP Projects: SR-1, SR-4, T-1, T-2, T-3, T-4, T-5, T-6, T-7
343, 542 Gregg, and 544 Lacamas Zone existing and 6-year storage deficiency (page 4-23)	Excess storage in other zones eliminates the deficit in these zones. The total storage of the City meets existing and 6-year storage requirements.
542 and 544 NUGA 6-year storage deficiency	NUGA growth is dependent on developer funded storage. The Gregg and Green Mountain Reservoirs are listed as CIP project for these areas. CIP Projects: S-4, S-6
PHD deficiencies (page 5-14)	Hydraulic modeling projects have been identified to eliminate these deficiencies. CIP Projects: D-2, D-6, D-7
Fire flow deficiencies (page 5-14)	Hydraulic modeling projects have been identified to eliminate these deficiencies. CIP Projects: D-4
20-year Deficiencies	
Instantaneous Water Right deficiency (page 4-9)	Pending water right applications for the Fire Station and Camas Meadows will add an additional 1,350 gpm. However, additional rights are still required. The City will pursue Steigerwald and NUGA Sources to secure additional water rights. CIP Projects: SR-4, SR-6, SR-8, SR-10, SR-11

Table 8-8 Summary of System Deficiencies (Continued)

Deficiency	CIP Project
Source Capacity, 20-year deficit (page 4-13)	In addition to the 6-year CIP projects listed above, the City will develop additional wells, upgrade the Crown Road Booster Station, upgrade the Lower Prune Hill Booster Station, construct the Cemetery Booster Station, and pursue additional water rights in the Steigerwald and NUGA areas. CIP Projects: SR-4, SR-6, SR-7, SR-8, SR-9, SR-10, SR-11, T-8, T-9, T-10, T-11, T-12, T-13, T-14, T-15, T-16
Maximum Day, 20-year Pumping deficiency (page 4-13)	In addition to the 6-year CIP project listed above, the City will develop additional wells, upgrade the Crown Road Booster Station, upgrade the Lower Prune Hill Booster Station, construct the Cemetery Booster Station, and pursue additional water rights in the Steigerwald and NUGA areas. CIP Projects: SR-4, SR-6, SR-7, SR-8, SR-9, SR-10, SR-11, T-8, T-9, T-10, T-11, T-12, T-13, T-14, T-15, T-16
20-year Storage Deficiency (page 4-24)	The Cemetery Reservoir will replace the Butler Reservoir and eliminate the zone deficiency. An additional Gregg Reservoir will be constructed to eliminate the deficiency. An additional Green Mountain Reservoir will be constructed to serve the 544 NUGA Zone. This provides an additional 4.8 MG of storage to the system, eliminating the total storage deficit shown in Table 4-22. CIP Projects: S-2, S-3, S-4, S-5, S-6
PHD deficiencies, 20-year (page 5-14)	Hydraulic modeling projects have been identified to eliminate these deficiencies. CIP Project: D-8

Table 8-9 6-year Capital Improvement Project Summary

No.	Title	Year	City Project Cost[1]
SR-1	Well 14 Development - Anderson Site	2010	$ 1,650,000
SR-2	Boulder Creek Fish Screen	2010	$ 35,000
C-1	Water Conservation Device Distribution Program	2010	$ 5,000
C-2	Leak Detection Study	2010	$ 6,000
C-3	Commercial/Industrial Water Audit Program	2010	$ 25,000
D-1	Pipeline Replacement	2010	$ 150,000
D-2	PRV Adjustments on NW 16th and NW McIntosh	2010	-
D-3	12-inch DI main on NW 38th Avenue	2010	$ 750,000
D-1	Pipeline Replacement	2011	$ 150,000
D-4	UPH PRV adjustments and looping around NW Astor	2011	$ 323,000
D-5	Butler Site PRV, 8-inch	2011	$ 89,000
T-1	Forest Home Booster Station Site Acquisition	2011	$ 50,000
C-2	Leak Detection Study	2011	$ 6,000
C-3	Commercial/Industrial Water Audit Program	2011	$ 25,000
C-4	Residential Water Audit Program	2011	$ 50,000
SR-3	Treatment Plant Facility Plan	2012	$ 60,000
D-1	Pipeline Replacement	2012	$ 150,000
D-6	Couch Street Booster Pump Station	2012	$ 120,000
D-7	UPH looping from NW 16th to NW 12th Avenue	2012	$ 78,000
T-2	Forest Home Booster Station Upgrade	2012	$ 464,800
T-3	Forest Home Transmission Upgrade	2012	$ 358,000
T-4	Crown Road 24-inch Transmission Main	2012	$ 1,508,000
T-5	Crown Road Booster Station	2012	$ 213,000
T-6	Portable Booster Station	2012	$ 15,000

Table 8-9 6-year Capital Improvement Project Summary (Continued)

No.	Title	Year	City Project Cost[1]
C-2	Leak Detection Study	2012	$ 6,000
C-3	Commercial/Industrial Water Audit Program	2012	$ 25,000
C-4	Residential Water Audit Program	2012	$ 50,000
D-1	Pipeline Replacement	2013	$ 150,000
T-7	NUGA 544 Zone - 24 inch Transmission Main	2013	$ 2,300,000
C-2	Leak Detection Study	2013	$ 6,000
C-4	Residential Water Audit Program	2013	$ 50,000
D-1	Pipeline Replacement	2014	$ 150,000
S-1	Lower Prune Hill Reservoir Evaluation	2014	$ 80,000
T-7	NUGA 544 Zone - 24 inch Transmission Main	2014	$ 2,300,000
C-2	Leak Detection Study	2014	$ 6,000
SR-4	Well 17 Feasibility Study - Camas Meadows Site	2015	$ 50,000
D-1	Pipeline Replacement	2015	$ 150,000
T-7	NUGA 544 Zone - 24 inch Transmission Main	2015	$ 2,441,000
6-Year Capital Improvement Total			**$14,044,800[2]**

(1) CCI = 8,660.08 per ENR January 2010.
(2) CIP totals only include portion City will fund. Does not include NUGA (N) projects or developer (DE) projects.

Table 8-10 20-year Capital Improvement Project Summary

No.	Title	Year	City Project Cost[1]
D-1	Pipeline Replacement	2016	$ 150,000
DE-1	DI main between NW Camas Meadows Drive to SE 1st Street	2016	$ 985,000
T-8	Transmission from Cemetery Reservoir to 290 Zone	2016	$ 514,000
T-9	Cemetery Booster Station	2016	$ 784,250
T-10	Transmission from Cemetery BS to 455 Zone	2016	$ 1,275,000
T-11	Convert 12-inch CI to supply 455 Zone	2016	$ 50,000
S-2	2.0-MG Cemetery Reservoir	2016	$ 2,188,000
S-3	Decommission Butler Reservoir	2016	$ 40,000
SR-5	Treatment Plant Upgrades	2017	$ 6,000,000
D-1	Pipeline Replacement	2017	$ 150,000
DE-2	UPH looping along NW 16th Avenue	2017	$ 323,000
N-1	15,600 LF of 12-inch NUGA Transmission Main	2017	$ 3,434,000
SR-6	Well 17 Development - Camas Meadows Site	2018	$ 1,650,000
T-12	Lower Prune Hill Booster Station Upgrade	2018	$ 483,000
D-1	Pipeline Replacement	2018	$ 150,000
DE-3	542 Zone looping	2018	$ 494,000
S-4	2.0 MG Gregg Reservoir	2018	$ 2,188,000
N-2	5,300 LF of 12-inch NUGA Transmission Main	2018	$ 1,294,000
D-1	Pipeline Replacement	2019	$ 150,000
DE-4	Decommission 10th Avenue/Francis Street Booster Station	2019	$ 471,000
N-3	1,900 LF of 12-inch NUGA Transmission Main	2019	$ 590,000
S-5	Lower Prune Hill Reservoir Replacement	2020	$ 1,539,000
D-1	Pipeline Replacement	2020	$ 150,000

Table 8-10 20-year Capital Improvement Project Summary (Continued)

No.	Title	Year	City Project Cost[1]
D-8	UPH Standpipe outlet piping upgrade, 24-inch	2020	$ 151,000
T-13	Lacamas Booster Station Upgrade	2020	$ 177,000
T-14	20-inch Suction Side Transmission to Lacamas Booster Station	2020	$ 1,731,000
N-4	11,200 LF of 12-inch NUGA Transmission Main	2020	$ 2,519,000
D-1	Pipeline Replacement	2021	$ 150,000
N-5	2,600 LF of 12-inch NUGA Transmission Main	2021	$ 735,000
SR-7	Well 15 Development - Parkers Landing Site	2022	$ 1,650,000
SR-8	NUGA Source Development	2022	$ 500,000
D-1	Pipeline Replacement	2022	$ 150,000
N-6	7,900 LF of 12-inch NUGA Transmission Main	2022	$ 1,835,000
D-1	Pipeline Replacement	2023	$ 150,000
T-15	Replace 14-inch Steel Transmission from Butler Site to 455 Zone	2023	$ 1,563,000
N-7	5,700 LF of 12-inch NUGA Transmission Main	2023	$ 1,379,000
SR-9	Well 16 Development - Wastewater Treatment Plant Site	2024	$ 1,650,000
D-1	Pipeline Replacement	2024	$ 150,000
DE-5	Upper Green Mountain Booster Station	2024	$ 419,200
S-6	2.0 MG Green Mountain Reservoir	2024	$ 1,838,000
T-16	Crown Road Booster Station Upgrade	2024	$ 80,250
T-17	12-inch along Polk Street for Well 16 transmission	2024	$ 514,000
T-18	Jones and Boulder Creek Transmission Improvements	2025	$ 6,974,000
D-1	Pipeline Replacement	2025	$ 150,000

Table 8-10 20-year Capital Improvement Project Summary (Continued)

No.	Title	Year	City Project Cost[1]
D-1	Pipeline Replacement	2026	$ 150,000
SR-10	Well 18 Development - Fire Station Site	2026	$ 1,000,000
SR-11	Steigerwald Source Development	2026	$ 500,000
D-1	Pipeline Replacement	2027	$ 150,000
D-1	Pipeline Replacement	2028	$ 150,000
D-1	Pipeline Replacement	2029	$ 150,000
6-Year Capital Improvement Total			**$14,044,800**
20-Year Capital Improvement Total			**$37,139,500**
Complete Capital Improvement Total			**$56,358,300[2]**

(1) CCI = 8,660.08 per ENR January 2010.
(2) CIP totals only include portion City will fund. Does not include NUGA (N) projects or developer (DE) projects.

Table 8-11 6-year Capital Improvement Project Schedule

No.	Total	2010	2011	2012	2013	2014	2015
SR-1	$ 1,650,000	$1,650,000					
SR-2	$ 35,000	$ 35,000					
SR-3	$ 60,000						
SR-4	$ 50,000			$ 60,000			$ 50,000
D-1	$ 900,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000
D-2		$ -					
D-3	$ 750,000	$ 750,000					
D-4	$ 323,000		$ 323,000				
D-5	$ 89,000		$ 89,000				
D-6	$ 120,000			$ 120,000			
D-7	$ 78,000			$ 78,000			
S-1	$ 80,000					$ 80,000	
T-1	$ 50,000	$ 50,000					
T-2	$ 464,800		$ 200,000	$ 264,800			
T-3	$ 358,000		$ 150,000	$ 208,000			
T-4	$ 1,508,000		$ 750,000	$ 758,000			
T-5	$ 213,000		$ 115,000	$ 98,000			
T-6	$ 15,000			$ 15,000			
T-7	$ 7,041,000				$2,300,000	$2,300,000	$2,441,000
C-1	$ 5,000	$ 5,000					
C-2	$ 30,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	
C-3	$ 75,000	$ 25,000	$ 25,000	$ 25,000			
C-4	$ 150,000		$ 50,000	$ 50,000	$ 50,000		
TOTAL	**$14,044,800**	**$2,671,000**	**$1,858,000**	**$1,832,800**	**$2,506,000**	**$2,536,000**	**$2,641,000**

Chapter 9
FINANCING

INTRODUCTION
This chapter analyzes the City's ability to finance the water improvements outlined in the previous chapters. The potential funding sources, financial status of the water utility, the funding required to pay for the scheduled improvements, and the impact of water improvements on water rates are presented.

CURRENT WATER RATES
Water rates for the City are defined in the Camas Municipal Code (CMC) Chapter 13.36.010. Rates are set by ordinance. Current rates were set in March 2009 by Ordinance No. 2539 and updated in December 2009. Water service is charged a flat monthly minimum service fee based on meter size, plus a commodity charge per hundred cubic foot based on customer classification. Customers outside the city limits are charged more for the monthly minimum service charge and consumption. Table 9-1 shows the current inside city and outside city minimum monthly service charges based on meter size. Table 9-2 shows the existing water commodity charge per hundred cubic feet by customer classification.

Table 9-1 Monthly Minimum Water Service Charge

Meter Size	Inside City	Outside City
5/8 Inch	$6.75	$10.13
3/4 Inch	$7.32	$10.98
1 Inch	$9.03	$13.55
1-1/4 Inch	$10.16	$15.24
1-1/2 Inch	$11.31	$16.97
2 Inch	$17.57	$26.36
3 Inch	$63.68	$95.52
4 Inch	$80.77	$121.16
6 Inch	$120.62	$180.93
8 Inch	$166.17	$249.26
10 Inch	$217.41	$326.12

Table 9-2 Water Volume Charge(1)

Customer Classification	Inside City	Outside City
Residential	$1.30 per 100 c.f.	$1.95 per 100 c.f.
Commercial	$1.58 per 100 c.f.	$2.36 per 100 c.f.
Industrial	$1.31 per 100 c.f.	$1.97 per 100 c.f.
Irrigation	$1.47 per 100 c.f.	$2.21 per 100 c.f.
Cemetery	$0.59 per 100 c.f.	$0.88 per 100 c.f.

(1) In one hundred cubic feet (100 cf) consumed per month.

CURRENT CONNECTION FEES

City water utilities are authorized by RCW 35.92.025 to charge connection fees based on an equitable share of existing and planned water system costs. The present City connection fees were established by Ordinance 2539. The current connection fees schedule is illustrated in Table 9-3.

Table 9-3 Connection Fees

Meter Size	Single-Family Residential(2)	Commercial	Industrial	Irrigation
5/8 Inch	$1,714	$1,673	$9,987	$3,263
3/4 Inch	$2,317	$2,182	$13,984	$4,790
1 Inch	$3,549	$3,224	$22,004	$7,871
1-1/2 Inch	$6,539	$5,738	$41,964	$11,676
2 Inch	$10,288	$8,917	$66,078	$15,481
3 Inch	$21,632	$18,741	$131,729	$24,775
4 Inch		$28,198	$203,992	$50,907
6 Inch		$58,122	$404,375	$78,711
8 Inch		$85,127	$644,731	$155,597

FINANCIAL OPERATIONS

The City performs financial analysis of their utility services periodically. The most recent study by FCS Group was performed in June 2009. FCS coordinated with Gray & Osborne to reflect the growth projections provided in Chapter 3, and the CIP projects presented in Chapter 7. Table 9-4 provides a summary of the City's 2008/2009 cash flow, and projected 6 year cash flow. The majority of this analysis was performed by FCS Group. However, the FCS Group analysis scope did not include growth within the NUGA. A conservative estimate has been provided for rate revenues within the NUGA. Projections also include an increase of rates to support the CIP. The rate increase is a 5 percent per year increase between 2010 and 2013. Water utility revenues, expenditures, and the resulting effects on water utility cash and investments for the years 2008-2015 is summarized in Table 9-4. The preliminary financial study by FCS Group is located in Appendix T. Table 9-5 summarizes the operating water fund balance from 2008 to 2015. Table 9-6 summarizes the capital water fund balance from 2008 to 2015.

Table 9-4 2008 – 2015 Net Operation Cash Flow[1]

Revenues	2008[2]	2009	2010	2011	2012	2013	2014	2015
Rate Revenue[3]	$2,765,100	$3,145,704	$3,424,819	$3,650,001	$3,889,989	$4,145,755	$4,207,941	$4,271,060
NUGA Revenue[4]	$ -	$ -	$ -	$ 90,860	$ 181,474	$ 272,334	$ 363,194	$ 454,054
Non-Rate Revenue	$ 330,300	$ 216,088	$ 232,008	$ 247,410	$ 257,712	$ 273,029	$ 286,680	$ 301,014
Total Revenue	**$3,095,400**	**$3,361,792**	**$3,656,827**	**$3,988,271**	**$4,329,175**	**$4,691,118**	**$4,857,816**	**$5,026,129**
Expenses	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Operating Expenses	$2,325,196	$2,607,902	$2,709,642	$2,815,625	$2,925,971	$3,041,027	$3,162,668	$3,289,175
Existing Debt Service	$ 380,659	$ 402,641	$ 403,908	$ 401,061	$ 401,757	$ 400,917	$ 400,917	$ 400,917
New Debt Service	$ -	$ 201,605	$ 272,261	$ 272,261	$ 559,428	$ 650,395	$ 650,395	$ 650,395
Additional Taxes from Rate Increase	$ -	$ 17,055	$ 28,974	$ 38,150	$ 48,038	$ 58,686	$ 58,686	$ 58,686
Rate Funded System Reinvestment	$ -	$ -	$ -	$ 200,000	$ 200,000	$ 200,000	$ -	$ -
Total Expenses	**$2,705,855**	**$3,229,203**	**$3,414,785**	**$3,727,097**	**$4,135,194**	**$4,351,025**	**$4,272,666**	**$4,399,173**
Net Cash Flow after Rate Increase	**$ 389,545**	**$ 132,589**	**$ 242,042**	**$ 261,174**	**$ 193,981**	**$ 340,093**	**$ 585,150**	**$ 626,956**

(1) 2008 – 2013 analysis conducted by FCS Group. 2014 and 2015 values projected by Gray & Osborne. Projections will be revisited by City personal as new information becomes available.
(2) Actual values used from records for 2008 data.
(3) Includes 5 percent per year rate increase from 2010 to 2013.
(4) Projected based on ERU growth within the NUGA as shown in Chapter 3. Conservative NUGA revenues based on 2008 residential rate revenue per ERU.

Table 9-5 2008 – 2015 Operating Funds Budget[1]

Operating Budget	2008[2]	2009	2010	2011	2012	2013	2014	2015
Beginning balance	$479,154	$573,337	$643,044	$668,131	$694,264	$721,472	$749,842	$779,835
Net cash flow after rate increase	$389,545	$132,589	$242,042	$261,174	$193,981	$340,093	$585,150	$626,956
Transfer to capital fund	($295,362)	($ 62,882)	($216,955)	($235,041)	($166,773)	($311,724)	($555,157)	($595,763)
Ending balance	**$573,337**	**$643,044**	**$668,131**	**$694,264**	**$721,472**	**$749,842**	**$779,835**	**$811,028**

(1) 2008 – 2013 analysis conducted by FCS Group. 2014 and 2015 values projected by Gray & Osborne.
(2) Actual values used from records for 2008 data.

Table 9-6 2008 – 2015 Capital Funds Budget[1]

Summary Capital Cash Flows	2008[2]	2009	2010	2011	2012	2013	2014	2015
Beginning Balance	**$ 181,256**	**$ 226,195**	**$1,258,181**	**$1,580,212**	**$1,162,618**	**$2,661,145**	**$3,573,592**	**$ 592,721**
(+) Rate funded system reinvestment	$ -	$ -	$ -	$ 200,000	$ 200,000	$ 200,000	$ -	$ -
(+) Grants/Developer donations/Outside sources	$ -	$ 390,000	$2,232,968	$ 363,657	$ -	$2,676,451	$ -	$ -
(+) Transfer from REET	$ 500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Existing bond proceeds	$4,084,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Connection charges	$ 189,104	$ 189,104	$ 189,104	$ 189,104	$ 189,104	$ 189,104	$ 189,104	$ 189,104
(+) Net debt proceeds available for projects	$ -	$2,140,000	$ 750,000	$ -	$3,220,000	$1,020,000	$ -	$2,000,000
(+) Interest earnings[3]	$ 5,673	$ -	$ 41,763	$ 51,273	$ 38,137	$ 84,714	$ 112,427	$ 18,879
(+) Transfer from operating fund	$ 295,362	$ 62,882	$ 216,955	$ 235,041	$ 166,773	$ 311,724	$ 555,157	$ 595,763
(-) Total Capital Expenses[4]	($5,030,000)	($1,750,000)	($3,106,000)	($1,454,383)	($2,313,390)	($3,567,328)	($3,852,043)	($3,089,000)
Ending Balance	**$ 226,195**	**$1,258,181**	**$1,580,212**	**$1,162,618**	**$2,661,145**	**$3,573,592**	**$ 576,591**	**$ 290,332**

(1) 2008 – 2013 analysis conducted by FCS Group. 2014 and 2015 values projected by Gray & Osborne.
(2) Actual values used from records for 2008 data.
(3) Interest rate = 3.1 percent.
(4) Total of CIP projects from Chapter 8, inflated to the year the project takes place at a rate of 4.1 percent.

SUMMARY OF PROJECTED FINANCIAL STATUS

The City will continue to update their financial report with FCS Group as new information is received. They have managed their funds responsibly in the past and will continue to make funds available for the required CIP. Rate increases are planned in the 6-year planning period, and funding is available.

AVAILABLE CAPITAL PROJECT FUNDING SOURCES

This section describes several funding sources available to the City without reference to any specific project, including information on the following:

Grants: USDA Rural Development (RD)

Loans: Public Works Trust Fund Loan
Drinking Water State Revolving Fund
USDA Rural Development (RD)
Community Economic Revitalization Board

Bonds: Revenue Bonds

USDA Rural Development

USDA Rural Development (RD) has a loan program that, under certain conditions, includes a limited grant program. Grant determination is based on a formula that incorporates existing debt service and existing utility water service rates.

In addition, RD has a loan program for needy communities that cannot obtain funding by commercial means through the sale of revenue bonds. The loan program provides long-term 30- to 40-year loans at interest rates that are based on federal rates and vary with the commercial market. Interest rates currently range from 4.5 percent to 5.25 percent and require a 1.1 debt coverage payment to a capital reserve.

Public Works Trust Fund

The Public Works Trust Fund (PWTF) is a revolving loan fund designed to help local governments finance needed public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by the legislature, offers loans below market rates, payable over periods ranging up to 20 years.

Interest rates are 0.5 percent, 1.0 percent, or 2.0 percent, with the lower rates providing an incentive for a higher financial share. The local community to qualify for a 2.0 percent loan must provide a minimum of 5 percent of the project's costs. A 10 percent local share qualifies the applicant for a 1.0 percent interest rate and a 15 percent local share qualifies for a 0.5 percent loan. The useful life of the project determines the loan term, with a maximum term of 20 years.

To be eligible, an applicant must be a local government such as a City, Town, County, or special purpose utility district, and have a long-term plan for financing its public work needs. If the applicant is a City, Town, or County it must adapt the 1/4 percent real estate excise tax dedicated to capital purposes. Eligible public works systems include streets and roads, bridges, storm sewers, sanitary sewers, and domestic water. Loans are presently offered only for purposes of repair, replacement, rehabilitation, reconstruction or improvement of existing service users. A recent change has now made projects intended to meet reasonable growth (as detailed in a twenty year growth management plan) eligible for PWTF funding.

The funding program operates on an annual cycle, with April and August application dates. The August application date is for preconstruction only, and pre-construction money is typically available by the end of the year. The April application date is both pre-construction and construction loans, with money available in May of the following year.

Drinking Water State Revolving Fund

Loans of up to $2,000,000 are available from this program, which involves the administration of federal funds by two state agencies. Applications are due in July of each year. Terms of the loan vary according to the market interest rate and financial hardship considerations. The most recently offered terms were an interest rate of 3.5 percent over a 20-year repayment period, with no local match requirement. There is also a 2 percent loan origination fee that can be included in the loan request. Lower interest rates and longer repayment periods are available in cases of financial hardship.

Community Economic Revitalization Board (CERB)

This low interest loan and grant program is sponsored by the Department of Trade and Economic Development. Funding is available for infrastructure that supports projects, which will result in specific private developments or expansions in manufacturing, and businesses that support the trading of goods and services outside the state's border. Funding is not available to support retail shopping developments or acquisition of real property. The projects must create or retain jobs. The funding is one job per $3,000 of CERB financing. The interest rate fluctuates with the state bond rate.

Revenue Bonds

A common source of funds for construction of major utility improvements is the sale of revenue bonds. The tax-free bonds would be issued by the City, and the bonds are repaid and backed by water service rate revenue. In order to market revenue bonds, the issuer must typically show that its net water utility operating income (gross income less expenses) is equal to or greater than a factor, typically 1.2 – 1.4, times the annual debt service on all par debt issued. This 1.4 factor is commonly referred to as the debt coverage factor and is applicable to revenue bonds sold on the commercial market. The required debt coverage factor may be specified in previous revenue bond ordinances. If not, it will be determined at the time of bond issue.

RECOMMENDATION

Scheduled capital improvement projects can be funded by operating revenues, system development charges, and PWTF loan financing. Financial reserves are projected to be adequate and available for operations, contingencies, and capital replacement. The City should aggressively pursue PWTF loan financing for capital improvements, closely monitor revenues, expenditures and reserve fund balances, adjusting water utility rates accordingly.

List of Appendices

APPENDICES:

Appendix A	WFI
Appendix B	DOH Checklist and Submittal Form
Appendix C	Water Rights Documentation
Appendix D	SEPA and DNS
Appendix E	City of Camas Design Standards
Appendix F	City of Camas 2008 Water Quality Report
Appendix G	City of Camas Intertie Agreement
Appendix H	Coliform Monitoring Plan
Appendix I	Volatile Organic Chemical Test Results
Appendix J	Lead and Copper Test Results
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Appendix L	Water Modeling Results
Appendix M	Preventative Maintenance Schedule
Appendix N	Emergency Response Program
Appendix O	Cross Connection Control Ordinance
Appendix P	Wellhead Protection Program
Appendix Q	Watershed Control Program
Appendix R	Consistency Statement
Appendix S	Detailed Cost Estimates
Appendix T	FCS Group Financial Analysis - DRAFT

Appendix A

WFI

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter 1
Updated: 03/03/2009
Printed: 11/24/2009
WFI Printed For: On-demand
Submission Reason: Pop/Connect Update

RETURN TO: Southwest Regional Office, PO Box 47823, Olympia, WA, 98504

1. SYSTEM ID NO	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
10800 2	CAMAS MUNICIPAL WATER SEWER SYSTEM	CLARK	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS

STEVENS MICHAEL A. [OPERATIONS SUP
1620 SE 8TH AVE
CAMAS, WA 98607

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

7. OWNER NAME & MAILING ADDRESS

CAMAS, CITY OF
MONTE BRACHMANN
PO BOX 1055
CAMAS, WA 98607

TITLE: PUBLIC WORKS DI

8. Owner Number 000789

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS 616 NORTHEAST FOURTH AVE
CITY CAMAS STATE WA ZIP 98607

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone:	(360) 817-1567 x4283	Owner Daytime Phone:	(360) 817-1534
Primary Contact Mobile/Cell Phone:	(360) 921-2872	Owner Mobile/Cell Phone:	(360) 921-3799
Primary Contact Evening Phone:	(xxx)-xxx-xxxx	Owner Evening Phone:	(xxx)-xxx-xxxx
Fax: (360) 834-0215	E-mail: mstevens@ci.camas.wa.us	Fax: (360) 834-1535	E-mail: mbrachmann@ci.camas.wa.us

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed
- [ ] Managed Only
- [ ] Owned Only

SMA NAME: _____ SMA Number: _____

12. WATER SYSTEM CHARACTERISTICS (mark ALL that apply)

- [ ] Agricultural
- [x] Commercial / Business
- [x] Day Care
- [x] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [x] Industrial
- [x] Licensed Residential Facility
- [x] Lodging
- [ ] Recreational / RV Park
- [x] Residential
- [x] School
- [ ] Temporary Farm Worker
- [x] Other (church, fire station, etc.): _____

13. WATER SYSTEM OWNERSHIP (mark only one)

- [ ] Association
- [x] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [ ] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons)

8,500,000

--- SEE NEXT PAGE FOR A COMPLETE LIST OF SOURCE

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
10800 2	CAMAS MUNICIPAL WATER SEWER SYSTEM	CLARK	A	Comm

15	16 SOURCE NAME	17 INTERTIE	18 SOURCE CATEGORY										19 USE			20	21 TREATMENT					22 DEPTH	23	24 SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	BOULDER CREEK									X				X		Y		X	X	X		X		500	SW NE	04	02N	04E
S02	JONES CREEK									X				X		Y		X	X	X		X		500	SE SW	03	02N	04E
S06	DEEP WELL #5 AFP623		X										X			Y		X		X		X	71	600	SW SE	12	01N	03E
S07	DEEP WELL #6 AFP624		X										X			Y		X		X		X	85	1400	NE SW	12	01N	03E
S08	DEEP WELL #7 AFP628		X										X			Y		X		X		X	84	950	NW SW	12	01N	03E
S09	DEEP WELL #8 AFP629		X										X			Y		X		X		X	90	1350	NW SW	12	01N	03E
S11	WELL #9 AFP631		X											X		Y		X		X			161	650	NE NW	04	01N	03E
S13	WELL #11 AHM259		X										X			Y		X		X		X	80	1200	NW SW	12	01N	03E
S14	WELL #12 AHM266		X										X			Y		X		X		X	81	1300	NW SW	12	01N	03E
S15	WELL #10 AGP495		X										X			Y		X		X		X	82	1300	NW SW	12	01N	03E
S16	WELL #13 ALL997		X										X			Y		X		X		X	80	1325	SW NW	12	01N	03E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
10800 2	CAMAS MUNICIPAL WATER SEWER SYSTEM	CLARK	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	6966	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or *more* per year)	6398		
B. Part Time Single Family Residences (Occupied *less than* 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	128		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *more than* 180	568		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *less than* 180	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	275	275	
28. TOTAL SERVICE CONNECTIONS		7241	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or *more* days p 17415

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
B. How many days per month is water accessible to the public?												

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?	3969	3969	3969	3969	3969	3969	1857	1857	3969	3969	3969	3969
B. How many days per month are they present?	20	20	20	20	20	20	20	20	20	20	20	20

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	20	20	20	20	20	20	20	20	20	20	20	20

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other _____

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: _____ DATE: _____

PRINT NAME: _____ TITLE: _____

WS ID	WS Name
10800	CAMAS MUNICIPAL WATER SEWER SYSTEM

Total WFI Printed: 1

Appendix B

DOH Checklist and Submittal Form

Water System Plan Submittal Form

This form is required to be submitted along with the Water System Plan (WSP). It will serve to expedite review and approval of your WSP. WSPs will not be reviewed until submittal form and checklist are completed.

City of Camas	10800	City of Camas
1. Water System Name	2. PWS ID# or Owner ID#	3. System Owner Name
Mike Stevens	(360) 817-1563	Operations Supervisor
4. Contact Name for Utility	Phone Number	Title
1620 SE 8th Ave	Camas	WA 98607
Contact Address	City	State Zip
Russ Porter, P.E. Gray & Osborne, Inc.	(206) 284-0860	Project Manager
5. Project Engineer	Phone Number	Title
701 Dexter Ave North, Suite 200	Seattle	WA 98109
Project Engineer Address	City	State Zip
6. Billing Contact Name (required if not the same as #4)	Billing Phone Number	Billing Fax Number
Billing Address	City	State Zip

6. How many services are presently connected to the system? 7,095
7. Is the system expanding? (seeking to extend service area or increase number of approved connections) ☒ Yes ☐ No
8. If number of services is expected to increase, how many new connections are proposed in the next six years? _____
9. If the system is private-for-profit, is it regulated by the State Utilities and Transportation Commission? ☐ Yes ☒ No
10. Is the system located in a Critical Water Supply Service Area (i.e., have a Coordinated Water System Plan)? ☒ Yes ☐ No
11. Is the system a customer of a wholesale water purveyor? ☐ Yes ☒ No
12. Will the system be pursuing additional water rights from the State Department of Ecology in the next twenty years? ☒ Yes ☐ No
13. Is the system proposing a new intertie? ☐ Yes ☒ No
14. Do you have projects currently under review by the Department of Health? ☐ Yes ☒ No
15. Are you requesting distribution main project report and construction document submittal exception, and if so, does the WSP contain standard construction specifications for distribution mains? ☒ Yes ☐ No
16. Are you requesting distribution related project report and construction document submittal exception, and if so, does the WSP contain distribution facilities design and construction standards, including internal engineering review procedures? ☒ Yes ☐ No
17. Have you sent copies of the draft WSP or notice to adjacent purveyors for their review? ☒ Yes ☐ No
18. Have you sent copies of the draft WSP to local governments with jurisdiction within your service area for their review? ☒ Yes ☐ No
19. Are you proposing a change in the place of use of your water right? ☐ Yes ☒ No

If answer to questions 17 and 18 is yes, list adjacent utilities/entities that have received a copy of the draft WSP: Clark County PUD, Clark County, City of Vancouver, and the City of Washougal.

Is this plan: ☐ an Initial Submittal ☒ a Revised Submittal

Please enclose the following number of copies of the WSP:

2 copies for Department of Health
1 copy for Department of Ecology
1 additional copy if you answered "yes" to question 9 — 3 Total copies attached

Please return completed form to the Office of Drinking Water regional office checked below.

☐ **Northwest Drinking Water Operations**	☒ **Southwest Drinking Water Operations**	☐ **Eastern Drinking Water Operations**
Department of Health	**Department of Health**	**Department of Health**
20435 72nd Ave. S, Ste 200	**PO Box 47823**	**1500 W. Fourth Ave, Suite 305**
Kent, WA 98032-2358	**Olympia, WA 98504-7823**	**Spokane, WA 99201**
(253) 395-6750	**(360) 236-3030**	**(509) 456-3115**

For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388).

WATER SYSTEM PLAN (WSP) CHECKLIST

	√ Required	Content Description	WSP Page #
	(√)	**Water System Plan Submittal Form**	
Chapter 1		**Description of Water System**	
	(√)	Ownership and management (updated/current WFI)	7-2, Apx A
	(√)	System history and background	1-2, 1-3
	(√)	Brief inventory of existing facilities	1-7, Fig 1-4
	(√)	Related plans: City/County land use map, CWSP, adjacent utilities	3-11, Fig 3-1
	(√)	Maps: existing, future and retail service area	Fig 3-2
	(√)	Discussion of service area agreements and policies, conditions of service, Satellite Management Agency	3-2
	(√)	Duty to serve policies for retail service area	3-3
	(√)	Local Government Consistency from **planning** agencies	Apx R
	(√)	"Not-inconsistent" statement from Ecology for **water resource inventory area** (WRIA) **WRIA # 28**	Apx R
Chapter 2		**Basic Planning Data**	
	(√)	Current: Population, service connections, & ERU's	3-11, 3-13, 3-20
	(√)	Population, service connections, & ERU projections for 6 & 20 years	3-26, 3-31
	(√)	Demand forecasts w/ & w/o expected WUE savings for 6 & 20 years	3-26, 6-13
	(√)	DSL percentage and volume	3-19
	(√)	Water Use Data: Monthly and annual production and consumption totals per source, annual usage by customer class, annual usage for water supplied to, or purchased from, other systems	3-14, 3-17
Chapter 3		**System Analysis**	
	(√)	System design standards (fire flow, system pressures, etc.)	2-10 to 2-14
	(√)	System inventory, description and analysis	1-7, 4-11
	(√)	Source	4-13
	(√)	Storage	4-18
	(√)	Distribution system/hydraulics (with equalization & FFS depleted)	5-9
	(√)	Add pressure zones	1-15
	(√)	Treatment	1-11, 4-2
	(√)	Capacity analysis source/storage/water rights/other	4-7, 4-17
	(√)	Water quality analysis	4-2
	(√)	Summary of system deficiencies	4-24
	(√)	Analysis of possible improvement projects	4-24
Chapter 4		**Water Use Efficiency (WUE) Program and Water Rights**	
	(√)	Water Use Efficiency Program per WAC 246-290-810	6-1
	(√)	Describe your current WUE program	6-5
	(√)	Identification of efficiency goal and meet public process requirements	6-9
	(√)	Evaluation of measures for cost-effectiveness w/schedule & budget	6-12

☆Counts as an efficiency measure if implemented

√ Required	Content Description	WSP Page #
(√)	Description of consumer education process ☆	6-11
(√)	Estimate of projected water savings from selected measures	6-12
(√)	Description of process to determine effectiveness of program	6-11
( )	**Greater than 1000 Connections** ♦ Estimate projected savings from efficiency measures for past 6 yrs ♦ Extra demand forecast if not implementing all measures ♦ Marginal cost identified ♦ Cost-effective evaluation of measures if shared with other systems ♦ Quantitative or qualitative evaluation of societal perspective	6-12, 6-13
( )	**Less Than 1000 Connections** ♦ Description of evaluation process used to select measures	
(√)	**Distribution System Leakage (DSL*)** Total Production and Purchased (TP): ♦ Add any water purchased from other water suppliers ♦ Subtract any water sold to another water system ♦ Subtract all estimated authorized consumption (e.g. fire flow, flushing of mains, etc.) ♦ Subtract any estimated transmission line loss, if applicable Total annual amount of water delivered to customers from service meter records (AC) Annual Distribution System Leakage (DSL)* in percent and volume, gallons or millions of gallons *DSL = [(TP – AC) / (TP)] X 100 *Where:* DSL = Percent of Distribution System Leakage (%) TP = Total Water Produced and Purchased AC = Authorized Consumption	6-5
( )	Not fully metered: ♦ Schedule for installation, including interties ♦ Funding and meter account identified in budget ♦ Percentage of meters to install each year identified ♦ Activities to minimize leakage ♦ Leak detection survey scheduled ♦ Identify date for meter installation status report	
( )	Clustered entity, designated by land use or local zoning, (campground, RV park, apartment bldg, designated mobile home park)	
( )	Alternate methodology to calculate distribution leakage	
(√)	**Control Plan (use 3 yrs of data)** **>10% Distribution System Leakage for 3-yr average** ♦ Schedule and Budget ♦ Technical and economic concerns addressed ♦ **>10% - < 19%** assessment of data accuracy and data collection ♦ **>19% - < 29%** assessment of data accuracy and data collection, and field activities to reduce leakage w/in 12 mos. ♦ **>29%** assessment of data accuracy and data collection, field activities to reduce leakage w/in 6 months	6-11
( )	**>10% DSL for last 3-year avg & < 500 request for 20% allowance** ♦ Production volume identified ♦ Distribution system leakage volume identified ♦ Evidence of leak detection survey w/in past 6 yrs ♦ All leaks repaired ♦ Unable to locate additional leaks ♦ Active program to minimize leakage identified	

☆Counts as an efficiency measure if implemented

√ Required	Content Description	WSP Page #
	♦ Describes system specific characteristics that justify higher leakage	

	(√)	**Water Rights** - 1) Description of water right status. 2) Legal description from water right. 3) Include a copy of water right certificate(s). 4) Capacity table. 5) Water right self assessment forms for existing, 6 & 20 year projections. 6) Well log and USGS map showing point of withdrawal/diversion and place of use.	1-5, 1-6 Apx C, Apx P
	(√)	Water supply characteristics, description & discussion on effect of water use	1-7, 1-8, 1-9
	(√)	Source of supply analysis and evaluation of supply alternatives	4-11
	(√)	Interties	1-23
	(√)	≥1,000 connections explore reclaimed water opportunities☆	6-11
Chapter 5		**Source Water Protection (Check One or Both)**	
	(√)	Wellhead protection program or two year update	Apx P
	(√)	Watershed control program	Apx Q
Chapter 6		**Operation and Maintenance Program**	
	(√)	Water system management and personnel	7-2
	(√)	Operator certification	7-3
	(√)	Routine operating procedures and preventive maintenance	7-3, Apx M
	(√)	Water quality sampling procedures & program	4-2
	(√)	Coliform monitoring plan	Apx H
	(√)	Emergency program, water shortage plan, service reliability per WAC 246-290-420	Apx N
	(√)	Safety procedures	Apx N
	(√)	Cross-connection control program (> 1,000 provide copies of annual summary report form)	7-9, Apx O
	(√)	Recordkeeping, reporting, and customer complaint program	7-11
	(√)	Summary of O&M deficiencies	7-11
Chapter 7		**Distribution Facilities Design and Construction Standards**	
	(√)	Standard construction specification for distribution mains	Apx E
Chapter 8		**Improvement Program**	
	(√)	Capital improvement schedule for 6 and 20 years	8-13, 8-15
Chapter 9		**Financial Program (See Financial Viability Manual)**	
	(√)	≥1000 connections – Balanced 1-year budget / UTC	9-6
	( )	<1000 connections – Balanced 6-year budget, w/ Financial Viability-Feasibility	
	(√)	Revenue and cash flow stability to fund capital and emergency improvements	9-4, 9-5, 9-6
Chapter 10		**Miscellaneous Documents**	
	( )	Meeting of the consumers (date and description)	
	( )	Local Government / Adjacent Utility Correspondence	
	(√)	State Environmental Policy Act (SEPA) Determination >1,000	Apx D
	( )	Agreements	
	( )	Satellite Management Contract and Water User Agreement	

*All maps should be a minimum of 11"x17".
*When DOH is ready to approve the final WSP, the plan must be adopted by the governing body (i.e. city council, board, etc.).

*If requesting source approval with WSP, please include all source approval documents in a separate section.

Appendix C

Water Rights Documentation

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 1

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – EXISTING STATUS

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates 1. S 712 CS2-SWC 712[1]		8/22/23	SO1/Boulder Creek		1120	1820	590	679	530	2288
2. S 711 CS2-SWC 711[1]		9/05/30	SO2/ Jones Creek		450	730	450		0	
3.G 85-A		7/21/45	SO13/Well 3 (transferred to Well 11)		1200	118	1200	3333 (includes SO14, SO15, and expanded wellfield permit below)	0	
4. G 4072-A		2/12/59	SO16/Well 4 (transferred to Well 13)		1325	1208	1325		0	
5. G 6636-A		3/22/68	SO6/Well 5		600	920	500		100	
6. G 6635-A		3/22/68	SO7/Well 6		1500	2400	1450		50	
7. G2-00501		3/22/71	SO8/Well 7		1000	530	950		50	
8. G2-24400		2/04/77	SO9/Well 8		900	530	900		0	
9. G2-27384		8/13/86	SO11/Well 9	210 Qa is supplemental	650	210 (S)	650	127	0	83 (S)
10. G2-30144		8/13/86	Expanded Wellfield		500	2150	450[4]	Included above	50	Included above
11. G2-30145[2]		8/13/86	Anderson Site		1000	880	0		1000	880
12. G2-30146[2]		8/13/86	Parkers Landing		1000	880	0		1000	880
13. G2-30147[2]		8/13/86	Treatment Plant Well		1000	880	0		1000	880
Claims 1.G2-CV1-2P159 121022		6/11/74	SO14/Well 1, (transferred to Well 10 & 12)		900	320	900	Included above	0	Included above

2. G2-CV1-2P160 121023		6/11/74	SO15/Well 2 (transferred to Well 10 & 12)		900	230	900		0	
TOTAL	**********	**********	**********	**********	12,475	11,090	8,695	3,460	3,780	7,630

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		EXISTING CONSUMPTION THROUGH INTERTIE		CURRENT INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Fire Station				350	
2. Camas Meadows				1000	
3.					
4.					

(1) These rights are not available for use during peak water use months. Only available between November 1 and May 14. Not included in instantaneous total.
(2) These site are not yet developed.
(3) Wells 5, 6, 7, 8, 10, 11, 12, and 13 are capped at 5,900 acre-ft per year.
(4) Excess wellfield right being utilized at Well 8.

The Department of Health is an equal opportunity agency. For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388). For additional copies of this form, call 1-800-521-0323. This and other forms are available at http://www.doh.wa.gov/ehp/dw

DOH Form #331-371 (09/07)

To return form, please see reverse side.

Please return completed form to the Office of Drinking Water regional office checked below.

☐ NWRO Drinking Water
Department of Health
20435 72nd Ave. S, Ste 200
Kent, WA 98032-2358
Fax: (253) 395-6750

☒ SWRO Drinking Water
Department of Health
PO Box 47823
Olympia, WA 98504-7823
Fax: (360) 664-8058

☐ ERO Drinking Water
Department of Health
1500 W. Fourth Ave, Suite 305
Spokane, WA 99201
Fax: (509) 456-3115

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 2

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 6 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (6-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates 1. S 712 CS2-SWC 712(1)		8/22/23	SO1/Boulder Creek		1120	1820				
2. S 711 CS2-SWC 711(1)		9/05/30	SO2/ Jones Creek		450	730				
3.G 85-A		7/21/45	SO13/Well 3 (transferred to Well 11)		1200	118				
4. G 4072-A		2/12/59	SO16/Well 4 (transferred to Well 13)		1325	1208				
5. G 6636-A		3/22/68	SO6/Well 5		600	920				
6. G 6635-A		3/22/68	SO7/Well 6		1500	2400				
7. G2-00501		3/22/71	SO8/Well 7		1000	530				
8. G2-24400		2/04/77	SO9/Well 8		900	530				
9. G2-27384		8/13/86	SO11/Well 9	210 Qa is supplemental	650	210 (S)				
10. G2-30144		8/13/86	Expanded Wellfield		500	2150				
11. G2-30145(2)		8/13/86	Anderson Site		1000	880				
12. G2-30146(2)		8/13/86	Parkers Landing		1000	880				
13. G2-30147(2)		8/13/86	Treatment Plant Well		1000	880				
Claims 1.G2-CV1-2P159 121022		6/11/74	SO14/Well 1, (transferred to Well 10 & 12)		900	320				

2. G2-CV1-2P160 121023		6/11/74	SO15/Well 2 (transferred to Well 10 & 12)		900	230				
TOTAL	**********	**********	**********	**********	12,475	11,090	9,054	6,639	3,421	4,451

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Fire Station				350	
2. Camas Meadows				1000	

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DOH Form #331-372 (09/07)

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Department of Health
20435 72nd Ave. S, Ste 200
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Department of Health
PO Box 47823
Olympia, WA 98504-7823
Fax: (360) 664-8058

☐ ERO Drinking Water
Department of Health
1500 W. Fourth Ave, Suite 305
Spokane, WA 99201
Fax: (509) 456-3115

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 3

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 20 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (20-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates 1. S 712 CS2-SWC 712(1)		8/22/23	SO1/Boulder Creek		1120	1820				
2. S 711 CS2-SWC 711(1)		9/05/30	SO2/ Jones Creek		450	730				
3.G 85-A		7/21/45	SO13/Well 3 (transferred to Well 11)		1200	118				
4. G 4072-A		2/12/59	SO16/Well 4 (transferred to Well 13)		1325	1208				
5. G 6636-A		3/22/68	SO6/Well 5		600	920				
6. G 6635-A		3/22/68	SO7/Well 6		1500	2400				
7. G2-00501		3/22/71	SO8/Well 7		1000	530				
8. G2-24400		2/04/77	SO9/Well 8		900	530				
9. G2-27384		8/13/86	SO11/Well 9	210 Qa is supplemental	650	210 (S)				
10. G2-30144		8/13/86	Expanded Wellfield		500	2150				
11. G2-30145(2)		8/13/86	Anderson Site		1000	880				
12. G2-30146(2)		8/13/86	Parkers Landing		1000	880				
13. G2-30147(2)		8/13/86	Treatment Plant Well		1000	880				
Claims 1.G2-CV1-2P159 121022		6/11/74	SO14/Well 1, (transferred to Well 10 & 12)		900	320				

2. G2-CV1-2P160 121023		6/11/74	SO15/Well 2 (transferred to Well 10 & 12)		900	230				
TOTAL	**********	**********	**********	**********	12,475	11,090	14,174	10,523	-1,699	567

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Fire Station				350	
2. Camas Meadows				1000	

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☒ SWRO Drinking Water
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PO Box 47823
Olympia, WA 98504-7823
Fax: (360) 664-8058

☐ ERO Drinking Water
Department of Health
1500 W. Fourth Ave, Suite 305
Spokane, WA 99201
Fax: (509) 456-3115

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION

WATER RIGHT CLAIM

RECEIVED
ECOLOGY
JUN 21 1974 32-272
NONE

1. NAME CITY OF CAMAS, WASHINGTON

ADDRESS 616 N.E. 4th Avenue

Camas, Washington ZIP CODE 98607

2. SOURCE FROM WHICH THE RIGHT TO TAKE AND MAKE USE OF WATER IS CLAIMED: Ground (SURFACE OR GROUND WATER)

W.R.I.A. 28 (LEAVE BLANK)

A. IF GROUND WATER, THE SOURCE IS Deep Well No. 1

B. IF SURFACE WATER, THE SOURCE IS

3. THE QUANTITIES OF WATER AND TIMES OF USE CLAIMED:

A. QUANTITY OF WATER CLAIMED 900 gpm PRESENTLY USED 900 gpm (CUBIC FEET PER SECOND OR GALLONS PER MINUTE)

B. ANNUAL QUANTITY CLAIMED 320 PRESENTLY USED Average 300 (ACRE FEET PER YEAR)

C. IF FOR IRRIGATION, ACRES CLAIMED PRESENTLY IRRIGATED

D. TIME(S) DURING EACH YEAR WHEN WATER IS USED: All Year

4. DATE OF FIRST PUTTING WATER TO USE: MONTH Unknown YEAR Before 1942

5. LOCATION OF THE POINT(S) OF DIVERSION/WITHDRAWAL: 2159 FEET North AND 667 FEET East FROM THE Southwest CORNER OF SECTION 12

BEING WITHIN Southwest quarter OF SECTION 12 T. 1 N., R. 3 E (E.OR W.) W.M.

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, LOT BLOCK OF

Within the City limits of the City of Camas
(GIVE NAME OF PLAT OR ADDITION)

6. LEGAL DESCRIPTION OF LANDS ON WHICH THE WATER IS USED: Municipal supply

Clark COUNTY Washington

7. PURPOSE(S) FOR WHICH WATER IS USED: Municipal - Domestic Supply

8. THE LEGAL DOCTRINE(S) UPON WHICH THE RIGHT OF CLAIM IS BASED:

DO NOT USE THIS SPACE
THE FILING OF A STATEMENT OF CLAIM DOES NOT CONSTITUTE AN ADJUDICATION OF ANY CLAIM TO THE RIGHT TO USE OF WATERS AS BETWEEN THE WATER USE CLAIMANT AND THE STATE OR AS BETWEEN ONE OR MORE WATER USE CLAIMANTS AND ANOTHER OR OTHERS. THIS ACKNOWLEDGEMENT CONSTITUTES RECEIPT FOR THE FILING FEE.
DATE RETURNED. THIS HAS BEEN ASSIGNED WATER RIGHT CLAIM REGISTRY NO.
FEB 7 1975 21022
DIRECTOR - DEPARTMENT OF ECOLOGY

I HEREBY SWEAR THAT THE ABOVE INFORMATION IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

X CITY OF CAMAS, WASHINGTON

DATE June 11, 1974

IF CLAIM FILED BY DESIGNATED REPRESENTATIVE, PRINT OR TYPE FULL NAME AND MAILING ADDRESS OF AGENT BELOW.

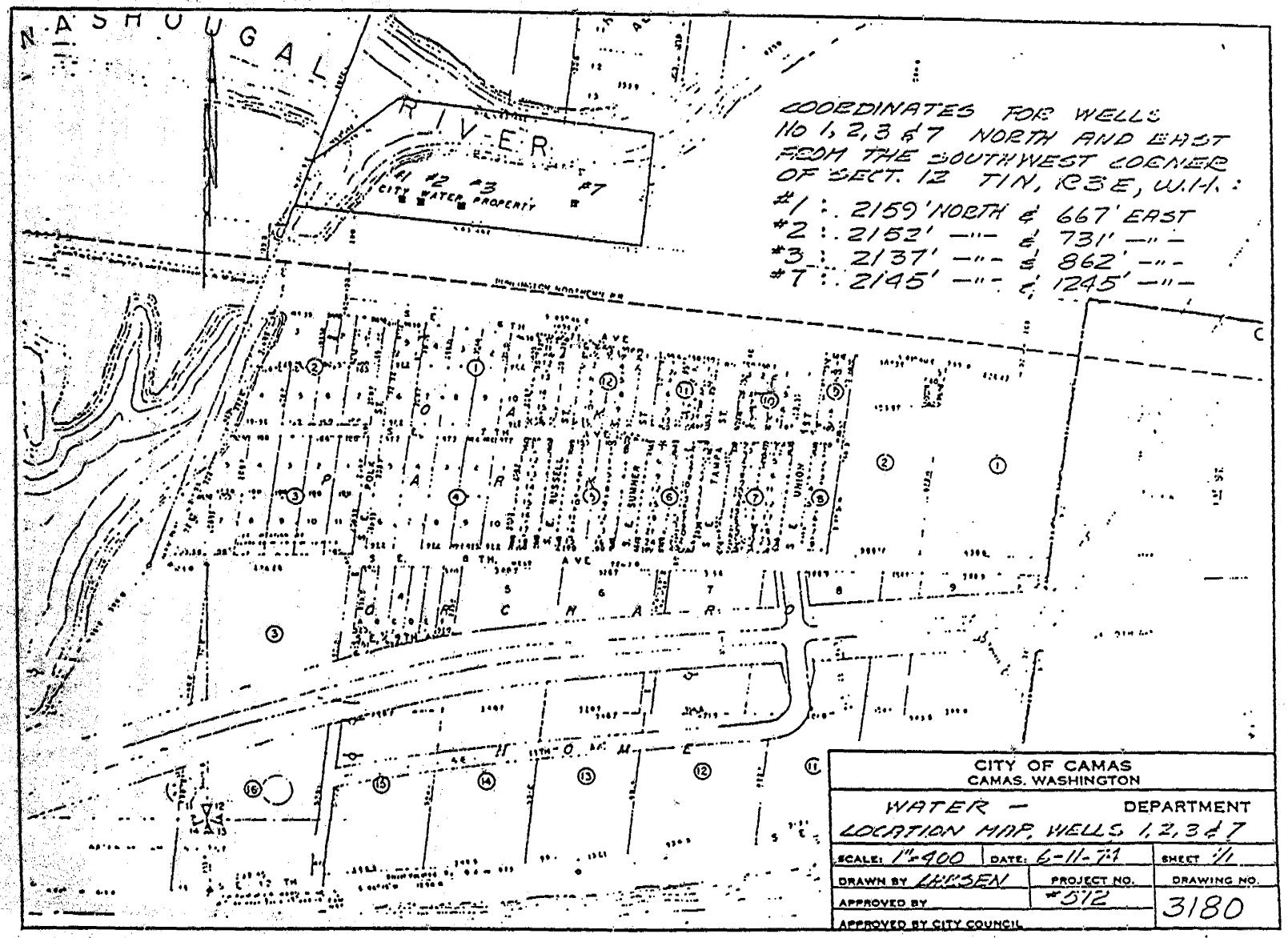
BY: Lewis Angelo
Lewis Angelo, Director of Public Works

☐ ADDITIONAL INFORMATION RELATING TO WATER QUALITY AND/OR WELL CONSTRUCTION IS AVAILABLE.

A FEE OF $2.00 MUST ACCOMPANY THIS WATER RIGHT CLAIM

ORIGINAL DWR

RETURN ALL THREE COPIES WITH CARBONS INTACT, ALONG WITH YOUR FEE TO:
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION
P.O. BOX 829 OLYMPIA, WASHINGTON 98504


N. ASHOUGAL RIVER
#1 #2 #3 #7
CITY WATER PROPERTY
COORDINATES FOR WELLS
No 1, 2, 3 & 7 NORTH AND EAST
FROM THE SOUTHWEST CORNER
OF SECT. 12 T1N, R3E, W.M.:
#1 : 2159' NORTH & 667' EAST
#2 : 2152' —"— & 731' —"—
#3 : 2137' —"— & 862' —"—
#7 : 2145' —"— & 1245' —"—
CITY OF CAMAS
CAMAS, WASHINGTON
WATER — DEPARTMENT
LOCATION MAP, WELLS 1, 2, 3 & 7
SCALE: 1"=400
DATE: 6-11-71
SHEET 1/1
DRAWN BY LARSEN
PROJECT NO. #512
DRAWING NO. 3180
APPROVED BY
APPROVED BY CITY COUNCIL

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION

WATER RIGHT CLAIM

RECEIVED
DEPARTMENT OF ECOLOGY
JUN 21 1974 132273
CASH___ CHECK___ NONE___

1. NAME CITY OF CAMAS, WASHINGTON

ADDRESS 616 N.E. 4th Avenue

Camas, Washington ZIP CODE 98607

2. SOURCE FROM WHICH THE RIGHT TO TAKE AND MAKE USE OF WATER IS CLAIMED: Ground (SURFACE OR GROUND WATER)

W.R.I.A. 28 (LEAVE BLANK)

A. IF GROUND WATER, THE SOURCE IS Deep Well No. 2

B. IF SURFACE WATER, THE SOURCE IS

3. THE QUANTITIES OF WATER AND TIMES OF USE CLAIMED:

A. QUANTITY OF WATER CLAIMED 900 gpm PRESENTLY USED 900 gpm
(CUBIC FEET PER SECOND OR GALLONS PER MINUTE)

B. ANNUAL QUANTITY CLAIMED 230 PRESENTLY USED 200
(ACRE FEET PER YEAR)

C. IF FOR IRRIGATION, ACRES CLAIMED PRESENTLY IRRIGATED

D. TIME(S) DURING EACH YEAR WHEN WATER IS USED: The months of May through August

4. DATE OF FIRST PUTTING WATER TO USE: MONTH Unknown YEAR Before 1945

5. LOCATION OF THE POINT(S) OF DIVERSION/WITHDRAWAL: 2152 FEET North AND 731

FEET East FROM THE Southwest CORNER OF SECTION 12

BEING WITHIN Southwest quarter OF SECTION 12 T. 1 N., R. 3 E (E.OR W.) W.M.

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, LOT ____ BLOCK ____ OF
Within the City limits of the City of Camas
(GIVE NAME OF PLAT OR ADDITION)

6. LEGAL DESCRIPTION OF LANDS ON WHICH THE WATER IS USED: Municipal supply

Clark COUNTY Washington

7. PURPOSE(S) FOR WHICH WATER IS USED: Municipal - Domestic Supply

8. THE LEGAL DOCTRINE(S) UPON WHICH THE RIGHT OF CLAIM IS BASED:

DO NOT USE THIS SPACE
THE FILING OF A STATEMENT OF CLAIM DOES NOT CONSTITUTE AN ADJUDICATION OF ANY CLAIM TO THE RIGHT TO USE OF WATERS AS BETWEEN THE WATER USE CLAIMANT AND THE STATE OR AS BETWEEN ONE OR MORE WATER USE CLAIMANTS AND NOTHING OTHERWISE. ACKNOWLEDGEMENT CONSTITUTES RECEIPT FOR THE FILING.
DATE RETURNED THIS HAS BEEN ASSIGNED WATER RIGHT CLAIM REGISTRY NO.
FILED JUN 24 10 28
DIRECTOR, DEPARTMENT OF ECOLOGY

I HEREBY SWEAR THAT THE ABOVE INFORMATION IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

X CITY OF CAMAS, WASHINGTON

DATE June 11, 1974

IF CLAIM FILED BY DESIGNATED REPRESENTATIVE, PRINT OR TYPE FULL NAME AND MAILING ADDRESS OF AGENT BELOW.

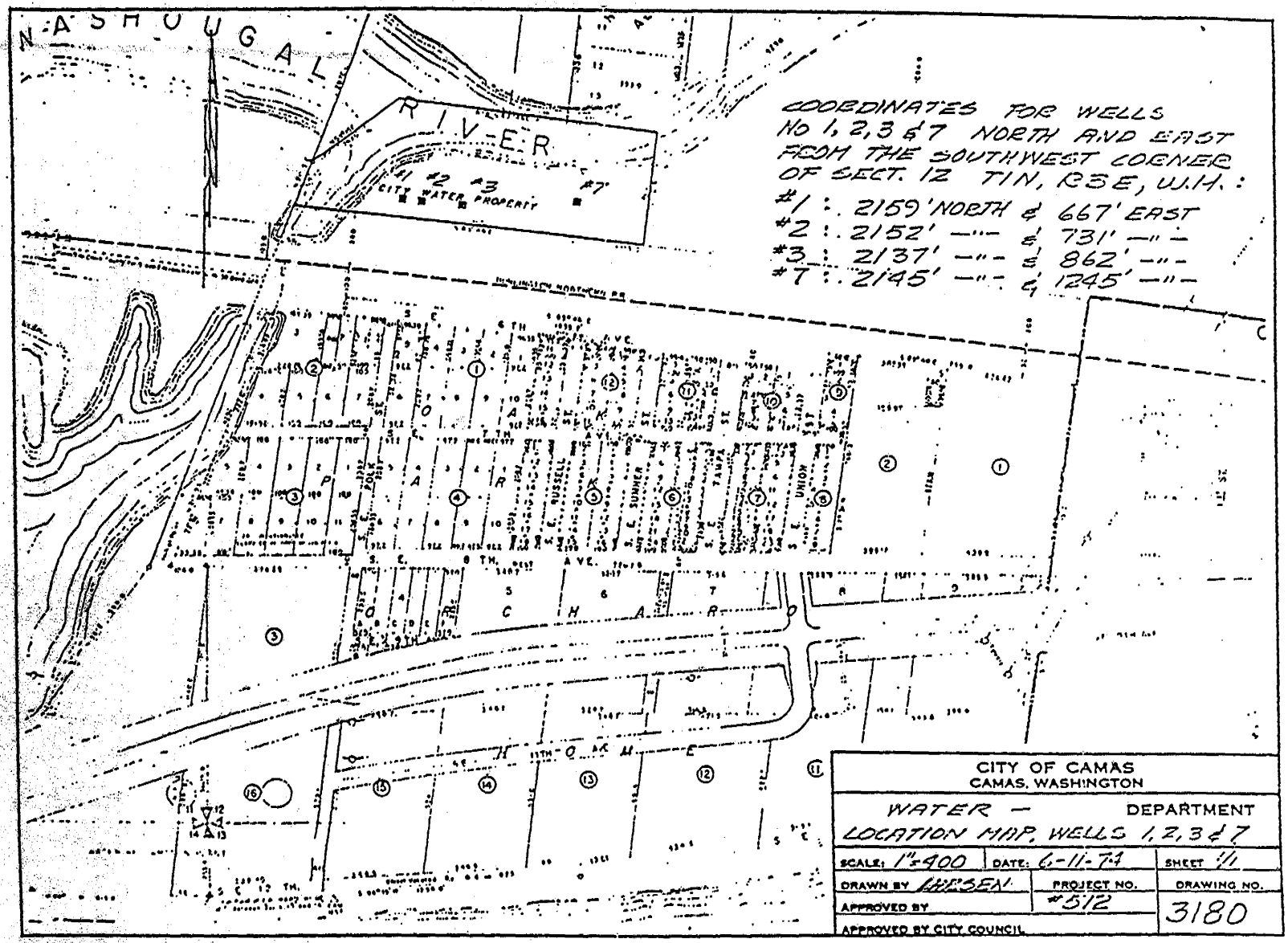
BY: Lewis Angelo
Lewis Angelo, Director of Public Works

☐ ADDITIONAL INFORMATION RELATING TO WATER QUALITY AND/OR WELL CONSTRUCTION IS AVAILABLE.

A FEE OF $7.00 MUST ACCOMPANY THIS WATER RIGHT CLAIM

ORIGINAL DWR

RETURN ALL THREE COPIES WITH CARBONS INTACT, ALONG WITH YOUR FEE TO:
DEPARTMENT OF ECOLOGY
WATER RIGHT CLAIMS REGISTRATION
P.O. BOX 829 OLYMPIA, WASHINGTON 98504


NASHOUGAL
RIVER
#1 #2 #3 #7
CITY WATER PROPERTY
COORDINATES FOR WELLS
No 1, 2, 3 & 7 NORTH AND EAST
FROM THE SOUTHWEST CORNER
OF SECT. 12 T1N, R3E, W.M.:
#1 : 2159' NORTH & 667' EAST
#2 : 2152' —"— & 731' —"—
#3 : 2137' —"— & 862' —"—
#7 : 2145' —"— & 1245' —"—
CITY OF CAMAS
CAMAS, WASHINGTON
WATER — DEPARTMENT
LOCATION MAP, WELLS 1, 2, 3 & 7
SCALE: 1"=400
DATE: 6-11-74
SHEET 1/1
DRAWN BY HIRSEN
PROJECT NO. #512
DRAWING NO. 3180
APPROVED BY
APPROVED BY CITY COUNCIL

No. 369.—1923. Approved as to Form by Dept. of Efficiency. 8509.

CERTIFICATE RECORD No. 2, PAGE No. 711

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF WATER RIGHT

(For rights perfected under original, enlargement or secondary permits.)

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and the regulations of the State Hydraulic Engineer thereunder.)

This is to certify, that City of Camas, *of* Camas, *State of* Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the waters of* Jones Creek, *a tributary of* Little Washougal River *for the purposes of* domestic supplies, *under* Appropriation *Permit No.* 1575, *of the State Supervisor of Hydraulics, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 2, *at Page* 711, *on the* 28th *day of* July, *19* 33; *that the right hereby confirmed dates from* September 5th, *19* 30; *that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 1.0 *cubic feet per second.*

A description of the lands under such right, and to which the water hereby confirmed is appurtenant, or if for other purposes, the place where such water is put to beneficial use, is as follows:

PLACE OF USE			LEGAL SUBDIVISION		
Section	Township	Range			
			City of Camas		

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Section 39, Chapter 117, Session Laws 1917.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 28th *day of* July, *19* 33.

Chas. L. Patterson
State Supervisor of Hydraulics.

ENGINEERING DATA

NOTICE OF PETITION FOR CHANGE OF
POINT OF DIVERSION OF WATER.

TO WHOM IT MAY CONCERN:

Notice is hereby given that the City of Camas, Clark County, Washington, has filed a petition with the State Supervisor of Hydraulics, Olympia, Washington, for a permit to change the point of diversion of one cubic foot per second of the waters of Jones Creek from a point set out in water right permit 1575 as NW¼ of NW¼ of Sec. 10, Twp. 2 N., Rge. 4 E.W.M., to a point within the SW¼ of SW¼ of Sec. 3, Twp. 2 N., Rge. 4 E.W.M., such point being approximately one-half mile above the point of diversion described in permit, all in Clark County, Wash.

Any person, firm or corporation whose right will be injuriously affected by the granting of said petition may file with the Supervisor of Hydraulics, at Olympia, Washington, such objections or representations, in writing, as he may desire to make within thirty (30) days after the date of last publication, which date is _____.

Witness my hand and official seal this 24th day of April, 1933.

CHAS. J. BARTHOLET
State Supervisor of Hydraulics

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions. ~~If for irrigation, this appropriation shall be subject to such reasonable rotation system as may be ordered by the State Supervisor of Hydraulics.~~ And is further subject to rights of C. W. Cottrell under certificate #121, for the appropriation and use of waters of Little Washougal River of which Jones Creek is a tributary.

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 1.0 *cubic feet per second, or its equivalent in case of rotation.*

The priority date of this permit is September 5th, 1930.

Actual construction work shall begin on or before December 1st, 1931 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before* December 1st, 1932

Complete application of the water to the proposed use shall be made on or before December 1st, 1937.

Given under my hand and the seal of this office at Olympia, Washington, this 2nd *day of* December, *1930*

Chas. J. Bartholet
State Supervisor of Hydraulics.

Application No. 3756
Permit No. 1575

PERMIT
To Appropriate Public Waters of the State of Washington

Filed by City of Camas
County of Clark

This instrument was first received in the office of the State Supervisor of Hydraulics, Olympia, Washington, on the 5th *day of* September, *19* 30, *at* 8:30 *o'clock* A. M.

Approved December 2nd, 1930
Recorded in Book No. 7 *of Permits, on Page* 1575

CHAS. J. BARTHOLET
State Supervisor of Hydraulics.

JAY E. BOWLES, PUBLIC PRINTER

Before your certificate of water right is issued it will be necessary for you to file with the State Supervisor of Hydraulics a copy of each of the following reports:

1st. Progress reports (in case temporary permit is issued).
2nd. Affidavit of publication of notice of water right application.
3rd. Notice of beginning of construction.
4th. Notice of prosecution of work with diligence.
5th. Notice of completion of construction.
6th. Notice of application of water to a beneficial use.
7th. Proof of appropriation of water.

Upon a satisfactory showing that the appropriation has been perfected as provided by statute the State Supervisor of Hydraulics will issue a water right certificate.

Blanks will be furnished by the office of State Supervisor of Hydraulics.

APPLICATION NO. 5126

CITY OF CAMAS

Examination made November 3rd & 4th, 1930

This application is for 1.0 c.f.s. for domestic use from Jones Creek a tributary of Washougal River.

November 3rd I talked to Mr. R. C. Sugg, Attorney for Mr. C. W. Cottrell who is making protest against the issuance of permit on this application. He stated he questioned the City of Camas right to Jones Creek but suggested I go over the ground with Mr. Cottrell.

November 4th I went over the ground with Mr. W. H. Barber, City Clerk and Superintendent of Water for City of Camas, also, in reference to application No. 924. Mr. Barber stated that a survey was made in 1925 and this system installed same year from the Little Washougal consisting of two reservoirs on hill above Camas and approximately 11 miles of pipe line. The main from reservoirs to "Y" is of 10 inch steel pipe the portion from "Y" to diversion of Little Washougal is of 8 inch steel pipe. The "Y" was installed for the purpose of diverting a portion of Jones Creek when the city needed the additional water.

There is approximately 6.0 c.f.s. in Jones Creek today.

I then went with Mr. Cottrell over the ground on Washougal River. There is approximately 15.0 c.f.s. in the Little Washougal at the mouth. Mr. Cottrell has a 75 K.W. plant on Washougal River about one-half mile below mouth of Little Washougal which is a part of supply. There is approximately 12.0 c.f.s. going over dam not utilized today.

Mr. Cottrell has another 2 unit hydro plant on Washougal River above mouth of Little Washougal which this application does not affect, it develops 362 K.W. He also has a 340 K.W. Diesel plant at Washougal.

Mr. Barber stated that the water supply from Little Washougal was so inadequate this summer that rigid restrictions were necessary and if they would of had fires the storage supply would have been exhausted.

Mr. Cottrell stated that shortage was experienced only at extreme low water.

The City of Camas has no other means of water supply. A permit should be issued the applicant for 1.0 c.f.s. subject to existing rights.

A. E. Hanson

Signed this 15 day of Nov. 1930.

OK. for Permit + Sub to Permit 465

Form No. 319—1933. Approved as to Form by Dept. of Efficiency. 8189.

CERTIFICATE RECORD NO. 2, PAGE NO. 712

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF WATER RIGHT

(For rights perfected under original, enlargement or secondary permits.)

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and the regulations of the State Hydraulic Engineer thereunder.)

This is to certify, that City of Camas, *of* Camas, *State of* Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the waters of* Little Washougal River, *tributary of* Washougal River, *for the purposes of* municipal supply, *under* Appropriation Permit No. 1576, *of the State Supervisor of Hydraulics, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 2, *at Page* 712, *on the* 28th *day of* July, *19*33, *that the right hereby confirmed dates from* August 22nd, *19*23, *that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 2.5 *cubic feet per second.*

A description of the lands under such right, and to which the water hereby confirmed is appurtenant, or if for other purposes, the place where such water is put to beneficial use, is as follows:

PLACE OF USE			LEGAL SUBDIVISION		
Section	Township	Range			
			City of Camas		

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Section 39, Chapter 117, Session Laws 1917.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this 28th *day of* July, *19*33.

Chas. Barnhart

State Supervisor of Hydraulics.

PERMIT

STATE OF WASHINGTON,
COUNTY OF THURSTON. } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions. ~~If for irrigation this appropriation shall be subject to such reasonable rotation system as may be ordered by the State Hydraulic Engineer~~ and is further subject to rights of C. W. Cottrell under certificate #121, for the appropriation and use of waters of Little Washougal River of which Jones Creek is a tributary.

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 2½ *cubic feet per second, or its equivalent in case of rotation.*

The priority date of this permit is August 22nd, 1923

Actual construction work shall begin on or before December 1st, 1951 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before* December 1st, 1952

Complete application of the water to the proposed use shall be made on or before December 1st, 1955

WITNESS my hand this 2nd *day of* December *19* 50

Chas. J. Barnhart
State Hydraulic Engineer.

This form approved by the State Hydraulic Engineer, 1917.

Application No. 924
Permit No. 1576

PERMIT
To Appropriate the Public Waters of the State of Washington

~~Issued to~~ City of Camas

County of Clark

This instrument was first received in the office of the State Hydraulic Engineer, Olympia, Washington, on the 22nd *day of* August, *19* 23, *at* 1:45 *o'clock* P. M.

Returned to applicant for correction

Corrected Application received

Approved December 2nd, 1950

Recorded in Book No. 7 *of Permits, on Page* 1576

CHAS. J. BARNHART
State Hydraulic Engineer,

PLANE M. LARSON, PUBLIC PRINTER, OLYMPIA

Before your certificate of water right is issued it will be necessary for you to fill out and file with the State Hydraulic Engineer a copy of each of the following reports:

1st. Progress report.
2nd. Notice of water right application.
3rd. Notice to begin construction.
4th. Notice of prosecution of work with diligence.
5th. Notice of completion of construction.
6th. Notice of application of water to a beneficial use.
7th. Proof of appropriation of water.

Upon a satisfactory showing that the appropriation has been perfected as provided by statute the State Hydraulic Engineer will issue a water right certificate.

(Blanks will be furnished by the office of State Hydraulic Engineer.)

APPLICATION NO. 924

CITY OF CAMAS

Examination made November 4, 1950

This application is for 2.5 c.f.s. from Little Washougal a tributary to Washougal River for domestic and municipal supply.

Mr. Sugg stated he did not question in his mind the legal right of this application.

I went over the ground with Mr. W. H. Barber, City Clerk and Superintendent of City Water and found the following:

This system was installed in 1925 after a survey had been made, a part of which included a survey for pipe line extended to Jones Creek. The main is of 10" steel pipe from the two reservoirs on a hill about a mile above town of Camas a distance of about 9 miles to a "Y" then approximately 2 miles of 8" pipe to point of diversion. There is approximately 2.5 c.f.s. now running in pipe line and approximately 1.5 c.f.s. going past intake.

Mr. Barber stated that they were taking all of the water up to the recent rains about a week ago and was not filling the pipe and the City of Camas was under a dangerous water shortage.

This application is in reference to application No. 5126.

A G Strunk

Signed this 15 day of Nov. 1950.

J.K.
Subject to prior Permit #465

CERTIFICATE RECORD No. 1 PAGE No. 85-A

STATE OF WASHINGTON, COUNTY OF Clark

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and the rules and regulations of the State Supervisor of Hydraulics thereunder.

THIS IS TO CERTIFY That THE CITY OF CAMAS

of Camas, Washington, *has made proof to the satisfaction of the State Supervisor of Hydraulics of Washington, of a right to the use of the ground waters of a* Well

located within the NW¼ of SW¼ of Sec. 12, Twp. 1 N., Rge. 3 E.W.M.

for the purpose of Municipal Supply

under Ground Water Permit No. 2 *issued by the State Supervisor of Hydraulics, and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Hydraulics of Washington and entered of record in Volume* 1 *at page* 85-A *; that the quantity of ground water to which such right is entitled and hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 1200 gallons per minute; 118 acre-feet per year; That the right hereby confirmed dates from July 21, 1945.

~~for irrigation of xxxx xxxxxxxx acres.~~

A description of the lands under such right to which the ground water hereby confirmed is appurtenant, and the place where such water is put to beneficial use, is as follows:

City of Camas, Clark County, Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Hydraulics affixed this [illegible] *day of* November, 19 47

[illegible]
State Supervisor of Hydraulics.

S. F. No. 7334—6-45—5C. 9235.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
DIVISION OF HYDRAULICS

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 1 of Ground Water Permits, on page 2 under Application No. 4

The City of Camas

of City Hall, Camas, Washington

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is July 21, 1945

Source of the proposed ground water appropriation is a well

within area, sub-area

zone. Name or number of works is

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1200 gallons per minute; 118 acre-feet per year, to be used for the following purposes: Municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is North 7°31' East 480 feet and South 83°46' East 112 feet from the Northwest corner of Block 1 of Oak Park Addition to the City of Camas,
being within NW¼ of SW¼ of Sec. 12, Twp. 1 N., Rge. 3 E.W.M.,

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 1200 gallons per minute; acre-feet per year,

to supply The City of Camas

For irrigation: gallons per minute; acre-feet per year,

for the irrigation of acres.

For miscellaneous uses: gallons per minute; acre-feet per year,

for

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas, Clark County, Washington

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be Drilled and have a diameter of 14 inches, and depth of 95 feet.
(Dug or drilled)

Description of tunnel or infiltration trench:

(Please read carefully provisions below)

Particular specifications required by the Supervisor of Hydraulics for the purpose of preventing waste of public waters:

Construction work shall begin on or before July 1, 1946
and shall thereafter be prosecuted with reasonable diligence and completed on or before
October 1, 1946
and complete application of water to proposed use shall be made on or before
October 1, 1947

Given under my hand and the seal of this office at Olympia, Washington, this 20th day of September 1945

CLARENCE B. SHAIN
State Supervisor of Hydraulics

By: Chas J. Carthart
Deputy.

GROUND WATER

APPLICATION NO. 4

... City of Camas.

The application of the City of Camas for the appropriation of 1200 gallons per minute from ground water through a well, which will be designated Well No. 3, was approved for a permit on September 6.

On September 21 the undersigned visited the locality, accompanied by Mr. Arthur K. Piper, Ground Water Geologist.

The City has a gravity water supply and an additional water supply from two wells. The supply from both of which sources does not furnish sufficient water for the town during the dry months. It was therefore found by the City officials that additional water had to be obtained in order to meet its requirements. For that reason they planned a third well to augment the water supply during critical periods.

Judging from the wells now in use, the amount of water applied for will be available and will be put to an important beneficial use.

Permit has been approved.

Signed this 25th day of September, 1945.

Chas. J. Bartholet

CHAS. J. BARTHOLET
Consulting Engineer

S. F. No. 1361—5-60—3M. 63304.

CERTIFICATE RECORD NO. 9 PAGE NO. 4072-A

STATE OF WASHINGTON, COUNTY OF Clark

Certificate of Ground Water Right

Issued in accordance with the provisions of Chapter 163, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the State Supervisor of Water Resources thereunder.

THIS IS TO CERTIFY THAT CITY OF CAMAS, WASHINGTON

~~X~~ _____, has made proof

to the satisfaction of the State Supervisor of Water Resources of Washington, of a right to the use of the ground waters of a well

located within ~~W½NW¼~~

Sec. 12, Twp. 1 N., R. 3 ~~W~~ E W.M.,

for the purpose of municipal supply

under and subject to provisions contained in Ground Water Permit No. 4804 issued by the State Supervisor of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the State Supervisor of Water Resources of Washington and entered of record in Volume 9 at page 4072-A that the right hereby confirmed dates from February 12, 1959; that the quantity of ground water under the right hereby confirmed for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1325 gallons per minute; 1208 acre-feet per year for municipal supply.

Special provisions required by the Supervisor of Water Resources:

A description of the lands to which such ground water right is appurtenant:

City of Camas, Clark County, Washington.

The right to the use of the ground water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in Sections 6 and 7, Chapter 122, Laws of 1929.

WITNESS the seal and signature of the State Supervisor of Water Resources affixed this 24th day of November, 19 61.

M Burkhart

S. F. No. 7336—12-58—30M. 5812F.

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 10 of Ground Water Permits, on page [illegible] under Application No. 5130

CITY OF CAMAS, WASHINGTON

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is February 12, 1959

Source of the proposed ground water appropriation is a well

within _____ area, _____ sub-area, _____ zone. Name or number of works is _____

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1500 gallons per minute; 1206 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is N.10°E. 350 feet from west quarter corner of sec.12

being within W½NW¼, sec.12, T.1 N., R.3 E.W.M.

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 1500 gallons per minute; 1206 acre-feet per year, to supply the City of Camas.

For irrigation: _____ gallons per minute; _____ acre-feet per year, for the irrigation of _____ acres.

For miscellaneous uses: _____ gallons per minute; _____ acre-feet per year for _____

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas, Clark County, Washington.

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be drilled and have a diameter of 16 inches and depth of 115 feet.
(Dug or drilled)

Description of tunnel or infiltration trench:

(Please read carefully provisions below)

Particular specifications required by the Supervisor of Water Resources for the purpose of preventing waste of public waters:

Construction work shall begin on or before May 1, 1960

and shall thereafter be prosecuted with reasonable diligence and completed on or before November 1, 1960

and complete application of water to proposed use shall be made on or before November 1, 1961

Given under my hand and the seal of this office at Olympia, Washington, this 6th day of May, 1959.

M. W. Wilkie
State Supervisor of Water Resources

RETURN TO:
DIVISION OF WATER RESOURCES
335 GENERAL ADMINISTRATION BLDG
OLYMPIA

RECEIVED
JUL 15 1959

RECORD BY WELL DRILLER OR OTHER CONSTRUCTOR OF WORKS FOR WITHDRAWAL OF GROUND WATER

Under Permit No. G. W. 4804

("The well driller or other constructor of works for the withdrawal of public ground waters shall be obligated to furnish the permittee a certified record of the factual information necessary to show compliance with the provisions of this section." Sec. 8, Chap. 283, Laws of 1945.)

1. City of Camas, Washington
(Name and address of owner of well or other works for withdrawal of water)

2. Type; name or number of works where water is taken Well
(Well, tunnel or infiltration trench)

3. Date on which work on well or other structure was started June 2, 1959

4. Date on which work was completed July 7, 1959

5. If work on well or other structure was abandoned, give date _____

and reason for abandonment _____

6. DESCRIPTION OF WORKS:

(a) WELL: Depth 112 ft. Diameter 16 in. or ft. Dug or drilled Drilled

Flowing or pump well _____ Water Temp. 46 degrees

IF PUMP WELL: Type and size of pump is Test pump: 1500 g.p.m. pump 11½" bowl 9" pump column.

Type and size of motor or engine is Guiberson Diesel 210 h.p.

Depth from ground surface to water level before pumping 25 ft.

After continuous operation for 8 (At least four) hours, the measured discharge of the pump is 1500 g.p.m., and the drawdown of water level is 24 ft. (Pumping level minus static water level)

Recovery data (taken after pump has been shut off) (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level
Immediate recovery.			

Date of test June 29, 1959

IF FLOWING WELL: Measured discharge _____ g.p.m. on _____ (Date)

Shut-in pressure at ground surface _____ lbs. per sq. in. on _____ (Date)

Water is controlled by _____ (Cap, valve, etc.)

CASING: (Give diameter, commercial specifications and depth below ground surface of each casing size.)

16 in. diameter _____ from 0 to 112 ft.

_____ in. diameter _____ from _____ to _____ ft.

_____ in. diameter _____ from _____ to _____ ft.

_____ in. diameter _____ from _____ to _____ ft.

Describe and show depth of shoe, plug, adapter, liner or other details:

Grout seal from 32-35.
Grout seal from 15-18

OK

Perforated casing or screens:

80 perf. per ft. each perf. 1&3/8 by 3/8" from 82 to 102 ft.
(Number per foot and size of perforations or describe screen)

from ____ to ____ ft.

from ____ to ____ ft.

from ____ to ____ ft.

from ____ to ____ ft.

LOG OF WELL OR TUNNEL: (Describe each stratum or formation clearly, indicate if water bearing, and give thickness and depth as indicated.)

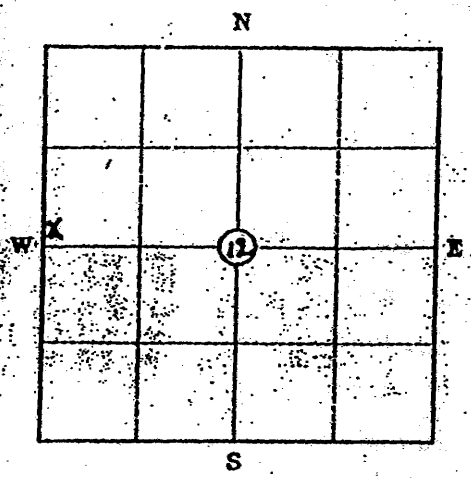
MATERIAL	Thickness (Feet)	Depth to bottom (Feet)
~~Top soil~~	3	3
Gravel and boulders	9	12
~~Gravel, some binder~~	9	21
~~Gravel and boulders~~	11	32
Cemented gravel	21	53
Loose sand and gravel, some silt	22	75
Loose sand and gravel, water-bearing	24	99
Large gravel and sand	11	110
Clay and gravel	2	112

(b) INFILTRATION TRENCH OR TUNNEL: Type ____

Dimensions: ____
(Tunnel—length, course, and cross-sectional size) (Trench—minimum and maximum depths)

Bottom width ____ ft. Discharge ____ g.p.m. Date of test ____

Position of water bearing stratum with reference to portal of tunnel ____



Scale: 1" = 2000'

Sec. 12 Twp. 1N Rge. 3E

Show approximate location of well or other works with (X) on section plat at left.

M. L. Strauss
Signature of well driller or other constructor

8110 S.E. Sunset Lane, Portland, Ore.
Address

STATE PRINTING PLANT OLYMPIA, WASH., 1957

well #4

Report of Examination on Ground Water

Received date 2-5-59 Date of exam 2-12-59 Appl. No. 5130

Name City of Camas Address Camas, Washington

Type of works well Dimensions 16"x125'

Progress of works not begun

Quantity applied for 1500 g.p.m. acre-feet per year

Legal sub. W½NW¼ Sec. 12 Twp. 1 N. Rge. 3 E. County Clark

Use municipal water supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 5391 as of 1959

Industrial

Time pump will be operated

Other water rights appurtenant to this land Cert's. 711, 712 & 85 A

Proximity to existing works, springs, wells, or streams approximately 300' to Washougal River; approx. 35' above river level

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1500 g.p.m. 1208 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

The water requirement for municiapl supply is calculated on a per capita consumption of 200 gallons a day or 0.224 acre-feet per year, a total of 1208 acre-feet per year for 5391 persons, less any quantity diverted to this use under existing water rights.

The installation of an access port to well as described in attached Ground Water Bulletin No. 1 is recommended.

Signed this 13th day of April, 1959.

DEE MOLENAAR, Geologist
Division of Water Resources

S. F. No. 2361—(Rev. 10-69)—10-60—534 1500.

CERTIFICATE RECORD NO. 14, PAGE NO. 6636-A

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF GROUND WATER RIGHT

(Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Water Resources thereunder.)

THIS IS TO CERTIFY *That* CITY OF CAMAS

of Camas, Washington, *has made proof to the satisfaction of the Department of Water Resources of a right to the use of the public ground waters of the State of Washington from* a well

located within Lot 9, Plat of Orchard Home within the City of Camas and road right of way abutting thereto to the east, of

Sec. 12, *Twp.* 1 *N., R.* 3 E, *W.M.,*

for the purpose(s) of Municipal supply

under and specifically subject to provisions contained in Ground Water Permit No. 8627

issued by the Department of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Water Resources and entered of record in Volume 14 *at page* 6636-A; *that the priority of the right hereby confirmed dates from* March 22, 1968; *that the quantity of ground water under the right hereby confirmed for the aforesaid purposes, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 600 gallons per minute, 920 acre-feet per year for municipal supply continuously during entire year to supply an estimated population of 8550 by 1970.

A description of the lands to which such ground water right is appurtenant is as follows:

City of Camas

The right to use of water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390 and 90.44.020.

This certificate of ground water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

WITNESS the seal and signature of the Assistant Director, Division of Water Management, Department of Water Resources, affixed this 17th *day of* November, *19*69

Glen H. Lidden

Assistant Director
Division of Water Management
Department of Water Resources

Engineering Data

S. F. No. 7334—OS—4-67.

STATE OF WASHINGTON
DEPARTMENT OF WATER RESOURCES
DIVISION OF WATER MANAGEMENT

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 18 of Ground Water Permits, on page 8627 under Application No. 9326

CITY OF CAMAS

of Camas, Washington

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is March 22, 1968

Source of the proposed ground water appropriation is a well

within _____ area, _____ sub-area

_____ zone. Name or number of works is _____

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 700 gallons per minute; 1120 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is 2760 feet east and 840 feet north of southwest corner of Sec. 12

being within Lot 9, Plat of Orchard Home within City of Camas and road right-of-way abutting thereto to the east, of Sec. 12, T. 1 N., R. 3 W.W.M.

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 700 gallons per minute; 1120 acre-feet per year, to supply municipal supply for estimated population of 8500 by 1970

For irrigation: _____ gallons per minute; _____ acre-feet per year, for the irrigation of _____ acres.

For miscellaneous uses: _____ gallons per minute; _____ acre-feet per year, for _____

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be drilled and have a diameter of 8 inches, and depth of 70 feet.
(Dug or drilled)

Description of tunnel or infiltration trench:

Please read carefully provisions below)

Particular specifications required by the Department of Water Resources for the purpose of preventing waste of public waters:

Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9325, for 700 gallons per minute and 1120 acre-feet per year; the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year.

Construction work shall begin on or before Started

and shall thereafter be prosecuted with reasonable diligence and completed on or before

September 1, 1969

and complete application of water to proposed use shall be made on or before

September 1, 1970

Given under my hand and the seal of this office at Olympia, Washington, this 21st day of August, 19 68.

Glen H. Fuller
Assistant Director
Division of Water Management
Department of Water Resources

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 9326
Permit No. 8627

(1) OWNER: Name City of Camas Address 616 N.E. 4th Avenue

(2) LOCATION OF WELL: County Clark - Lot 9, Plat of Orchard SW ¼ SE ¼ Sec. 12 T. 1 N., R. 3 E W.M.

Bearing and distance from section or subdivision corner: Home within City of Camas& road right of way abutting thereto to the East of Sec. 12 T1N R3 East of WM

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 5
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 71 ft. Depth of completed well 71 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from ft. to ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used
SIZE of perforations 3/8" in. by 1-1/4" in.
408 perforations from 44'6" ft. to 65 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? 22 ft.
Material used in seal Concrete grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off gravity

(7) PUMP: Manufacturer's Name Johnson
Type: V.H.S. Turbine H.P. 75

(8) WATER LEVELS: Land-surface elevation above mean sea level 38 ft.
Static level 36 ft. below top of well Date 7-25-68
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? O.J. Norris
Yield: 450 gal./min. with 1 ft. drawdown after 8 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 3-16-68
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 53° Was a chemical analysis made? Yes ☒ No ☐

See attached copy

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Surface dirt with small boulder	0	3
Gravel & Bouxlers, very little binder	3	7
Gravel & boulders w/ clay binder	7	21
Large gravel & small boulders, loose	21	24
Med. size gravel, fairly loose	24	33
Med size gravel	33	35
Large to fine gravel, some red gravel	35	45
Started making water at 35 feet		
Med. to fine gravel, clean some red - very little sand	45	48
Some larger gravel	48	56
Med. to fine gravel, clean & loose	56	60
Med to fine gravel clean, loose	60	65
Med to fine gravel, clean, loose	65	67' 6"
Loose gravel formation	67'6"	68' 6"
Loose gravel formation	68'6"	69' 6"
Fine yellow sand	69'6"	71
Sealed bottom with concrete	71	

Work started Feb. 14, 19 68. Completed Mar. 19, 19 68

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME O.J. NORRIS - WATER WELL DRILLING (Person, firm, or corporation) (Type or print)
Address 4411 N.E. 59th Avenue Vancouver, Washington

[Signed] O. J. Norris (Well Driller)

License No. 223 02 4069 Date Sept. 9, 19 68

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7154—(Rev. 2-66)—2-66—5M—(16) 25/WRB

Report of Examination on Ground Water

Received date March 22, 1968 Date of exam May 28, 1968 Appl. No. 9326

Name City of Camas Address 616 N.E. 4th Ave., Camas, Wash. 98607

Type of works a well Dimensions 8" x 70'

Progress of works Started

Quantity applied for 700 g.p.m. acre-feet per year

Lot 9, Plat of Orchard Home within City of Camas & road right of way abutting thereto to the east

Legal sub / Sec. 12 Twp. 1 N. Rge. 3 E. County Clark

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 8500 as of 1970

Industrial

Time pump will be operated May 1st through September 30th

Other water rights appurtenant to this land SW Cert. 711 for 1.0 cfs from Jones Cr. for dom. supply; SW Cert. 712 for 2.5 cfs from Little Washougal R. for Munic. supply; GW Cert. 85-A for 1200 gpm, 118 ac-ft/yr for munic. supply; GW Cert. 4072-A for 1325 gpm; 1208 ac-ft/yr for mun. sup.; and concurrent GW App. 9325 for 1500 gpm for mun. supply.

Proximity to existing works, springs, wells, or streams City of Washougal, northeasterly 1200 feet

Area Sub-area Zone

RECOMMENDATIONS

Approved for 700 g.p.m. 1120 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

It is noted that the well site and water transmission facilities therefrom are not located upon the land owned by the applicant. Applicant is, accordingly, advised that the issuance of permit by this department for appropriation of the waters in question does not convey a right of access to, or other right to use, land which the applicant does not legally possess. Obtainment of such right is a private matter between applicant and owner of that land.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the State Director of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Department of Health, 304 Public Health Building, Olympia, with regard to the need for compliance.

The following water rights are appurtenant to this land:

Certificate Number	c.f.s./g.p.m.
Surface Water Cert. 711	1.0 c.f.s.
Surface Water Cert. 712	2.5 c.f.s.
Ground Water Cert. 85-A	1200 g.p.m.
Ground Water Cert. 4072-A	1325 g.p.m.
Concurrent Ground Water Appli. 9325	1500 g.p.m.

(over)

The total requirement based on an engineering study is 345 gallons per capita per day for all purposes for an estimated population of 8500 by 1970, or approximately 3300 acre-feet per year.

The quantity recommended under this application is 700 gallons per minute pumping continuously, or 1120 acre-feet per year.

The permit when issued will carry the following provision: "Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9225, for 700 gallons per minute and 1120 acre-feet per year, the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year."

Signed at Olympia, Washington
this 5 day of June, 1968

B. A. Cameron

B. A. CAMERON, Engineer
Division of Water Management

R. F. No. 7341—(Rev. 10-001—10-00—33M 12000.

CERTIFICATE RECORD NO. 14, PAGE NO. 6635-A

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF GROUND WATER RIGHT

(Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Water Resources thereunder.)

THIS IS TO CERTIFY *That* CITY OF CAMAS

of Camas, Washington, *has made proof*

to the satisfaction of the Department of Water Resources of a right to the use of the public ground waters of the State of Washington from a well

located within David C. Parker D.L.C. No. 48

Sec. 12, *Twp.* 1 *N., R.* 3 E. *W.M.,*

for the purpose(s) of Municipal supply

under and specifically subject to provisions contained in Ground Water Permit No. 8544

issued by the Department of Water Resources and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Water Resources and entered of record in Volume 14 *at page* ~~6635-A~~ 6635-A; *that the priority of the right hereby confirmed dates from* March 22, 1968; *that the quantity of ground water under the right hereby confirmed for the aforesaid purposes, is limited to an amount actually beneficially used for said purposes, and shall not exceed* 1500 gallons per minute, 2400 acre-feet per year for municipal supply to supply a population of 8500 by 1970 continuously during entire year.

A description of the lands to which such ground water right is appurtenant is as follows:

City of Camas

The right to use of water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390 and 90.44.020.

This certificate of ground water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

WITNESS the seal and signature of the Assistant Director, Division of Water Management, Department of Water Resources, affixed this 17th *day of* November, *19*69

Glen H. Lillie

S. F. No. 7334—OS—4-61.

STATE OF WASHINGTON
DEPARTMENT OF WATER RESOURCES
DIVISION OF WATER MANAGEMENT

Permit to Appropriate Public Ground Waters of the State of Washington

Book No. 18 of Ground Water Permits, on page 8544 under Application No. [illegible]

CITY OF CAMAS

of Camas, Washington

is hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights, and to the limitations and provisions set out herein.

Priority date of this permit is March 22, 1968

Source of the proposed ground water appropriation is a well

within _____ area, _____ sub-area

_____ zone. Name or number of works is _____

Quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1500 gallons per minute; 2400 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Location of the well, tunnel, or infiltration trench is 2300 feet east and 1800 feet north of southwest corner of Sec. 12

being within David C. Parker D.L.C. No. 48 of Sec. 12, T. 1 N., R. 3 E.W.M.

county of Clark

Use, or uses to which water is to be applied:

For municipal supply: 1500 gallons per minute; 2400 acre-feet per year, to supply a population of 8500 by 1970 continuously during entire year.

For irrigation: _____ gallons per minute; _____ acre-feet per year, for the irrigation of _____ acres.

For miscellaneous uses: _____ gallons per minute: _____ acre-feet per year, for _____

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Camas

DESCRIPTION OF WORKS FROM WHICH WATER IS TO BE WITHDRAWN

The well will be drilled (Dug or drilled) and have a diameter of 16 inches, and depth of 85 feet.

Description of tunnel or infiltration trench:

Please read carefully provisions below)

Particular specifications required by the Department of Water Resources for the purpose of preventing waste of public waters: 1) The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final Certificate of Water Right. 2) Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9126, for 1500 gallons per minute and 2400 acre-feet per year; the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year.

Gallons Min.

2400

Construction work shall begin on or before July 1, 1969

and shall thereafter be prosecuted with reasonable diligence and completed on or before July 1, 1970

and complete application of water to proposed use shall be made on or before July 1, 1971

Given under my hand and the seal of this office at Olympia, Washington, this 20th day of June, 1968

Glen H. Fuller

Assistant Director
Division of Water Management
Department of Water Resources

WELL #6

Report of Examination on Ground Water

Received date March 22, 1968 Date of exam May 28, 1968 Appl. No. 9325

Name City of Camas Address 616 N.E. 4th Ave., Camas, Wash. 98607

Type of works a well Dimensions 16" x 85'

Progress of works Not started

Quantity applied for 1500 g.p.m. 2300 acre-feet per year

Legal sub. / Sec. 12 Twp. 1 N. Rge. 3 E. County Clark
David C. Parker D.L.C. No. 48

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 8500 as of 1970

Industrial

Time pump will be operated Continuously

Other water rights appurtenant to this land SW Cert. 711 for 1.0 cfs from Jones Cr. for dom. supply; SW Cert. 712 for 2.5 cfs from Little Washougal R. for munic. supply; GW Cert. 85-A for 1200 gpm, 118 ac-ft/yr for munic. supply; GW Cert. 4072-A for 1325 gpm; 1208 ac-ft/yr for mun. sup.; and concurrent GW App. 9326 for mun. supply, 700 gpm.

Proximity to existing works, springs, wells, or streams
City of Camas, west 1300 feet:
City of Washougal, east 1300 feet

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1500 g.p.m. 2400 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

It is noted that the well site and water transmission facilities therefrom are not located upon the land owned by the applicant. Applicant is, accordingly, advised that the issuance of permit by this department for appropriation of the waters in question does not convey a right of access to, or other right to use, land which the applicant does not legally possess. Obtainment of such right is a private matter between applicant and owner of that land.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the State Director of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Department of Health, 304 Public Health Building, Olympia, with regard to the need for compliance.

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final Certificate of Water Right. The applicant may, for his own convenience, wish to install an air-line and gage in addition to the access port.

(over)

The following water rights are appurtenant to this land:

Certificate Number	c.f.s./g.p.m.
Surface Water Cert. 711	1.0 c.f.s.
Surface Water Cert. 712	2.5 c.f.s.
Ground Water Cert. 85-A	1200 g.p.m.
Ground Water Cert. 4072-A	1325 g.p.m.
Concurrent Ground Water Appli. 9326	700 g.p.m.

The total requirement based on an engineering study is 345 gallons per capita per day for all purposes for an estimated population of 8500 by 1970, or approximately 3300 acre-feet per year.

The quantity recommended under this application is 1500 gallons per minute pumping continuously, or 2400 acre-feet per year.

The permit when issued will carry the following provision: "Issued as a supplementary supply to Surface Water Certificates 711 and 712, Ground Water Certificates 85-A and 4072-A and concurrent Ground Water Application 9326, for 1500 gallons per minute and 2400 acre-feet per year; the total quantity withdrawn or diverted from all sources is not to exceed 3300 acre-feet per year."

Signed at Olympia, Washington
this 2 day of June, 1968

B. A. Cameron

B. A. CAMERON, Engineer
Division of Water Management

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 9325

Permit No. 8544

(1) OWNER: Name City of Camas Address 616 N.E. 4th Avenue

(2) LOCATION OF WELL: County Clark David C Parker D.L.C. #48 NE ¼ SW ¼ Sec. 12 T. 1 N. R. 3E W.M.

Bearing and distance from section or subdivision corner.

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 6

New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches. Drilled 85 ft. Depth of completed well 85 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" OD Diam. from 0 ft. to 85 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used Mill knife
SIZE of perforations 5/16 in. by 3-1/2 in.
perforations from ft. to ft.
552 perforations from 56 ft. to 80 ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 22 ft.
Material used in seal Concrete grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata 27
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 48 ft.
Static level 45 ft. below top of well Date 6-29-68
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? City
Yield: 1600 gal./min. with 5 ft. drawdown after 12 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test June 29, 1968
Bailer test gal./min. with ft drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 53° Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Surface Soil	0	2
Gravel & Small Boulders	2	6
Gravel & Boulders	6	10
Gravel & Small Boulders	10	14
Boulders	14	15
Pea Gravel	15	17
Boulders	17	19
Boulders	19	21
Large to Medium gravel	21	26
Medium to fine gravel, some sand	26	30
Medium to fine gravel with a few boulders	30	40
Med. to fine gravel with fine sand	40	48'6"
Med to fine gravel with some sand	48'6"	53
Water bearing gravel and sand	53	55
Med to fine gravel, water bearing	55	59
Med to fine gravel, water bearing	59	69
Med to fine gravel, some black sand water bearing	69	76
Med to large gravel	76	80
Gravel & small boulders, very tight formation	80	83'9"
Med hard gray rock	83'9"	85

Work started June 5, 1968. Completed 6-27-68, 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME O.J. NORRIS-WATER WELL DRILLING (Person, firm, or corporation) (Type or print)
Address 4411 N.E. 59th Avenue Vancouver, Washington

[Signed] O. J. Norris (Well Driller)

License No. 223 02 4069 Date Sept. 9, 1968

See Enclosed

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 1336—(Rev. 2-66)—2-66—5M. 4516

CK/WB

S. F. No. 2361—(Rev. 6-70).

WELL No 7

CERTIFICATE RECORD NO. ——, PAGE NO. G 2-00501 C

STATE OF WASHINGTON, COUNTY OF Clark

CERTIFICATE OF GROUND WATER RIGHT

(Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology thereunder.)

THIS IS TO CERTIFY THAT CITY OF CAMAS

of Camas, Washington, has made proof to the satisfaction of the Department of Ecology of a right to the use of the public ground waters of the State of Washington from a well

located within a portion of David C. Parker D.L.C. #48 lying within the SW¼ within the city limits of Camas

Sec. 12, Twp. 1 N., R. 3 E., W.M.,

for the purpose(s) of municipal supply

under and specifically subject to provisions contained in Ground Water Permit No. 10513

issued by the Department of Ecology and that said right to the use of said ground waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Ecology and entered of record in Volume — at page G 2-00501 C; that the priority of the right hereby confirmed dates from March 22, 1971; that the quantity of ground water under the right hereby confirmed for the aforesaid purposes, is limited to an amount actually beneficially used for said purposes, and shall not exceed 1000 gallons per minute; 530 acre-feet per year, during entire year for municipal supply.

A description of the lands to which such ground water right is appurtenant is as follows:

Area served by the City of Camas.

The right to use of water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390 and 90.44.020.

This certificate of ground water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

Given under my hand and seal of this office at Olympia, Washington, this 16th day of February, 19 73

JOHN A. BIGGS, Director
Department of Ecology

Engineering Data
TM

C-43 by R. L. Bolton

S. F. No. 7354—(Rev. 6-70)

Well No 7

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Permit to Appropriate Public Waters of the State of Washington

Book No. 22 of Ground Water Permits, on page 10515 under Application No. 11718

CITY OF CAMAS

of CAMAS, WASHINGTON

is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

Priority date of this permit is March 22, 1971

Source(s) of the proposed ground water appropriation is/~~are~~ a well

The quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 1000 gallons per minute; 530 acre-feet per year, to be used for the following purposes: municipal supply

as more definitely set out below.

Approximate location(~~s~~) of the point(~~s~~) of withdrawal is/~~are~~ 1245 feet east and 2145 feet north of southeast corner of Sec. 12

being within A portion of David C. Parker D.L.C. # 48 lying within the SW¼ within the city limits of Camas

of Sec. 12, Twp. 1 N., Rge. 3 E. W.M., Clark County.

The use, or uses, to which water is to be applied:

~~Domestic~~ municipal supply: 1000 gallons per minute; 530 acre-feet per year, during entire year.

Irrigation: gallons per minute; acre-feet per year from to , each year, for the irrigation of acres.

Other use(s): gallons per minute: acre-feet per year, from to each year, for

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Camas

ADDITIONAL LIMITATIONS AND PROVISIONS: The installation and maintenance of an access port as described in Ground Water Bulletin No. ' shall be required prior to issuance of final Certificate of Water Right.

The total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates No. 711 and 712 and Ground Water Certificates Nos. 85, 4072, 6635 and 6636 shall not exceed 5750 acre-feet per year.

Nothing in this permit shall **be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971.**

DESCRIPTION OF PROPOSED WORKS:

The well will be **drilled** (Dug or drilled) and have a diameter of **14** inches, and depth of **85** feet.

Description of tunnel or infiltration trench: _____

DEVELOPMENT SCHEDULE:

Construction work shall begin on or before **Started**

and shall thereafter be prosecuted with reasonable diligence and completed on or before **November 1, 1972**

and complete application of water to proposed use shall be made on or before **November 1, 1973**

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Olympia, Washington, this **10th**

day of **November** 19 **71**

JOHN A. BIGGS, *Director*
Department of Ecology

by R. Jerry Bollen

ENGINEERING DATA
OK R.T.

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 11716
Permit No. .....

(1) OWNER: Name CITY OF CAMAS, WASH Address 616 NE. 4TH AVE CAMAS, WASH

(2) LOCATION OF WELL: County CLARK — NE ¼ SW ¼ Sec. 12 T. 1 N. R. 3E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 7
New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 14 inches.
Drilled 84 ft. Depth of completed well 84 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 14" Diam. from +5 ft. to 84 ft.
Threaded ☐ ..." Diam. from ... ft. to ... ft.
Welded ☒ ..." Diam. from ... ft. to ... ft.

Perforations: Yes ☒ No ☐
Type of perforator used STAR
SIZE of perforations 3/8 in. by 1 1/4 in.
520 perforations from 49 ft. to 77 ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type ... Model No.
Diam. ... Slot size ... from ... ft. to ... ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ... ft. to ... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal CEMENT GROUT
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ... Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: Submersible turbine H.P. 100
1-25-75 JM

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 8.5 ft. below top of well Date 6/22/71
Artesian pressure ... lbs. per square inch Date
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? STRASSER
Yield: 1000 gal./min. with 4 ft. drawdown after 1 1/2 hrs.
" 1425 " 5 " 6 "
" 1200 " 4 " 2 1/2 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
IMMEDIATE RECOVERY					

Date of test JUNE 22, 1971
Bailer test ... gal./min. with ... ft. drawdown after ... hrs.
Artesian flow ... g.p.m. Date
Temperature of water 57 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
GRAVEL AND BOULDERS	0	8
GRAVEL, SOME CLAY	8	18
CEMENTED GRAVEL	18	20
LOOSE GRAVEL	20	30
PACKED GRAVEL	30	36
GRAVEL AND GREY CLAY	36	39
LOOSE GRAVEL (WATER)	39	65
MEDIUM GRAVEL (WATER)	65	70
LARGE GRAVEL (WATER)	70	81
RED CLAY	81	84

RECEIVED
DEPARTMENT OF ECOLOGY
JUL 1 1971
AM 7,8,9,10,11,12,1,2,3,4,5 PM

Work started JUNE 7, 19 71. Completed JUNE 25, 19 71

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME R J STRASSER DRILLING CO (Person, firm, or corporation) (Type or print)

Address 8110 SE SUNSET LANE PORTLAND ORE

[Signed] Robert L Strasser (Well Driller)

License No. 223022806 Date JULY 12, 19 71

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7256—(Rev. 2-68)—Form No. 4516.

well #7

Report of Examination on Ground Water

Received date March 22, 1971 Date of exam. August 31, 1971 Appli. No. 11718

Name City of Camas Address 616 N.E. 4th Ave., Camas WA 98607

Type of works A well Dimensions 14" x 85'

Progress of works Well drilled and capped

Quantity applied for 1000 g.p.m. 530 acre-feet per year

of David C. Parker D.L.C. #48 within the City of Camas (lying within the SW¼)

Legal sub A portion/Sec. 12 Twp. 1 Rge. 3 E. County Clark

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: ~~Population~~ Area served 15,000 as of 1990

Industrial

Time pump will be operated Continuously

Other water rights appurtenant to this land See Surface Water Certificates Nos. 712 & 711; Ground Water Certificates Nos. 85, 4072, 6635 and 6636

Proximity to existing works, springs, wells, or streams City of Camas, west 400'; City of Camas, southeasterly 1000'; City of Camas, north; Washougal River, north 200'

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1000 g.p.m. 530 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The applicant may, for his own convenience, wish to install an airline and gage in addition to the access port.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the Assistant Secretary, Division of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Division of Health, Public Health Bldg. No. 7, Thurston Airdustrial Center, Olympia, with regard to the need for compliance.

The following water rights are appurtenant to this land:

Certificate No.	c.f.s./g.p.m.	ac-ft per yr.
SWC 711	1.0 c.f.s.	730
SWC 712	2.5 c.f.s.	1820
GWC 85-A	1200 g.p.m.	118
GWC 4072-A	1325 g.p.m.	1208
GWC 6635	1500 g.p.m.	2400
GWC 6636	600 g.p.m.	920

The total requirement based on an engineering study is 345 gallons per capita per day for all purposes for an estimated population of 15,000 by 1990 or approximately 5,750 acre-feet per year.

The quantity recommended under this application is 1000 gallons per minute not to exceed 530 acrefeet per year as requested in the application.

The permit when issued will carry the following provision: "The total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates Nos. 711 and 712 and Ground Water Certificates Nos. 85, 4072, 6635 and 6636 shall not exceed 5,750 acre-feet per year."

Additionally, the permit when issued shall carry the following provision: "Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971."

Signed at Olympia, Washington
this 28th day of September, 1971.

Jerry Louthain
JERRY LOUTHAIN, Engineer
Department of Ecology

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF WATER RIGHT

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 4, 1977	G 2-24400	G 2-24400 P	G 2-24400 C

NAME
CITY OF CAMAS

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 1055	Camas	Washington	98607

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown.

PUBLIC WATER TO BE APPROPRIATED

SOURCE
well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	900	530

QUANTITY, TYPE OF USE, PERIOD OF USE		
530 acre-feet per year	municipal supply	continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
1375 feet East and 2145 feet North of Southwest corner of Section 12.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼	12	1	3 E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the Camas Municipal water system.

"The total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificate No. 711 and 712 and Ground Water Certificate Nos. 85A, 4072 A, 6635 A and G 2-00501 and this certificate shall not exceed 5750 acre-feet per year."

↑ 6636A ?

The access port as required on your permit shall be maintained at all times.

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and maintenance of Water Wells)."

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020.

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

Given under my hand and the seal of this office at Olympia *Washington, this* 23rd *day of* May *19* 79

WILBUR G. HALLAUER, DIRECTOR
Department of Ecology

ENGINEERING DATA
OK RPS
OTES

by E.W. Asselstine
E.W. ASSELSTINE, Regional Manager

FOR COUNTY USE ONLY

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. G2-24400P
Permit No.

(1) OWNER: Name City of Camas Address Camas, Washington

(2) LOCATION OF WELL: County Clark NW SW Sec. 12 T. 1 N. R. 3E W.M.
Bearing and distance from section or subdivision corner 1375 E & 2145' N of SW Corner of Sec 12

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 8
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 14 inches.
Drilled 87 ft. Depth of completed well 87 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 14" Diam. from 0 ft. to 87 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.
(3' riser added for future fill)
Perforations: Yes ☒ No ☐
Type of perforator used Mills Knife
Size of perforations 3/8 in. by 3½ in.
8 rows perforations from 44 ft. to 79 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 33.2 ft. below top of well Date 5/10/77
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? driller
Yield: 1,040 gal./min. with 1.15 ft. drawdown after ½ hrs.
" 1,791 " 3.60 " 6 "
" 1,921 " 3.65 " 7 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0:00	36.85				
7:00	34.00				

minutes

Date of test 5/10/77
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 50° Was a chemical analysis made? Yes ☒ No ☐

OK PRS

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Topsoil	0	6"
Gravel, small boulders	6"	4'
Gravel, boulders	4'	21'
Gravel, small boulders, brown clay seams	21'	37'
Gravel, loose, some brown clay	37'	39'
Gravel, sand, gray	39'	42'
Gravel, sand, gray, water bearing	42'	49'
Gravel, medium size, sand, gray, loose, water bearing	49'	55'
Gravel, small to large, loose, water bearing	55'	75'
Gravel, medium to large, loose	75'	79'
Gravel, large, red clay	79'	82'
Clay, red	82'	87'

RECEIVED
JUL 6 1977
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 4/14 19 77 Completed 5/14 19 77

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME NORRIS DRILLING & PUMP CO., INC. (Person, firm, or corporation) (Type or print)
Address 11026 N.E. St. Johns Blvd. Vancouver, Washington 98665

[Signed] O. J. Norris (Well Driller)

License No. 0366 Date June 6 19 77

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 4, 1977	G 2-24400	G 2-24400 P	

NAME
CITY OF CAMAS

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 ~~NE 4th Ave.~~ PO Box 1655	Camas	Washington	98607

The applicant is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

PUBLIC WATER TO BE APPROPRIATED

SOURCE
well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	900	530

QUANTITY, TYPE OF USE, PERIOD OF USE
530 acre-feet per year — municipal supply — continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
1375 feet East and 2145 feet North of Southwest corner of Section 12.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼	12	1	3 E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the Camas Municipal water system.

DESCRIPTION OF PROPOSED WORKS

Well 14" x 85', 100 HP pump to municipal water system.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	July 1, 1979	July 1, 1980

PROVISIONS

"The total amount of water to be withdrawn or diverted, which includes the amounts as approved in surface water certificate No. 711 and 712 and Ground Water Certificate Nos. 85A, 4072 A, 5635 A and G2-00501 and this permit shall not exceed 5750 acre-feet per year.

The installation of an access port as described in Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The permittee, may for his own convenience, wish to install an airline and gage in addition to the access port.

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and maintenance of Water Wells)."

Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971.

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Olympia *Washington, this* 15th *day of* March, *19* 78

WILBUR HALLAUER, DIRECTOR
Department of Ecology

ENGINEERING DATA
OK RPB

by E.W. Asselstine

E.W. Asselstine, Regional Manager

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

REPORT OF EXAMINATION
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 4, 1977	G 2-24400		

NAME
CITY OF CAMAS

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4 th Ave	Camas	Washington	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	900	530

QUANTITY, TYPE OF USE, PERIOD OF USE		
530 acre-feet per year	municipal supply	continuously

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
1375 feet East and 2145 feet North of Southwest corner of Section 12.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼	12	1	3 E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the Camas Municipal water system.

DESCRIPTION OF PROPOSED WORKS

1 14" x 85', 100 HP pump to municipal water system.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	July 1, 1979	July 1, 1980

PROVISIONS

Recommend this application be approved for 900 gallon per minute and 530 acre-feet per year for a municipal supply for the City of Camas.

The following water rights are appurtenant to this land.

Certificate No.	CFS/GPM	Acre-feet per year
SWC 711	1.0 CFS	730
SWC 712	2.5 CFS	1820
GWC 85-A	1200 GPM	118
GWC 4072 A	1325 GPM	1208
GWC 6635	1500 GPM	2400
GWC 6636	600 GPM	920
G2 - 00501 C	1000 GPM	530

total requirement based on an engineering study is 345 gallons per capita per day for all poses for an estimated population of 15,000 by 1990 or approximately 5,750 acre-feet per year. The permit when issued will carry the following provision: "The total amount of water to be withdrawn or diverted, which includes the amounts as approved in surface water certificate Nos. 711 and 712 and Ground Water Certificate Nos. 85A, 4072A, 6635 A 6636 A and G2-00501 and this application shall not exceed 5750 acre-feet per year.

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The applicant may for his own convenience, wish to install an airline and gage in addition to the access port.

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the Water Supply and Waste Section, Department of Social and Health Services, Mail Stop 4-1, Building 4, Olympia, Washington, 98504, prior to any new construction or alterations of a public water supply.

"All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under Chapter 18.104 RCW (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells)."

Nothing in this application shall be construed as excusing the applicant from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971.

ned at Olympia, Washington,
...is 4 day of August, 1977.

Robert P. Burrell
Department of Ecology

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regul the Department of Ecology.)

☒ Ground Water (issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regul the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 13, 1986	G2-27384	G2-27384 P	

NAME
City of Camas

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4th Avenue	Camas	Washington	98607

The applicant is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appr the following described public waters of the State of Washington, subject to existing rights and to the limitations and provisions s herein.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Well No. 9

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	650	210 Supplemental

QUANTITY, TYPE OF USE, PERIOD OF USE		
210 acre-feet per year Supplemental to existing rights	Municipal Supply	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION–WITHDRAWAL
600 feet south and 700 feet west of the north quarter corner of Section 4.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NE¼NW¼	4	1	3E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Camas.

This permit is subject to the implementation of the minimum requirements established in the Interim Guidel for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology and Conserva Programs, July 1990.

Under RCW 90.03.005 and 90.54.020(6), conservation and improved water use efficiency must be emphas in the management of the states water resources, and must be considered as a potential new source of w Accordingly, as part of the terms of this permit, the applicant shall prepare and implement a water conserva plan approved by Department of Health. The standards for such a plan may be obtained from either Department of Health or the Department of Ecology.

The Water Resources Act of 1971 specifies certain criteria regarding utilization and management of the wa of the state in the best public interest. Use of water may be subject to regulation at certain times, based on necessity to maintain water quantities sufficient for preservation of the natural environment.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

REPORT OF EXAMINATION

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regu the Department of Ecology.)

☒ Ground Water (issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regu the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 13, 1986	G2-27384		

NAME
City of Camas

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
616 NE 4th Avenue	Camas	Washington	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Well No. 9

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	650	210 Supplemental

QUANTITY, TYPE OF USE, PERIOD OF USE		
210 acre-feet per year Supplemental to existing rights	Municipal Supply	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION–WITHDRAWAL
600 feet south and 700 feet west of the north quarter corner of Section 4.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NE¼NW¼	4	1	3E	28	Clark

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by the City of Camas.

Existing City of Camas rights. The City of Camas has several surface and ground water rights and clair shown below:

Little Washougal River (reach now known as Boulder Creek), Certificate No. S 711 C, is for 1.0 cfs an acre-feet per year (AF/Y). This source is subject to low flow conditions in the summer.

Jones Creek, Certificate No. S 712 C, is for 2.5 cfs and 1820 AF/Y. This source goes low in the summe

Well No. 1, Claim No. 121022 for vested rights, is for 900 gpm and 320 AF/Y. The well is no longer us a regular basis.

Well No. 2, Claim No. 121023 for vested rights, is for 900 gpm and 230 AF/Y. The well is no longer us a regular basis.

Well No. 3, Certificate No. G 85-A C, is for 1200 gpm and 118 AF/Y.

Well No. 4, Certificate No. G 4072 C, is for 1325 gpm and 1208 AF/Y.

Well No. 5, Certificate No. G 6636 C, is for 600 gpm and 920 AF/Y.

Well No. 6, Certificate No. G 6635 C, is for 1500 gpm and 2400 AF/Y.

Well No. 7, Certificate No. G2-00501, is for 1000 gpm and 530 AF/Y.

Well No. 8, Certificate No. G2-24400, is for 900 gpm and 530 AF/Y.

Under the provisions of Certificates No. G2-00501C and G2-24400, the total annual quantity allowed u existing rights is 5,750 AF/Y.

Clark County Reservation. Under the provisions of Chapter 173-592 WAC, Reservation of Future Public W Supply for Clark County, ground water was reserved for future beneficial use for public water supply in C County. Since the enactment of this reservation, water rights issued pursuant to WAC 173-592 have rece a priority date of August 13, 1986, the effective date of said regulation. The total reservation quantity is 97 gpm and 65,300 AF/Y prorated by aquifer as follows:

1) Columbia River Alluvium (1A) and Sandy River Mudstone (1C) 77,000 gpm, 51,800 AF/Y;

2) Upper Troutdale (1B-2B) 20,000 gpm, 13,500 AF/Y.

The subject well is completed within the Upper Troutdale sediments. This appropriation, therefore, falls u WAC 173-592 and will, when permitted, be debited against the reserved quantity for the Upper Trout aquifers. In addition, the permit will carry the August 13, 1986, priority date of the reservation.

Annual quantity supplemental to existing rights. The total annual allocation under the City's existing rig 5,750 AF/Y, was based on a projected population of 15,000. The City of Camas' actual water use for the 1989 amounted to 1,930 acre-feet for a population of 6,600 (Clark County Coordinated Water system P Update, April 1991; Intergovernmental Resource Center population summary, March 1990).

The City's annual water use should remain within existing rights (5,750 AF/Y) for the foreseeable fut Therefore the annual quantity recommended for this permit will be supplemental to existing rights, augmen system supply within the 5,750 AF/Y already authorized.

Quantities from this well. Due to the apparent limitations of the aquifer, this well is probably not suitable use as a major production well, but it could serve to boost system capacity during peak periods. Mr. Levi requested that the permit authorize a maximum withdrawal of 650 gpm up to 20% of the time on average allow the City to determine the optimum rate and pumping schedule. Accordingly, the permit will autho 650 gpm and 210 AF/Y from Well 9, subject to the provisions below.

Water right certificate. Pursuant to RCW 90.03.330 and 90.44.080, a final certificate will be issued upo showing satisfactory to the Department that the appropriation has been perfected in compliance with the te of the subject permit. The certificated withdrawal rate and annual quantity will reflect a sustainable yield protection of senior rights, within the amounts specified on the permit. Monitoring and data submittal will required under the certificate as well as the permit.

Report Continued

The Water Resources Act of 1971 specifies certain criteria regarding utilization and management of the w
of the state in the best public interest. Favorable consideration of this application has been based on suf
waters available, at least during portions of the year. However, it is pointed out to the applicant that th
of water may be subject to regulation at certain times, based on the necessity to maintain water qua
sufficient for preservation of the natural environment.

REPORTED BY: Vinnie Wright DATE: October 12, 1992

The statutory permit fee for this application is $20.00.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30144		

NAME
City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
8 Wells (Lower Washougal Wellfield)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	500	2,150

QUANTITY, TYPE OF USE, PERIOD OF USE

2,150 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

Well 5: 2600ft E & 790ft N of SW corner of Section 12, T1NR3E; Parcel=87268000; Lat=45.58059763; Long=122.38336343
Well 6: 2410ft E & 1795ft N of SW corner of Section 12, T1NR3E; Parcel=89927000; Lat=45.58340428; Long=122.38412204
Well 7: 1280ft E & 2110ft N of SW corner of Section 12, T1NR3E; Parcel=89891000; Lat=45.58431461; Long=122.38852327
Well 8: 1410ft E & 2080ft N of SW corner of Section 12, T1NR3E; Parcel=89888000; Lat=45.58426809; Long=122.38802699
Well 10: 790ft E & 2170ft N of SW corner of Section 12, T1NR3E; Parcel=89866000; Lat=45.58447735; Long=122.39044258
Well 11: 1060ft E & 2145ft N of SW corner of Section 12, T1NR3E; Parcel=89892000; Lat=45.58439709; Long=122.38937969
Well 12: 1030ft E & 2145ft N of SW corner of Section 12, T1NR3E; Parcel=89892000; Lat=45.58439492; Long=122.38950256
Well 13: 15ft E & 3410ft N of SW corner of Section 12, T1NR3E; Parcel=90928000; Lat=45.58783343; Long=122.39350782

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Washougal River Wellfield	See above	See above	See above	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS
8 Existing Wells in the Lower Washougal Wellfield

DEVELOPMENT SCHEDULE		
BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

   - Construction shall begin by August 1, 2008

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30145		

NAME
City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Proposed Well (Anderson Site)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	1000	880

QUANTITY, TYPE OF USE, PERIOD OF USE

880 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

1900 feet north and 2050 feet west of SE corner of Section 12

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW 1/4 SE 1/4	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Anderson proposed well	91045003	45.58349161	122.38087177	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS
A proposed well

DEVELOPMENT SCHEDULE		
BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30146		

NAME
City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Proposed Well (Parkers Landing)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	1000	880

QUANTITY, TYPE OF USE, PERIOD OF USE

880 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

200 feet north and 2500 feet west of the SE corner of Section 12

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW 1/4 SE 1/4	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Parkers Landing proposed well	73134162	45.57960601	122.38210695	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS

A proposed well

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
REPORT OF EXAMINATION

Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

[X] Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 21, 2003	G2-30147		

NAME
City of Camas

ADDRESS (STREET)	CITY	STATE	ZIP CODE
616 NE Fourth Avenue	Camas	WA	98607

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Proposed Well (Treatment Plant Well)

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	1000	880

QUANTITY, TYPE OF USE, PERIOD OF USE

880 acre-feet per year	Municipal	Year-round, as needed

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL

200 feet north and 200 feet west of the SW corner of Section 12

SMALLEST SUBDIVISION	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW 1/4 SW ¼	12	1 N	3 E.W.M.	28	Clark

POINT OF WITHDRAWAL NAME	PARCEL NUMBER	LATITUDE	LONGITUDE	DATUM
Treatment Plant proposed well	87360000	45.57902697	122.39273145	NAD 83 (orthophoto)

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED
[Attachment 1 shows location of the authorized place of use and point(s) of diversion or withdrawal]

Area served by the City of Camas. The place of use of this water right is the service area described in the currently approved Water System Plan as approved by the Washington State Department of Health. RCW 90.03.386 may have the effect of revising the place of use of this water right if the criteria in section RCW 90.03.386(2) are met.

DESCRIPTION OF PROPOSED WORKS
A proposed well

DEVELOPMENT SCHEDULE		
BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
August 1, 2008	August 1, 2015	August 1, 2025

PROVISIONS

Monitoring

The City of Camas shall develop a monitoring plan that includes the following:

a.) Monitor water levels in existing wells (TW-C and Well 4) and three new monitoring wells. The new monitoring wells must be installed as a cluster in the lower Washougal River in general proximity to the Georgia Pacific wellfield (where the largest drawdown occurs in the area). Two wells must be completed in the lower permeability streambed unit that lies beneath the river, and the third well must be completed in the more permeable PAA aquifer. All water levels must be measured to the nearest tenth of a foot, on an hourly basis during baseflow periods. New monitoring wells must be accurately located within 10 feet horizontally and 0.1 foot vertically. All monitoring wells must be constructed according to WAC 173-160-400.

b.) The City shall install a continuous river stage monitoring station in vicinity of the new monitoring wells. The monitoring station must include a staff gage which is accurately located within 10 feet horizontally and 0.1 foot vertically. Stage readings shall also be recorded on an hourly basis.

c.) Aquifer tests on the new Camas production wells must coincide with summer/fall low-flow periods and include seepage surveys during testing events. New supply wells must be accurately located within 10 feet horizontally and 0.1 foot vertically.

d.) The City shall submit water level data from their monitoring network for the previous year by January 31 to the Department of Ecology. Data shall be provided in a digital format along with a two page summary attached. A more thorough monitoring report must be provided after 5 years from the date of issuance of this water right or when this permit is perfected (whichever comes first), to further evaluate the effects of pumping on the Washougal River.

Operations of Surface Water System

1. Prior to groundwater being withdrawn under this water right, the City of Camas must cease their surface water diversions from Jones and Boulder Creeks between May 15 and October 31 of each year. At the State's discretion, the water rights associated with these diversions will be placed into the State's Trust Water Program as permanent, seasonal donations.

Metering and Reporting Diversions

1. An approved measuring device shall be installed and maintained for each of the wells authorized by this water right, in accordance with the rule "Requirements for Measuring and Reporting Water Use", WAC 173-173.

2. Reported water use data shall be submitted via the Internet. To set up an Internet reporting account, access https://fortress.wa.gov/ecy/wrx/wrx/Meteringx/. If you do not have Internet access, contact the Southwest Regional Office for forms to submit your data.

3. Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation, and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements."

4. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions and may inspect, at reasonable times, any measuring device used to meet the above conditions.

Development Schedule

1. The development schedule shall be as follows:

RECEIVED
SEP 04 2001
Washington State

For Ecology Use
Fee Paid _____
Date _____

State of Washington
Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays.

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of Camas Home Tel:( ) -
Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451
City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above

Name Eric Levison Home Tel:( ) -
Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451
City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535
Relationship to applicant Engineering Manager - City of Camas

Section 3. STATEMENT OF INTENT

Municipal

The applicant requests a permit to use not more than 1,000 (☒ gallons per minute or ☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s) of Domestic/Public Supply. **ATTACH A "LEGAL" DESCRIPTION OF THE PLACE OF USE.** (See instructions.) *NOTE: A tax parcel number or a plat number is not sufficient.* Area served by City of Camas.
Estimate a maximum annual quantity to be used in acre-feet per year: 1200 AF/YR

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:
From ___/___/___ to ___/___/___

Section 4. WATER SOURCE

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.: Number of diversions: _____	A permit is desired for 2 well(s).
Source flows into (name of body of water):	Size & depth of well(s): 12-inch deep 150 feet deep

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: 1600 feet east and 1000 feet south of the NW 1/4 of Section 28, Township 2 North, Range 3 East

¼ of	¼ of	Section	Township	Range(E/W)	County	If location of source is platted, complete below:		
						Lot	Block	Subdivision
NE	NW	28	2N	3E	Clark			

For Ecology Use Date Received: 9-4-01 Priority Date: 9-4-01
SEPA: Exempt/Not Exempt FERC License # _____ Dept. Of Health # _____
Date Accepted As Complete 9-21-01 By SC Date Returned _____ By _____ WRIA: 28

ECY 040-1-14
Rev. 9/95 F

APPLICATION

Appl. No.: G2-30019

Section 5. GENERAL WATER SYSTEM INFORMATION

A. Name of system, if named: Camas Municipal Water-Sewer System

B. Briefly describe your proposed water system. (See instructions.)

Two 12-inch supply wells will be constructed to depths of 150 feet. The wells will be used to provide water supply to municipal and industrial water users that are served by the City of Camas in the Lacamas Basin area. See 1996 Water System Plan documents for other related water system information.

C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
PROVIDE DOCUMENTATION. See list of City Water Rights and claims that are attached.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION
(Completed for all domestic/public supply uses.)

A. Number of "connections" requested: 4896 (current number of connections) Type of connection Municipal Industrial Hookup (Homes, Apartment, Recreational, etc.)

B. Are you within the area of an approved water system? ☒ YES ☐ NO
If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* The applicant (City of Camas) is the regional water provider.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: City is currently updating water system plan. New plan should be approved in early 2002.

D. Do you have an approved conservation plan? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: Water Conservation Plan incorporated into 1996 Water System Plan, which is currently being updated.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION
(Complete for all irrigation and agriculture uses.) N/A

A. Total number of acres to be irrigated: _____

B. List total number of acres for other specified agricultural uses:

Use_____ Acres_____
Use_____ Acres_____
Use_____ Acres_____

C. Total number of acres to be covered by this application: _____

D. Family Farm Act (Initiative Measure Number 59, November 3, 1977)
Add up the acreage in which you have a controlling interest, including only:
‡ Acreage irrigated under water rights acquired after December 8, 1977;
‡ Acreage proposed to be irrigated under this application;
‡ Acreage proposed to be irrigated under other pending application(s).

1. Is the combined acreage greater than 2000 acres? ☐ YES ☐ NO
2. Do you have a controlling interest in a Family Farm Development Permit? ☐ YES ☐ NO
If yes, enter permit no:_____

E. Farm uses:
Stockwater - Total # of animals _____ Animal type _____ (If dairy cattle, see below)
Dairy - # Milking _____ # Non-milking _____

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☐ YES ☒ NO

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the project site. From Lacey, WA, go southbound on I-5. Take I-205 exit at Hazel Dell. Proceed southbound on I-205 to SR-14. Take SR-14 eastbound to Brady Road. Proceed north on Brady Road which turns into NW Parker Avenue. Continue northbound on NW Parker to SE 1st Street. Go westbound on NW 1st to 216th Ave. Take 216th Ave. northbound to Camas Meadows Golf Course. Take service road through golf course to well site.

Section 10. REQUIRED MAP

A. Attach a map of the project. (See instructions.)

Section 11. PROPERTY OWNERSHIP

A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City will use the water for supply within their service area.

B. Does the applicant own the land on which the water source is located? ☐ YES ☒ NO
If no, submit a copy of agreement:
The City will purchase property as part of the supply well development.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

CITY OF CAMAS E. Levison ERIC LEVISON — 8/29/01

Applicant (or authorized representative) — Date

Landowner for place of use (if same as applicant, write "same") — Date

Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

We are returning your application for the following reason(s):	
_____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
_____ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation:	
Please provide the additional information requested above and return your application by _____ _____ *(date).*	

Ecology staff_____ Date_____

To receive this document in alternative format, contact Lisa Newman at (360) 407-6604 (Voice) or (360) 407-6006 (TDD).

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

October 1, 2001

City of Camas
Attn Eric Levison
616 NE 4th Avenue
Camas WA 98607

Re: Water Right Application No. G2-30018

This letter is to acknowledge that the Washington State Department of Ecology received your water right application. We have assigned your application the number indicated above. Please include this number in future correspondence regarding your application with the Department of Ecology.

When we begin actively evaluating applications in your area, we will prepare a public notice and send it to you with publication instructions. It will be sometime before we are able to begin working in your area. In the meantime, please notify Ecology of changes such as address, property ownership, or variations in your proposed water use plans.

The availability of water in Washington state is a serious problem. Much of the water in our state has already been appropriated. The competition for water has escalated with our state's increasing population, conflicting water policy issues, and grave declines in salmon and other fish populations. A new watershed management law brings us a step closer to addressing some of these issues. It sets into motion a locally based process to address water quantity, quality, and habitat issues. Watershed management will help meet challenges for getting water to people, industries, farms, and fish.

In some areas of the state, we are continuing to evaluate applications within watersheds where we have previously gathered information and completed watershed assessments. We are also continuing to process water right permit or change applications that are intended to address public health and safety emergencies, the natural environment, or are for nonconsumptive withdrawals. All other applications are grouped by watershed and processed according to the date of submittal, and when we have enough information and staff resources to make decisions.

If you would like further information on your application, please contact the Southwest Regional Office at (360) 407-0240.

Sincerely,

J. Mike Harris

J. Mike Harris
Water Resources Supervisor
Southwest Regional Office

JMH:th (applet.doc)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

October 1, 2001

City of Camas
Attn Eric Levison
616 NE 4th Avenue
Camas WA 98607

Re: Water Right Application No. G2-30019

This letter is to acknowledge that the Washington State Department of Ecology received your water right application. We have assigned your application the number indicated above. Please include this number in future correspondence regarding your application with the Department of Ecology.

When we begin actively evaluating applications in your area, we will prepare a public notice and send it to you with publication instructions. It will be sometime before we are able to begin working in your area. In the meantime, please notify Ecology of changes such as address, property ownership, or variations in your proposed water use plans.

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Southwest Regional Office

JMH:th (applet.doc)

CITY OF CAMAS
616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
http://www.ci.camas.wa.us

RECEIVED
DEPT. OF ECOLOGY/SWRO

'01 SEP -4 A10:37

August 29, 2001

DEPARTMENT OF PUBLIC WORKS

Mr. Mike Harris
Department of Ecology
300 Desmond Drive
P.O. Box 47600
Olympia, WA 98504-7600

Subject: ***Water Right Application Submittals***
City of Camas

Dear Mr. Harris:

Enclosed you will find two water right applications along with the statutory examination fee of $10.00 for each water right application (total of $20.00). The enclosed applications are for new water supply sources in the Lacamas Basin.

The City of Camas would like to develop three new supply wells under these applications to meet the rapid growth, which is occurring in the western portion of our service area. We recently completed an extensive test well drilling program in this area. The results of the exploratory drilling and aquifer testing are summarized in the attached report titled *City of Camas, Westside Test Well Drilling Program (PGG, 2001).*

At your convenience, we would like to schedule a meeting with you and your staff to discuss the results of our test well program and strategies for obtaining water right permits for new production wells.

We appreciate your assistance on this matter.

Sincerely,

Eric Levison
Engineering Manager

Enclosures: Water Right Applications

rls:g:\pworks\eric\harris 082901.doc

Printed By: Dawn Merryman
On: 09/07/2001 At: 10:10 am

RECEIPT

Department of Ecology (4610)
PO Box 5128
Lacey, WA 98509-5128
(360) 407-7095

Receipt Number **02-005123**

Current Document Number **461G0355CJ** Date **09/10/2001** FM **03**

Remitter Name **CAMAS CITY** Receipt Name

Check/Draw Number **4149**
Document Amount **$20.00**
Method of Payment **Check**
Comment Description **WATER RIGHTS**

Ref Doc Nr	Ref Doc Sfx	Inv Nr	Id Nr	Prgm Cd	T C	R	Fund	Maj Grp	Maj Src	Sub Src	Cnty	Work Cls	PIC	AI	Org	Prj	Sub Prj	Prj Phs	Sub Obj	Sub Sub Obj	Var GL	Sub Sid Dr	Sub Sid Cr	Alloc Amt
				H00	001		001	02	85	000010														$20.00

TABLE 1-3

City of Camas Water Right Summary

Source	Location of Diversion	Identification Number	Priority Date	Instantaneous Quantity Q_i (gpm)	Annual Quantity Q_a (ac-ft/yr.)
Claims					
Well No. 1	2159 ft. N, 667 ft. E, from the SW corner, S12, T1N, R3E	121022	6/11/74	900	320(1)
Well No. 2	2152 ft. N, 731 ft. E, from the SW corner, S12, T1N, R3E	121023	6/11/74	900	230(1)
Certificates					
Boulder Creek	(need this info)	S 712 C	8/22/23	1120 [2.5 cfs]	1820(2) (P)
Jones Creek	SE1/4, SW1/4, S3, T2N,R4E	S 711 C	9/5/30	450 [1.0 cfs]	730(3) (P)
Well No. 3	NW1/4, SW1/4, S12,T1N, R3E	G 85-A C	7/21/45	1200	118 (P)
Well No. 4	W1/2, NW1/4, S12, T1N, R3E	G 4072-A C	2/12/59	1325	1208 (S)
Well No. 5	Lot 9 of Orchard Homes, 2760 ft. E, 840 ft. N from SW corner, S12, T1N, R3E	G 6636-A C	3/22/68	600	920(4) (P)
Well No. 6	2300 ft. E, 1800 ft. N from SW corner, S12, T1N, R3E	G 6635-A C	3/22/68	1500	2400(4) (P)
Well No. 7	1245 ft. E, 2145 ft. N from SW corner, S12, T1N, R3E	G2-00501 C	3/22/71	1000	530(5) (P)
Well No. 8	1375 ft. E, 2145 ft. N from SW corner, S12, T1N, R 3E	G2-24400 C	2/4/77	900	530(5) (P)
Permits					
~~Well No. 9~~	~~600 ft. S, 700 ft. W from N1/4 corner, S4, T1N, R3E~~	~~G4-27384 P~~	~~8/13/86~~	~~650~~	~~210(5) (S)~~
Total	Sum of all existing water right certificates and permits. **These values do not include claims.**			**SW = 1570 gpm** **GW = 7175 gpm** **Total = 8745 gpm**	**SW = 2550 ac-ft.** **GW = 3200 ac-ft.** **Total = 5750 ac-ft.**

(1) Claims must go through an adjudication procedure in state court to determine validity.
(2) This source was formerly known as the Little Washougal River. The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 1820 ac-ft/yr. for Boulder Creek (S 712 C) based on continuous withdrawal at the instantaneous right specified.
(3) The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 730 ac-ft/yr. for Jones Creek (S 711 C) based on continuous withdrawal at the instantaneous right specified.
(4) The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 3300 ac-ft/yr."
(5) The Permit and Report of Examination preceding this certificate provided for "the total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates No. 711 and 712 and Ground Water Certificates No. 85,4072, 6635, 6636, shall not exceed 5750 ac-ft/yr."
(P) Primary water right, additive to other rights.
(S) Supplemental water right, not additive or considered when summing a cumulative total of all rights.

Legend

- Proposed Supply Well Site
- Roads
- Parcels
- Rivers, Streams
- Water bodies

0 4000 Feet

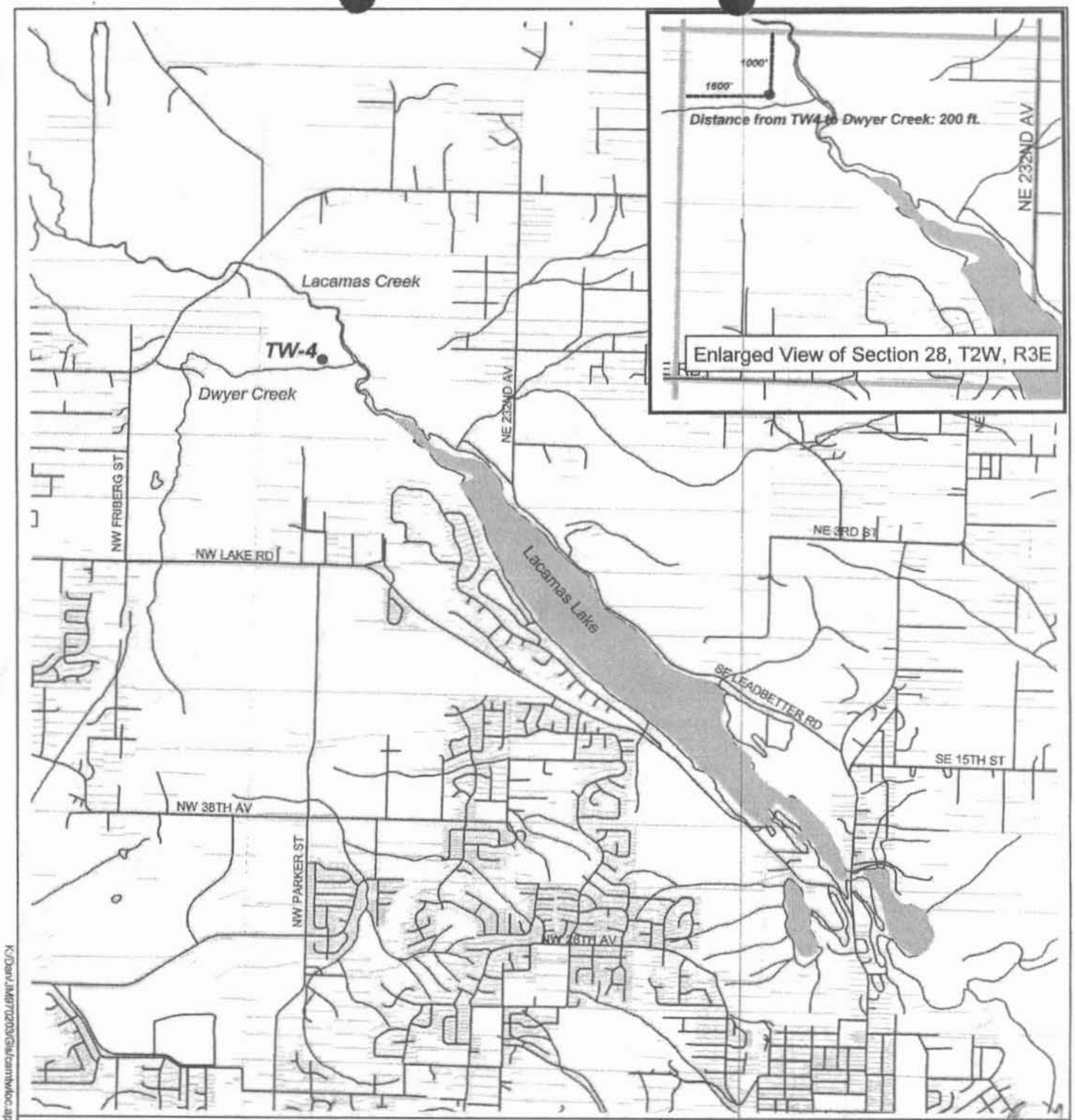
Figure 1
Proposed Well Location Map

City of Camas
Westside Test Well
Drilling Program

JM9702.03

Pacific Groundwater Group

K:\Data\JM9702\03\Site\camwloc.apr (Test Well Location Map), 2/22/01



Legend

- Proposed Supply Well Site
- Roads
- Parcels
- Rivers, Streams
- Water bodies

0 4000 Feet

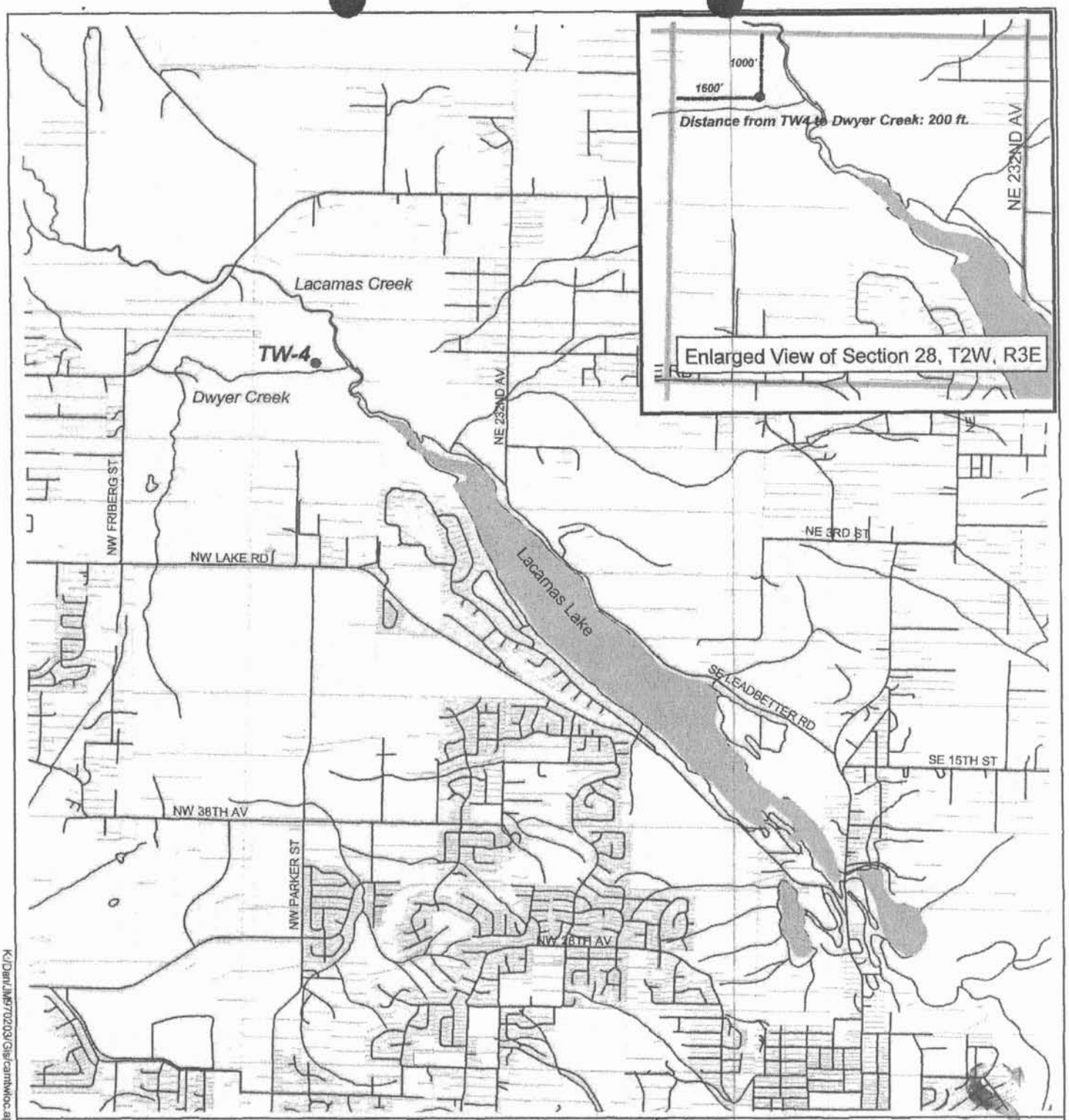
Figure 1
Proposed Well Location Map

City of Camas
Westside Test Well
Drilling Program

JM9702.03

Pacific Groundwater Group

K:\Dwr\JM97020\Siteplan\wloc.apr (Test Well Location Ma



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0 4000 Feet

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City of Camas
Westside Test Well
Drilling Program

JM9702.03

Pacific Groundwater Group

K:\Dan\JM9702\03\Gis\camtwloc.apr (Test Well Location Map), 2/22/01

Account Transfers Recurring Transfers **Third-Party Transfers** External Transfers
IRA/ESA Certificate Add-On

Third Party Transfer Confirmation

Transfer of funds successfully completed. See the new account balances below.

From Account:	Share Savings 1274297009 KENNETH C ALEXANDER
From Account Balance:	$14.25
To Account:	EveryDay Checking 1274297710 ERNESTINE P ALEXANDER
Payment Amount:	$3,325.00
Effective Date:	03/09/2009
Confirmation Number:	304756

Print Receipt

ROTORK CONTROLS, INC.
SCOPE OF WORK
START UP/COMMISSIONING OF ROTORK ACTUATORS

JOB SITE LOCATION: WARDEN, WASHINGTON

Rotork Field Engineer will:

1. Inspect all installed Rotork actuators for proper orientation.
2. Inspect all installed Rotork actuators for proper wiring terminations.
3. Electrically power up Rotork actuators and perform initial programming.
4. Set both the Open and Closed limits on the Rotork actuators.
5. Electrically stroke all valves with Rotork actuators to ensure proper operation.
6. Provide customer with the Field Service Report for their records.
7. Correct any discrepancies found during this course of work.

rotork
factory service

2180 South Mc Dowell Blvd. Suite B
Petaluma, CA 94954
Phone: (707) 769-4880
Fax: (707) 769-4888

Service Report

Job No.:
Engineer:
Date:
Site:

Site Contact:
Phone Number:
Date Service Performed:
PO Number:
Type of Service:

Serial Number:	**Type:**	**WD:**	**RPM:**	**Volts:**
Gearbox Type:	**Valve Type:**		**Service Type:**	**Valve Tag No:**

Reported Problem:

Work Completed:

If there is additional work needed, please explain:

Rotork Site Training Syllabus (for IQT)

I. Introduction to Rotork

A. Tech introduction
B. Rotork Controls, Inc.
C. Types and models of actuators. Sizing, classifications. Nameplates.
D. Documentation, Rotork.com
  1) IQT- E110, E120, E175, E185, Wiring diagrams

II. IQT

A. Nomenclature and parts ID.
  1) Gearcase, center column, drive bushings, battery, seals and o-rings.
  2) Motor & wormwheel, resolver.
  3) Handwheel, hand/auto lever, H/A cover.
  4) Electronics- Cover (UV Window/ local controls), main pcb, power module, motor control pcb
  5) Options, if applicable

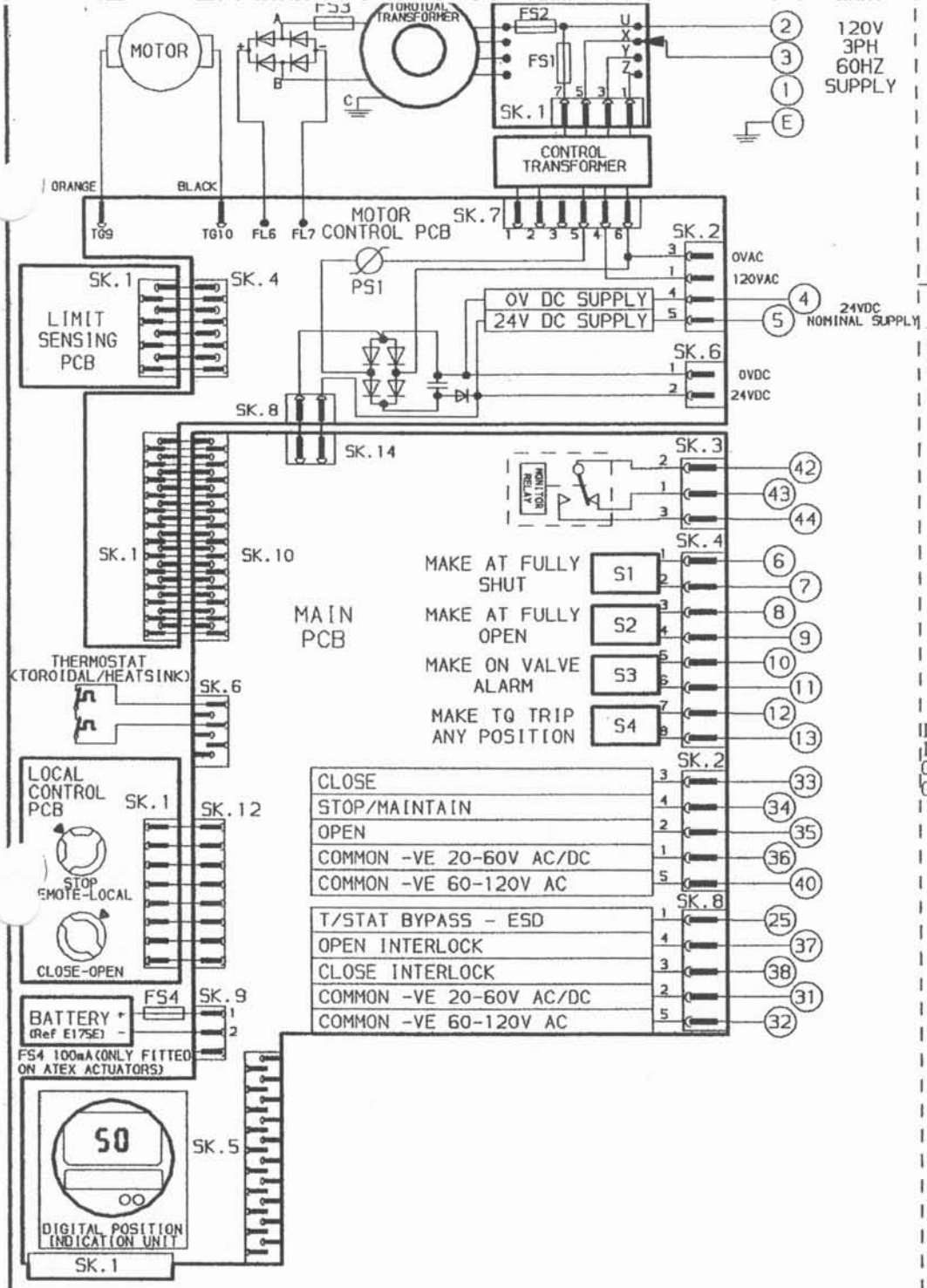
III. Operation, set-up and calibration (using live demo actuator)

A. Manual operation B. Setting tool and display
C. Menu structure and functions
  1) Torque display, password screen
  2) Primary functions- open/close action, torque setting, limit setting.
  3) Secondary functions-Indication, ESD(emerg shut down), options, IQT type and speed.
D. Local operation
E. Remote operation
  1) Remote voltage supplies 2) Remote control configurations 3) Network options
F. Installation and adaption
G.Troubleshooting
  1) Alarms 2) Help screens 3) Common faults and checks
H. Maintenance - 1) Lubrication 2) inspection 3) spares

IV. Advanced Functions and Utilities (using laptop and PDA)

A. Insight
B. Configuration Files
C. Datalogger files
  1) Torque profiles (for baseline files/trending, torque issues)
  2) Event logging and review

V. Conclusion- Review and Follow-up



RWS300

TRANSFORMER TAPPING

TYPE 1

TAP	NOM	RANGE
Z	120	96-144
FS1-250mA A/S FS2-5A A/S		

FUSE FS3 - 20A ATO FAST ACTING

PS1 SELF RESETTING FUSE

NOTE

REFER TO PUBLICATION E175E FOR APPROVED FUSES FS1, FS2 AND FS3.

MAX EXTERNAL LOAD ON TERMINALS 4 & 5 TO BE 5W.

CONTROL SIGNAL THRESHOLD VOLTAGES TO BE MINIMUM 'ON' 20V AC/DC
MAXIMUM 'OFF'= 3V
MINIMUM CONTROL SIGNAL DURATION TO BE 300mS.

CURRENT DRAWN FROM EACH REMOTE CONTROL SIGNAL IS 5mA ON 24V DC OR 12mA ON 120V AC

WIRES ARE IDENTIFIED AT EACH END BY TERMINAL No. OR TAG No.

INDICATION CONTACTS S1-S4 ARE SHOWN IN THEIR DEFAULT CONFIGURATION. CONTACTS MAY BE CONFIGURED FOR ANY OF THE FUNCTIONS DESCRIBED IN E175E

IQT

No	DATE	REVISION DETAILS
01	061008	FIRST ISSUE

www.rotork.com

CONFIG BY TPW
DATE 061008

6000-000 B1,C1,41,M1
CUSTOMER SPECIFIC

Rotork Site Training Syllabus (for IQMKII)

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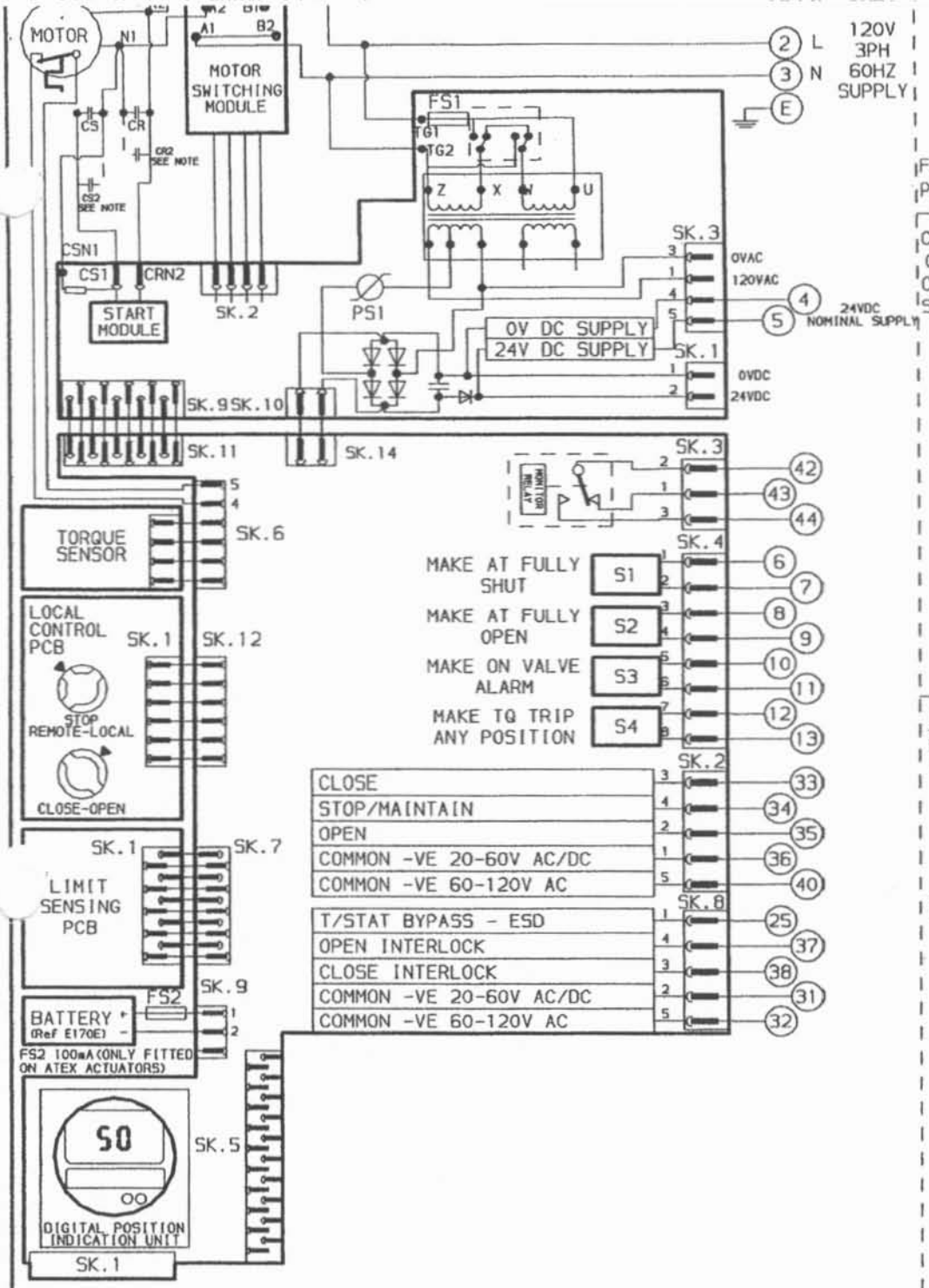

RWS300

TRANSFORMER TAPPING

VOLTAGE	60HZ
LOW	92-135

FUSE FS1 - 500mA ANTI-SURGE
PS1 SELF RESETTING FUSE.

CAPACITOR START/RUN (CS/CS2 and CR/CR2) COMBINATIONS & VALUES VARY WITH SUPPLY VOLTAGE & ACTUATOR SIZE.

NOTE

REFER TO PUBLICATION E170E FOR APPROVED FUSES FS1 AND FS2.

MAX EXTERNAL LOAD ON TERMINALS 4 & 5 TO BE 5W.

CONTROL SIGNAL THRESHOLD VOLTAGES TO BE MINIMUM 'ON' 20V AC/DC
MAXIMUM 'OFF'= 3V
MINIMUM CONTROL SIGNAL DURATION TO BE 300mS.

CURRENT DRAWN FROM EACH REMOTE CONTROL SIGNAL IS 5mA ON 24V DC OR 12mA ON 120V AC

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1Q

No	DATE	REVISION DETAILS
01	061008	FIRST ISSUE

www.rotork.com

CONFIG BY TPW
DATE 061008

3001-000 B1,C1,41,M1
CUSTOMER SPECIFIC

CITY OF CAMAS
616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
http://www.ci.camas.wa.us

RECEIVED
DEPT. OF ECOLOGY/SWRO

'01 SEP -4 A10:37

August 29, 2001

DEPARTMENT OF PUBLIC WORKS

Mr. Mike Harris
Department of Ecology
300 Desmond Drive
P.O. Box 47600
Olympia, WA 98504-7600

Subject: ***Water Right Application Submittals***
City of Camas

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Sincerely,

Eric Levison
Engineering Manager

Enclosures: Water Right Applications

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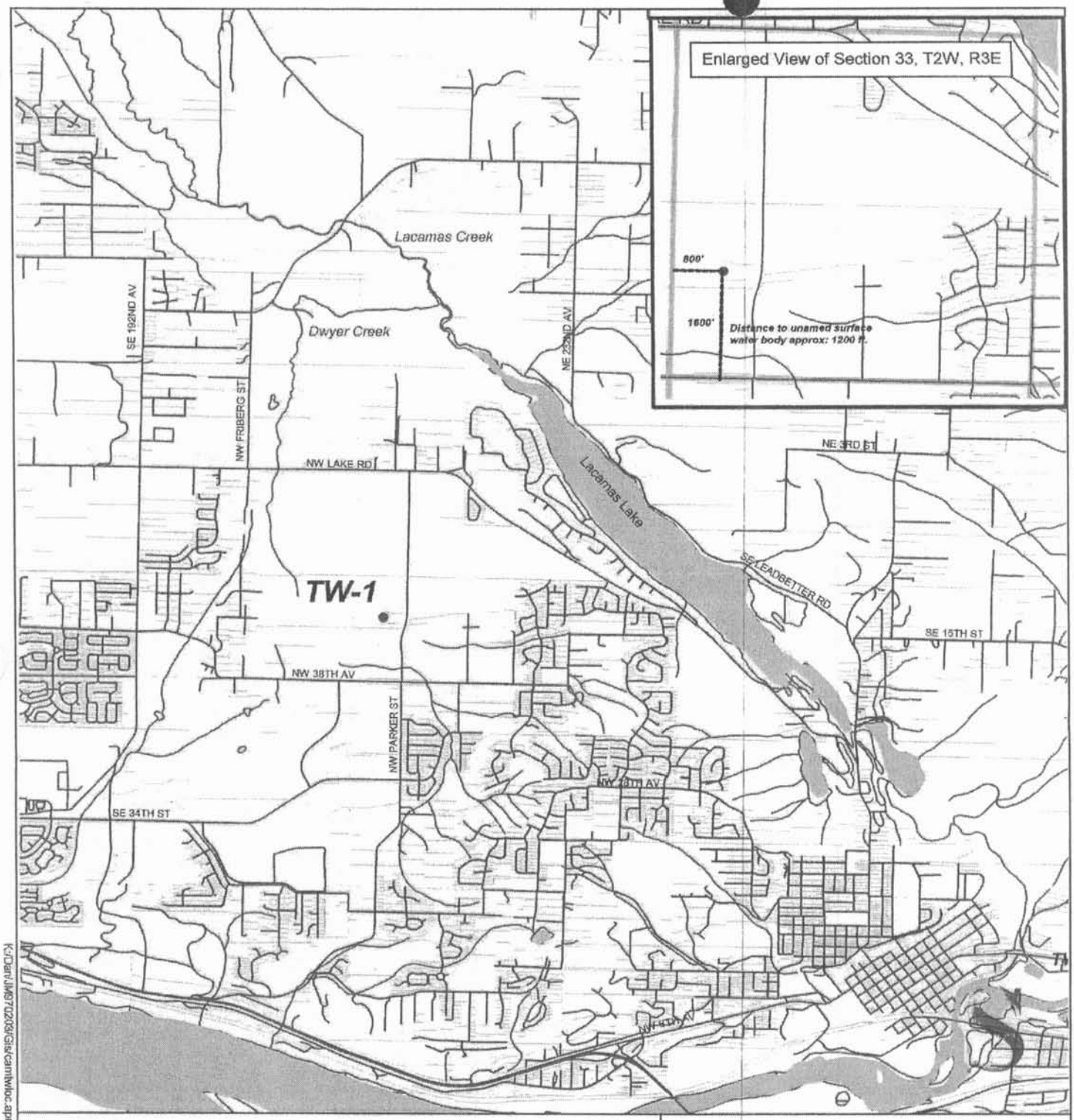

Legend

- Proposed Supply Well Site
- Roads
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- Rivers, Streams
- Water bodies

N

0 4000 Feet

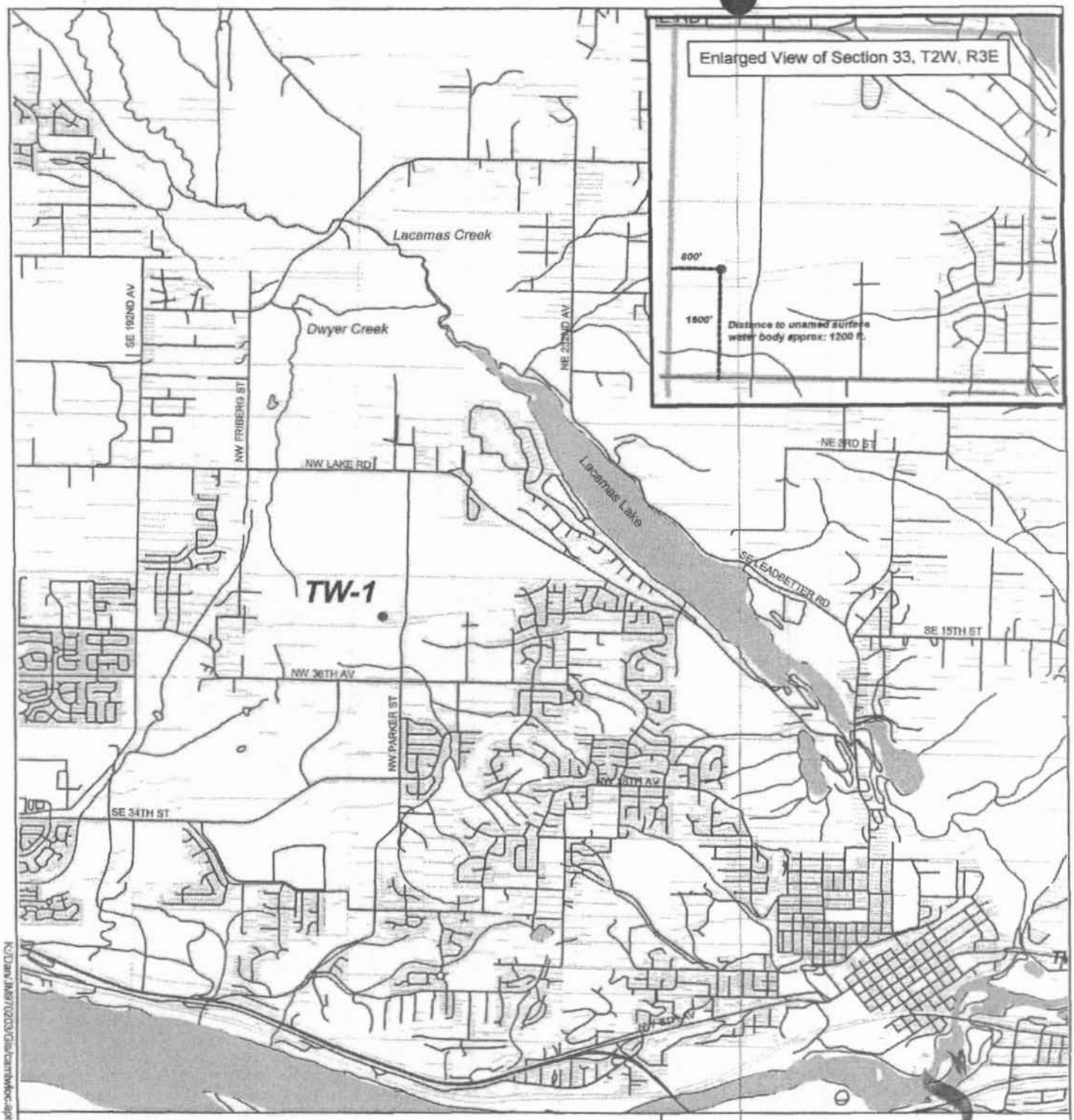
Figure 1
Proposed Well Location Map

City of Camas
Westside Test Well
Drilling Program

JM9702.03

Pacific Groundwater Group

K:/Dan/JM9702.03/Gis/camtwloc.apr (Test Well Location Map) 7/22/01



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0 4000 Feet

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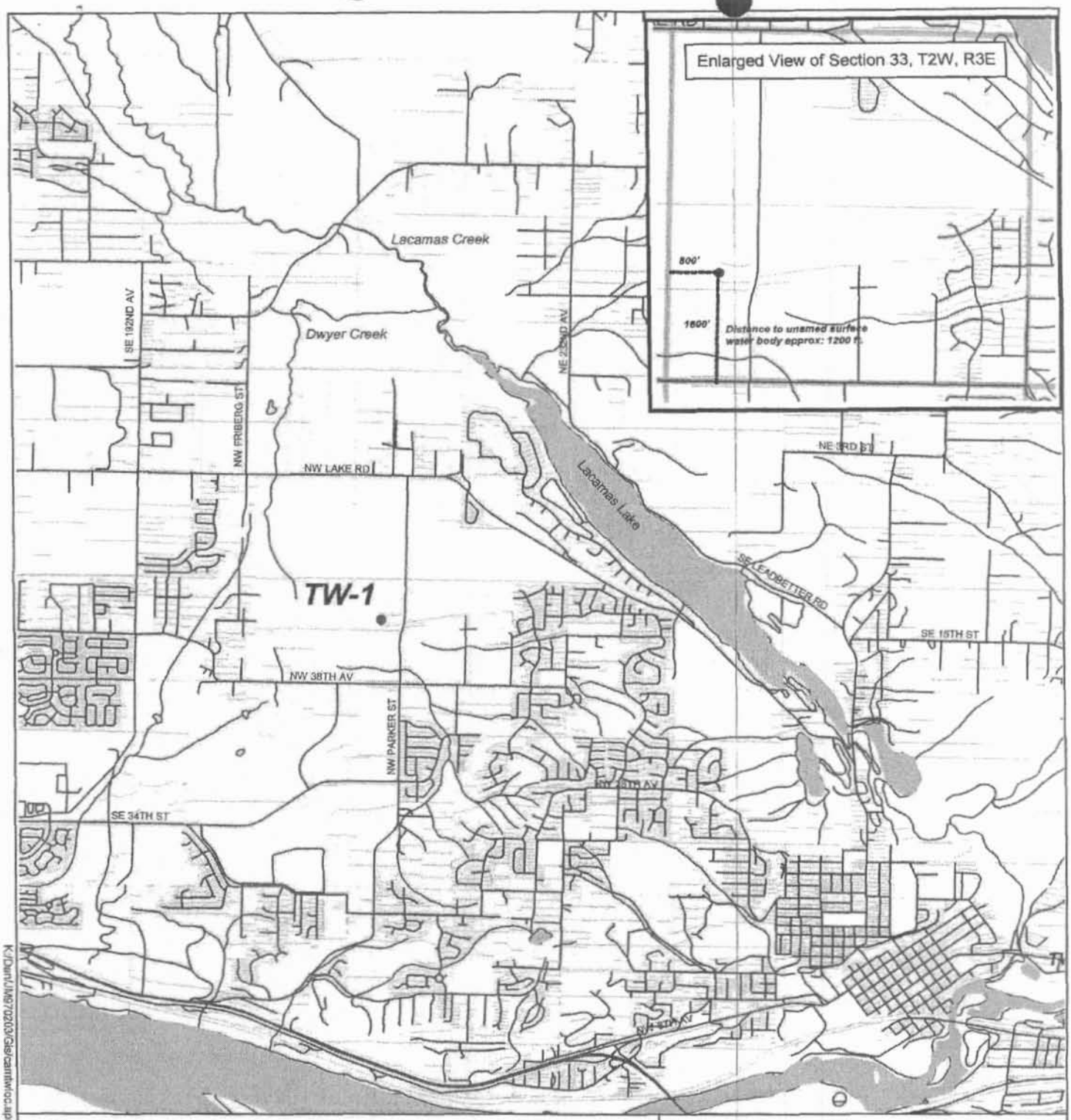
Westside Test Well
Drilling Program

JM9702.03

Pacific Groundwater Group

K:\Data\JM9702\03\Gis\camwfloc.apr (Test Well Location Map), 2/22/01



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0 4000 Feet

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Drilling Program

JM9702.03

Pacific Groundwater Group

K:\Dwn\JM9702\03\Gis\camtwloc.apr (Test Well Location Map), 2/22/01

TABLE 1-3

City of Camas Water Right Summary

Source	Location of Diversion	Identification Number	Priority Date	Instantaneous Quantity Q_i (gpm)	Annual Quantity Q_a (ac-ft/yr.)
Claims					
Well No. 1	2159 ft. N, 667 ft. E, from the SW corner, S12, T1N, R3E	121022	6/11/74	900	320(1)
Well No. 2	2152 ft. N, 731 ft. E, from the SW corner, S12, T1N, R3E	121023	6/11/74	900	230(1)
Certificates					
Boulder Creek	(need this info)	S 712 C	8/22/23	1120 [2.5 cfs]	1820(2) (P)
Jones Creek	SE1/4, SW1/4, S3, T2N,R4E	S 711 C	9/5/30	450 [1.0 cfs]	730(3) (P)
Well No. 3	NW1/4, SW1/4, S12,T1N, R3E	G 85-A C	7/21/45	1200	118 (P)
Well No. 4	W1/2, NW1/4, S12, T1N, R3E	G 4072-A C	2/12/59	1325	1208 (S)
Well No. 5	Lot 9 of Orchard Homes, 2760 ft. E, 840 ft. N from SW corner, S12, T1N, R3E	G 6636-A C	3/22/68	600	920(4) (P)
Well No. 6	2300 ft. E, 1800 ft. N from SW corner, S12, T1N, R3E	G 6635-A C	3/22/68	1500	2400(4) (P)
Well No. 7	1245 ft. E, 2145 ft. N from SW corner, S12, T1N, R3E	G2-00501 C	3/22/71	1000	530(5) (P)
Well No. 8	1375 ft. E, 2145 ft. N from SW corner, S12, T1N, R 3E	G2-24400 C	2/4/77	900	530(5) (P)
Permits					
Well No. 9	600 ft. S, 700 ft. W from N1/4 corner, S4, T1N, R3E	G4-27384 P	8/13/86	650	210(5) (S)
Total	Sum of all existing water right certificates and permits. These values do not include claims.			**SW = 1570 gpm** **GW = 7175 gpm** **Total = 8745 gpm**	**SW = 2550 ac-ft.** **GW = 3200 ac-ft.** **Total = 5750 ac-ft.**

(1) Claims must go through an adjudication procedure in state court to determine validity.
(2) This source was formerly know as the Little Washougal River. The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 1820 ac-ft/yr. for Boulder Creek (S 712 C) based on continuous withdrawal at the instantaneous right specified.
(3) The certificate refers to an instantaneous quantity (Q_i) and does not specify an annual withdrawal. A DOE Report of Examination for Well No. 7 (G2-00501 C) summarizes existing water rights including 730 ac-ft/yr. for Jones Creek (S 711 C) based on continuous withdrawal at the instantaneous right specified.
(4) The Permit and Report of Examination preceding this certificate limited water rights to "the total quantity withdrawn or diverted from all sources is not to exceed 3300 ac-ft/yr."
(5) The Permit and Report of Examination preceding this certificate provided for "the total amount of water to be withdrawn or diverted, which includes the amounts as approved in Surface Water Certificates No. 711 and 712 and Ground Water Certificates No. 85,4072, 6635, 6636, shall not exceed 5750 ac-ft/yr."
(P) Primary water right, additive to other rights.
(S) Supplemental water right, not additive or considered when summing a cumulative total of all rights.

Printed By: Dawn Merryman
On: 09/07/2001 At: 10:10 am

RECEIPT

Receipt Number **02-005123**

Department of Ecology **(4610)**
PO Box 5128
Lacey, WA 98509-5128
(360) 407-7095

Current Document Number **461G0355CJ** Date **09/10/2001** FM **03**

Remitter Name **CAMAS CITY** Receipt Name

Check/Draw Number **4149**
Document Amount **$20.00**
Method of Payment **Check**
Comment Description **WATER RIGHTS**

Ref Doc Nr	Ref Doc Sfx	Inv Nr	Id Nr	Prgm Cd	T C	R	Fund	Maj Grp	Maj Src	Sub Src	Cnty	Work Cls	PIC	AI	Org	Prj	Sub Prj	Prj Phs	Sub Obj	Sub Sub Obj	Var GL	Sub Sid Dr	Sub Sid Cr	Alloc Amt
				H00	001		001	02	85	000010														$20.00

RECEIVED
DEPT. OF ECOLOGY/SWRO
'01 NOV -5 A11:26

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
Mailing Address: 600 Capitol Way N • Olympia, WA 98501-1091 • (360) 902-2200, TDD (360) 902-2207
Main Office Location: Natural Resources Building • 1111 Washington Street SE • Olympia, WA

October 31, 2001

Department of Ecology
Southwest Regional Office
7272 Cleanwater Lane
Olympia, Washington 98504-6811

WATER RIGHT APPLICATION REVIEW

Application Number: G230018

Applicant: City of Camas
616 NE 4th Avenue
Camas, Washington 98607

WRIA: 28
Water: Well near Lacamas Lake and the Columbia River.
This water and/or affected reaches downstream are inhabited by:

Based on: ☐ Site-specific observations ☐ WDFW database or GIS
☐ Literature ☐ Knowledge of this type of stream

Amount: cfs 359.00 gpm 300.00 acre-ft
Point of diversion: NW1/4 SW1/4 of S33 T2N R3E.
Point of use:

WDFW recommended conditions:

☐ Instream flows in WAC 173-5

☐ This water right should be subject to any established lake levels, if any.

Instream flows based on: ☐ IFIM study ☐ USGS toe-width ☐ Tennant
☐ Other:

WDFW requests that water right be subject to the following instream flows or natural flow, whichever is less:

Jan
Feb
Mar
Apr
May
Jun

S

Jul
Aug
Sep
Oct
Nov
Dec

Instream flows to be measured at:

Other conditions requested by WDFW indicated by ☐:

☐ HPA

☐ Screen intake if accessible to fish (to be determined during application for HPA) according to WDFW standards.

☐ Based upon review of fish resources present, type and amount of water use, condition of habitat, and amount of water available, WDFW REQUESTS DENIAL of this application, in accordance with RCW 75.20.050, IF THIS SPACE IS CHECKED.

☐ WDFW recommends modification of this proposal to minimize impacts to fish.

☐ WDFW is a landowner and water user that will be affected by this proposed use.

☐ Please HOLD this application pending field review. WDFW staff will provide detailed response by

☐ Granting this water right application would adversely affect WDFW's existing water rights for a facility. We request the following conditions for this water right if it is granted.

Rationale for WDFW recommendations if not based on existing rules or statutes: WDFW has no objections to this application.

Additional Comments:

Karen Kloempken

Karen Kloempken
Water Rights Biologist
360-902-2615
Fax: 360-902-2946
E-mail: kloemkak@dfw.wa.gov

S

For Ecology Use

Fee Paid _____

Date _____

State of Washington
Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays.

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of Camas Home Tel:( ) -

Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451

City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above

Name Eric Levison Home Tel:( ) -

Mailing Address 616 NE 4th Ave. Work Tel:(360) 834 - 3451

City Camas State WA Zip+4 98607 + FAX:(360) 834 - 1535

Relationship to applicant Engineering Manager - City of Camas

Section 3. STATEMENT OF INTENT

Municipal

The applicant requests a permit to use not more than 350 (☒ gallons per minute or ☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s) of Domestic/Public Supply. **ATTACH A "LEGAL" DESCRIPTION OF THE PLACE OF USE. (See instructions.)** *NOTE: A tax parcel number or a plat number is not sufficient.* Area served by City of Camas

Estimate a maximum annual quantity to be used in acre-feet per year: 300 AF/YR

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ___/___/___ to ___/___/___

Section 4. WATER SOURCE

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.: Number of diversions: _____	A permit is desired for 1 well(s).
Source flows into (name of body of water):	Size & depth of well(s): 12-inch well 400 feet deep

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: 1600 feet north and 800 feet east of the SW 1/4 of Section 33, Township 2 North, Range 3 East

¼ of	¼ of	Section	Township	Range(E/W)	County	If location of source is platted, complete below:		
						Lot	Block	Subdivision
NW	SW	33	2N	3E	Clark			

For Ecology Use Date Received: 9-4-01 Priority Date: 9-4-01

SEPA: Exempt/Not Exempt FERC License # _____ Dept. Of Health # _____

Date Accepted As Complete 9-21-01 By SC Date Returned _____ By _____ WRIA 28

ECY 040-1-14
Rev. 9/95 F

APPLICATION

Appl. No.: G2-30018

e9-30018

Section 5. GENERAL WATER SYSTEM INFORMATION

A. Name of system, if named: Camas Municipal Water-Sewer System

B. Briefly describe your proposed water system. (See instructions.)

One 12-inch supply well will be constructed to a depth of 400 feet. The well will be used to provide water supply to municipal and industrial water users that are served by the City of Camas in the Lacamas Basin Area. See City's 1996 Water System Plan documents for other related water system information.

C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
PROVIDE DOCUMENTATION. See list of city water right permits and claims that are attached.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION
(Completed for all domestic/public supply uses.)

A. Number of "connections" requested: 4896 Type of connection Municipal Industrial Hookup (Homes, Apartment, Recreational, etc.)

B. Are you within the area of an approved water system? ☒ YES ☐ NO
If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* The applicant (City of Camas) is the regional water provider.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: City is currently updating their Waster System Plan. The new plan should be approved in early 2002.

D. Do you have an approved conservation plan? ☒ YES ☐ NO
If yes, when was it approved? 1996 Please attach the current approved version of your plan.
Note: Water Conservation Plan incorporated into 1996 Water System Plan which is currently being updated.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION
(Complete for all irrigation and agriculture uses.) N/A

A. Total number of acres to be irrigated: _____

B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
Use _____ Acres _____
Use _____ Acres _____

C. Total number of acres to be covered by this application: _____

D. Family Farm Act (Initiative Measure Number 59, November 3, 1977)
Add up the acreage in which you have a controlling interest, including only:
‡ Acreage irrigated under water rights acquired after December 8, 1977;
‡ Acreage proposed to be irrigated under this application;
‡ Acreage proposed to be irrigated under other pending application(s).

1. Is the combined acreage greater than 2000 acres? ☐ YES ☐ NO
2. Do you have a controlling interest in a Family Farm Development Permit? ☐ YES ☐ NO
If yes, enter permit no: _____

E. Farm uses:
Stockwater - Total # of animals _____ Animal type _____ (If dairy cattle, see below)
Dairy - # Milking _____ # Non-milking _____

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☐ YES ☒ NO

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the project site. From Lacey, WA, go southbound on I-5. Take I-205 exit at Hazel Dell. Proceed southbound on I-205 to SR-14. Take SR-14 eastbound to Brady Road. Proceed northbound on Brady Road, which turns into NW Parker Avenue, continue northbound on NW Parker Avenue past 20th Street NW. Turn into Fire Station Property, which is located on west side of NW Parker Avenue.

Section 10. REQUIRED MAP

A. Attach a map of the project. (See instructions.)

Section 11. PROPERTY OWNERSHIP

A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City will use the water for supply within their service area.

B. Does the applicant own the land on which the water source is located? ☐ YES ☐ NO
If no, submit a copy of agreement:

The City will purchase the property as part of the supply well development.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

City of Camas E. Levison — Eric Levison — 8/20/01

Applicant (or authorized representative) — Date

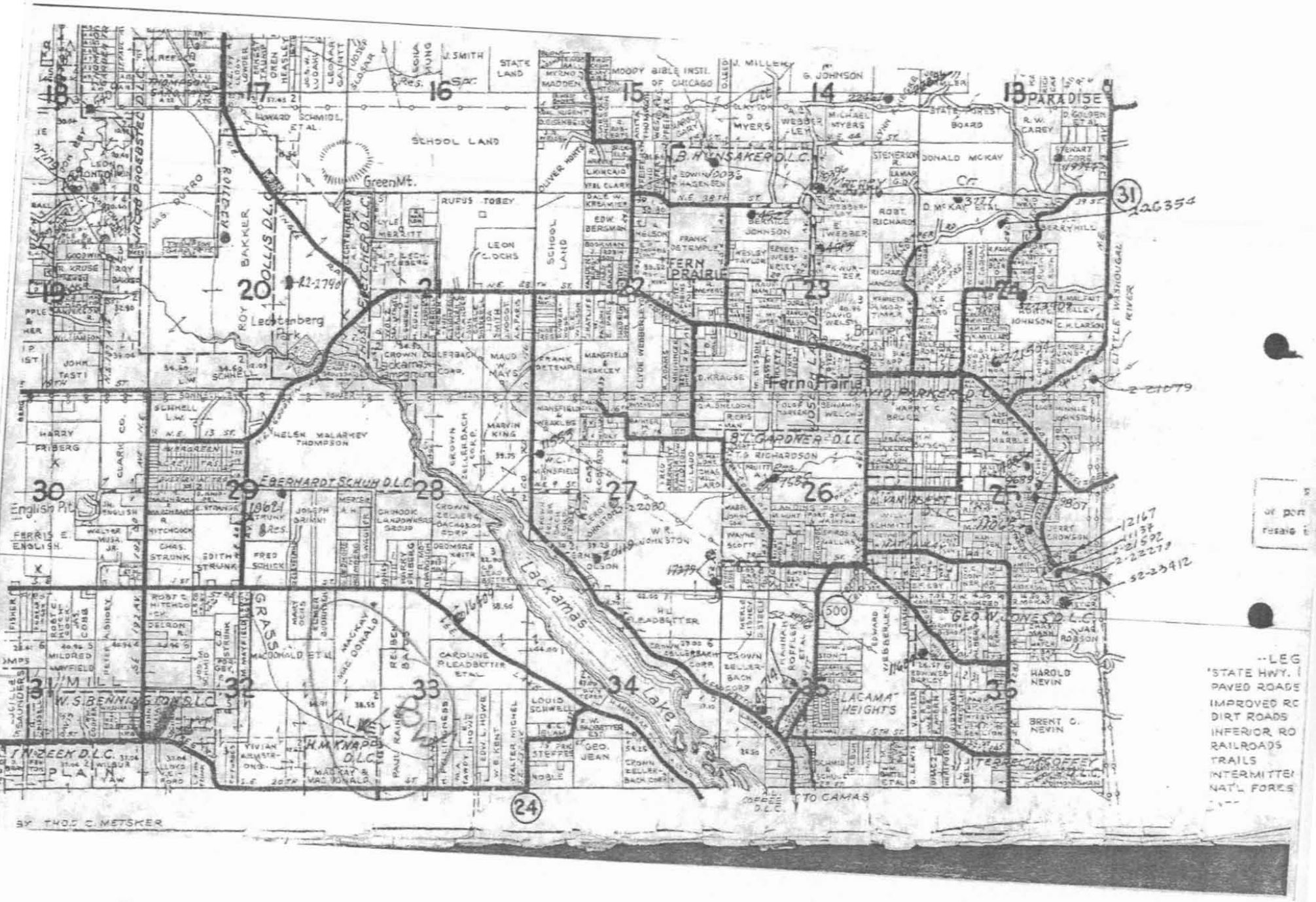
Landowner for place of use (if same as applicant, write "same") — Date

Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

We are returning your application for the following reason(s):	
_____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
_____ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation:	
Please provide the additional information requested above and return your application by _____ _____ *(date).*	

Ecology staff_____ Date_____

To receive this document in alternative format, contact Lisa Newman at (360) 407-6604 (Voice) or (360) 407-6006 (TDD).


SCHOOL LAND
GreenMt.
Leontenberg Park
FERN PRAIRIE
Fern Prairie
Lackamas Lake
LACAMA HEIGHTS
PARADISE
English Pit
TO CAMAS
BY THOS. C. METSKER
STATE HWY.
PAVED ROADS
IMPROVED RO
DIRT ROADS
INFERIOR RO
RAILROADS
TRAILS
INTERMITTE
NAT'L FORES

616 NE 4 Avenue
PO Box 1055
Camas WA 98607

WASHINGTON STATE DEPARTMENT OF ECOLOGY

STATE OF WASHINGTON
CERTIFICATE OF CHANGE ON A CLAIM

Document Title: Certificate of Water Right

Agency: Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Applicant: **City of Camas**
616 NE 4th Ave
PO Box 1055
Camas, WA 98607

Reference Number:

PRIORITY DATE	CLAIM NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
3/09/2001	G2-121022		G2-CV1-2P159

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown, but is limited to an amount actually beneficially used.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE	TRIBUTARY OF (IF SURFACE WATERS)
Well 12	

MAX. CUBIC FEET PER SECOND	MAX GALLONS PER MINUTE	MAX. ACRE-FEET PER YEAR
	900 GPM	320 AF/Y

QUANTITY/TYPE OF USE/PERIOD OF USE

320 Acre-feet per year Municipal Supply Year-round, as needed

LEGAL DESCRIPTION OF LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF WITHDRAWAL

2240 feet North and 1000 feet East of the Southwest corner of Section 12.

¼ ¼	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW ¼ SW ¼	12	1	3E	28	Clark

PARCEL # 89892000

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

1/4 1/4	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R I.A.	COUNTY
N/A	N/A	N/A	N/A	28	Clark

PARCEL #

Area served by City of Camas for municipal supply.

N/A

CONTINUED LEGAL DESCRIPTION FOR PROPERTY ON WHICH WATER IS TO BE USED

N/A

PROVISIONS

All conditions and requirements contained in reports of examination or permits previously issued apply to this certificate unless specifically noted below.

The water appropriated under this application will be used for public water supply. The State Board of Health rules require public water supply owners to obtain written approval from the Office of Water Supply, Department of Health, 1112 SE Quince Street, PO Box 47890, Olympia, Washington 98504-7890, prior to any new construction or alterations of a public water supply system.

An approved measuring device shall be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC.

Water use data shall be recorded monthly. The maximum rate of diversion/withdrawal and the annual total volume shall be submitted to Ecology by January 31st of each calendar year.

The following information shall be included with each submittal of water use data: owner, contact name if different, mailing address, daytime phone number, WRIA, Permit/Certificate/Claim No., source name, annual quantity used including units, maximum rate of diversion including units, monthly meter readings including units, peak monthly flow including units, Department of Health WFI water system number and source number(s), well tag number, and period of use. In the future, Ecology may require additional parameters to be reported or more frequent reporting. Ecology prefers web based data entry, but does accept hard copies. Ecology will provide forms and electronic data entry information. Submit data to: Department of Ecology, SWRO/WR PO Box 47775, Olympia, WA 98504-7775.

Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation and maintenance requirements are enclosed as a document entitled "Water Measurement Device Installation and Operation Requirements".

Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable

(continued on page 3)

The right to use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.100.

This certificate of water right is specifically subject to relinquishment for non-use of water as provided in Chapter 90.14 RCW.

Given under my hand and the seal of this office at Olympia, Washington, this 5th *day of* February, *2008.*

DEPARTMENT OF ECOLOGY STATE OF WASHINGTON

Jay Manning, Director
Department of Ecology

By Thomas Loranger
Thomas Loranger Section Manager

OK

Provisions Continued

times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

All wells constructed in the State shall meet the construction requirements of Chapter 173-160 WAC entitled "Minimum Standards for the Construction and Maintenance of Wells" and Chapter 18-104 RCW entitled "Water Well Construction, Act (1971)."

In accordance with Chapter 173-160 WAC, wells shall not be located within certain minimum distances of potential sources of contamination. These minimum distances shall comply with local health regulations, as appropriate. In general, wells shall be located at least 100 feet from sources of contamination. Wells shall not be located within 1,000 feet of a solid waste landfill.

Nothing in this approval shall be construed as lessening or enlarging any water rights represented by Water Right Claim No's 121022 & 121023. The water use authorized under this filing (fill in with water right no.) shall be considered supplemental to any water rights confirmed for said claim as a result of a general adjudication through Superior Court, should adjudication be undertaken.

616 NE 4th Avenue
PO Box 1055
Camas WA 98607

WASHINGTON STATE DEPARTMENT OF ECOLOGY

STATE OF WASHINGTON
CERTIFICATE OF CHANGE ON A CLAIM

Document Title: Certificate of Water Right

Agency: Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Applicant: **City of Camas**
616 NE 4th Ave
PO Box 1055
Camas, WA 98607

Reference Number:

PRIORITY DATE	CLAIM NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
4/06/2001	G2-121023		G2-CV1-2P160

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown, but is limited to an amount actually beneficially used.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE	TRIBUTARY OF (IF SURFACE WATERS)
Well 10	

MAX. CUBIC FEET PER SECOND	MAX. GALLONS PER MINUTE	MAX. ACRE-FEET PER YEAR
	900	230

QUANTITY/TYPE OF USE/PERIOD OF USE

230 Acre-feet per year Municipal Supply Seasonal Use, May 1 – August 31

LEGAL DESCRIPTION OF LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF WITHDRAWAL

2220 feet North and 710 feet East of the Southwest corner of Section 12.

¼ ¼	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R I.A.	COUNTY
NW ¼ SW ¼	12	1	3E	28	Clark

PARCEL # 89866000

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

1/4 1/4	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	W.R I.A.	COUNTY
N/A	N/A	N/A	N/A	28	Clark

PARCEL #

Area served by City of Camas for municipal supply.

N/A

CONTINUED LEGAL DESCRIPTION FOR PROPERTY ON WHICH WATER IS TO BE USED

N/A

PROVISIONS

All conditions and requirements contained in reports of examination or permits previously issued apply to this certificate unless specifically noted below.

The water appropriated under this application will be used for public water supply. The State Board of Health rules require public water supply owners to obtain written approval from the Office of Water Supply, Department of Health, 1112 SE Quince Street, PO Box 47890, Olympia, Washington 98504-7890, *prior to any new construction or alterations of a public water supply system.*

An approved measuring device shall be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC.

Water use data shall be recorded monthly. The maximum rate of diversion/withdrawal and the annual total volume shall be submitted to Ecology by January 31st of each calendar year.

The following information shall be included with each submittal of water use data: owner, contact name if different, mailing address, daytime phone number, WRIA, Permit/Certificate/Claim No., source name, annual quantity used including units, maximum rate of diversion including units, monthly meter readings including units, peak monthly flow including units, Department of Health WFI water system number and source number(s), well tag number, and period of use. In the future, Ecology may require additional parameters to be reported or more frequent reporting. Ecology prefers web based data entry, but does accept hard copies. Ecology will provide forms and electronic data entry information. Submit data to: Department of Ecology, SWRO/WR PO Box 47775, Olympia, WA 98504-7775.

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Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable

(continued on page 3)

The right to use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.100.

This certificate of water right is specifically subject to relinquishment for non-use of water as provided in Chapter 90.14 RCW.

Given under my hand and the seal of this office at Olympia, Washington, this 5th *day of* February, *2008.*

Jay Manning, Director
Department of Ecology

By Thomas Loranger
Thomas Loranger, Section Manager

OK

Provisions Continued

times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

All wells constructed in the State shall meet the construction requirements of Chapter 173-160 WAC entitled "Minimum Standards for the Construction and Maintenance of Wells" and Chapter 18-104 RCW entitled "Water Well Construction, Act (1971)."

In accordance with Chapter 173-160 WAC, wells shall not be located within certain minimum distances of potential sources of contamination. These minimum distances shall comply with local health regulations, as appropriate. In general, wells shall be located at least 100 feet from sources of contamination. Wells shall not be located within 1,000 feet of a solid waste landfill.

Nothing in this approval shall be construed as lessening or enlarging any water rights represented by Water Right Claim No's 121022 & 121023. The water use authorized under this filing (fill in with water right no.) shall be considered supplemental to any water rights confirmed for said claim as a result of a general adjudication through Superior Court, should adjudication be undertaken.

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 1

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – EXISTING STATUS

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates 1. S 712 CS2-SWC 712[1]		8/22/23	SO1/Boulder Creek		1120	1820	590	679	530	2288
2. S 711 CS2-SWC 711[1]		9/05/90	SO2/ Jones Creek		450	730	450		0	
3.G 85-A		7/21/45	SO13/Well 3 (transferred to Well 11)		1200	118	1200	3333 (includes SO14, SO15, and expanded wellfield permit below)	0	
4. G 4072-A		2/12/59	SO16/Well 4 (transferred to Well 13)		1325	1208	1325		0	
5. G 6636-A		3/22/68	SO6/Well 5		600	920	500		100	
6. G 6635-A		3/22/68	SO7/Well 6		1500	2400	1450		50	
7. G2-00501		3/22/71	SO8/Well 7		1000	530	950		50	
8. G2-24400		2/04/77	SO9/Well 8		900	530	900		0	
9. G2-27384		8/13/86	SO11/Well 9	210 Qa is supplemental	650	210 (S)	650	127	0	83 (S)
10. G2-30144		8/13/86	Expanded Wellfield		500	2150	450[4]	Included above	50	Included above
11. G2-30145[2]		8/13/86	Anderson Site		1000	880	0		1000	880
12. G2-30146[2]		8/13/86	Parkers Landing		1000	880	0		1000	880
13. G2-30147[2]		8/13/86	Treatment Plant Well		1000	880	0		1000	880
Claims 1.G2-CV1-2P160 121023		6/11/74	SO14/Well 1, (transferred to Well 10 & 12)		900	320	900	Included above	0	Included above

2. G2-CV1-2P160 121023		6/11/74	SO15/Well 2 (transferred to Well 10 & 12)		900	230	900		0	
TOTAL	**********	*********	*********	**********	**12,475**	**11,090**		**3,460**	**3,780**	**7,630**

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		EXISTING CONSUMPTION THROUGH INTERTIE		CURRENT INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Fire Station				350	
2. Camas Meadows				1000	
3.					
4.					

(1) These rights are not available for use during peak water use months. Only available between November 1 and May 14. Not included in instantaneous total.
(2) These site are not yet developed.
(3) Wells 5, 6, 7, 8, 10, 11, 12, and 13 are capped at 5,900 acre-ft per year.
(4) Excess wellfield right being utilized at Well 8.

The Department of Health is an equal opportunity agency. For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388). For additional copies of this form, call 1-800-521-0323. This and other forms are available at http://www.doh.wa.gov/ehp/dw

DOH Form #331-371 (09/07)

To return form, please see reverse side.

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 2

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 6 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (6-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates 1. S 712 CS2-SWC 712(1)		8/22/23	SO1/Boulder Creek		1120	1820				
2. S 711 CS2-SWC 711(1)		9/05/90	SO2/ Jones Creek		450	730				
3.G 85-A		7/21/45	SO13/Well 3 (transferred to Well 11)		1200	118				
4. G 4072-A		2/12/59	SO16/Well 4 (transferred to Well 13)		1325	1208				
5. G 6636-A		3/22/68	SO6/Well 5		600	920				
6. G 6635-A		3/22/68	SO7/Well 6		1500	2400				
7. G2-00501		3/22/71	SO8/Well 7		1000	530				
8. G2-24400		2/04/77	SO9/Well 8		900	530				
9. G2-27384		8/13/86	SO11/Well 9	210 Qa is supplemental	650	210 (S)				
10. G2-30144		8/13/86	Expanded Wellfield		500	2150				
11. G2-30145(2)		8/13/86	Anderson Site		1000	880				
12. G2-30146(2)		8/13/86	Parkers Landing		1000	880				
13. G2-30147(2)		8/13/86	Treatment Plant Well		1000	880				
Claims 1.G2-CV1-2P160 121023		6/11/74	SO14/Well 1, (transferred to Well 10 & 12)		900	320				

2. G2-CV1-2P160 121023		6/11/74	SO15/Well 2 (transferred to Well 10 & 12)		900	230				
TOTAL	**********	*********	*********	**********	**12,475**	**11,090**	**9,054**	**6,639**	**3,421**	**4,451**

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Fire Station				350	
2. Camas Meadows				1000	

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DOH Form #331-372 (09/07)

To return form, please see reverse side.

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Table 3

WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 20 YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (20-year Demand)		FORECASTED WATER RIGHT STATUS (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates 1. S 712 CS2-SWC 712(1)		8/22/23	SO1/Boulder Creek		1120	1820				
2. S 711 CS2-SWC 711(1)		9/05/90	SO2/ Jones Creek		450	730				
3.G 85-A		7/21/45	SO13/Well 3 (transferred to Well 11)		1200	118				
4. G 4072-A		2/12/59	SO16/Well 4 (transferred to Well 13)		1325	1208				
5. G 6636-A		3/22/68	SO6/Well 5		600	920				
6. G 6635-A		3/22/68	SO7/Well 6		1500	2400				
7. G2-00501		3/22/71	SO8/Well 7		1000	530				
8. G2-24400		2/04/77	SO9/Well 8		900	530				
9. G2-27384		8/13/86	SO11/Well 9	210 Qa is supplemental	650	210 (S)				
10. G2-30144		8/13/86	Expanded Wellfield		500	2150				
11. G2-30145(2)		8/13/86	Anderson Site		1000	880				
12. G2-30146(2)		8/13/86	Parkers Landing		1000	880				
13. G2-30147(2)		8/13/86	Treatment Plant Well		1000	880				
Claims 1.G2-CV1-2P160 121023		6/11/74	SO14/Well 1, (transferred to Well 10 & 12)		900	320				

2. G2-CV1-2P160 121023		6/11/74	SO15/Well 2 (transferred to Well 10 & 12)		900	230				
TOTAL	**********	*********	*********	**********	**12,475**	**11,090**	**14,174**	**10,523**	**-1,699**	**567**

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED INTERTIE SUPPLY STATUS (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. Fire Station				350	
2. Camas Meadows				1000	

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DOH Form #331-373 (09/07)

To return form, please see reverse side.

Appendix D

SEPA and DNS

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
PH: 360-834-6864 • F: 360-834-1535
http://www.ci.camas.wa.us

Curleigh Carothers Engineering Manager

COMMUNITY DEVELOPMENT DEPARTMENT

Date Published: April 6, 2010

To Whom It May Concern:

Please find enclosed a Determination of Nonsignificance (DNS) for the **City of Camas Water System Plan Update (SEPA10-04)** that was issued pursuant to the State Environmental Policy Act (SEPA) Rules, Chapter 197-11, Washington Administrative Code. The enclosed review comments reflect evaluation of the environmental checklist by the lead agency as required by WAC 197-11-330(1)(a)(i).

A CD is enclosed that contains the draft Camas Water System Plan Update.

Written comments may be submitted on this determination within fourteen (14) days of its issuance, April 20, 2010, after which the DNS will be reconsidered in light of the comments received.

Please address all correspondence to:

City of Camas, SEPA Official
Community Development Department
616 NE Fourth Avenue / P.O. Box 1055
Camas, Washington 98607

Distribution

Bureau of Indian Affairs
C-Tran
Camas School District, Heidi Rosenberg
Camas Mayor Paul Dennis
Camas City Administrator, Lloyd Halverson
Camas Council Members (7)
Camas Engineering Department, James Carothers
Camas Fire Department, Randy Miller
Camas Finance Director, Joan Durgin
Camas Operations Manager, Eric Levison
Camas Parks and Recreation, Jerry Acheson
Camas Planning Commission (7)
Camas Police Chief, Mitch Lackey
Camas Public Works Director, Monte Brachmann
Camas Public Library, David Zavortink
Chinook Indian Nation
City of Vancouver
City of Washougal
Cultural Resource Program, Cowlitz Indian Tribe, Dave Burlingame
Cultural Resource Program, Yakama Indian Nation, Clifford Washines
Cultural Resource Program, Yakama Indian Nation, Johnson Meninick
Clark County Community Development
Clark County Department of Transportation, Steve Schulte
Clark County Parks Department, Jeroen Kok
Clark County Natural Resources Council
Clark Public Utilities
CPU Const., Service Manager
Department of Ecology
Department of Fish and Wildlife
Department of Health, Washington State
Department of Natural Resources, SEPA Center
Department of Natural Resources, Pacific Cascade Region
Department of Transportation, Washington State
Parks & Recreation Commission
Port of Camas-Washougal
Post Record Publications
Southwest Air Pollution Control Authority
US Army Corps of Engineers
Washington Office of Archaeology & Historic Preservation
UCAN (United Camas Neighborhood Association)

STATE ENVIRONMENTAL POLICY ACT

DETERMINATION OF NON-SIGNIFICANCE
(Non-project Action)

CASE NO: SEPA10-04 – City of Camas Water System Plan Update

APPLICANT: City of Camas

REQUEST: Adopt the City of Camas Water System Plan Update to provide a long-term planning strategy for the City's water utility for the 6-year and 20-year planning periods.

Location:
The proposal covers the corporate limits of the City of Camas.

Legal Description:
The planning area is bounded by:
Portions of Township 2 North, Range 3E, Sections 17, 20, 21, 27, 28, 29, 32, 33, 34, 35 and 36;
Portions of Township 1 North, Range 3 E, Sections 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16; and
Portions of Township 1 North Range 4E, Section 7, and further defined as the Camas City Limits.

SEPA Determination:
Determination of Non-Significance. (Non-project Action)

Comment Deadline:
April 20, 2010

As lead agency under the State Environmental Policy Act (SEPA) Rules [Chapter 197-11, Washington Administrative Code (WAC)], the City of Camas must determine if there are possible significant adverse environmental impacts associated with this proposal. The options include the following:

- DS = Determination of Significance (The impacts cannot be mitigated through conditions of approval and, therefore, requiring the preparation of an Environmental Impact Statement (EIS).
- MDNS = Mitigated Determination of Non-Significance (The impacts can be addressed through conditions of approval), or;
- DNS = Determination of Non-Significance (The impacts can be addressed by applying the Camas Municipal Code).

Published: Post Record on *April 6, 2010.*
Posted: Camas Post Office, City Hall, Camas Library, & City of Camas web site at:
http://www.ci.camas.wa.us/govern/publicnotice.htm

Determination:
Determination of Non-Significance (DNS). The City of Camas, as lead agency for review of this proposal, has determined that this proposal does not have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(e). This decision was made after review of a completed environmental checklist and other information on file with the City.

Date of Publication & Comment Period:
Publication date of this DNS is April 6, 2010, and is issued under WAC 197-11-340. The lead agency will not act on this proposal until the close of the 14-day comment period which ends on April 20, 2010.

SEPA Appeal Process:
An appeal of any aspect of this decision, including the SEPA determination and any required mitigation, must be filed with the Community Development Department within fourteen (14) calendar days from the date of the decision notice. The letter of appeal should contain the following information.

1. The case number designated by the City of Camas and the name of the applicant; and,
2. The name and signature of each person or group (petitioners) and a statement showing that each petitioner is entitled to file an appeal as described under Section 16.28.060 of the Camas Municipal Code. If multiple parties file a single petition for review, the petition shall designate one party as the contact representative with the City Planner. All contact with the City Planner regarding the petition, including notice, shall be with this contact person.

The appeal request and appropriate fee is to be submitted to the Community Development Department between 8:00 a.m. and 5:00 p.m. Monday through Friday, at the address listed below:

Appeal to the City of Camas SEPA Official
Community Development Department
616 NE Fourth Avenue / P.O. Box 1055
Camas, Washington 98607

Staff Contact Person: James Carothers (360) 817-1561
Responsible Official: Phil Bourquin (360) 817-1562

Phil Bourquin, Community Development Director and Responsible Official	**April 6, 2010** **Date**

Published: Post Record on *April 6, 2010.*
Posted: Camas Post Office, City Hall, Camas Library, & City of Camas web site at:
http://www.ci.camas.wa.us/govern/publicnotice.htm

WAC 197-11-960 Environmental checklist.

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:
   City of Camas Water System Plan Update

2. Name of applicant:
   City of Camas Public Works Department

3. Address and phone number of applicant and contact person:

   Monte Brachmann
   616 NE Fourth Avenue
   Camas, Washington 98607
   360 817-1561

4. Date checklist prepared:
   February 2, 2010

5. Agency requesting checklist:
   City of Camas

6. Proposed timing or schedule (including phasing, if applicable):
Adoption of plan anticipated in 2010.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.
This Plan will provide a 6-year capital improvement plan (CIP). These projects will be implemented based on need and available financing.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.
None

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.
No

10. List any government approvals or permits that will be needed for your proposal, if known.
This Plan will require approval by the Washington Department of Health prior to adoption by the City.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)
    - **Chapter 1 provides an introduction, Plan summary, historical information about the water system, and a summary of existing facilities.**
    - **Chapter 2 provides an overview of the regulatory requirements regarding legislation, regulatory agencies, system design standards, and water quality standards.**
    - **Chapter 3 provides the basic planning data and water use projections used in developing the planning strategy for the next twenty years.**
    - **Chapter 4 provides an analysis of the City's water quality, including Department of Health regulations, water treatment information, and recorded water quality information. This chapter also analyzes the water system components and their ability to meet the projected demands on the system.**
    - **Chapter 5 provides the hydraulic analysis for the water system using H2O Map modeling software. This chapter illustrates how the system responds to various modeling scenarios, including identifying available fire flows and system pressures.**
    - **Chapter 6 outlines the City's water use efficiency program, including current conservation efforts, target water use reductions, and an investigation of the potential for water reuse as a component of the water use efficiency plan.**
    - **Chapter 7 provides a summary of the operation and maintenance (O&M) program. This chapter summarizes water system management, system operations, emergency response planning, safety procedures, cross connection control, record keeping, and identifies O&M improvements.**
    - **Chapter 8 presents the capital improvements, needed to address requirements identified by the analyses provided in Chapters 4 through 7.**
    - **Chapter 9 presents the current financial status of the City, along with a discussion of funding for the identified capital improvement projects.**

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.
The City of Camas water service area and Jones and Boulder Creeks' watershed area and transmission main.

B. ENVIRONMENTAL ELEMENTS

This is a nonproject action, therefore a number of the environmental elements will not apply. A general answer will be provided where appropriate. The answers will apply generally to the Water Company's service area.

1. Earth

a. General description of the site (underline one): Flat, rolling, hilly, steep slopes, mountainous, other ____.
Topography in the area ranges from flat in the older core of Camas and on the west side of Prune Hill, to hilly on the flanks of Prune Hill, to steep slopes in some areas of Prune Hill and in some canyons on the south side of Prune Hill. On the northeast side of Lacamas Lake the topography ranges from flat to hilly, with some steep slopes.

b. What is the steepest slope on the site (approximate percent slope)?
The steepest slope in the area is well over 40%, in the southern area of Prune Hill overlooking the Columbia River.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.
The US Soil Conservation Service survey of Clark County shows a number of soils series in the Camas area. The area northeast of Lacamas Lake contains approximately 330 acres in agricultural use.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.
There are areas of potentially unstable soils within the City Limits. This plan would have no affect on soils.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.
The adoption of the proposed plan would not directly result in filling or grading.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.
Non-project action.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?
Non-project action.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:
None.

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, and industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities, if known.
None.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
Non-project action.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
None.

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.
There are six main surface water bodies in the area: Lacamas Lake, Round Lake, Fallen Leaf Lake, Lacamas Creek, Washougal River, and Columbia River.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.
No

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetland, and indicate the area of the site that would be affected. Indicate the source of fill material.
None

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose and approximate quantities, if known.
No

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.
There are areas within the City of camas that lie within the 100-year floodplains of the Columbia River, the Washougal River or Lacamas Creek.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.
No.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose and approximate quantities, if known.
No. This proposed plan is a non-project action.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial; containing the following chemicals...; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) is expected to serve.
None.

c. Water Runoff (including storm water):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.
Non-project action.

2) Could waste materials enter ground or surface waters? If so, generally describe.
No.

d. Proposed measures to reduce or control surface, ground and runoff water impacts, if any:
None.

4. Plants

a. Check or underline types of vegetation found on the site:
_X_ deciduous tree: alder, maple, aspen, other
_X_ evergreen tree: fir, cedar, pine, other
_X_ shrubs
_X_ grass
_X_ pasture
_X_ crop or grain
_X_ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
_X_ other types of vegetation

b. What kind and amount of vegetation will be removed or altered?
None.

c. List threatened or endangered species known to be on or near the site.
Non-project action.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
Non-project action.

5. Animals

a. Underline any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other: _osprey, waterfowl_
mammals: deer, bear, elk, beaver, raccoon, possum
fish: bass, salmon, trout, herring, shellfish, other: _____

b. List any threatened or endangered species known to be on or near the site.
Five salmonoid species – Fall Chinook, Chum and Coho salmon, Summer and Winter steelhead, and Bull trout – are present within Lacamas Creek, the Washougal River and the Columbia River within the community. Bald eagles have been known to be along the Lacamas Lake/Lacamas Creek corridor and the Columbia River.

c. Is the site part of a migration route? If so, explain.
Portions of the City are within the Pacific Flyway, which is used by migratory waterfowl species.

d. Proposed measures to preserve or enhance wildlife, if any:
None.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.
Non-project action.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
No

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any.
Non-project action.

7. **Environmental health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

The proposed plan will not result in any health hazards.

1) Describe special emergency services that might be required.
None.

2) Proposed measures to reduce or control environmental health hazards, if any:
None.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?
None

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.
Non-project action.

3) Proposed measures to reduce or control noise impacts, if any:
None.

8. **Land and Shoreline Use**

a. What is the current use of the site and adjacent properties?
Camas is an urbanized and urbanizing community that has a variety of land uses from a large historic pulp and paper manufacturer to a modern semi-conductor plant, and from older residential neighborhoods to new subdivisions, as well as some areas in agricultural use. Commercial development centers are in the downtown core near the pulp and paper mill, and in outlying corridors. Camas also has natural open spaces, parks, and other public areas.

b. Has the site been used for agriculture? If so, describe.
Portions of the community (in Grass Valley) were in agricultural use in the past, and some southern portions appear to still be used for hay production or pasture. Approximately 330 acres northeast of Lacamas Lake are currently being used for agriculture.

c. Describe any structures on the site.
There are several thousand structures in the city, including more than 6,400 dwelling units.

d. Will any structures be demolished? If so, what?
The proposed plan will not result in structures being demolished.

e. What is the current zoning classification of the site?
The City of Camas has adopted the following zoning districts throughout the community.

District	Symbol	Comprehensive Plan Designation
Residential -- 20,000	R-20	Single-family Low
Residential -- 15,000	R-15	Single-family Low
Residential -- 12,000	R-12	Single-family Medium
Residential -- 10,000	R-10	Single-family Medium
Residential -- 7,500	R-7.5	Single-family Medium
Residential -- 6,000	R-6	Single-family High
Residential -- 5,000	R-5	Single-family High
Multifamily -- 10	MF-10	Multifamily Low
Multifamily -- 18	MF-18	Multifamily High
Multifamily -- 24	MF-24	Multifamily High
Neighborhood Commercial	NC	Commercial
Community Commercial	CC	Commercial
Regional Commercial	RC	Commercial
Mixed Use	MX	Commercial
Downtown Commercial	DC	Commercial
Light Industrial	LI	Industrial
Light Industrial/ Business Park	LI/BP	Light Industrial/Business Park

f. What is the current comprehensive plan designation of the site? **Please see table above.**

g. If applicable, what is the current shoreline master program designation of the site?
Non-project action.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.
No.

i. Approximately how many people would reside or work in the completed project?
The City of Camas has a current population of approximately 16,950, with a forecasted population of approximately 22,000 in a twenty-year planning horizon.

j. Approximately how many people would the completed project displace?
The proposed plan will not displace any people.

k. Proposed measures to avoid or reduce displacement impacts, if any:
None.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The Plan will be reviewed by all applicable land use authorities for compatibility. This includes Growth Management planning requirements.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle or low-income housing.
None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.
None.

c. Proposed measures to reduce or control housing impacts, if any:
None.

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?
The proposed plan will not result in structural construction.

b. What views in the immediate vicinity would be altered or obstructed?
None.

c. Proposed measures to reduce or control aesthetic impacts, if any:
None.

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?
Non-project action.

b. Could light or glare from the finished project be a safety hazard or interfere with views?
No.

c. What existing off-site sources of light or glare may affect your proposal?
Non-project action.

d. Proposed measures to reduce or control light and glare impacts, if any:
None.

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?
There are numerous active and passive recreational opportunities within the City of Camas and the immediate vicinity. Active recreational opportunities exist in the twelve developed parks, and on the major waterways within city limits. Passive recreation opportunities exist within the approximately 436 acres of open space areas within the city. A 312-acre regional park (Lacamas Lake County Park) provides both active and passive recreation. Numerous paved and unpaved trails within residential developments, parks, and open space areas also provide both active and passive recreational opportunities.

b. Would the proposed project displace any existing recreational uses? If so, describe.
Non-project action.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any: **None.**

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state or local preservation registers known to be on or next to the site? If so, generally describe.
Several sites within the City of Camas are listed on national, state or local preservation registers.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific or cultural importance known to be on or next to the site.
There are five sites on the Clark County Heritage Register, twenty-one sites on the Clark County Historical Resources Inventory, and two sites on the National Register of Historical Places.

c. Proposed measures to reduce or control impacts, if any:
None.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.
The basic roadway system providing circulation to and from Camas is the federal and state highway system: Interstate 5, Interstate 205, State Route 14, and State Route 500. The interstates link Camas and surrounding areas to Portland to the south, as well as Olympia and Seattle to the north. State Route 14 is the major east-west connection from Camas to I-205 and I-5. State Route 500 provides access to the northern parts of the County.

There are some major arterials: Pacific Rim Boulevard, SE 1st/Lake Road, Leadbetter Road, Brady/Parker Road, and NE 3rd Avenue, to name a few, and several minor arterials that provide circulation between Camas and communities to the east and west. These arterials also provide a significant amount of circulation within the community.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?
Yes, the City is served by public transit. This proposal will not affect any routes.

c. How many parking spaces would the completed project have? How many would the project eliminate?
None.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).
Non-project action.

e. Will the project use (or occur in the immediate vicinity of) water, rail or air transportation? If so, generally describe.
Non-project action.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.
Non-project action.

g. Proposed measures to reduce or control transportation impacts, if any:
None.

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.
No

b. Proposed measures to reduce or control direct impacts on public services, if any.
None.

16. **Utilities**

a. Circle utilities currently available at the site: **electricity**, **natural gas**, **water**, **refuse service**, **telephone**, **sanitary sewer**, septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
The proposed plan will not result in utility construction.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Matt Anderson

Date Submitted: 2/4/2010

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; pro-duction, storage, or release of toxic or hazardous substances; or production of noise?

It is not anticipated that the proposed plan will increase discharge to water; emissions to air; production, storage or release of toxic or hazardous substances; or production of noise.

Proposed measures to avoid or reduce such increases are:
Construction Best Management practices.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

The proposed plan is not likely to affect plants, animals, fish or marine life.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:
N/A

3. How would the proposal be likely to deplete energy or natural resources?

The proposed plan will not likely deplete energy or natural resources.

Proposed measures to protect or conserve energy and natural resources are:
None

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

The potential for construction related affects to wetlands and the floodplain does exist, however, construction is expected to occur on or adjacent to municipal roads and/or property, outside of environmentally sensitive areas as much as possible.

Proposed measures to protect such resources or to avoid or reduce impacts are:

Project-specific affects to sensitive areas will be minimized and, if necessary, mitigated.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

The proposed projects in the capital improvement plan are compatible with existing plans.

Proposed measures to avoid or reduce shoreline and land use impacts are:

None

6. How would the proposal be likely to increase demands on transportation or public services and utilities?
The proposed plan would not increase demands on transportation. Demands on public services and utilities will be determined on a project specific basis.

   Proposed measures to reduce or respond to such demand(s) are:

   The proposed plan is intended to address supplying future demands to the Camas Water System.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.
The proposed plan does not knowingly conflict with any local, state or federal laws.

Appendix E

City of Camas Design Standards

City of Camas Water Details ~ INDEX

Detail No.	Detail Name	Rev.	Rev. Date
W1	Water Notes	1	5/1/2007
W2	1" Water Service - New (Subdivision)	1	5/1/2007
W3	1" Water Service - Replacement	1	5/1/2007
W4	1" Water Service - Meter Relocation	1	5/1/2007
W5	1" Water Service - Rural	1	5/1/2007
W6	2" Water Service	1	5/1/2007
W7a & b	3" Water Service	1	5/1/2007
W8	2" Standard Blowoff	2	9/18/2007
W9	6" Low Point Blowoff - Ditch	1	5/1/2007
W10	6" Low Point Blowoff - Street	1	5/1/2007
W11	Fire Hydrant	1	5/1/2007
W12	Valve Box and Riser	1	5/1/2007
W13	Water Main Line and Valve	1	5/1/2007
W14	Pipe Joint Restraint	1	5/1/2007
W15	Thrust Block	1	5/1/2007
W16	2" Air/Vacuum Release Valve	2	9/18/2007
W17	2" Pressure Relief Valve Assembly	1	5/1/2007
W18	4" Vacuum Relief Valve	1	5/1/2007
W19a & b	6"x2" PRV Station with 3" Relief	1	5/1/2007
W20	Above Ground PRV Relief Drain	1	5/1/2007
W21	Water Quality Sampling Station	1	5/1/2007
W22a & b	Standard Double Check Detector Valve Assembly	1	5/1/2007
W23	Utility Crossing Detail	1	5/1/2007

WATER CONSTRUCTION NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST CURRENT A.W.W.A. STANDARDS, AND THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF AT AN APPROVED SITE.

2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.

3. TRENCH COMPACTION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD USED TO ACHEIVE THE REQUIRED COMPACTION AND BE APPROVED BY THE CITY OF CAMAS. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.

4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

5. ALL VALVES 10 INCHES OR LESS IN DIAMETER SHALL BE A.W.W.A. APPROVED RESILIENT WEDGE GATE VALVES, BUBBLE TIGHT AT 200PSI, HAVE NON RISING STEMS, AND OPEN BY TURNING TO THE LEFT. PROVIDE A 2 INCH SQUARE NUT TO CONFORM TO A.W.W.A. C-504. ALL VALVES 12 INCHES OR LARGER IN DIAMETER SHALL BE A.W.W.A. APPROVED BUTTERFLY VALVES.

6. ALL WATER PIPE 12 INCHES OR LESS IN DIAMETER SHALL BE DUCTILE IRON CLASS 52 PIPE. ALL WATER PIPE 14 INCHES IN DIAMETER AND LARGER SHALL BE DUCTILE IRON CLASS 51 PIPE. RUBBER GASKET TYPE SHALL BE U.S. PIPE, TYTON OR APPROVED EQUAL. ALL FITTINGS SHALL BE DUCTILE IRON AND SHALL CONFORM TO THE A.W.W.A. STANDARD C-110.

7. ALL TEES, FLANGES, CAPS, BENDS AND OFFSETS, AS WELL AS ALL OTHER APPURTENCES WHICH ARE SUBJECT TO UNBALANCED THRUST, SHALL BE PROPERLY BRACED BY ONE OF THE FOLLOWING METHODS:
   A. CONCRETE THRUST BLOCKING- AS DETAILED IN THE PLANS, SHALL BE PLACED AT BENDS, TEES, DEAD ENDS AND CROSSES. BLOCKING SHALL BE 3000 PSI CONCRETE POURED IN PLACE. CONCRETE BLOCKING SHALL BE AGAINST SOLID UNDISTURBED EARTH AT THE SIDES AND BOTTOM OF THE TRENCH EXCAVATION AND SHALL BE SHAPED SO AS NOT TO OBSTRUCT ACCESS TO THE JOINTS OF THE PIPE. 6 MIL. PLASTIC SHALL BE USED TO INSULATE PIPE.
   B. MECHANICAL JOINT RESTRAINT-USE "EBBA IRON SERIES 1100 MEGA LUG MECHANICAL JOINT THRUST RESTRAINT" OR APPROVED EQUAL. CONTRACTOR TO RESTRAIN THE MINIMUM REQUIRED PIPE LENGTH WITH "FIELD-LOK" GASKETS OR APPROVED EQUAL.

8. ALL WATER MAINS SHALL BE TESTED AT 200PSI IN ACCORDANCE WITH SECTION 7-11.3(11) OF THE STANDARD SPECIFICATIONS. THE CITY SHALL BE NOTIFIED 48 HOURS IN ADVANCE OF ACCEPTANCE TESTING. MAXIMUM LENGTH OF PIPE TO BE TESTED AT ONE TIME IS 1000 FT.

9. CHLORINATION SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 7-11.3(12) OF THE STANDARD SPECIFICATIONS. CITY INSPECTOR WILL TAKE SAMPLES AND DELIVER TO LABORATORY FOR BACTERIA TESTING, NEGATIVE SAMPLE RESULTS SHALL BE CONFIRMED, PRIOR TO PRESSURE TESTING. DECLORINATION OR DISPOSAL TO SANITARY MAIN MAY BE REQUIRED.

10. APPROPRIATE DISPOSAL AND OR DECHLORINATION OF FLUSHED WATER DURING BLOWOFF IS THE RESPONSIBILITY OF THE CONTRACTOR. METHOD USED SHALL BE APPROVED BY CITY AND OTHER REGULATING AUTHORITIES.

11. WATER MAIN TO HAVE A MINIMUM COVER OF 30 INCHES. WATER SERVICES TO HAVE A MINIMUM 24" OF COVER.

12. ALL EXISTING VALVES TO BE OPERATED BY CITY OF CAMAS WATER/SEWER DEPARTMENT PERSONNEL ONLY.

13. NO CONNECTIONS TO EXISTING WATER MAINS SHALL BE MADE PRIOR TO SATISFACTORY PRESSURE TESTING, DISINFECTION, AND THE CONFIRMATION OF A NEGATIVE BACTERIA TEST.

REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

WATER CONSTRUCTION NOTES

James E. Carothers 5-8-07

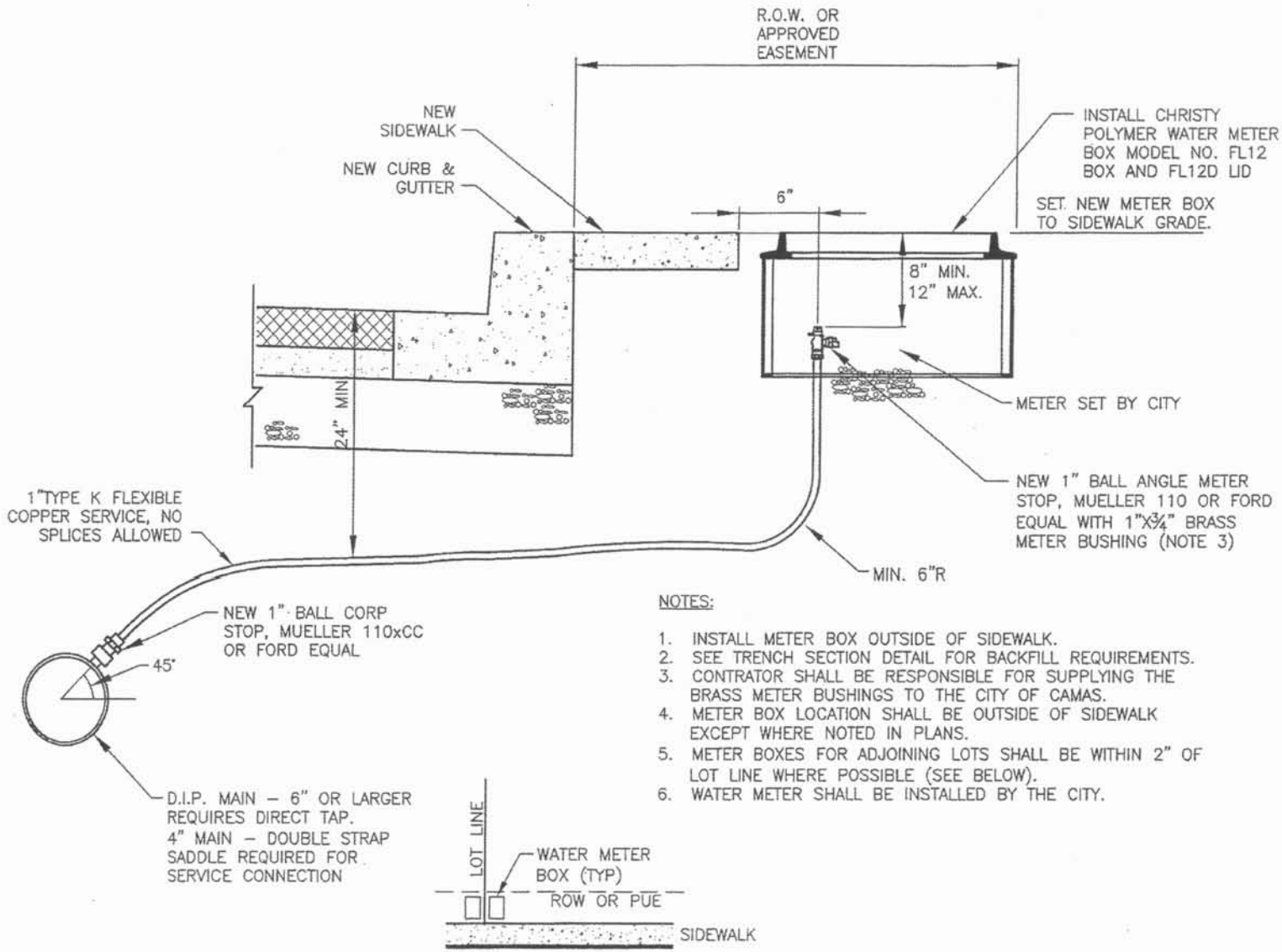
DETAIL APPROVED BY DATE

NO SCALE

DETAIL NO.

W1

WTR-NOTES.DWG



NOTES:

1. INSTALL METER BOX OUTSIDE OF SIDEWALK.
2. SEE TRENCH SECTION DETAIL FOR BACKFILL REQUIREMENTS.
3. CONTRATOR SHALL BE RESPONSIBLE FOR SUPPLYING THE BRASS METER BUSHINGS TO THE CITY OF CAMAS.
4. METER BOX LOCATION SHALL BE OUTSIDE OF SIDEWALK EXCEPT WHERE NOTED IN PLANS.
5. METER BOXES FOR ADJOINING LOTS SHALL BE WITHIN 2" OF LOT LINE WHERE POSSIBLE (SEE BELOW).
6. WATER METER SHALL BE INSTALLED BY THE CITY.

LOCATION OF ADJOINING LOT METER BOXES

REV. NO.	DATE	BY	APPR.
1	7/17/06	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

1" WATER SERVICE – NEW (SUBDIVISION)

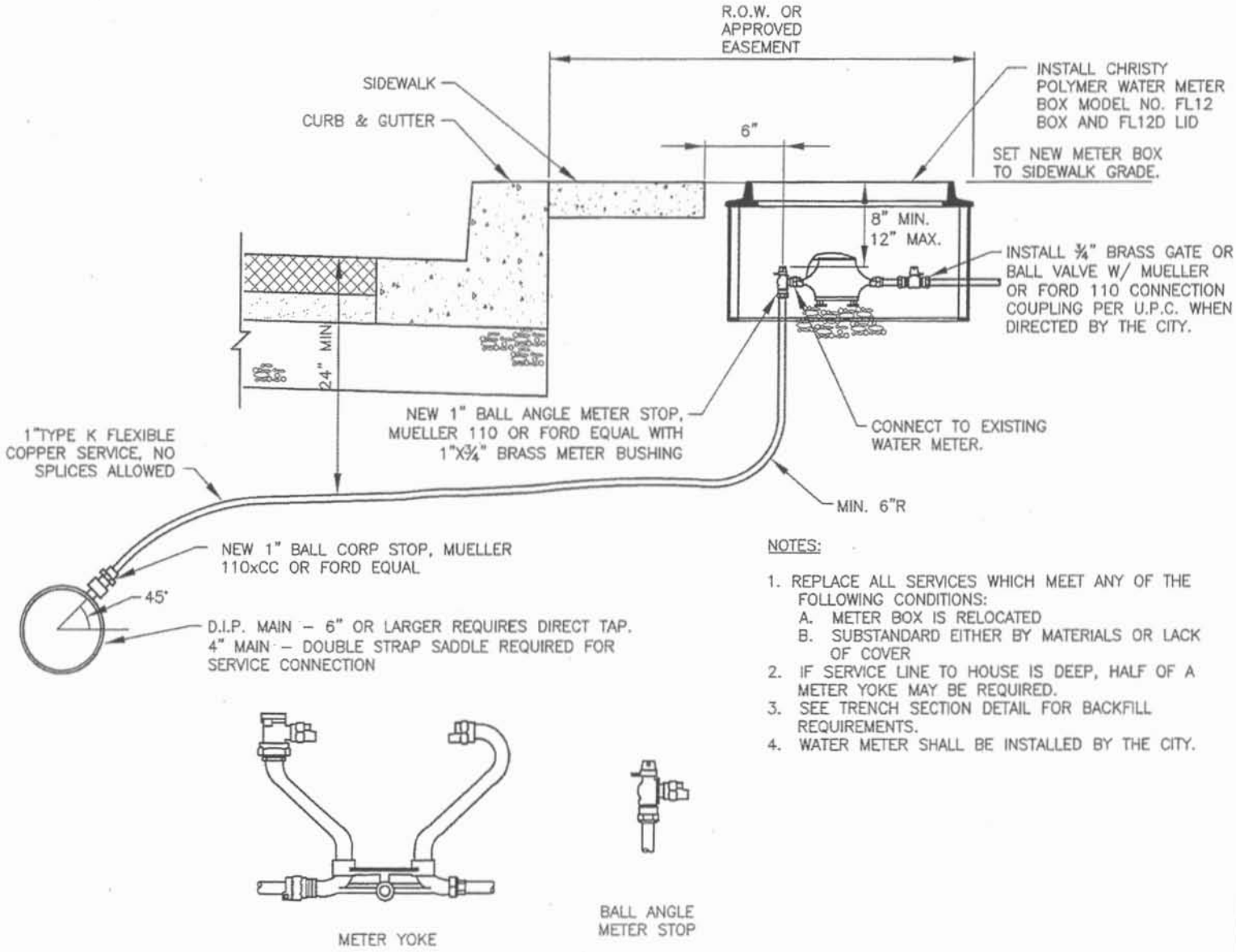
DETAIL APPROVED BY

DATE 5-8-07

NO SCALE

DETAIL NO. W2

WTR-WS.DWG



NOTES:

1. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   A. METER BOX IS RELOCATED
   B. SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
2. IF SERVICE LINE TO HOUSE IS DEEP, HALF OF A METER YOKE MAY BE REQUIRED.
3. SEE TRENCH SECTION DETAIL FOR BACKFILL REQUIREMENTS.
4. WATER METER SHALL BE INSTALLED BY THE CITY.

REV. NO.	DATE	BY	APPR.
1	7/17/08	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

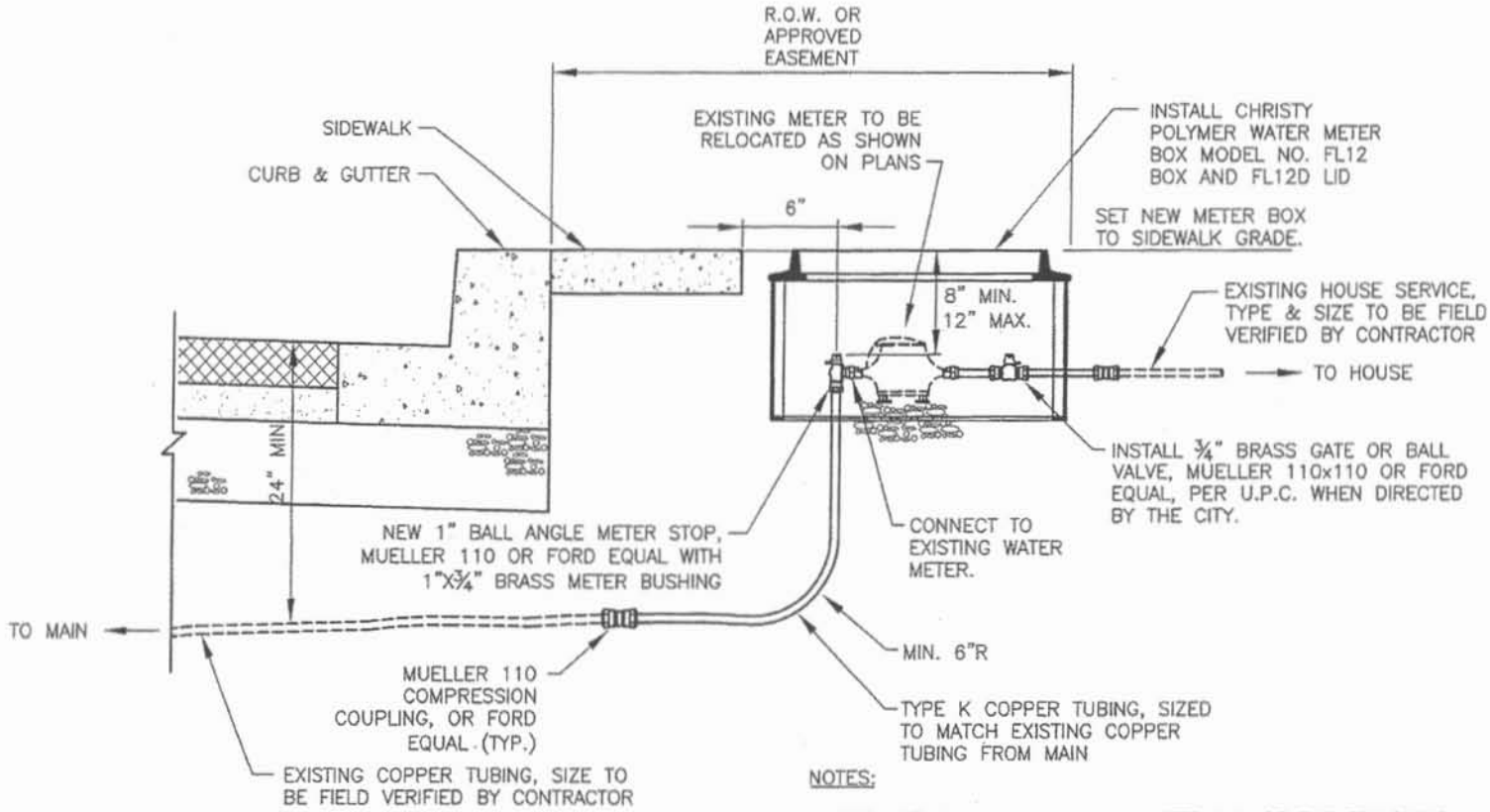
1" WATER SERVICE – REPLACEMENT

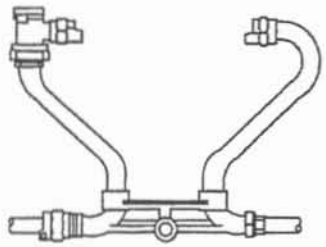
DETAIL APPROVED BY: James E. Carothers 5-8-07 DATE

NO SCALE

DETAIL NO. W3

WTR–WS.DWG





METER YOKE

BALL ANGLE METER STOP

NOTES:

1. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   A. METER BOX IS RELOCATED
   B. SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
   C. METER IS TOO DEEP AND A YOKE MUST BE ADDED.
2. IF SERVICE LINE TO HOUSE IS DEEP, HALF OF A METER YOKE MAY BE REQUIRED.
3. IF SERVICE IS NOT COPPER, CONTRACTOR IS TO REFER TO DETAIL W3 (REPLACEMENT WATER SERVICE) FOR INSTALLATION.
4. FOR SERVICE RELOCATIONS, ONLY ONE FITTING IS ALLOWED BETWEEN THE CORP STOP AND THE METER STOP. A METER ADAPTER REDUCING FROM A 1" SERVICE TO A SMALLER METER MAY BE ALLOWED IN ADDITION TO THE ONE FITTING.
5. INSTALL METER BOX OUTSIDE OF SIDEWALK
6. CALL FOR INSPECTION OF COUPLING UNDER PRESSURE PRIOR TO BACKFILLING.
7. SEE TRENCH SECTION DETAIL FOR BACKFILL REQUIREMENTS.
8. WATER METER SHALL BE INSTALLED BY THE CITY.

REV. NO.	DATE	BY	APPR.
1	7/17/06	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

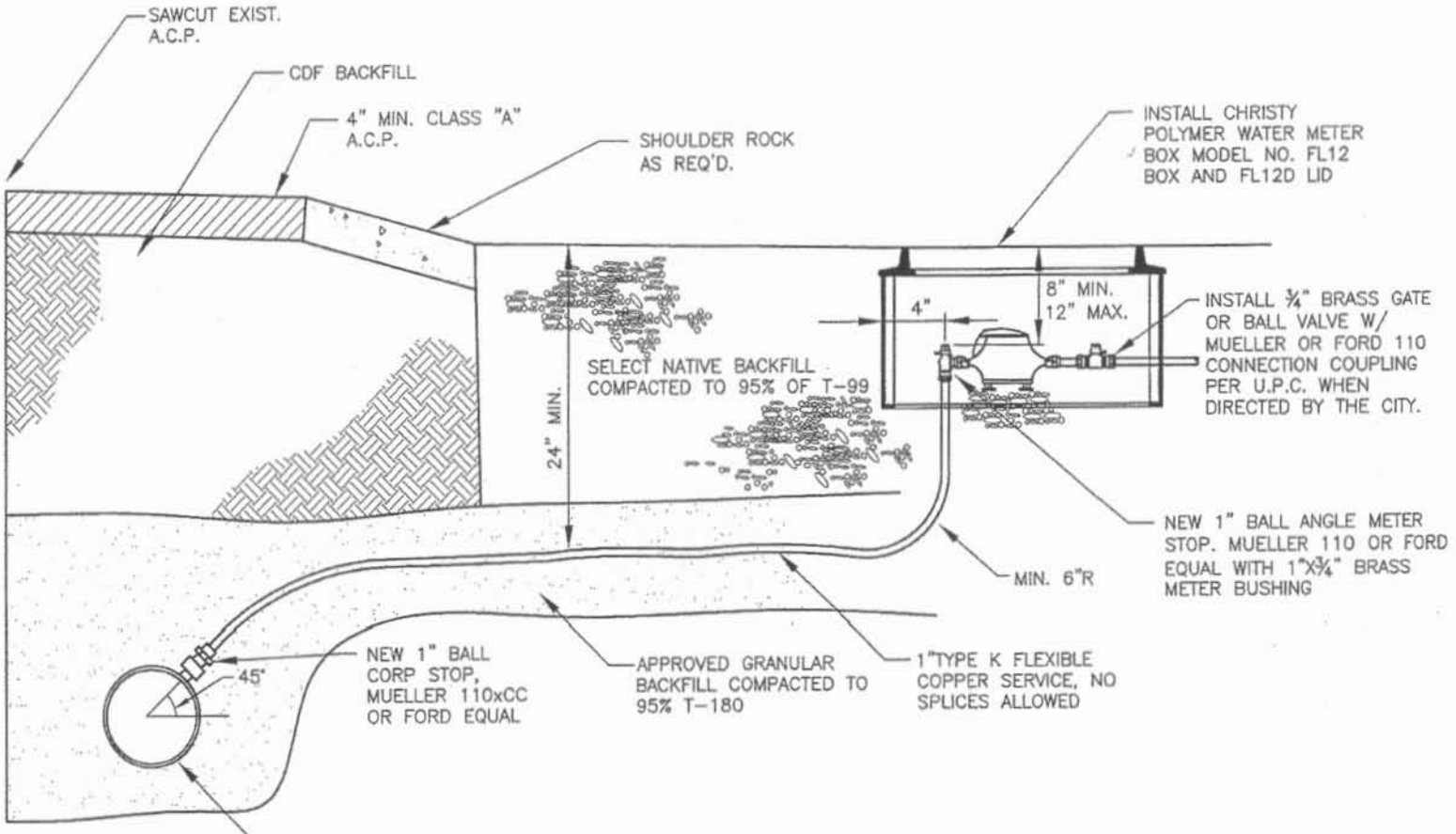
1" WATER SERVICE – METER RELOCATION

DETAIL APPROVED BY: 5-8-07 DATE

NO SCALE

DETAIL NO. W4

WTR-WS.DWG



NOTES:

1. BACKFILL REQUIREMENTS PER CITY/COUNTY/STATE ROAD CUT PERMIT. CONTRACTOR MUST SECURE PERMIT PRIOR TO START OF CONSTRUCTION AND COORDINATE INSPECTION WITH APPROPRIATE JURISDICTION.
2. WATER METER SHALL BE INSTALLED BY THE CITY

REV. NO.	DATE	BY	APPR.
1	7/17/06	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WASHINGTON

CITY OF CAMAS ~ WATER DETAIL

1" WATER SERVICE – RURAL

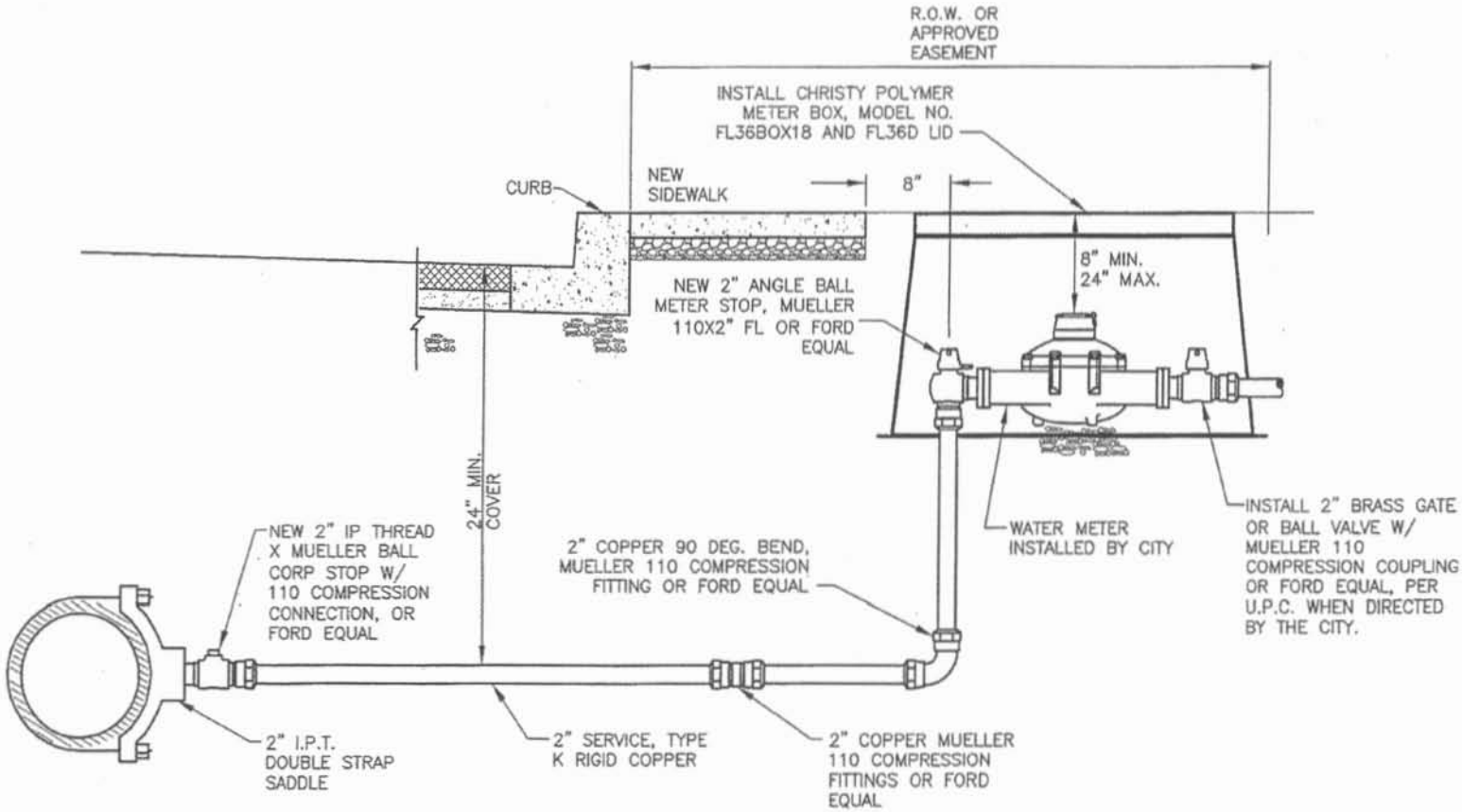
DETAIL APPROVED BY

5-8-07
DATE

NO SCALE

DETAIL NO. W5

WTR-WS.DWG



NOTES:

1. REPLACE ALL SERVICES WHICH MEET ANY OF THE FOLLOWING CONDITIONS:
   A. METER BOX IS RELOCATED
   B. SUBSTANDARD EITHER BY MATERIALS OR LACK OF COVER
2. INSTALL CHRISTY POLYMER METER BOX, MODEL NO. FL36BOX18 AND FL36D LID, OUTSIDE OF SIDEWALK. INSTALL FL36X6 OR FL36X8 BASE EXTENSIONS AS REQUIRED.
3. INSTALL COMPRESSION FITTINGS OUTSIDE OF STREET WHERE POSSIBLE.
4. SEE TRENCH SECTION DETAIL FOR BACKFILL REQUIREMENTS.
5. WATER METER SHALL BE INSTALLED BY THE CITY.

REV. NO.	DATE	BY	APPR.
1	7/17/06	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

2" WATER SERVICE

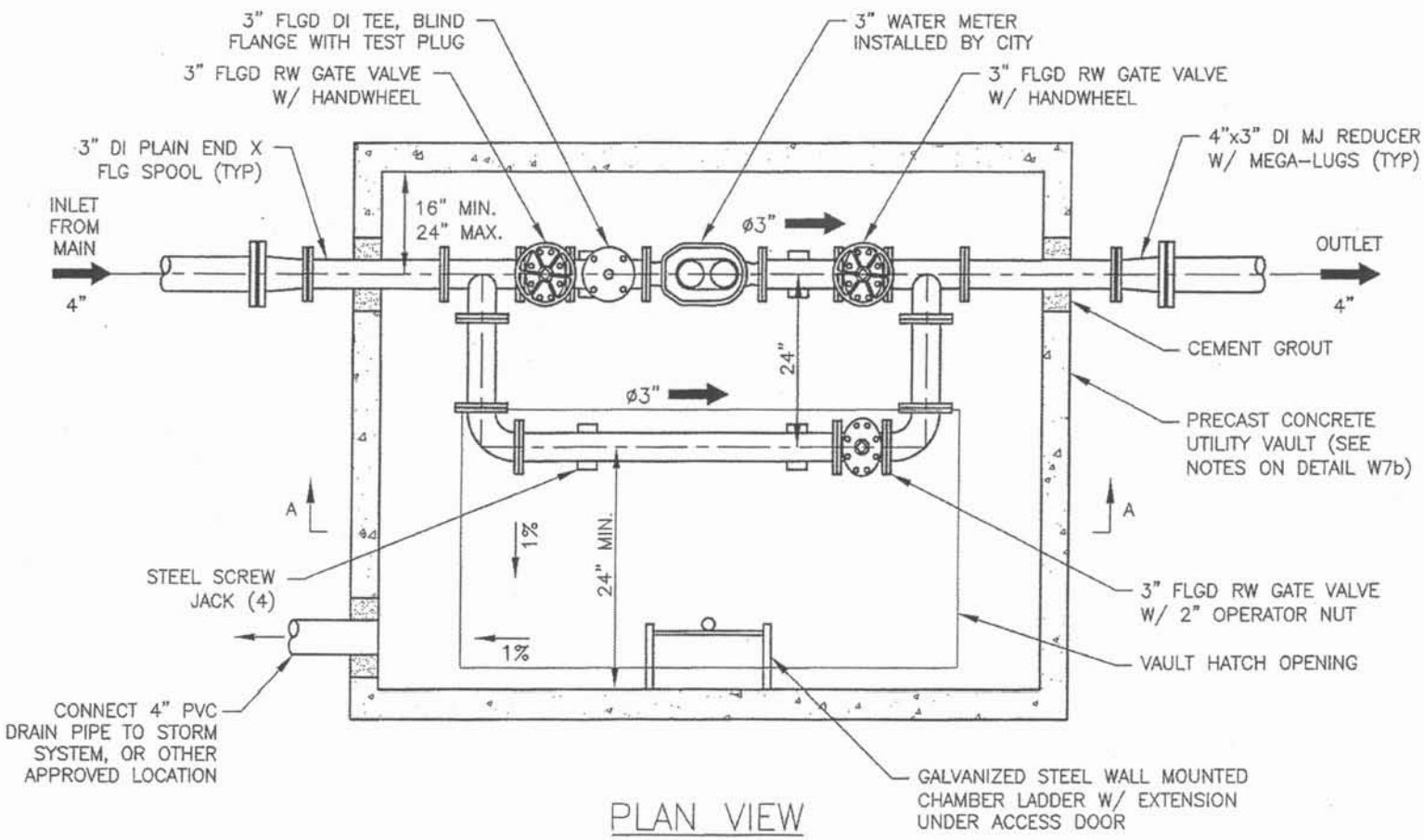
DETAIL APPROVED BY

DATE 5-8-07

NO SCALE

DETAIL NO. W6

WTR-WS2.DWG



PLAN VIEW

WATER METER NOTES:

1. FOR NEW MAINS, INSTALL MAIN SIZE MJ x 4" FL TEE. FOR EXISTING MAINS, LIVE TAP TO BE PERFORMED BY APPROVED TAPPING CONTRACTOR.
2. PROVIDE APPROVED JOINT RESTRAINT FOR ALL JOINTS ON 4" DUCTILE IRON PIPE. MINIMUM COVER 30".
3. PROVIDE FLANGED CONNECTIONS FOR ALL JOINTS ON 3" DUCTILE IRON PIPE AND FITTINGS.

REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

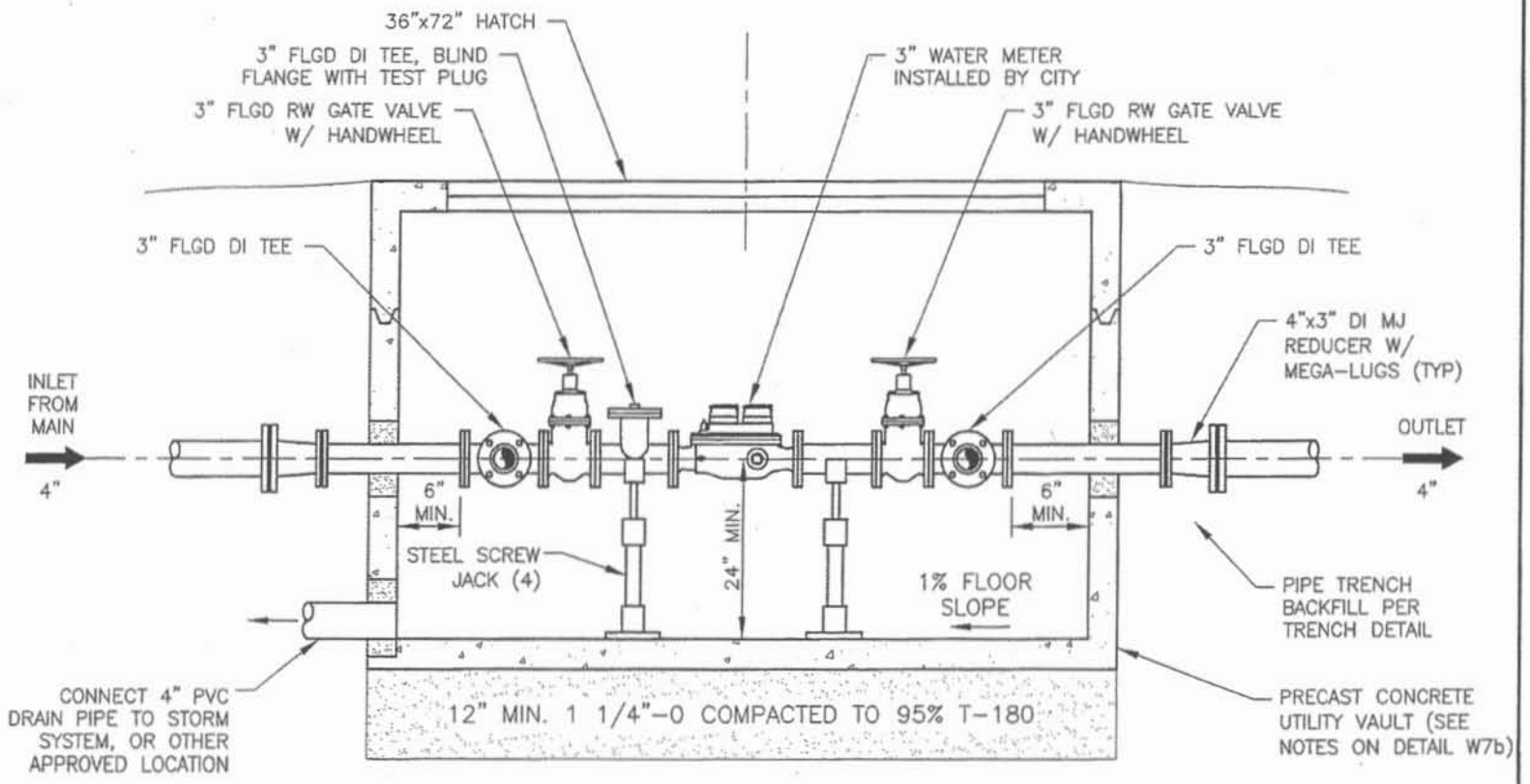
3" WATER SERVICE

DETAIL APPROVED BY: 5-8-07 DATE

NO SCALE

DETAIL NO. W7a

WTR-WS3.DWG



SECTION A–A

(BY–PASS LINE REMOVED FOR CLARITY)

VAULT CONSTRUCTION NOTES:

1. VAULT SHALL BE PRE–APPROVED PRIOR TO INSTALLATION.
2. VAULTS SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
3. APPROVED VAULT SHALL BE RATED FOR H20 LOADING AND INCLUDE AN EXTENSION LADDER, MINIMUM INSIDE DIMENSIONS 8'Lx6'Wx5'H.
4. VAULT SHALL BE SET FOR 1% SLOPE TO DRAIN.
5. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.
6. HATCH SHALL BE AN H20 RATED, 36"x72" SPRING ASSISTED, HOT DIPPED GALVANIZED DIAMOND PLATE DOUBLE DOOR. FOR TRAFFIC INSTALLATIONS A 30" MANHOLE LID SHALL BE USED INSTEAD OF A HATCH.
7. SUMP PUMP MAY BE REQUIRED ON INSTALLATIONS WHERE DRAIN PIPE CANNOT BE CONNECTED TO ADEQUATE STORM DRAIN SYSTEM. THE APPROVED SUMP PUMP SHALL BE A COMMERCIAL GRADE WATER POWERED VENTURI DESIGN WITH BACKFLOW PREVENTION, SIZED TO PROVIDE 10GPM AT 10 FEET OF HEAD AT THE AVAILABLE SYSTEM WATER PRESSURE. BACKFLOW DEVICE SHALL BE CERTIFIED BY WASHINGTON STATE CERTIFIED BACKFLOW TESTER AFTER INSTALLATION AND PRIOR TO ACCEPTANCE. TEST RESULTS SHALL BE SENT TO CITY OF CAMAS WATER DEPARTMENT.

REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

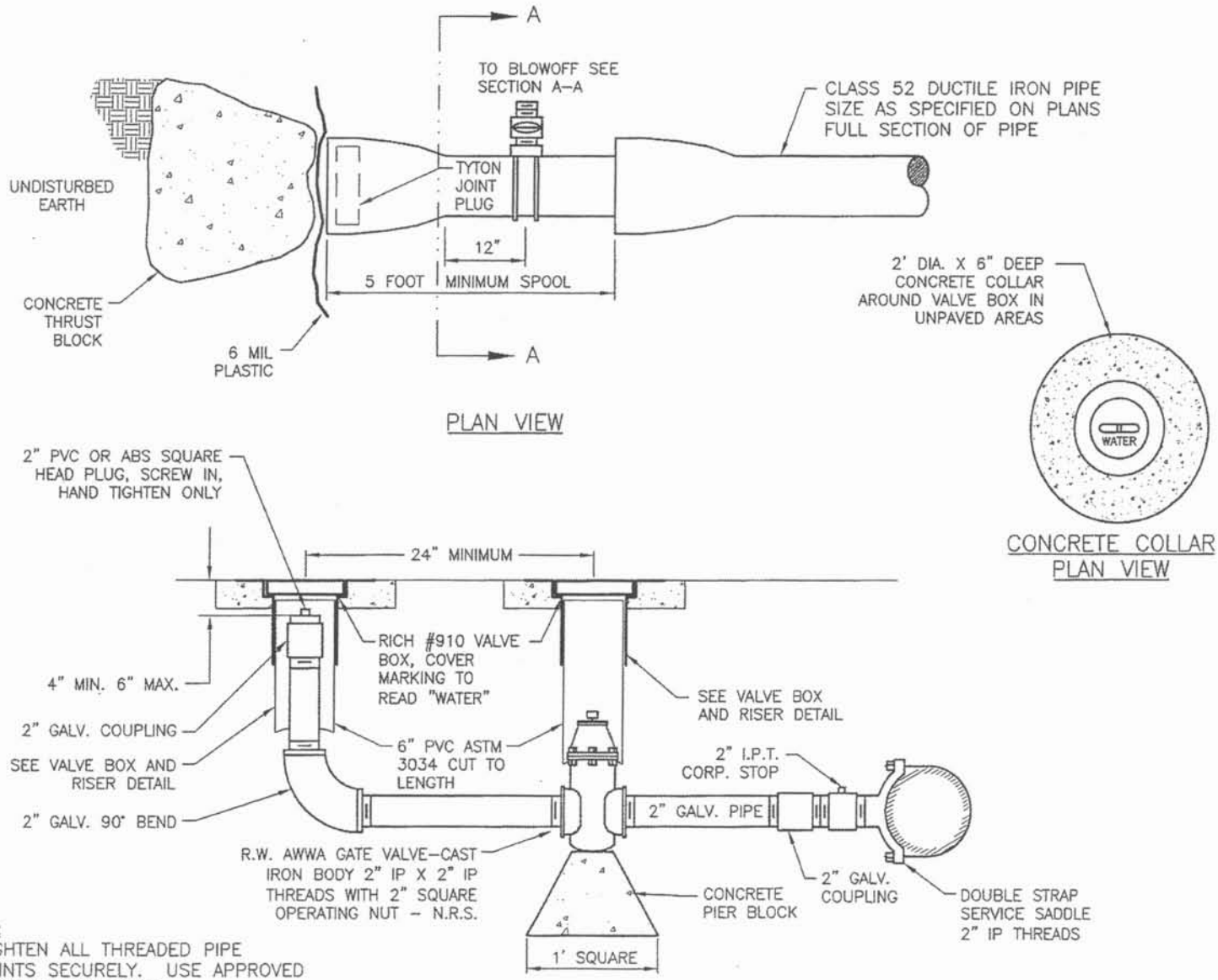
3" WATER SERVICE

DETAIL APPROVED BY: James E. Carothers 5-8-07 DATE

NO SCALE

DETAIL NO. W7b

WTR–WS3.DWG



NOTES:
1. TIGHTEN ALL THREADED PIPE JOINTS SECURELY. USE APPROVED JOINTING COMPOUND.
2. SWAB ALL PIPE WITH CHLORINE MIXTURE PRIOR TO SERVICE.

REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC
3	9/18/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

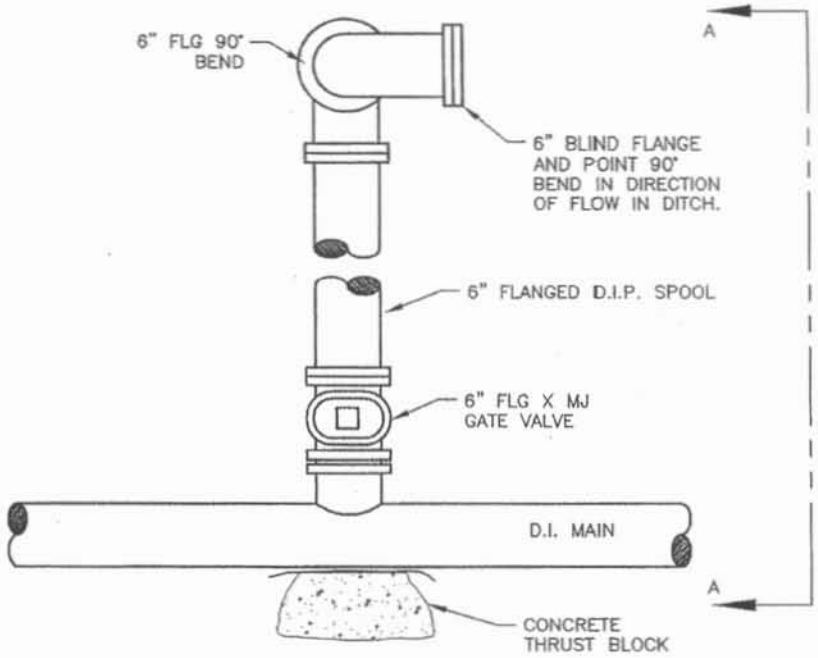
2" STANDARD BLOWOFF

DETAIL APPROVED BY Spencer E. Gottlieb 9-21-07 DATE

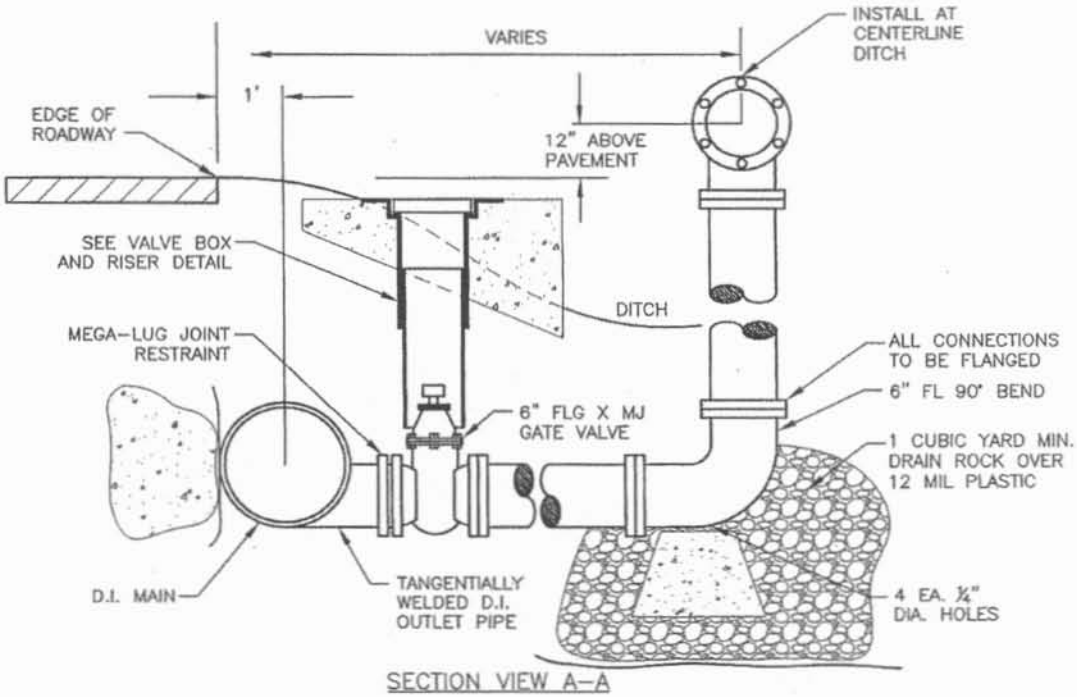
NO SCALE

DETAIL NO. W8

WTR-BLWOFF.DWG



PLAN VIEW



SECTION VIEW A–A

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

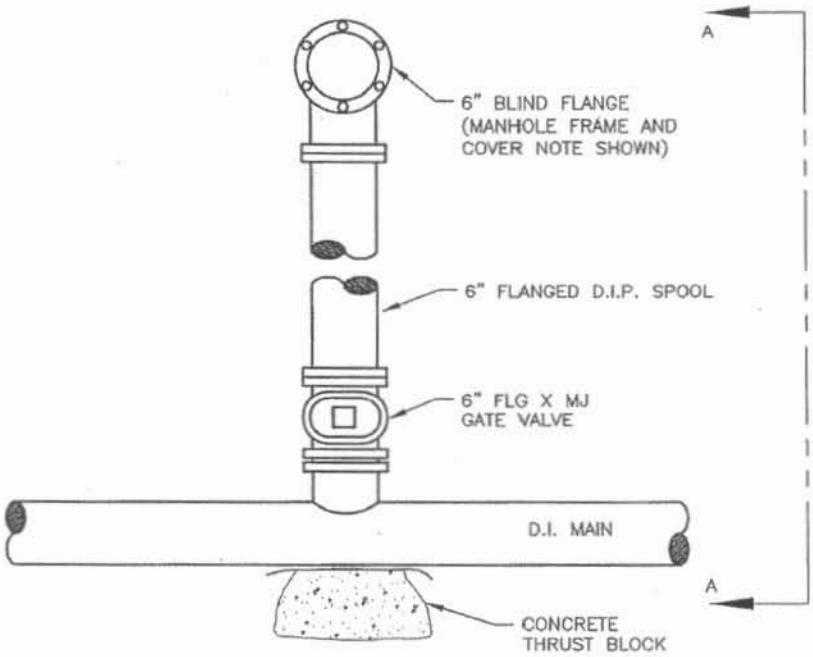
6" LOW POINT BLOW OFF – DITCH

DETAIL APPROVED BY 5-8-07 DATE

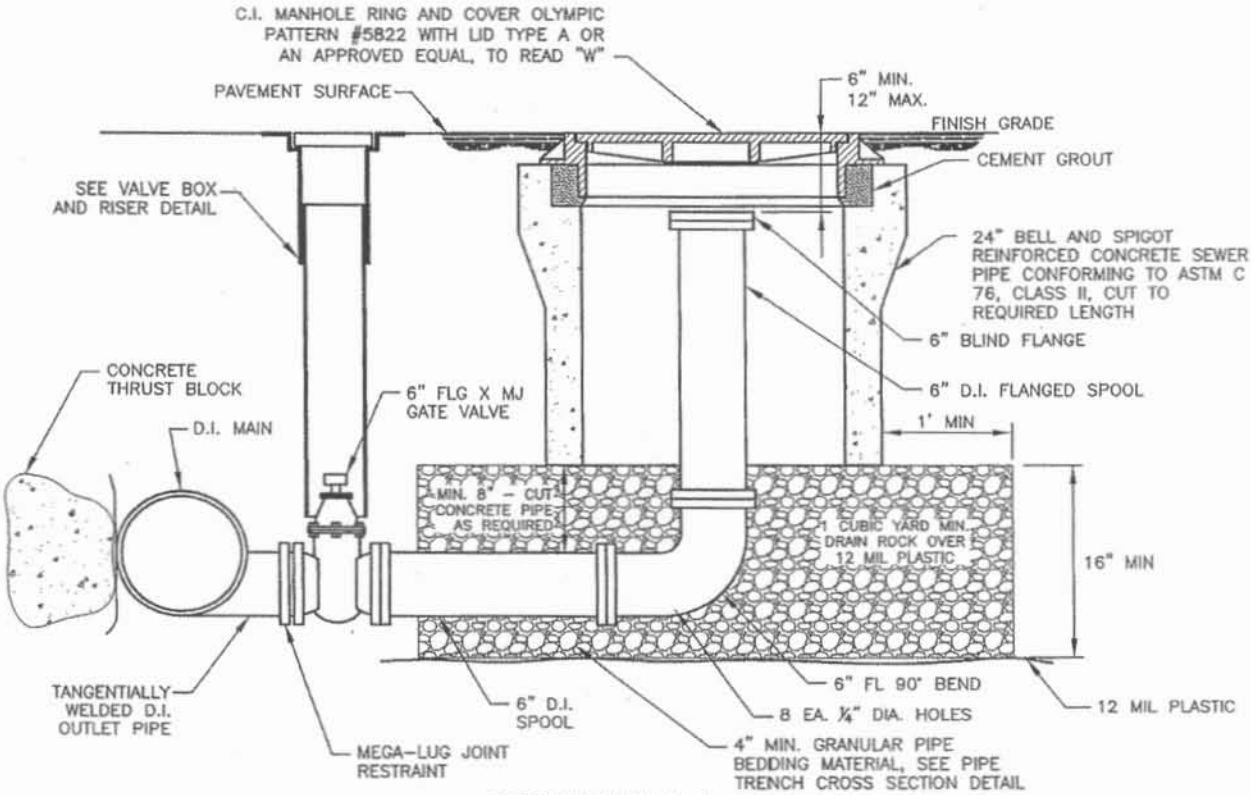
NO SCALE

DETAIL NO. W9

6BLOWOFF.DWG



PLAN VIEW



SECTION VIEW A–A

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

6" LOW POINT BLOW OFF – STREET

James C. Carter 5-8-07

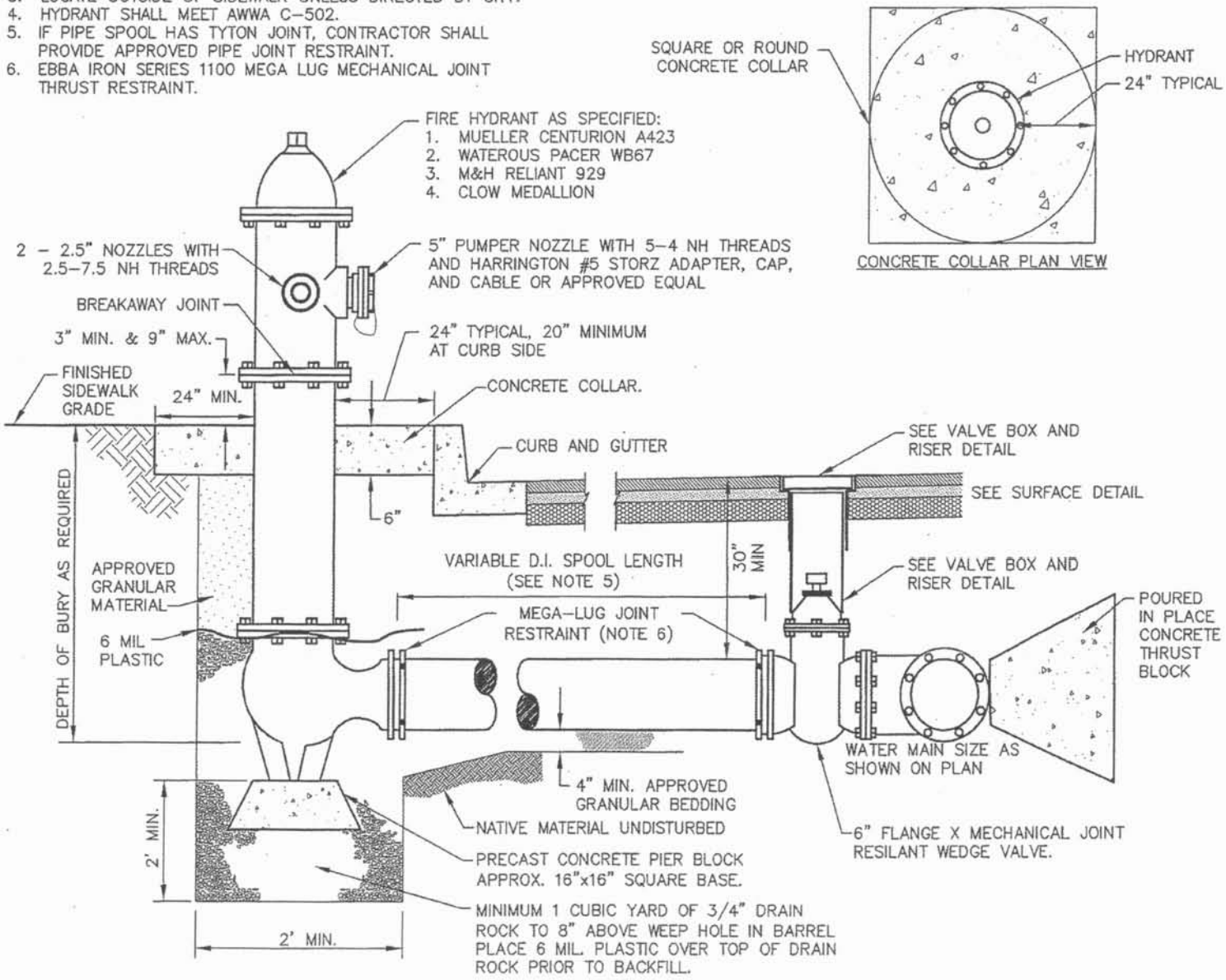
DETAIL APPROVED BY DATE

NO SCALE

DETAIL NO. W10

6BLOWOFF.DWG

NOTES:
1. HYDRANT SHALL BE SET PLUMB.
2. HYDRANT TO BE PAINTED WITH TWO COATS OF PAINT, TYPE AND COLOR SPECIFIED BY CITY.
3. LOCATE OUTSIDE OF SIDEWALK UNLESS DIRECTED BY CITY.
4. HYDRANT SHALL MEET AWWA C-502.
5. IF PIPE SPOOL HAS TYTON JOINT, CONTRACTOR SHALL PROVIDE APPROVED PIPE JOINT RESTRAINT.
6. EBBA IRON SERIES 1100 MEGA LUG MECHANICAL JOINT THRUST RESTRAINT.



REV. NO.	DATE	BY	APPR.
1	7/17/06	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

FIRE HYDRANT

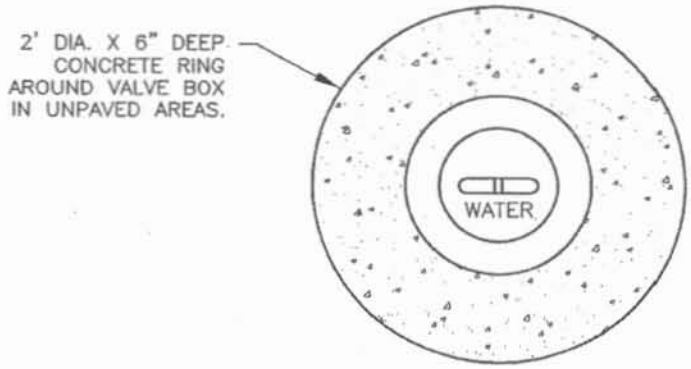
DETAIL APPROVED BY

DATE 5-8-07

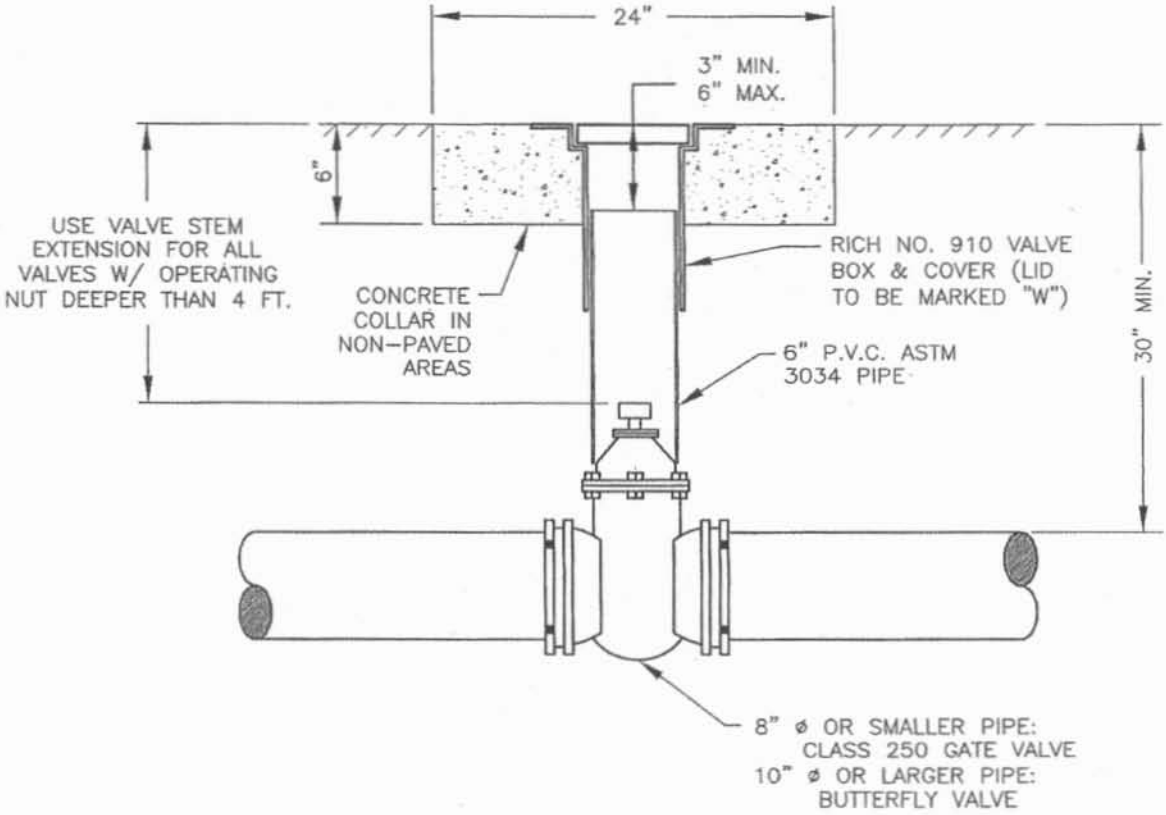
NO SCALE

DETAIL NO. W11

WTR-FHYD.DWG



CONCRETE COLLAR PLAN VIEW



REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

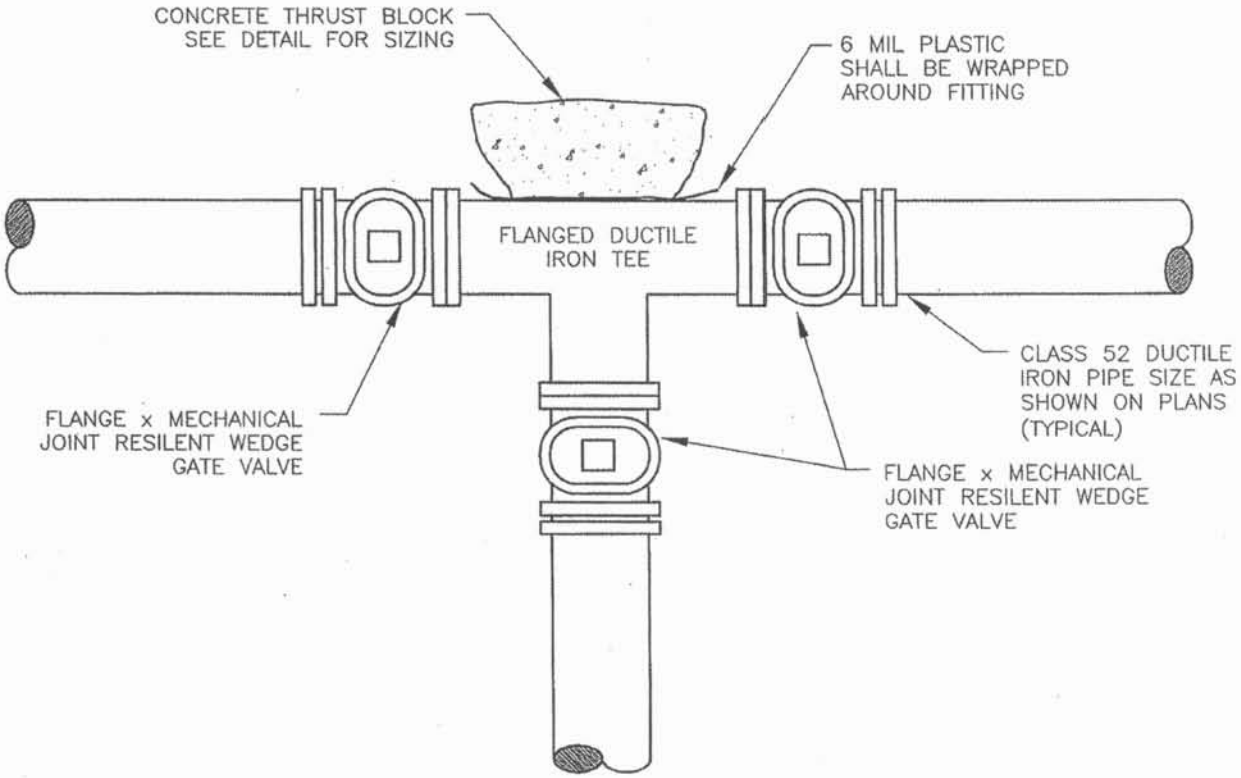
VALVE BOX AND RISER

DETAIL APPROVED BY — DATE 5-8-07

NO SCALE

DETAIL NO. W12

WTR-RISER.DWG



NOTES:

1. VALVES TO BE INSTALLED AT ALL BRANCHES. FOR LONG MAIN LINE RUNS INLINE VALVE SPACING NOT TO EXCEED 500'. LOOP WATER SYSTEM WHEREVER POSSIBLE. KEEP DEAD ENDS TO A MINIMUM.
2. MECHANICAL THRUST RESTRAINT MAY BE USED DUE TO UNSTABLE SOILS OR THE ENGINEER'S DISCRETION

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JH

CITY OF CAMAS ~ WATER DETAIL

WATER MAIN LINE AND VALVE

James E. Carothers 5-8-07

DETAIL APPROVED BY DATE

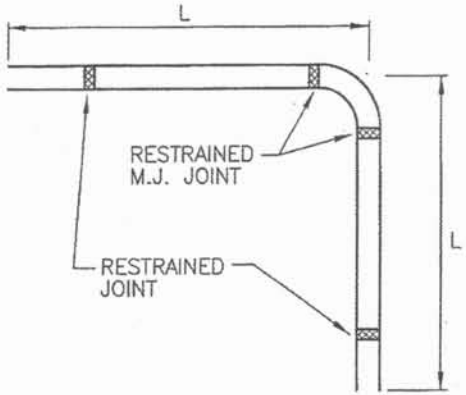
NO SCALE

DETAIL NO.

W13

WTR-VALVE.DWG

FOR HORIZONTAL BENDS:



MINIMUM REQUIRED PIPE LENGTHS
FOR RESTRAINED JOINTS

BEND IN DEGREES	PIPE DIAMETER 6"	8"	10"	12"
90	25'	33'	39'	45'
45	10'	13'	16'	19'
22 1/2	5'	6'	8'	9'
11 1/2	3'	3'	4'	4'

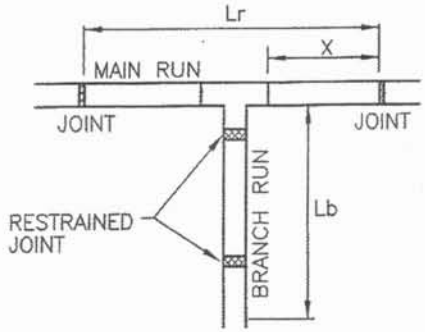
NOTE: CHART USES WORKING PRESSURE OF 200 PSI

FOR PRESSURES OTHER THAN
200 PSI USE:

$$\frac{(L) \times (\text{PRESSURE})}{200}$$

NOTE: FIELD-LOCK GASKETS ARE APPROVED FOR RESTRAINED JOINT INSTALLATION.

TEES:



MINIMUM REQUIRED PIPE LENGTHS
FOR RESTRAINED JOINTS

FOR 6" TEES USE FORMULA
Lb=50 − 1.63 (Lr)

WHERE:
Lb= THE MINIMUM REQUIRED RESTRAINED PIPE (IN FEET) ON THE BRANCH LINE
Lr= THE TOTAL LENGTH (IN FEET) BETWEEN THE FIRST JOINTS ON EITHER SIDE OF THE TEE ON THE MAIN RUN.

NOTE: CONDITIONS TO BE FIELD VERIFIED BY ENGINEER.

IF (X) IS LESS THAN 5 FEET THEN PIPE MUST BE RESTRAINED TWO FULL LENGTHS.

FOR 8" TEE USE FORMULA
Lb=64 − 1.65(Lr)

FOR 12" TEE USE FORMULA
Lb=90 −1.67(Lr)

REV. NO.	DATE	BY	APPR.
1	7/17/06	RES1071	COUNCIL
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

PIPE JOINT RESTRAINT

DETAIL APPROVED BY: 5-8-07
DATE

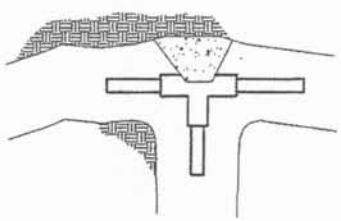
NO SCALE

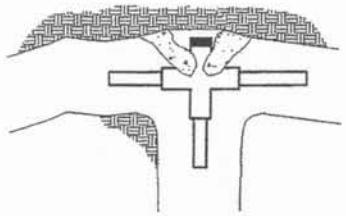
DETAIL NO. W14

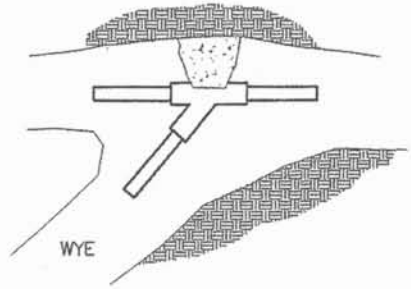
WTR-JOINT.DWG

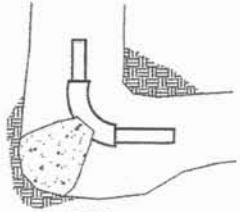
FITTING SIZE	TEE, WYE, PLUG OR CAP	90° BEND PLUGGED CROSS	TEE PLUGGED ON RUN		45° BEND	22 1/2° BEND	11 1/2° BEND
			A1	A2			
4	1.0	1.4	1.9	1.4	1.0	--	--
6	2.1	3.0	4.3	3.0	1.6	1.0	--
8	3.8	5.3	7.6	5.4	2.9	1.5	1.0
10	5.9	8.4	11.8	8.4	4.6	2.4	1.2
12	8.5	12.0	17.0	12.0	6.6	3.4	1.7
14	11.5	16.3	23.0	16.3	8.9	4.6	2.3
16	15.0	21.3	30.0	21.3	11.6	6.0	3.0
18	19.0	27.0	38.0	27.0	14.6	7.6	3.8
20	23.5	33.3	47.0	33.3	18.1	9.4	4.7
24	34.0	48.0	68.0	48.0	26.2	13.6	6.8

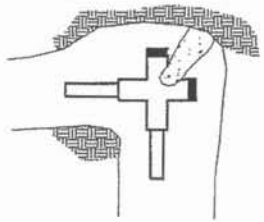
NOTES:
1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH
2. KEEP CONCRETE CLEAR OF JOINTS AND ACCESSORIES.
3. THE REQUIRED THRUST BEARING AREAS FOR SPECIAL CONNECTIONS ARE SHOWN ENCIRCLED ON THE PLANS. e.g. (15) INDICATES 15 SQUARE FEET BEARING AREA REQUIRED.
4. IF NOT SHOWN ON PLANS REQUIRED BEARING AREAS AT FITTINGS SHALL BE AS INDICATED BELOW, ADJUSTED IF NECESSARY, TO CONFORM TO THE TEST PRESSURE(S) AND ALLOWED SOIL BEARING STRESS(ES) STATED IN THE SPECIAL SPECIFICATIONS.
5. BEARING AREAS AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS. TAKE PRECEDENCE OVER BEARING AREAS AND BLOCKING DETAILS SHOWN ON THIS STANDARD DETAILS.
6. ALL FITTINGS SHALL BE WRAPPED IN 6 MIL PLASTIC PRIOR TO THRUST BLOCK PLACEMENT. MAKING SURE THE BOLTS AND NUTS ARE PROTECTED.
7. THRUST BLOCKS SHALL BE GIVEN 72 HOURS TO SET UP PRIOR TO PRESSURIZING LINE OR AS DIRECTED BY CITY INSPECTOR.

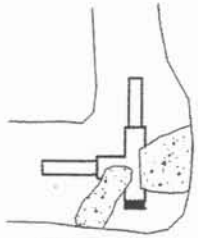

TEE

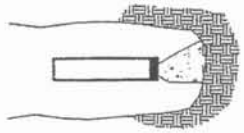

PLUGGED CROSS


WYE


BEND


PLUGGED CROSS


PLUGGED TEE


PLUG OR CAP

NOTES:
ABOVE BEARING AREAS BASED ON TEST PRESSURE OF 150 PSI AND AN ALLOWABLE SOIL BEARING STRESS OF 2,000 LBS. PER SQUARE FOOT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSESM USE THE FOLLOWING EQUATION:
BEARING AREA= (TEST PRESSURE/150)x(2000/SOIL BEARING STRESS)x(TABLE VALUE)

EACH AREA IS 1/2 OF REQUIRED TOTAL AREA

REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

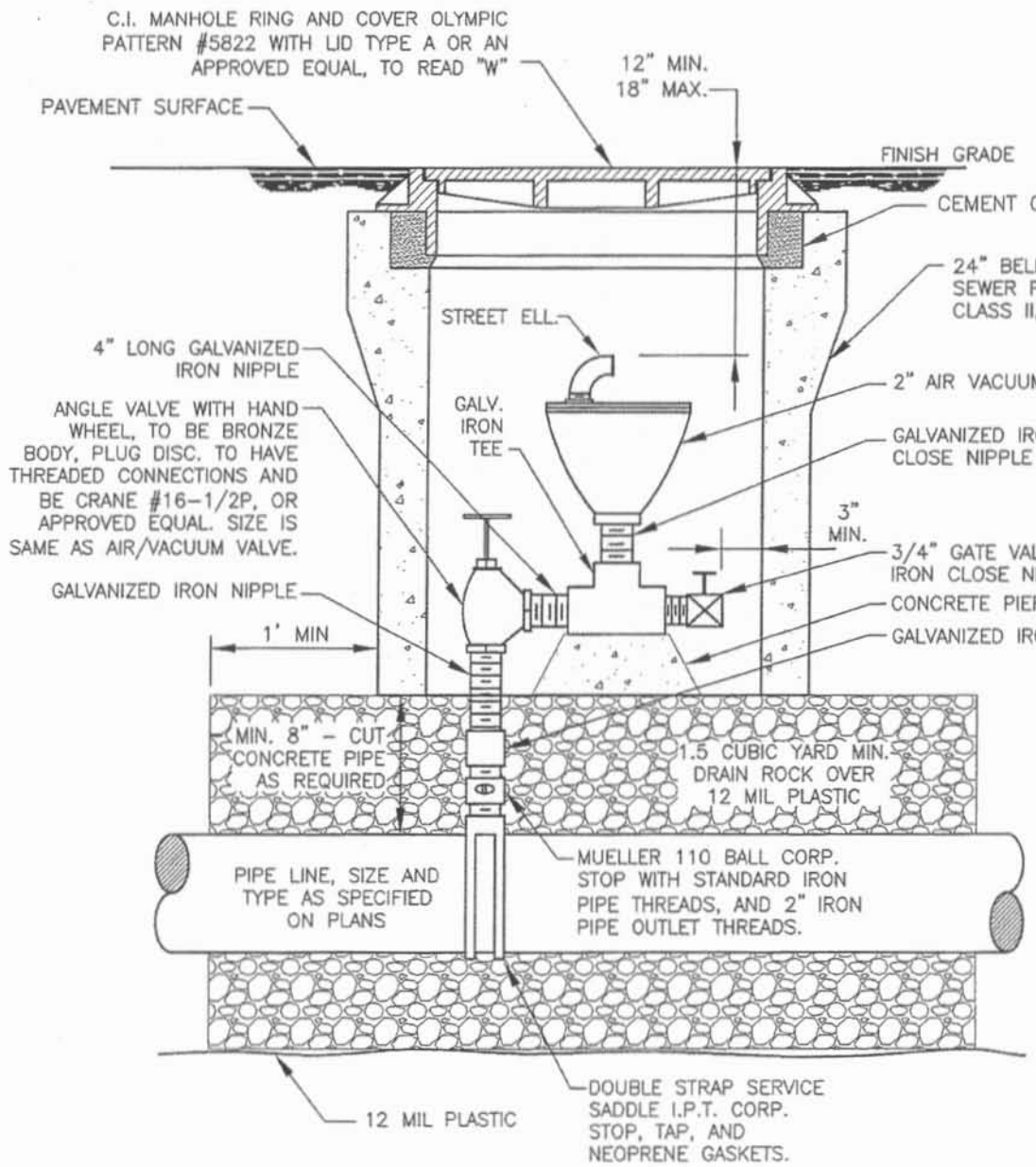
THRUST BLOCK DETAIL

DETAIL APPROVED BY: 5-8-07 DATE

NO SCALE

DETAIL NO. W15

WTR-THRUST.DWG



NOTES:

1. CORPORATION STOP, ANGLE VALVE, AND CONNECTING PIPE SHALL BE THE SAME DIAMETER AS THE AIR INLET.
2. USE APPROVED JOINTING COMPOUND ON ALL THREADED CONNECTIONS.
3. ROTATE AIR/VACUUM VALVE TO PROVIDE MAXIMUM CLEARENCE FOR ACCESS TO ANGLE VALVE.
4. AIR/VACUUM VALVE TO BE EQUAL TO APCO HEAVY DUTY COMBINATION AIR RELEASE VALVE, MODEL #145C.
5. ALL PIPE SHALL BE SCHEDULE40 GALV. STEEL PIPE CONFORMING TO ASTM A 120.
6. DETAILS SHOWN ON THE PLANS TAKE PRECEDENCE OVER THIS STANDARD DETAIL.
7. AIR/VAC ASSEMBLY MAY BE LOCATED ADJACENT TO MAIN LOCATION AT THE DISCRETION OF ENGINEER.

REV. NO.	DATE	BY	APPR.
1	7/17/06	COUNCIL	RES1071
2	5/1/07	SD	JC
3	9/18/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

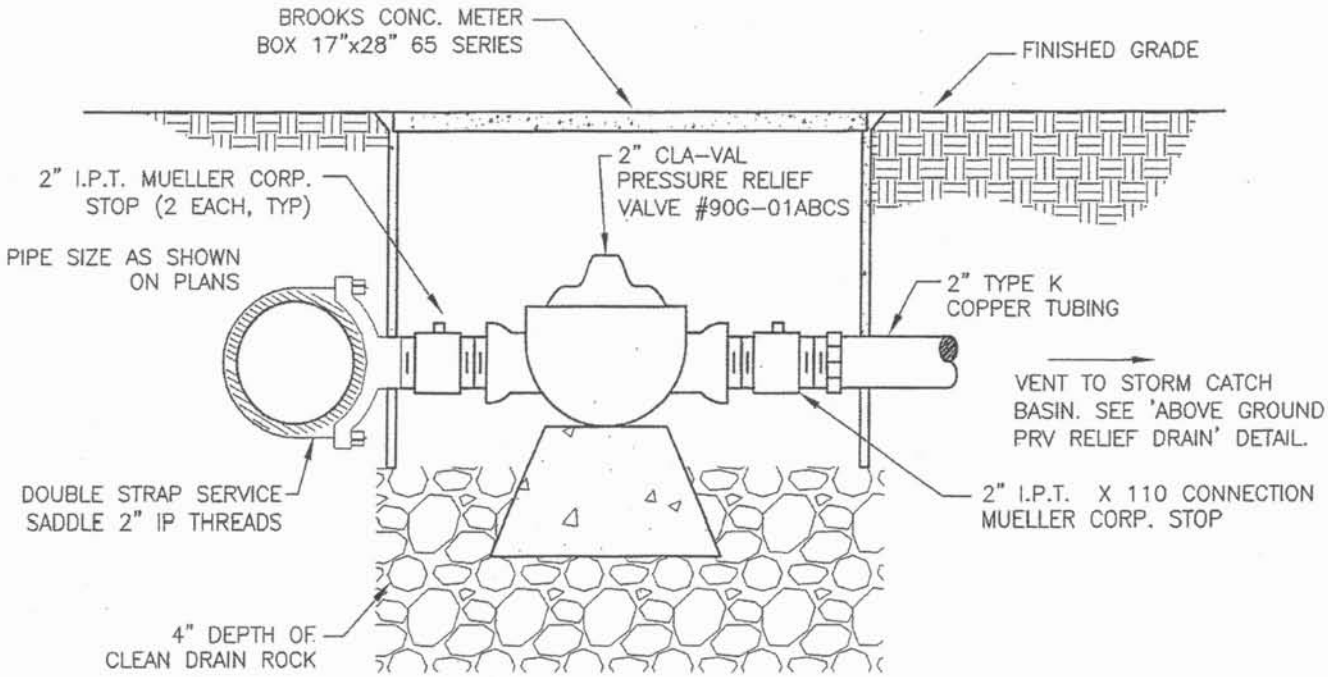
2" AIR/VACUUM RELEASE VALVE

DETAIL APPROVED BY: James E. Carothers 9-21-07 DATE

NO SCALE

DETAIL NO. W16

WTR-2VACVLV.DWG



REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

2" PRESSURE RELIEF VALVE ASSEMBLY

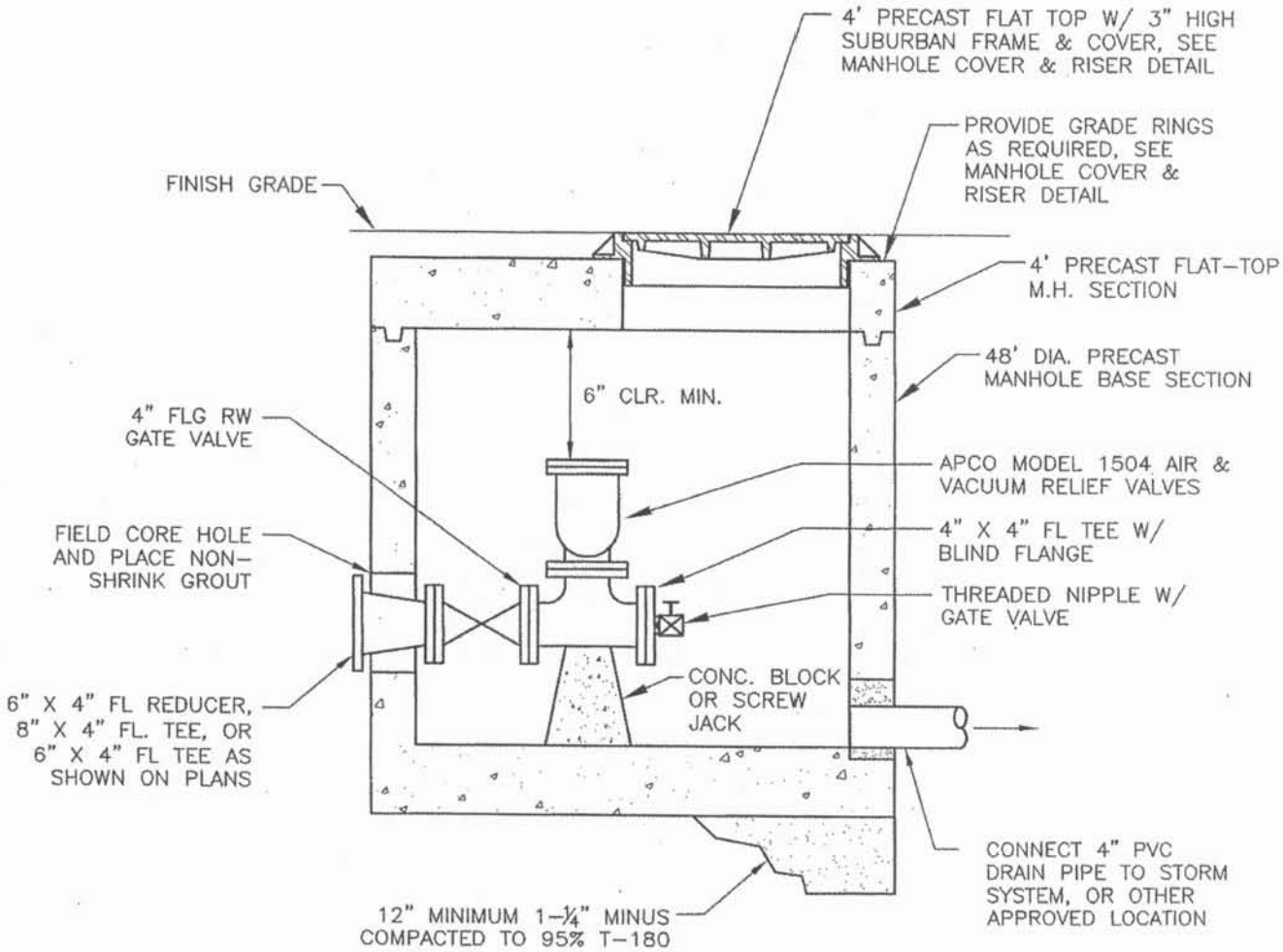
DETAIL APPROVED BY

DATE 5-8-07

NO SCALE

DETAIL NO. W17

2PRV.DWG



NOTES:

1. MANHOLE SHALL CONFORM TO ASTM C-478.
2. MASTIC SEAL REQUIRED ON ALL KEYLOCK JOINTS.
3. VAULT SHALL BE SET FOR 1% SLOPE TO DRAIN.
4. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.
5. SUMP PUMP MAY BE REQUIRED ON INSTALLATIONS WHERE DRAIN PIPE CANNOT BE CONNECTED TO ADEQUATE STORM DRAIN SYSTEM. THE APPROVED SUMP PUMP SHALL BE A COMMERCIAL GRADE WATER POWERED VENTURI DESIGN WITH BACKFLOW PREVENTION, SIZED TO PROVIDE 10GPM AT 10 FEET OF HEAD AT THE AVAILABLE SYSTEM WATER PRESSURE. BACKFLOW DEVICE SHALL BE CERTIFIED BY WASHINGTON STATE CERTIFIED BACKFLOW TESTER AFTER INSTALLATION AND PRIOR TO ACCEPTANCE. TEST RESULTS SHALL BE SENT TO CITY OF CAMAS WATER DEPARTMENT.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

4" VACUUM RELIEF VALVE

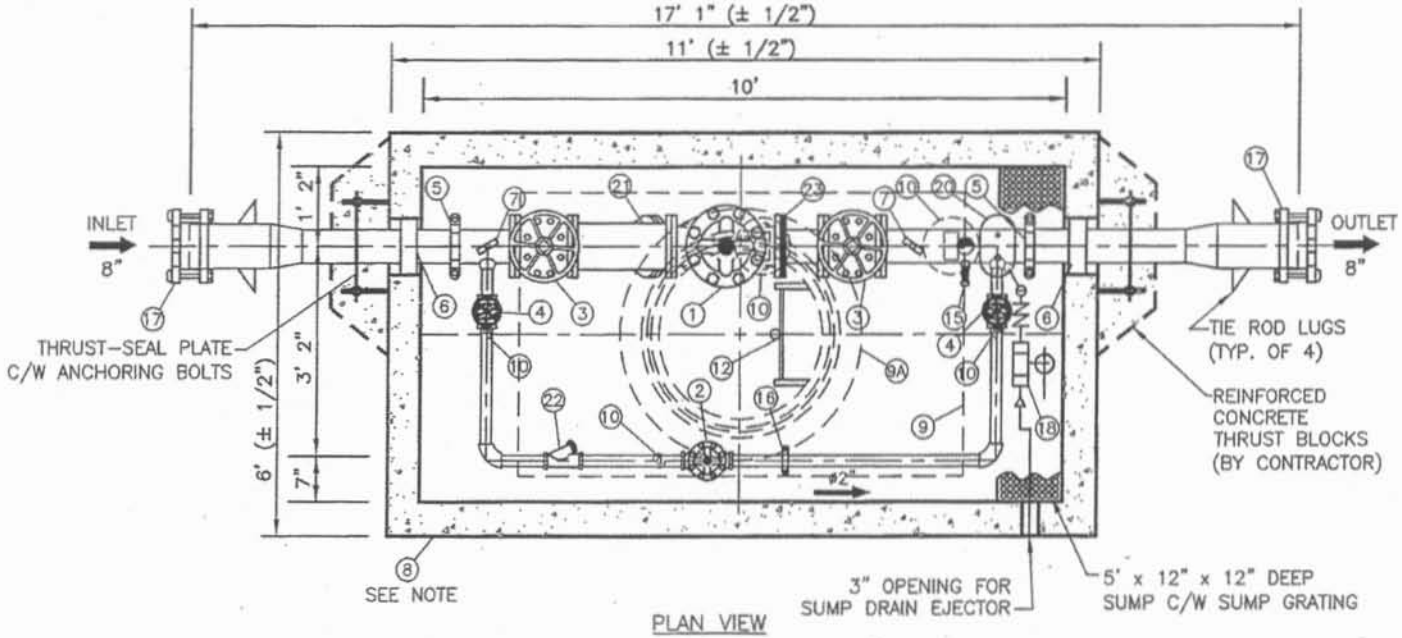
Jason E. Carothers 5-8-07

DETAIL APPROVED BY DATE

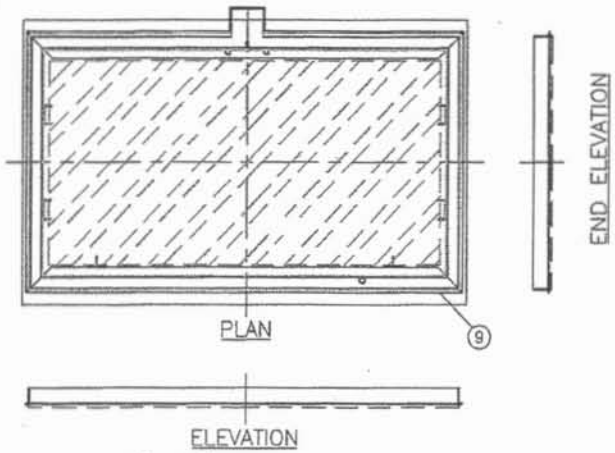
NO SCALE

DETAIL NO. W18

WT4-4ARV.DWG



PLAN VIEW



NOTES:
VAULT #10565 (H20 LOADING) INSIDE DIMENSIONS 10'LX5'WX6'6"H

STANDARD FABRICATION & FINISHING SPECIFICATION:
ALL 2" AND SMALLER PIPE TO BE THREADED BRASS. ALL 3" AND LARGER PIPE, INSIDE WETTED SURFACES TO BE SANDBLASTED, EPOXY LINED AND COATED TO AWWA C-210 AND NSF-61 SPECIFICATION. FINISH COATING WILL BE BLUE ENAMEL.

FABRICATED STEEL PIPE & FITTINGS TO BE SCHEDULE NO. 40 STEEL PIPE FOR SIZES TO 10" AND ⅜" WALL FOR 12" AND LARGER.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS - WATER DETAIL

6"X2" PRV STATION W/ 3" RELIEF

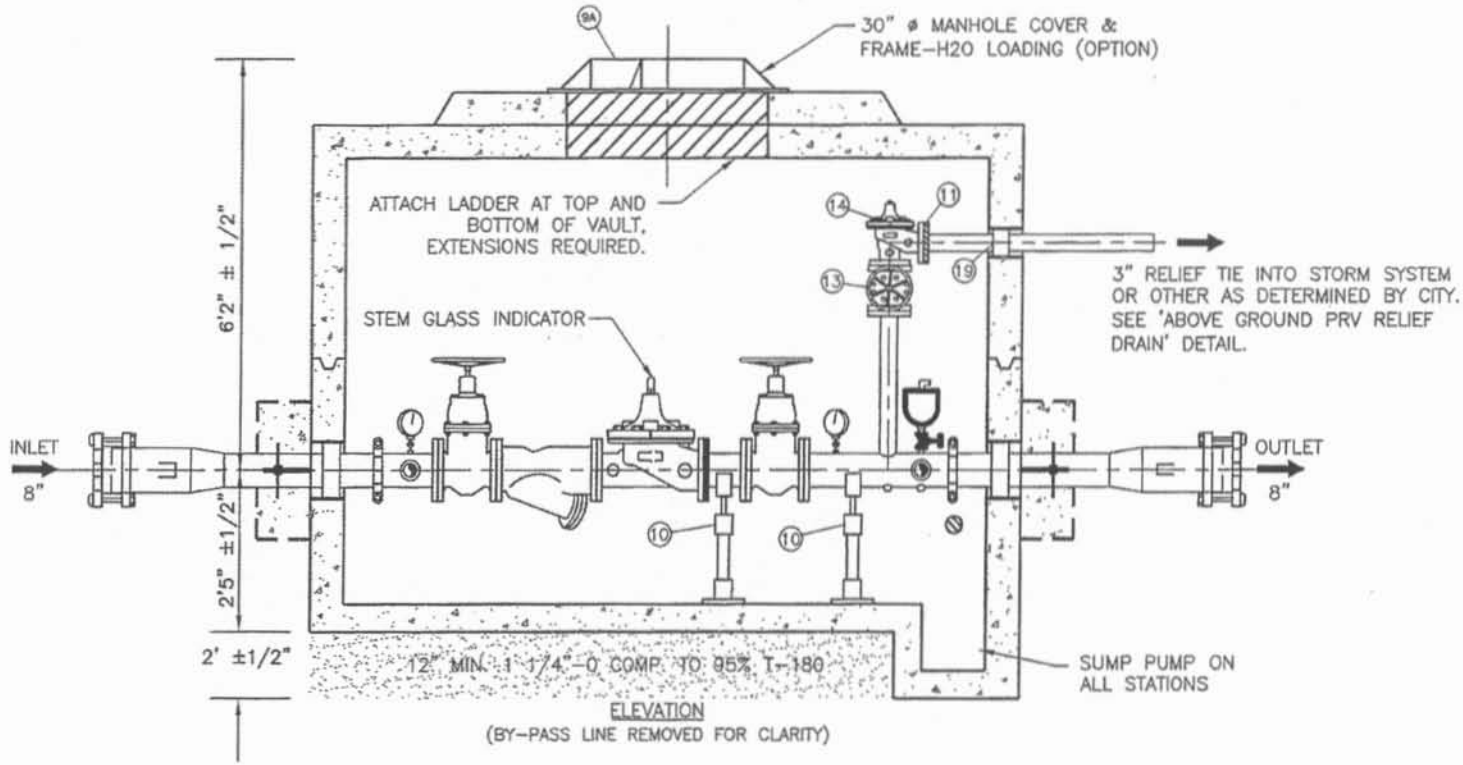
DETAIL APPROVED BY

DATE 5-8-07

NO SCALE

DETAIL NO. W19a

WTR-PRV3RELIEF.DWG



ELEVATION
(BY-PASS LINE REMOVED FOR CLARITY)

MATERIALS

ITEM	QTY.	DESCRIPTION
1	1	6" CLA-VAL 90-01YBCS PRESSURE REDUCING VALVE
		C/W X 101 POSITION INDICATOR, DIBT-#150 FLG (15-75PSI)
2	1	2" CLA-VAL 90-01YBCS PRESSURE REDUCING VALVE
		C/W X 101 POSITION INDICATOR, DIBT-THREADED (15-75 PSI)
3	2	6" MUELLER A2360-6W41 NRS GATE VALVE C/W HANDWHEEL -#125 FLGD
4	2	2" MUELLER A2360-8 RW NRS GATE VALVE C/W HANDWHEEL-THREADED
5	2	6" VICTAULIC #07 COUPLING
6	2	6" PIPE SEAL ASSEMBLY
7	2	4" WIKA (0-200PSI) PRESSURE GAUGE C/W GAUGE COCK
8	1	#10565 PRECAST CONCRETE VAULT C/W WHITE INTERIOR, BLACK EXTERIOR
9	1	36"x72" ALUMINUM HATCH W/ SPRING ASSIST
10	5	ADJUSTABLE PIPE SUPPORTS
11	1	3" VICTAULIC #741 FLANGE ADAPTER ADAPTOR

ITEM	QTY.	DESCRIPTION
12	1	ALUMINUM LADDER WITH LADDER-UP ASSEMBLY
13	1	3" MUELLER A2360-6W41 NRS GATE VALVE C/W
		HANDWHEEL-#125 FLGD.
14	1	3" CLA-VAL 50A-01B PRESSURE RELIEF VALVE
		C/W DIBT-150# FLG (20-200 PSI)
15	1	3/4" HOSE BIB ASSEMBLY
16	1	2" VICTAULIC #07 COUPLING
17	1	8" SMITH BLAIR ST X DI TRANSITION COUPLING
18	1	SUMP DRAIN INJECTOR
19	1	3" PIPE SEAL ASSEMBLY
20	1	1" APCO 143C.1 COMB. A.R.V. C/W ISOLATION VALVE
21	1	6" MUELLER 758 Y-STRAINER - #125 FLGD
22	1	2" MUELLER 35' Y-STRAINER - THD
23	1	6" VICTAULIC #741 FLANGE ADAPTOR

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS - WATER DETAIL

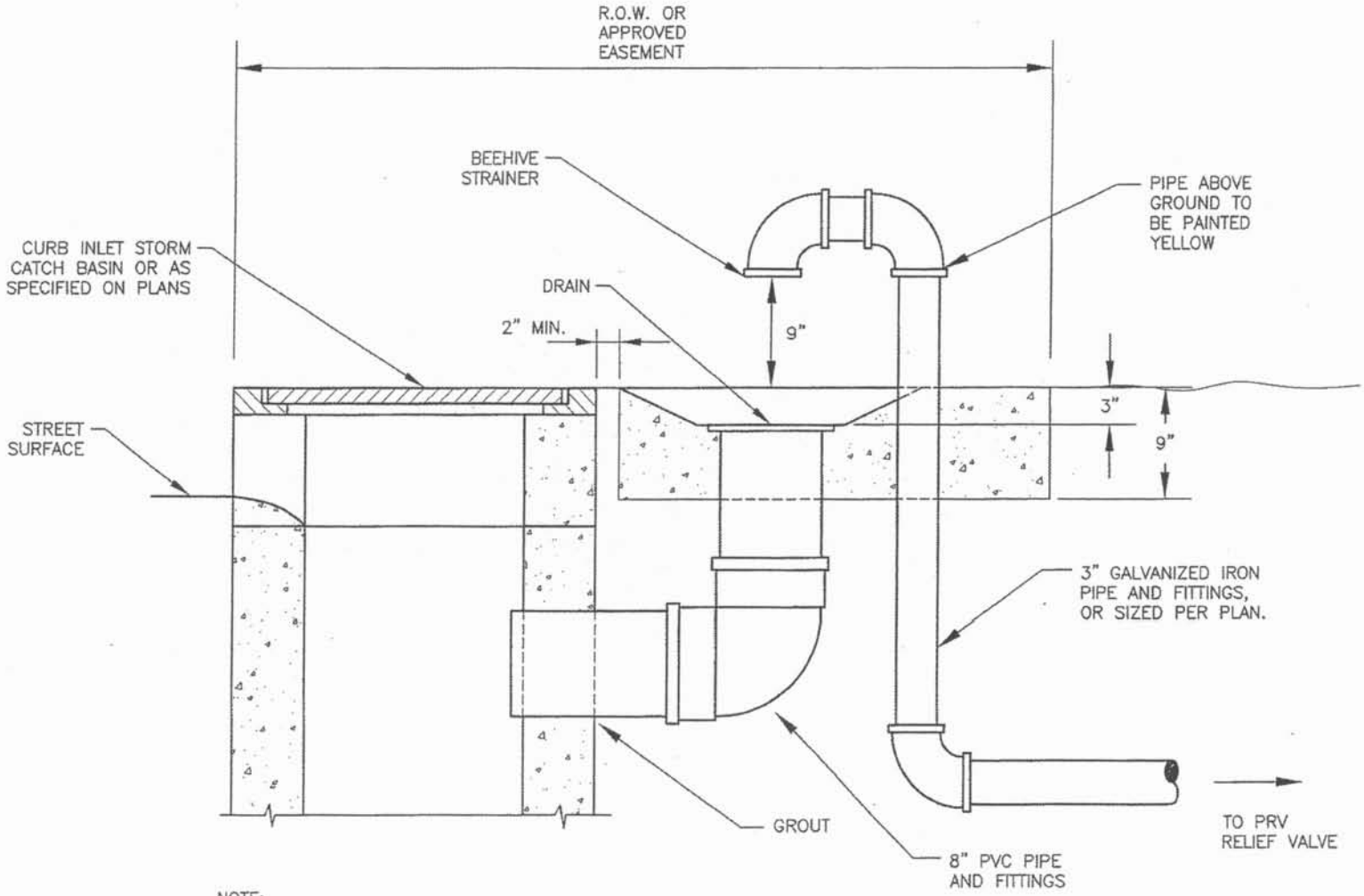
6"X2" PRV STATION W/ 3" RELIEF

DETAIL APPROVED BY: James P. Gaither 5-8-07 DATE

NO SCALE

DETAIL NO. W19b

WTR-PRV3RELIEF.DWG



NOTE:
1. IF CATCH BASIN IS NOT AVAILABLE, A DEDICATED STORM LATERAL MAY BE REQUIRED.

REV. NO.	DATE	BY	APPR.
1	5/1/06	SD	JC

CITY OF CAMAS ~ WATER DETAIL

ABOVE GROUND PRV RELIEF DRAIN

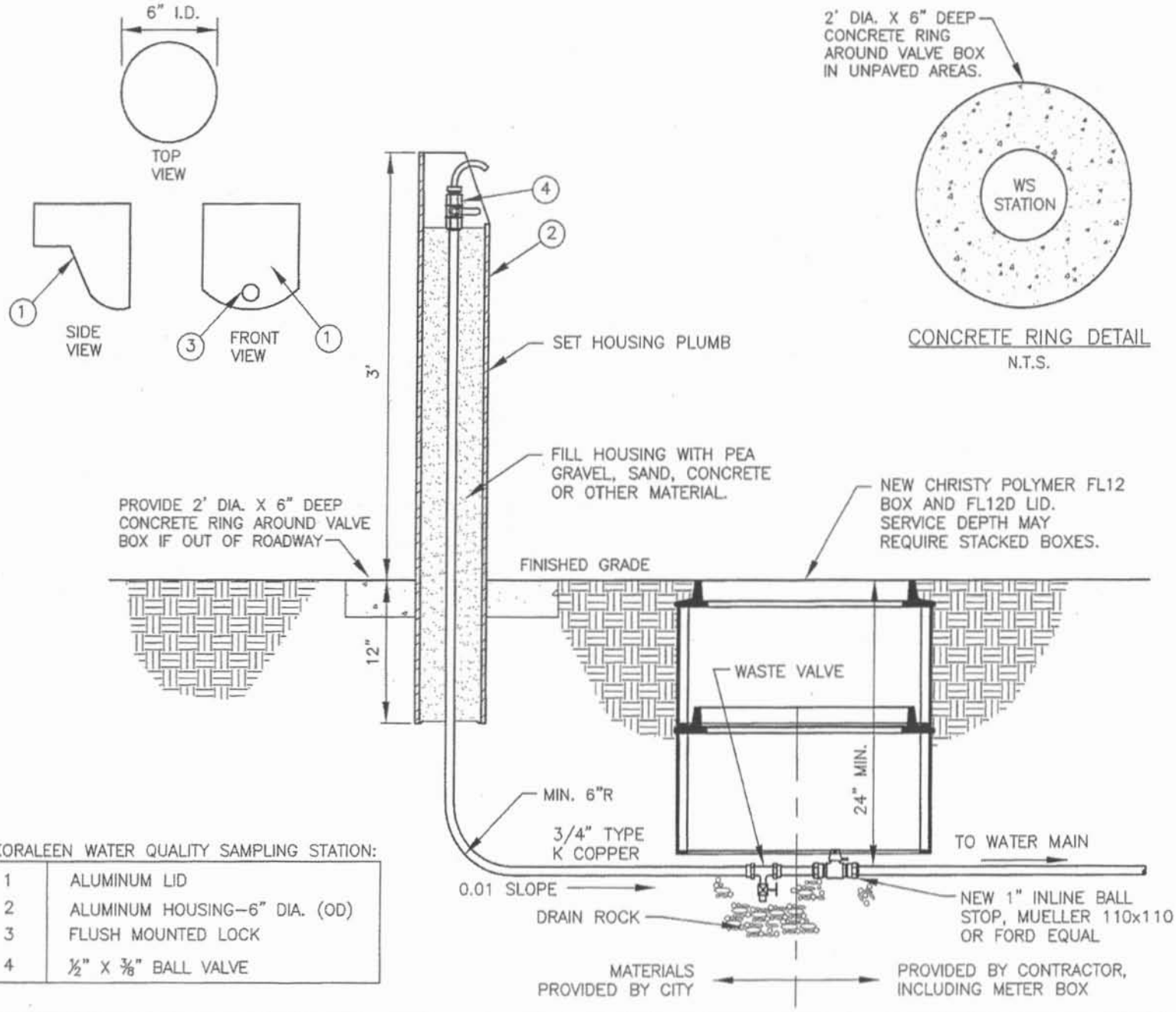
DETAIL APPROVED BY

DATE 5-8-07

NO SCALE

DETAIL NO. W20

WTR-RELIEFDRN.DWG



KORALEEN WATER QUALITY SAMPLING STATION:

1	ALUMINUM LID
2	ALUMINUM HOUSING–6" DIA. (OD)
3	FLUSH MOUNTED LOCK
4	½" X ⅜" BALL VALVE

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS – WATER DETAIL

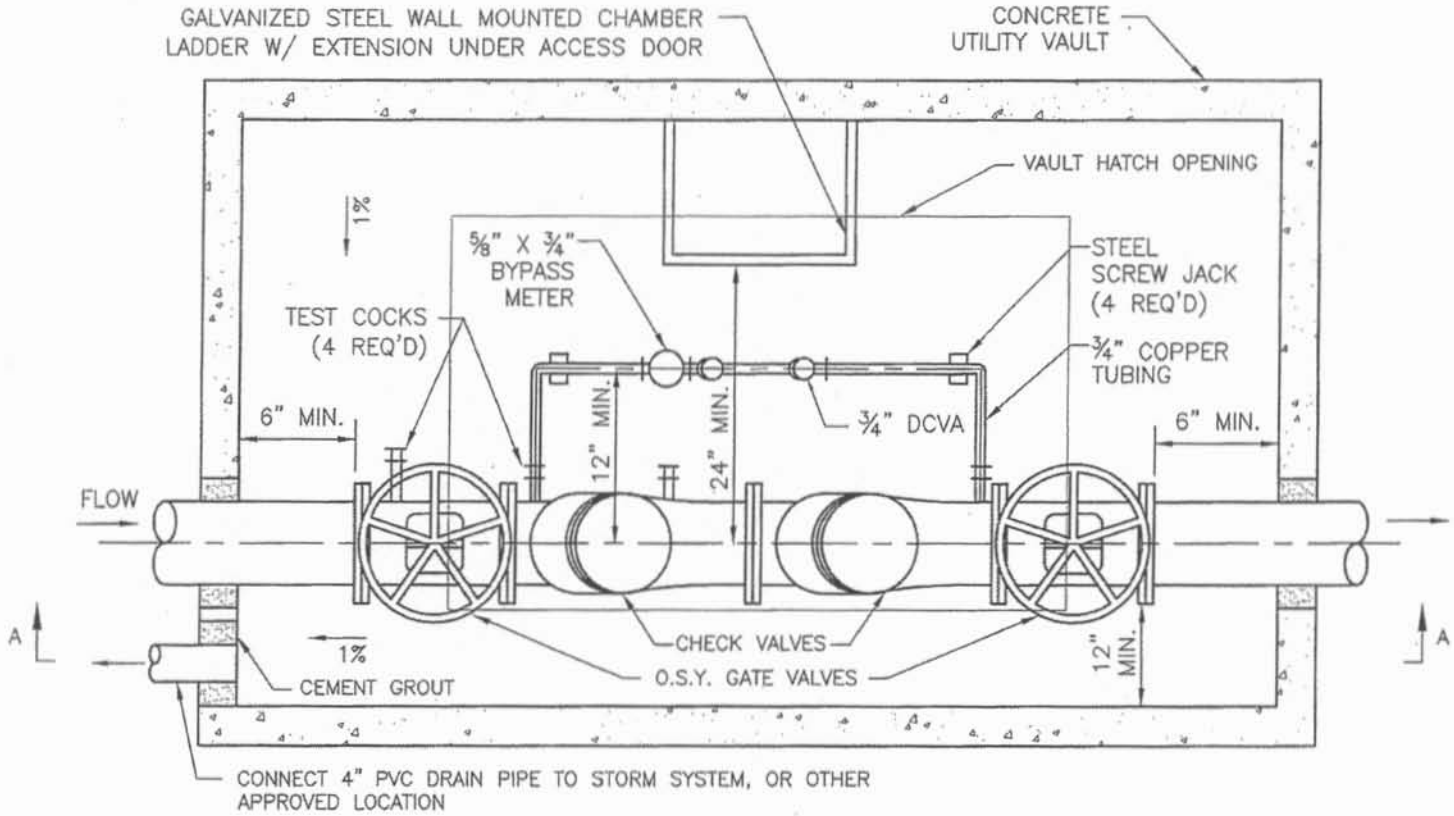
WATER SAMPLING STATION

DETAIL APPROVED BY: 5-8-07 DATE

NO SCALE

DETAIL NO. W21

WTR–WQSMPL.DWG



PLAN VIEW

DOUBLE CHECK DETECTOR VALVE ASSY. NOTES:

1. APPROVED DOUBLE CHECK DETECTOR VALVE ASSEMBLY TO LAY HORIZONTAL WITH THE GROUND, SHALL BE INSTALLED ON FIRE PROTECTION SYSTEMS WHEN CONNECTED TO POTABLE WATER SUPPLY. THE ASSEMBLY SHALL BE A COMPLETE ASSEMBLY INCUDING UL LISTED RESILIENT SEATED OSY SHUTOFF VALVES AND TEST COCKS. THE UNIT SHALL BE UL/FM APPROVED WITH UL/FM APPROVED OSY SHUTOFF VALVES. THE AUXILIARY LINE SHALL CONSIST OF AN APPROVED BACKFLOW PREVENTER AND WATER METER. THE ASSEMBLY SHALL MEET THE BASIC REQUIREMENTS OF ASSE 1048; AWWA STD. C510 FOR DOUBLE CHECK VALVES, AND BE APPROVED BY THE FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AT THE UNIVERSITY OF SOUTHERN CALIFORNIA.
2. SYSTEM SHALL BE DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE.
5. THE WATER LINE SHALL BE DISINFECTED, FLUSHED, AND PRESSURE TESTED PRIOR TO INSTALLING THE BACKFLOW ASSEMBLY. THE BACKFLOW ASSEMBLY SHALL BE PROTECTED FROM FREEZING AND FLOODING.
4. ALL PIPE, VALVE, AND FITTING JOINTS FROM THE SUPPLY MAIN SHALL BE FLANGED AND RESTRAINED. MINIMUM COVER 30". GROUT PIPE ENTRANCE AND EXIT IN VAULT WITH WATER TIGHT GROUT.
5. THE BACKFLOW ASSEMBLY SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE AND ALSO YEARLY THEREAFTER BY A WASHINGTON STATE CERTIFIED BACKFLOW TESTER. TEST RESULTS SHALL BE SENT TO THE CITY OF CAMAS WATER DEPARTMENT.
6. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

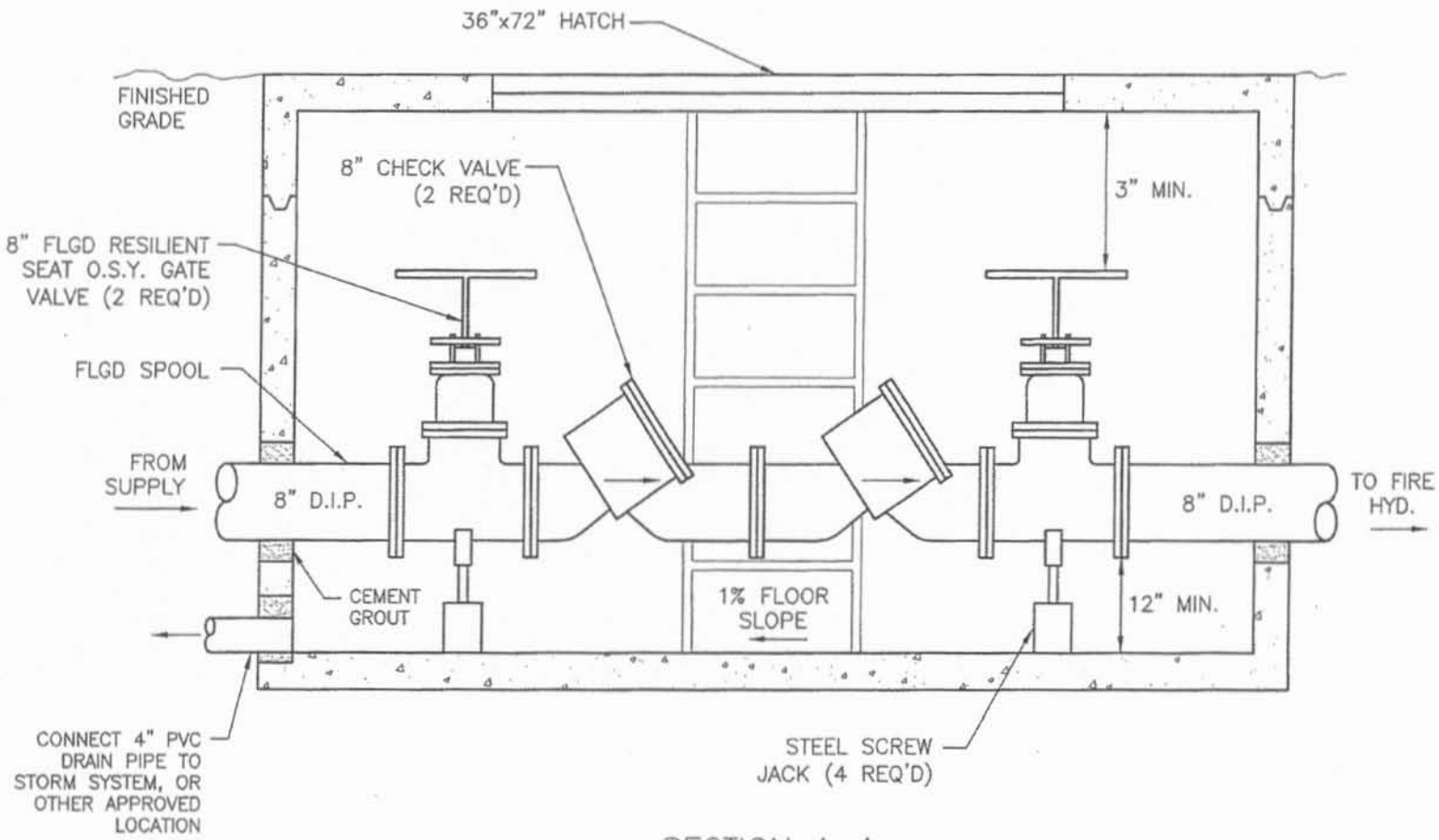
STANDARD DOUBLE CHECK DETECTOR VALVE ASSY.

DETAIL APPROVED BY: 5-3-07 DATE

NO SCALE

DETAIL NO. W22a

WTR-DCDVA.DWG



SECTION A–A

VAULT CONSTRUCTION NOTES:

1. VAULT SHALL BE PRE-APPROVED PRIOR TO INSTALLATION.
2. VAULT SHALL BE INSTALLED AT PROPERTY LINE OR EASEMENT LINE AND ON OWNERS PROPERTY.
3. VAULTS SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
4. APPROVED VAULT SHALL BE RATED FOR H20 LOADING AND INCLUDE AN EXTENSION LADDER, MINIMUM INSIDE DIMENSIONS 8'Lx5'Wx6'H.
5. VAULT SHALL BE SET FOR 1% SLOPE TO DRAIN.
6. ALL BACKFILL SHALL BE APPROVED GRANULAR MATERIAL.
7. HATCH SHALL BE AN H20 RATED, 36"x72" SPRING ASSISTED, HOT DIPPED GALVANIZED DIAMOND PLATE DOUBLE DOOR. FOR TRAFFIC INSTALLATIONS A 30" MANHOLE LID SHALL BE USED INSTEAD OF A HATCH.
8. SUMP PUMP MAY BE REQUIRED ON INSTALLATIONS WHERE DRAIN PIPE CANNOT BE CONNECTED TO ADEQUATE STORM DRAIN SYSTEM. THE APPROVED SUMP PUMP SHALL BE A COMMERCIAL GRADE WATER POWERED VENTURI DESIGN WITH BACKFLOW PREVENTION, SIZED TO PROVIDE 10GPM AT 10 FEET OF HEAD AT THE AVAILABLE SYSTEM WATER PRESSURE. BACKFLOW DEVICE SHALL BE CERTIFIED BY WASHINGTON STATE CERTIFIED BACKFLOW TESTER AFTER INSTALLATION AND PRIOR TO ACCEPTANCE. TEST RESULTS SHALL BE SENT TO CITY OF CAMAS WATER DEPARTMENT.

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS - WATER DETAIL

STANDARD DOUBLE CHECK DETECTOR VALVE ASSY.

DETAIL APPROVED BY: [signature] DATE: 5-3-07

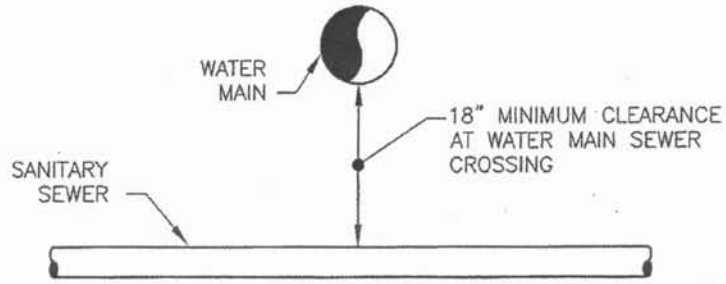
NO SCALE

DETAIL NO. W22b

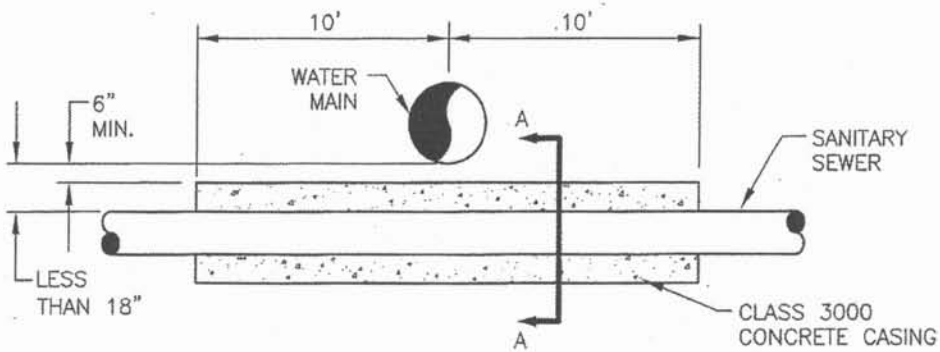
WTR-DCDVA.DWG

NOTE:

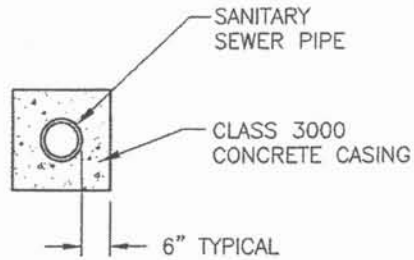
1. IF VERTICAL CLEARANCE IS LESS THAN 18", THE SEWER PIPE SHALL BE ENCASED. MINIMUM CLEARANCE WITH CASING SHALL BE 6".
2. CASING SHALL BE A 20' LENGTH OF CLASS 200 P.V.C. WITH BOTH ENDS PLUGGED, OR 6" CLASS 3000 CEMENT CONCRETE AS SHOWN BELOW.
3. MINIMUM VERTICAL CLEARANCE FOR WATER-ENCASEMENT, WATER-STORM OR SANITARY-STORM CROSSINGS SHALL BE 6".



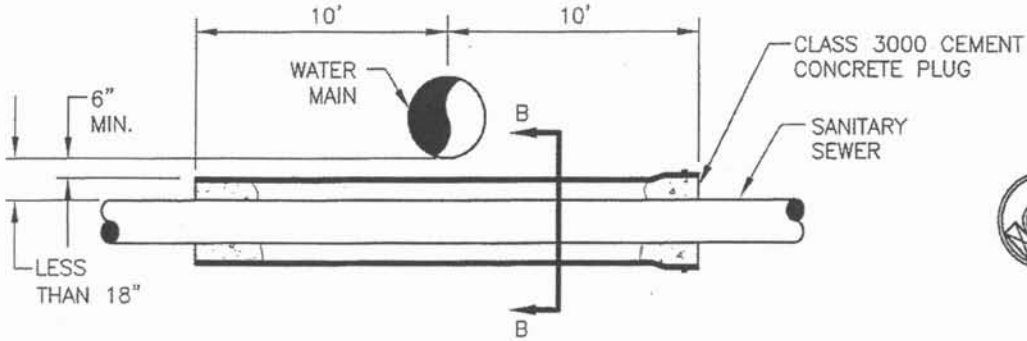
CROSSING WITHOUT ENCASEMENT



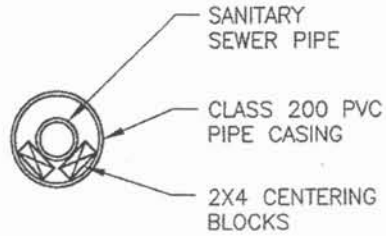
CEMENT CONCRETE ENCASEMENT



SECTION A-A



PVC PIPE ENCASEMENT



SECTION B-B

REV. NO.	DATE	BY	APPR.
1	5/1/07	SD	JC

CITY OF CAMAS ~ WATER DETAIL

UTILITY CROSSING DETAIL

DETAIL APPROVED BY: Steven C. Cantellow

DATE: 5-8-07

NO SCALE

DETAIL NO. W23

CROSSING.DWG

Appendix F

City of Camas 2008 Water Quality Report

City of Camas Public Water System ID 108002

2008 Water Quality Report

City of Camas Consumer Confidence Report

HOW TO CONTACT US:

Water Department

817-1567

Operations Center

817-1563

Billing (Finance) Dept.

834-2462

Finance Dept. Location:

616 NE Fourth Avenue

Camas, WA 98607

Emergency After Hours/

Holidays: 737-0592

City of Camas Website:

www.ci.camas.wa.us

City Council Meetings:

Two Workshops/Council meetings every 1st and 3rd Monday.

Workshops start at 4:30 p.m., followed by a Council meeting at 7:00 p.m.

Note: If Monday is a holiday, the workshop and council meeting are on the following business day.

The City of Camas Water Department is Ensuring the Quality of Your Water is Safe

Attention Non-English Speaking Customers

This report contains important information about your drinking water. Translate it or speak with someone who can translate it for you.

Russian

Это сообщение содержит важную информацию о вашей питьевой воде. Переведите это или говорите с кем - то, кто может перевести это для Вас.

Spanish

Este informe contiene informa-ción importante acerca de su agua potable. Haga que alguien lo traduzca para usted, o hable con alguien que lo entienda.

2008 Water Quality Report

We are pleased to report that our drinking water is safe, and meets Federal and State requirements.

At the City of Camas we understand how important it is to ensure the quality of the water we provide. The health of our consumers and their families is paramount. Our goal is to provide you with a safe and dependable supply of drinking water. We work diligently to provide top quality water to more than 16,700 consumers (this equates to 6,801 utility customers which include residential, industrial and commercial users) each day. We are therefore pleased to report that our drinking water is safe, and surpasses all State and Federal health standards.

We ask that all of our customers help us protect our water sources, which are the heart of our community, our way of life, and our children's future. This report provides a summary of the tests and processes performed to ensure the safety of your drinking water. For more information or questions about this report, please contact Mike Stevens at 817-1563, extension 4283. This report can also be found on our website at www.ci.camas.wa.us.

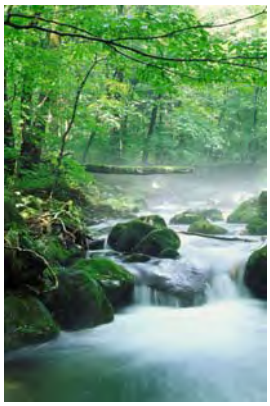
Conserve and Protect Our Water Resources

2009 Rate Increase

Financial Consulting Solutions Group conducted a water, sewer, sanitation, and stormwater rate study that was presented to the City Council on February 2, 2009. Subsequently, an increase in the water rates was approved and became effective in April, 2009. For a typical customer using approximately 800 cubic feet of water per month, the water portion of their bill will increase 82 cents per month. In the coming months, City staff will be briefing the City Council about necessary system improvements and future rate implications. The rate study presentation can be viewed at the City of Camas website at www.ci.camas.wa.us.

What's Ahead

Water Is a precious resource. Let's use It wisely!



Our water system continues to change and expand to keep pace with the demand for reliable clean water for industrial, commercial, and residential use. In 2008 the Department of Ecology granted Camas new water rights that will meet the projected demand for the next 20 years. As part of the water right's grant, the City will forgo use of our surface source from May 15th through October 31st of 2009. To replace the surface source during the summer months, the City will start construction on Well 14 in 2009.

This year the City will complete an update of the Water Facility Plan that is required every six years. The plan analyzes our water system operations, capacity, infrastructure, regulatory compliance, and outlines improvements needed for deficiencies that are found.

2008 Water Quality Test Results

The City of Camas has its water analyzed for more than 200 different contaminants, some regulated and some not regulated. Only the contaminants that have a test result are required by law to be reported to the public. The contaminants listed on page three are REGULATED and were in Camas' water during 2008. All samples taken are from treated water that is delivered to the distribution system. All are below levels allowed by Federal and State agencies. We have provided definitions to help you understand the terms and abbreviations that are used in the Test Results on page 3. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline at 800-426-4791. No violations were found in the test samples.

Continued on Page 3

Important Health Information

Please report possible water pollution (illicit discharge) to the City of Camas at 360-817-1561, or the Department of Ecology Southwest Regional Office at 360-407-6300

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (800-426-4791).

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radio-active material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water before we treat it include:

- Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.
- Pesticides and herbicides, which may come from a variety of sources such as agriculture and residential uses.
- Radioactive contaminants, which are naturally occurring.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. We treat our water according to EPA's regulations. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the Safe Drinking Water Hotline at 800-426-4791.

2008 Water Quality Test Results

Terms and Abbreviations:

Color Units - Color may be indicative of dissolved organic material, inadequate treatment, high disinfectant demand and the potential for the production of excess amounts of disinfectant by-products. Inorganic contaminants such as metals are also common causes of color. In general, the point of consumer complaint is variable over a range from 5 to 30 color units, though most people find color objectionable over 15 color units.

Maximum Contaminant Level – The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Maximum Contaminant Level Goal – The "Goal" (MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Milligrams Per Liter (MG/L) - a unit used in reporting the concentration of matter in water as determined by water analyses.

Nephelometric Turbidity Unit (NTU) - Nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Ug/L – Units of measurement in micrograms/liter. A unit of concentration for dissolved substances based on their weights.

uMhos/cm (Micromos Per Centimeter) – Used to measure conductivity. Conductivity is the numerical expression of the ability of water to carry an electrical current. It is determined by the number of ionic particles present.

Contaminant (Unit Measurement)	Violation	Range of Level Detected	Ideal Goal (MCLG)	Maximum Allowed (MCL)	Description & Origin of Substance
Health Related (Primary) Standards: Inorganic					
Fluoride (MG/L)	No	1.06	2.0	4.0	sodium fluoride added to Camas water to maintain good dental hygiene
Chloride (MG/L)	No	3.90	250	250	chlorides in groundwater can be naturally occurring in deep aquifers or caused by pollution from brine, or industrial or domestic wastes
Copper (MG/L)	No	.034	0.0	1.3	corrosion of household plumbing systems; erosion of natural products
Iron (MG/L)	No	.25	.30	.30	erosion of natural deposits
Nitrate (MG/L) (As Nitrogen)	No	1.46	5.0	10.0	runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products
Nitrite (MG/L) (As Nitrogen)	No	.10	1.0	1.0	runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural products
Sodium (MG/L)	No	18.6*	N/A	N/A	erosion of natural deposits and ph adjustment
Aesthetic (Secondary) Standards and Other Characteristics (Physical)					
Turbidity (NTU)	No	.29 to 2.45**	1.0	1.0	naturally occurring; soil runoff
Color (color units)	No	<5	15	15	naturally occurring
Conductivity (uMhos/cm)	No	241	700	700	naturally occurring
Sulfate (MG/L)	No	10.97	250	250	naturally occurring
Disinfection By-Products and Residuals within the Distribution System					
Haloacetic acids	No	.90-12.3	48	60	by-product of drinking water disinfection
Total *** Trihalomethanes (Ug/L)	No	1.1-11.8	60	80	chlorination by-product caused by the reaction of chlorine with organic matter

Table Notes

*A recommended level of concern for those on diets with daily sodium intake restrictions. This "Level Detected" was the highest level detected in one of many samples taken throughout the water system in 2008.

** Number 9 Well exceeded MCL in May, 2008.

*** The sum of the concentration in milligrams per liter of the trihalomethane compounds (trichloromethane (chloroform), dibromo-chloromethane, bromodichloromethane and tribromomethane (bromoform)), rounded in two significant figures.

Water Quality Monitoring

The City of Camas routinely monitors for constituents in your drinking water according to Federal and State laws. Field and laboratory analyses include tests for bacteria, as well as chemical and physical indicators. Reports are submitted monthly to the Department of Health to report that your water meets all drinking water standards. Should there ever be a public health concern, you would be notified immediately.

Water Conservation & Protection

The average daily consumption of water for Camas in 2008 was 3.71 millions of gallons per day (mgd). During our peak day on June 28th, the temperature in Camas was 97° F, and we consumed 7.8 mgd. Most of this increase in the summer months is due to irrigation demand.

We are once again asking for your help to reduce the amount of water wasted this year by implementing a voluntary odd/even lawn watering program for residential customers. Water on odd days if your house number ends in an odd number, and even days if it ends in an even number.

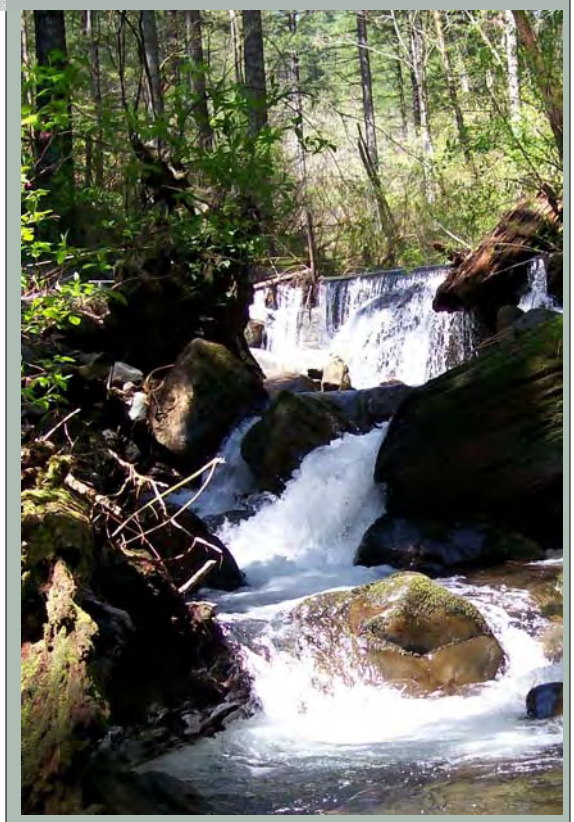
Tips for Conserving and Protecting Water Resources

- Fix leaks inside and outside, including old leaky faucets, toilets, hoses and sprinkler systems.
- Choose water saving fixtures and appliances, such as high-efficiency clothes washers and water-efficient dishwashers, which use 30% less water than traditional machines.
- Sweep porches, driveways, and sidewalks rather than hosing, to not only conserve water, but to avoid runoff.
- Water late at night or early in the morning (10p.m. to 6a.m.). **An inch of water per week is enough to keep lawns green.** Amend your soil, which allows the soil to more easily absorb water.

For more water saving ideas see our newsletters, news releases, printed material available at City Hall and the Operations Center, or visit our website at ci.camas.wa.us/services/forms/Utilities/WaterConservation.pdf, or the State website at ecy.wa.gov/programs/wr/ws/wtrcnsv.html.

Our Water System

The City of Camas has multiple water sources that include surface and ground water. The surface water sources, Boulder and Jones Creeks, are located on the south side of Larch Mountain, north-east of Camas. This surface water is disinfected, and then filtered at the Water Filtration Plant located near Lacamas Lake, before it enters the distribution system. The ground water sources include eight wells near the Washougal river, and one well in Grass Valley. All water sources are treated with chlorine for disinfection, fluoride for good dental health, and sodium hydroxide to reduce the corrosion of copper piping to meet State and EPA standards. Water pressure and fire flows are maintained throughout the service area with six distribution reservoirs, seven pumping stations, and over 137.5 miles of pipeline.



Surface Water Source Boulder Creek

Irrigation Systems

Washington State law requires every irrigation system to have a backflow device installed and inspected annually by a certified backflow tester to ensure it is working properly. Backflow devices are important because they prevent irrigation pipe contaminants from backing up into our community's drinking water supply. A list of certified backflow testers can be obtained from the City of Camas Building Department, or our City website above. For questions regarding backflow device testing, please leave a message on the City of Camas' Backflow Hotline at 817-1569. For more information go to www.ci.camas.wa.us/services/utilities/irrigation.

Newest Water Source

Our newest water source is Well 13. It was built to look like a residence to blend into the existing neighborhood. It produces 1,325 gallons per minute, and will be a great water asset during the hot summer days.

Water Leaks

Check out this helpful website www.epa.gov/watersense/fixaleak

The majority of leaks in residential plumbing systems are found at the toilet tank (fill and flapper valves). Locate your master water supply valve and label it.. The master supply-valve can be turned off easily in case of a major leak or broken pipe.

Other Common Leaks

- Lawn irrigation valves and lines
- Hose in yard turned on or leaking
- Ornamental fountains, fish ponds
- Relief valve or fittings on water heater
- Leaking pipes or fittings in the house
- Line between the meter and the house
- Dripping faucets in bathrooms or sinks
- Outside faucet open or dripping

Appendix G

City of Camas Intertie Agreement

Water service requirements: Process, cost, time frame and appeal process

In-City:

- Application for water service is made through the Building department and in accordance with CMC 13.52.050.
- Fees for service are in accordance with CMC 13.36.050-Connection Charges and CMC 13.52.060 – System Development Charges.
- Typical process time is two to six weeks after payment of fees.
- Appeals for water service related issues will be addressed by City Council in accordance with CMC 13.12.100

Retail Service area in UGA:

- Application for water service is made in accordance with CMC 13.52.050.
- Prior to staff approval, the request is processed through City council for approval.
- Fees for service are in accordance with CMC 13.36.050-Connection Charges and CMC 13.52.060 – System Development Charges.
- Typical process time is one to two months from time of application to Council approval. Service installation is two to six weeks after payment
- Appeals for water service related issues will be addressed by City Council in accordance with CMC 13.12.100. Applicants may also file suit in Superior Court

Service area boundary out of UGA:

- Application for water service is made in accordance with CMC 13.52.050.
- Prior to staff approval, the request is processed through City council for approval.
- Fees for service are in accordance with CMC 13.36.050-Connection Charges and CMC 13.52.060 – System Development Charges.
- Typical process time is one to two months
- Appeals for water service related issues will be addressed by City Council in accordance with CMC 13.12.100. Applicants may also file suit in Superior Court

Referenced CMC's

13.36.050 Connection charges.

A. Charges for connection to the city water system including setting the meter, installing a service line and tapping the water main shall be computed as follows:

1. Except as hereinafter provided, the connection charge shall be the cost of materials, the labor costs for city personnel billed at then existing rates for such personnel, and any fees or charges that were necessary to be paid to third parties in order to make such connection.

2. For installing a water meter for services one inch or smaller, the connection charge shall be: TABLE INSET:

5/8"	$325.00
3/4"	350.00
1"	395.00

or the actual cost to the city calculated as in accordance with subsection (A)(1) of this section, whichever is greater.

3. For installing a water meter, service line, and tapping the water main for a service one inch or smaller, the connection charge shall be one thousand five hundred dollars or the actual cost to the city calculated in accordance with subsection (A)(1) of this section, whichever is greater.

B. There shall be no charge for connecting a sprinkler system to a water main for fire protection other than the installation cost of the same, providing that such system shall include a detector to record water usage.

13.48.010 Water main extensions.

A. Extensions to water mains will be made only upon proper petitions to the city. The city shall have the right to reject such petitions or enter into contract with the petitioners under such conditions as the city may elect.

B. All water main extensions installed, whether within or without the corporate limits of the city, shall be six inches in diameter or larger.

C. All extensions of mains required to serve new customers shall be constructed at the expense of such customers.

D. If in the judgment of the water department of the city, it is in the best interest of the city and of the general area where a new main is contemplated to install a larger main than that required by the immediate development, the city may install such larger main and shall pay the increased difference in cost between installation of the smaller and of the larger main.

E. Every service pipe shall be provided with a stopcock and service box at suitable location, either on or off the premises to be served, which shall be accessible to employees of the city water department only. Where curbs and walks are in place, or where space has been provided for future curbs and walks, the stopcock and service box shall be located in said space or between said walk and curb. There shall be a short piece of pipe and a union placed in the stopcock or meter, as the case may be, so the service can be extended to the premises or place of consumption.

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
http://www.ci.camas.wa.us

November 4, 2004

DEPARTMENT OF PUBLIC WORKS

Elaine Spray
City of Vancouver
PO Box 1995
Vancouver, WA 98668-1995

SUBJECT: Inter-Local Agreement—Water Service Boundary

Dear Elaine:

Please find the enclosed "Interlocal Agreement For Establishing Water Utility Service Boundaries". It has been signed by your PW Director and our Mayor. This adjusts the City of Camas/Vancouver water service boundary so that the City of Vancouver can serve the Evergreen School District and the Glad Tidings Church site between NW Friburg Street (Camas) and NE 192nd Ave. on NE 1st Street. I see that the agreement is supposed to be approved by the Clark County Commissioners. Since the agreement originated with the City of Vancouver, I will let you folks carry that through.

If you have questions about this, please call me at 817-1534. Thanks for your help!

Sincerely,

Monte Brachmann
Public Works Director

INTERLOCAL AGREEMENT FOR ESTABLISHING WATER UTILITY SERVICE BOUNDARIES

BETWEEN

City of Vancouver and City of Camas

THIS AGREEMENT, entered into by and between City of Vancouver and City of Camas, (hereinafter referred to as the WATER PURVEYORS), WITNESS THAT:

WHEREAS, Clark County and the WATER PURVEYORS conduct capital facilities and land use planning under the Growth Management Act as adopted by the State of Washington and subsequently amended; and

WHEREAS, RCW 70.116 Public Water System Coordination Act, and WAC 246-293-250 require development of a Coordinated Water System Plan, including establishment of service area boundaries; and

WHEREAS, the designation of service area boundaries will help facilitate efficient planning and delivery of water services within Clark County, will help ensure that unnecessary duplication of service is avoided, and will provide predictability to the WATER PURVEYORS, Clark County, and to citizens using water services; and

WHEREAS, the designation of service area boundaries will help assure that water reserved for public water supply proposed within the CWSSA will be utilized in the future in an efficient planned manner;

NOW THEREFORE, in consideration of covenants, conditions, performances, and promises hereinafter contained, the undersigned parties hereto agree as follows:

1. Service Area Boundaries. The undersigned acknowledges that the maps identifying their service area boundaries, dated May 28, 2004 and attached to this agreement, accurately identifies the water system's future service area. This signed Interlocal Agreement verifies that there are no service area conflicts with adjacent water utilities.

2. Boundary Streets. Where streets or portions of streets serve as a service area boundary, both WATER PURVEYORS may extend service within the street itself. The utility which is located to the north and/or east of the portion of the street serving as a boundary will also be entitled to extend service across the boundary to abutting streetside lots. Any other service extensions into adjacent service area boundaries shall require agreement of the WATER PURVEYORS involved.

3. Boundary Adjustments. If, at some time in the future, it is in the best interests of the undersigned parties to make service area boundary adjustments, such modifications must have the written concurrence of all involved parties and the proper legislative authority(ies), and must be noted and filed with Clark County and Washington State Department of Health.

As specified in WAC 246-293-250, Service Area Agreements-Requirements, this Agreement shall become effective once this document is approved by the Clark County Board of Commissioners.

This Interlocal agreement for establishing water utility service boundaries is hereby approved.

Utility Representative
Brian K. Carlson

Title Public Works Director
City of Vancouver

Date 5/28/04

Utility Representative
Paul Dennis

Title Mayor
City of Camas

Date 10-12-04

APPROVED BY CLARK COUNTY BOARD OF COMMISSIONEERS

Chair

Resolution No.

Date:

NE 194th PL
NE 6th ST
NE 193rd AVE
NE 196th AVE
NE 192nd AVE
Glad Tidings Church
Evergreen School District
NE 202nd AVE
NE 1st ST
SE 197th CT (P)
SE 199th AVE (P)
EXISTING BOUNDARY
PROPOSED BOUNDARY
100 200 400
8/04 GPH

mv

CITY OF VANCOUVER

Post Office Box 1995 - Vancouver, Washington 98668-1995

November 22, 2004

Mr. Monte Brachmann
Public Works Director
P.O. Box 1055
Camas, Washington 98607

SUBJECT: Camas/Vancouver Inter-Local Agreement as signed 10/12/04 - CORRECTED MAP

Dear Monte –

Thank you for returning the recently signed Inter-Local Agreement documenting the proposed changes to the Camas/Vancouver Water Service Boundary in the vicinity of SE 1st St and SE 192nd Ave. As you had noted, the document still needs to be signed by the County Commissioners. In order to complete this last step, the Agreement is now with our Public Works Director, Brian Carlson. After we get all signatures on the final document, I make sure you get a copy for your records.

While we were reviewing these documents, we realized the original map had an incorrect scale on it. Please use this updated map, re-plotted with the correct scale, as the permanent attachment for these records.

Thank you again for assisting us with coordinating this revision to our respective Service Area Boundaries. If you have any questions, please do not hesitate to call me at 360-696-8008.

Sincerely,

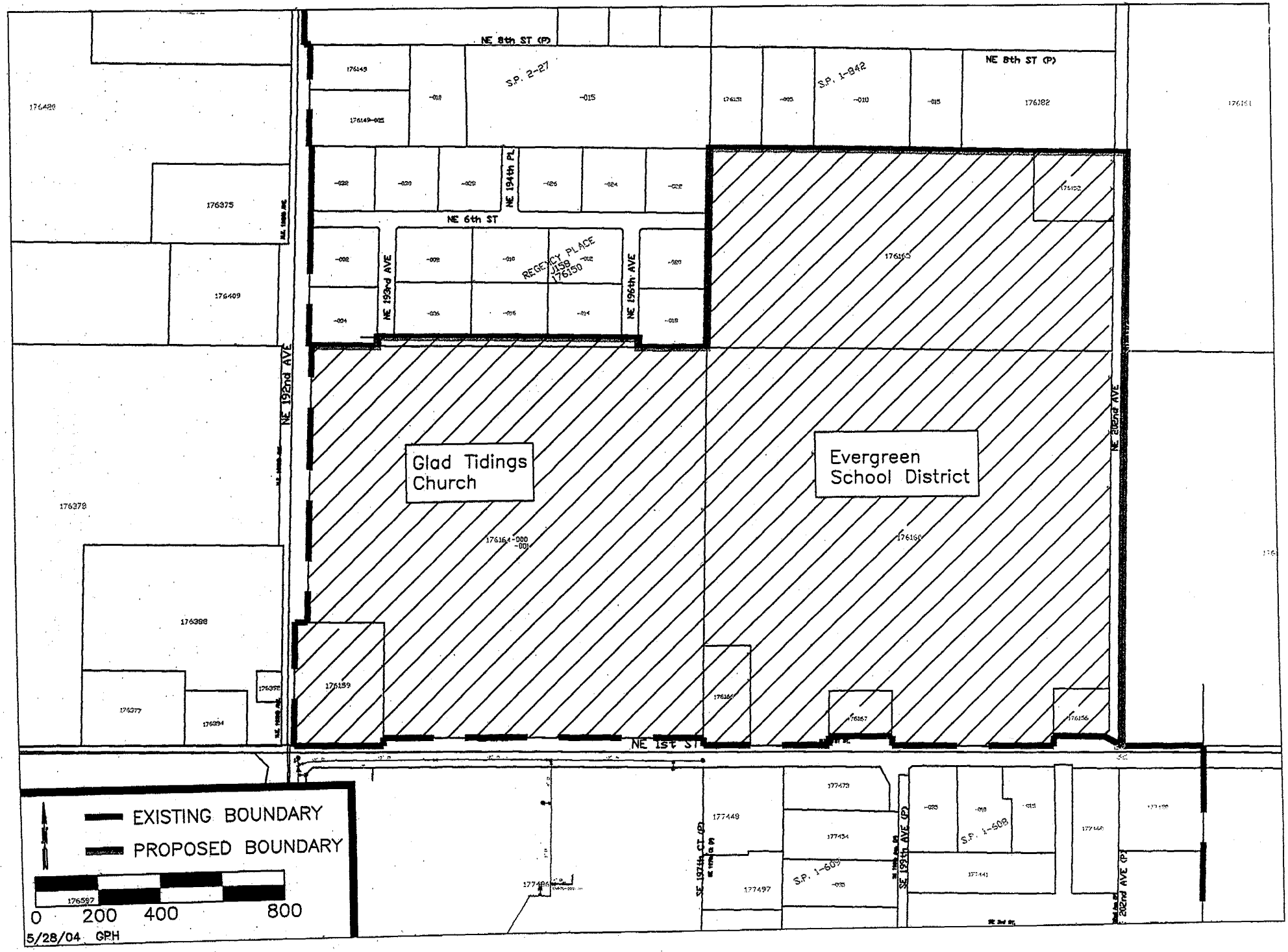
Elaine Spray

Elaine Spray, P. E.
Water System Planning and Design
City of Vancouver

Cc: Brian Carlson, Public Works Director
Victor Ehrlich, City Engineer
Thomas D. Boyer, Assistant City Engineer
File

ENCL

Water Engineering Services
Phone (360) 696-8008 Fax (360) 696-8460


NE 8th ST (P)
S.P. 2-27
S.P. 1-842
NE 8th ST (P)
NE 194th PL
NE 6th ST
REGENCY PLACE
NE 193rd AVE
NE 196th AVE
NE 192nd AVE
Glad Tidings Church
Evergreen School District
NE 212nd AVE
NE 1st ST
S.P. 1-609
S.P. 1-609
SE 197th CT (P)
SE 199th AVE (P)
NE 212nd AVE (P)
EXISTING BOUNDARY
PROPOSED BOUNDARY
0 200 400 800
5/28/04 GPH

FINANCE

INTERLOCAL AGREEMENT FOR ESTABLISHING WATER UTILITY SERVICE BOUNDARIES

BETWEEN

City of Vancouver and City of Camas

THIS AGREEMENT, entered into by and between City of Vancouver and City of Camas, (hereinafter referred to as the WATER PURVEYORS), WITNESS THAT:

WHEREAS, Clark County and the WATER PURVEYORS conduct capital facilities and land use planning under the Growth Management Act as adopted by the State of Washington and subsequently amended; and

WHEREAS, RCW 70.116 Public Water System Coordination Act, and WAC 246-293-250 require development of a Coordinated Water System Plan, including establishment of service area boundaries; and

WHEREAS, the designation of service area boundaries will help facilitate efficient planning and delivery of water services within Clark County, will help ensure that unnecessary duplication of service is avoided, and will provide predictability to the WATER PURVEYORS, Clark County, and to citizens using water services; and

WHEREAS, the designation of service area boundaries will help assure that water reserved for public water supply proposed within the CWSSA will be utilized in the future in an efficient planned manner;

NOW THEREFORE, in consideration of covenants, conditions, performances, and promises hereinafter contained, the undersigned parties hereto agree as follows:

1. Service Area Boundaries. The undersigned acknowledges that the maps identifying their service area boundaries, dated May 28, 2004 and attached to this agreement, accurately identifies the water system's future service area. This signed Interlocal Agreement verifies that there are no service area conflicts with adjacent water utilities.

2. Boundary Streets. Where streets or portions of streets serve as a service area boundary, both WATER PURVEYORS may extend service within the street itself. The utility which is located to the north and/or east of the portion of the street serving as a boundary will also be entitled to extend service across the boundary to abutting streetside lots. Any other service extensions into adjacent service area boundaries shall require agreement of the WATER PURVEYORS involved.

3. Boundary Adjustments. If, at some time in the future, it is in the best interests of the undersigned parties to make service area boundary adjustments, such modifications must have the written concurrence of all involved parties and the proper legislative authority(ies), and must be noted and filed with Clark County and Washington State Department of Health.

As specified in WAC 246-293-250, Service Area Agreements-Requirements, this Agreement shall become effective once this document is approved by the Clark County Board of Commissioners.

This Interlocal agreement for establishing water utility service boundaries is hereby approved.

Utility Representative Brian K. Carlson	Title Public Works Director City of Vancouver	Date 5/28/04
Utility Representative Paul Dennis	Title ~~Mayor~~ Mayor City of Camas	Date 10-12-04

APPROVED BY CLARK COUNTY BOARD OF COMMISSIONEERS

_____

Chair

Resolution No._____

Date:_____

NE 194th PL
NE 6th ST
NE 193rd AVE
NE 196th AVE
NE 192nd AVE
Glad Tidings Church
Evergreen School District
NE 1st ST
EXISTING BOUNDARY
PROPOSED BOUNDARY
0 100 200 400
5/28/04 GPH

INTERLOCAL AGREEMENT BETWEEN
the
CITY OF WASHOUGAL and the CITY OF CAMAS

The corporate limits of the cities of Camas and Washougal are irregular along their common boundary. In particular, an area within the Camas corporate limits (herein referred to as "subject area", as described in attached Exhibit "A") located north of the intersection of Shepherd Road and 3rd Avenue is currently surrounded on approximately eighty-four (84) percent of its perimeter by Washougal's corporate limits.

Further, the cities have mutually entered into an Interlocal Agreement which designates the City of Washougal as the utility service (water and sewer) provider to the land located within the subject area.

The City of Washougal is in the process of preparing a Comprehensive Subarea Plan for an area lying north of the subject area, including the land surrounding the subject area. The Subarea Plan will address land uses, environmental protection, storm water drainage and infrastructure impacts for the area. Including the subject area would assure the orderly and logical progression of land development under the jurisdiction of the City of Washougal.

The purpose of this agreement is to establish the City of Washougal as the presiding jurisdiction with respect to land use planning and implementation, including, but not limited to the following:

1. Implementation of land division regulations.
2. Imposition and implementation of zoning regulations
3. Implementation of development standards, including streets, storm and sanitary sewer, water and other utility provision.

Pursuant to this, the City of Washougal and the City of Camas hereby agree to the following:

1. Presiding Jurisdiction. The City of Washougal shall be the presiding jurisdiction in all planning programs, land use designations and land use application processing for land within the subject area.

2. Land Use Planning and Implementation. All land use actions shall be processed under the rules and regulations of the City of Washougal, including but not limited to Titles 15 (Building), 16 (Environmental), 17 (Land Divisions) and 18 (Zoning) of the Washougal Municipal Code, the City of Washougal Engineering Standards for Public Works Construction and any and all provisions of the Woodburn Hill Comprehensive Subarea Plan. No provision of this agreement shall preclude future revisions, amendments or addenda to these regulations from being implemented by the City of Washougal within the subject area without prior written consent of the City of Camas.

3. Annexation. Both the City of Camas and the City of Washougal agree to pursue the necessary routes to transfer true corporate jurisdiction for the subject area from the City of Camas to the City of Washougal.

4. Effective Date and Duration. This agreement shall be effective upon signature by the presiding officer of both the City of Camas and the City of Washougal, and shall be in effect until terminated by one of the following methods:

   a. Ninety (90) day written notice of termination by either party subject to the agreement.
   b. Termination of agreement upon formal annexation of the subject area by the City of Washougal, said termination being effective concurrent with the effective date of the annexation.

5. Application Processing Upon Termination. Upon termination of this agreement, the city of Washougal shall complete processing of any technically complete land use application filed with the City of Washougal pursuant to the provisions of this agreement.

APPROVED this 4th day of August, 1997 by:

City of Washougal

Mayor Charles Crumpacker

City of Camas

Mayor Dean Dossett

Approved as to form:

City of Washougal

Don English, City Attorney

City of Camas

Roger Knapp, City Attorney

f:\eric\woodburn\intrlocl

CITY OF CAMAS
616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607

October 8, 1997

Mike Conway, Director
Department of Public Works
City of Washougal
1701 C Street
Washougal WA 98671

Gentlemen Mike

Enclosed please find an executed copy of the *INTERLOCAL AGREEMENT BETWEEN the CITY OF WASHOUGAL and the CITY OF CAMAS.* Said agreement designates the City of Washougal as the utility service (water and sewer) provider to the land located north of the intersection of Shepherd Road and 3rd Avenue.

Any questions pertaining to this agreement may be directed to Eric Levison, our Assistant City Engineer, at 834-3451.

Sincerely,

Douglas A. Quinn, P.E.
Director

enclosure

Administration (360) 834-6864 | Building (360) 834-8860 | Finance (360) 834-2462 | Fire (360) 834-2262 | Library (360) 834-4692 | Police (360) 834-4151 | Public Works (360) 834-3451 | Parks & Recreation (360) 834-7092

Emergency Water Supply

INTER-LOCAL COOPERATION AGREEMENT

THIS AGREEMENT made this day by and between the CITY OF CAMAS, a municipal corporation organized under the laws of the State of Washington, hereinafter referred to as "Camas", and the CITY OF WASHOUGAL, a municipal corporation organized under the laws of the State of Washington, hereinafter referred to as "Washougal",

In accordance with the Inter-Local Cooperation Act (RCW Chapter 39.34), Camas and Washougal, in consideration of the payments, covenants and agreements hereinafter mentioned, to be made and performed by the parties, do covenant and agree as follows:

Section 1. **PURPOSE:** The purpose of this agreement is to allow Camas and Washougal to sell water to the other due to the occurrence of an emergency situation where either city is unable to meet their service demands within internal water sources. The designation of an emergency shall be made by the respective Public Works Directors of each city and shall include, but not be limited to, drought conditions or a break in a water main. The delivery of water upon the designation of an emergency shall be through Inter-Ties between the respective water systems of Camas and Washougal at locations approved by the Public Works Directors of each city.

Section 2. **DURATION:** This agreement shall be for an indefinite duration.

Section 3. **ADMINISTRATION:** No new or separate legal or administrative entity is created to administer the provisions of this agreement. This agreement shall be administered jointly by Camas and Washougal by and through the Public Works Directors of both cities, who shall jointly administer this undertaking in accordance with the terms and conditions of this agreement.

Section 4. **FINANCING:** In the event either Camas or Washougal receives water

pursuant the provisions of this agreement then the receiving city shall remit payment in full for the water received at a rate equivalent to the receiving city's residential, inside city, water volume rate at the time of provision of the water. Invoicing shall be on a monthly basis.

Section 5. **WATER QUALITY:** The water supplied by either Camas or Washougal, in accordance with the terms of this agreement, shall be deemed "finished and treated" drinking water at the point of delivery. The city providing water shall have no responsibility to maintain drinking water quality standards once the water has been provided to the receiving city's distribution system. The receiving city shall be solely responsible to maintain drinking water quality standards upon receipt.

Section 6. **INDEMNIFICATION:** Camas and Washougal shall indemnify and hold harmless the other, its officers, agents, and employees, or any of them, from any and all claims, actions, suits, liability, loss, costs, expenses and damage of any nature whatsoever, by reason of or arising out of any action or omission of the respective employees, officers and agents, in the execution and administration of this agreement.

Section 7. **INSURANCE:** Each city shall obtain and keep in full force and effect liability insurance protecting itself and its employees, officers and agents, and the party, its employees, officers and agents, for claims of any persons for injuries to life, person or property by reason of anything done or permitted to be done or suffered or admitted to be done by the parties in the administration of the project. If either party withdraws from the Washington Cities Insurance Authority, that party shall deliver a certificate of insurance showing compliance with this section.

Section 8. **TERMINATION:** Each party shall have the right to terminate this entire agreement, with or without cause, upon 180 days written notice to the other party. Such notice shall be sufficient if it is in writing and deposited in the United States mail, certified mail, return receipt requested, with postage fully prepaid and addressed to the parties at their last known addresses as follows:

City of Camas P.O. Box 1055 Camas, WA 98607	City of Washougal 1701 "C" Street Washougal, WA 98671

Section 9. **FILING:** This agreement shall be filed with the city clerks of Camas and Washougal and with the Clark County Auditor and the Washington Secretary of State.

Section 10. **EFFECTIVE DATE:** This agreement shall be effective upon signing by the respective parties hereto.

DATED this 7 day of August, 2006.

CITY OF CAMAS

By: _____
Mayor

Attest: _____
Clerk

Approved as to form:
_____
City Attorney

CITY OF WASHOUGAL

By: _____
Mayor

Attest: _____
Clerk

Approved as to form:
_____
City Attorney

INTER-LOCAL COOPERATION AGREEMENT

THIS AGREEMENT made this day by and between the CITY OF CAMAS, a municipal corporation organized under the laws of the State of Washington, hereinafter referred to as "Camas", and the CITY OF WASHOUGAL, a municipal corporation organized under the laws of the State of Washington, hereinafter referred to as "Washougal",

In accordance with the Inter-Local Cooperation Act (RCW Chapter 39.34), Camas and Washougal, in consideration of the payments, covenants and agreements hereinafter mentioned, to be made and performed by the parties, do covenant and agree as follows:

Section 1. **PURPOSE:** The purpose of this agreement is to provide for the drilling, testing and evaluation of drinking water wells in the Steigerwald Lake area east of the Port of Camas-Washougal Industrial Park, more particularly described, and subject to that certain Option to Purchase Exclusive Easement for Well Site attached hereto as Exhibit "A", and to allocate the costs and responsibilities associated for such projects.

Section 2. **DURATION:** This agreement shall be for an indefinite duration.

Section 3. **ADMINISTRATION:** No new or separate legal or administrative entity is created to administer the provisions of this agreement. This agreement shall be administered jointly by Camas and Washougal and there is hereby created a board comprised of the Public Works Directors of both cities, which shall jointly administer this undertaking in accordance with the terms and conditions of this agreement.

Section 4. **FINANCING:** Camas and Washougal shall each be responsible for fifty percent (50%) of the total actual costs incurred on this project, including any project costs associated with the discovery of an available and useable source of water within the property,

more particularly described in Exhibit "A", or within a ½ mile radius thereof. The initial costs for calendar year 2006 shall be allocated with Washougal to be responsible for paying $65,000.00 and Camas to be responsible for paying the remaining costs, but no more than $155,000.00. Camas shall not incur additional costs above $155,000.00, of which Washougal is to share, without the prior approval of Washougal.

Camas shall bill Washougal for its share of the expenses herein described in accordance with Camas' normal billing procedures for public works projects. Washougal shall remit payment in full for each such billing invoice no later than five (5) days after the first meeting of the Washougal City Council immediately following submission of such invoices by Camas.

Section 5. **PROJECT ADMINISTRATION:**

A) Camas shall be designated as the lead agency in reference to negotiating and obtaining of any contract for work on the project. Camas engineering staff shall provide staff oversight of all consultants and contractors working upon the drilling project.

B) In the event either Camas or Washougal, or both jointly, develop a source of water on the property as herein described, then the parties hereto agree to negotiate in good faith for the execution of a revised Inter-Local Agreement for allocation of costs and distribution of water resources.

Section 6. **INDEMNIFICATION:** Camas and Washougal shall indemnify and hold harmless the other, its officers, agents, and employees, or any of them, from any and all claims, actions, suits, liability, loss, costs, expenses and damage of any nature whatsoever, by reason of or arising out of any action or omission of the respective employees, officers and agents, in the

execution and administration of this agreement.

Section 7. **INSURANCE:** Each city shall obtain and keep in full force and effect liability insurance protecting itself and its employees, officers and agents, and the party, its employees, officers and agents, for claims of any persons for injuries to life, person or property by reason of anything done or permitted to be done or suffered or admitted to be done by the parties in the administration of the project. If either party withdraws from the Washington Cities Insurance Authority, that party shall deliver a certificate of insurance showing compliance with this section.

Section 8. **TERMINATION:** Each party shall have the right to terminate this entire agreement, with or without cause, upon 180 days written notice to the other party. Such notice shall be sufficient if it is in writing and deposited in the United States mail, certified mail, return receipt requested, with postage fully prepaid and addressed to the parties at their last known addresses as follows:

City of Camas P.O. Box 1055 Camas, WA 98607	City of Washougal 1701 "C" Street Washougal, WA 98671

Section 9. **FILING:** This agreement shall be filed with the city clerks of Camas and Washougal and with the Clark County Auditor and the Washington Secretary of State.

Section 10. **EFFECTIVE DATE:** This agreement shall be effective upon signing by the respective parties hereto.

///

DATED this 7 day of August, 2006.

CITY OF CAMAS

By: _____
Mayor

Attest: _____
Clerk

Approved as to form:
_____
City Attorney

CITY OF WASHOUGAL

By: _____
Mayor

Attest: _____
Clerk

Approved as to form:
_____
City Attorney

OPTION TO PURCHASE EXCLUSIVE EASEMENT FOR WELL SITE

In consideration of the recognition by the parties hereto of the need for enhanced water capacity benefiting the respective Cities and the Port's Industrial Park and the sum of One Thousand and no/100 dollars ($1,000.00), in hand paid, receipt of which is hereby acknowledged, the undersigned Optionor(s) hereby grant(s) to the CITY OF CAMAS, WASHINGTON, a municipal corporation of the State of Washington, and the CITY OF WASHOUGAL, WASHINGTON, a municipal corporation of the State of Washington, and their respective successors, assigns, lessees and agents (herein collectively called "Optionees") an option to purchase an Exclusive Right-of-Way and Easement as described in the document marked "Exhibit A" and entitled **"Grant of Right of Way Easement and Agreement"** as said document is attached hereto and made a part hereof. The Easement shall be for approximately 2 acres of land, generally described in "Exhibit B".

In addition to said approximate 2 acre parcel, Optionor(s) agree to grant to Optionees a 20' wide easement for ingress and egress and utilities to the proposed well site. Said access easement may be joint use with the Optionor(s) until such time as the remainder property is developed.

This option shall be subject to all terms and conditions of said attached document and shall continue in force from the date hereof until midnight Dec. 31, 2006, and at any time within said period Optionees shall have the right to exercise said option by giving Optionor(s) notice thereof, either in person or by letter mailed to the address given below. At any time within said period, Optionees or their contractors may enter upon said land for the purpose of making surveys and performing other work for the purpose of obtaining information to be used in exercising the rights above described without being deemed to have exercised the option..

If the Optionees exercise this option, Optionees agree to pay to Optionor(s) an amount equal to the fair market value of the perpetual easement provided for herein, to be determined by an appraiser mutually acceptable to both parties. In the alternative to payment of fair market value, in whole or part, the parties agree to negotiate in good faith for an exchange in value based upon the assumption of financing by Optionees of improvements to water capacity at the Grove Field Airport. The costs for said appraisal shall be shared by the parties hereto. Optionor(s) agree that at such time as Optionees may elect to exercise this option, Optionor(s) will execute and deliver to Optionees, a properly executed instrument of conveyance, in the form of said document marked "Exhibit A", attached hereto and made a part hereof, whereby the above described rights of way and easements are conveyed to Optionees.

It is understood and agreed that this option may be renewed for an additional 6 month period, upon payment by the Optionees to the Optionor(s) of an additional One-Thousand and no/100 dollars ($1,000.00).

It is understood and agreed that the exercising of this option is subject to acceptance by the Optionees, of an adequate public water supply, based upon the results of a test well, completed by the Optionees, which will determine whether the site is acceptable for municipal well(s).

If the Optionees do not exercise this option, the consideration paid for this option shall be retained by Optionor(s) with no further obligation to Optionees.

The terms, conditions, and provisions herein shall extend to and be binding upon the heirs, executors, administrators, personal representatives, successors, assigns, lessees and agents of the parties hereto.

EXECUTED this 17 day of July, 2006, at _____.

OPTIONEES:

City of Camas
By: Paul Dennis
Title: Mayor

City of Washougal
By: Stacey Hansen-Lecceard
Title: Mayor

OPTIONOR(S):

Port of Camas-Washougal
By: [signature]
Title: Executor Director

Notice address of Optionor(s):

24 South A Street
Washougal, WA 98671

STATE OF WASHINGTON)
) ss.
COUNTY OF CLARK)

On this 18th day of JULY, 2006, before me personally appeared PAUL DENNIS, known to me to be the MAYOR, of the CITY OF CAMAS, a municipal corporation, that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he was authorized to execute said instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

JAMES M HODGES
STATE OF WASHINGTON
NOTARY — • — PUBLIC
My Commission Expires Dec. 15, 2009

James M. Hodges
Notary Public in and for the State of Washington, residing at VANCOUVER
My commission expires 12/15/09.

STATE OF WASHINGTON)
) ss.
COUNTY OF CLARK)

On this 26 day of July, 2006, before me personally appeared Scott P. Sawyer, known to me to be the Public Works Director, of the CITY OF WASHOUGAL, a municipal corporation, that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he was authorized to execute said instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

TOMMYE J. BRATTON
NOTARY PUBLIC
STATE OF WASHINGTON
My Commission Expires
NOVEMBER 18, 2007

T Bratton
Notary Public in and for the State of Washington, residing at Washington
My commission expires 11/18/07

STATE OF WASHINGTON)
) ss.
COUNTY OF CLARK)

On this 13 day of June, 2006, before me the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared SHELDON TYLER, to me known to be the Executor Director of the Port of Camas-Washougal, the municipal corporation that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

NOTARY PUBLIC in and for the State of Washington, Residing at Camas.
My appointment expires: 12-7-07.

RETURN ADDRESS:

City of Camas
616 NE 4th Avenue
Camas, WA 98607

GRANT OF RIGHT OF WAY EASEMENT AND AGREEMENT

Grantor: Port of Camas-Washougal, a municipal corporation
Grantees: City of Camas, Washington and City of Washougal, Washington
Legal Desc. (abbrev.):
Tax Parcel ID No.:

THE GRANTOR, PORT OF CAMAS-WASHOUGAL, a municipal corporation, in consideration of Ten and no/100 dollars ($10.00), in hand paid, hereby acknowledged, does grant and conveys to the CITY OF CAMAS, WASHINGTON, a municipal corporation of the State of Washington and to the CITY OF WASHOUGAL, WASHINGTON, a municipal corporation of the State of Washington, its successors and assigns, including joint users, an exclusive and perpetual easement and right of way together with the right of ingress and egress for the purpose of installing, constructing, erecting, altering, repairing, maintaining and operating thereon and therein a municipal water supply system, including all appurtenances necessary thereto, in, on, over, under and across the lands in Clark County, Washington, described as follows:

TO BE SUPPLIED BY SURVEYORS

Together with a 20 foot wide easement for ingress, egress and underground utilities to said well site.

<u>This easement is subject to the following conditions</u>:

1. The subject 2 acre (approximate) parcel will be surveyed and a legal description provided for recording purposes by the Grantees.

2. The ingress, egress and utility easement may be relocated in the future to accommodate development of the parcel. Any relocation shall be agreed upon by both the Grantors and Grantees.

3. Upon development of the remainder property of Grantors, Grantors agree to identify this easement area as "Tract A" (or similar) on the face of the plat, and dedicate said "Tract A" to the City of Camas, by recital and recording on the face of the plat.

EXHIBIT A
PAGE 1 OF 2

4. The Grantees herein agree to conduct their well drilling and operations in a safe and prudent manner so as not to cause any harm to the Grantor

5. Upon completion of any well drilling operations, and when weather is suitable, the Grantees shall restore any disturbed surrounding property as nearly as possible to its condition prior to the well drilling operations and to the reasonable satisfaction of the Grantor.

6. The Grantees shall indemnify and hold the Grantor harmless from all claims for damages or injuries alleged to arise or to accrue to any person or entity as a result of any activity or conduct assumed or performed by the Grantees.

7. Upon completion of the test well, if said test well proves to be inadequate for a public water supply, the Grantees agree to properly abandon the well so as to prevent any injuries and to restore the property as specified above. Or, at the discretion of the Grantors, the Grantees may abandon said facilities "in place".

The Grantor covenants for itself, successors and assigns, that it will not build or place, or allow to be built or placed, any structure of any kind over the easement granted herein.

The Grantor also covenants to and with the Grantees that Grantor has the right and power to convey an Easement for the purposes mentioned over the tract of land described herein.

PORT OF CAMAS-WASHOUGAL

By: _____

Title: EXEC DIR

EXHIBIT A

PAGE 1 OF 2

Exhibit "A"
Legal Description
For
Proposed Well Field and Transmission Line

A tract of land for a future water well area together with an easement for a transmission main located in portions of Sections 17, 20 and 21, Township 1 North, Range 4 East, Willamette Meridian, Clark County, Washington; said tract is a portion of that particular parcel shown on the official record of survey recorded in Book 43 at Page 9, Records of Clark County, Washington, being more particularly described as follows:

Beginning at the Northwest corner of said Section 21 per said record of survey in Book 43 at Page 9; Thence South 62°02'18" East a distance of 3,104.73 feet to the northerly right of way line of the dike road as shown in said survey and the point of beginning of this description; Thence along the following described courses:

North 10°34'45" East a distance of 461.58 feet;
South 88°36'01" East a distance of 347.39 feet;
South 68°07'52" East a distance of 343.29 feet;
South 73°19'26" East a distance of 198.86 feet;
South 73°26'56" East a distance of 160.51 feet;
North 17°28'45" East a distance of 102.65 feet;
South 65°33'04" East a distance of 376.31 feet;
North 63°42'19" East a distance of 112.43 feet;
South 01°23'59" West a distance of 292.78 feet to a point here and after referred to as Point "A", said point also being located on the northerly dike road right of way line; Thence following along said northerly line the following described courses:

North 88°35'14" West a distance of 850.42 feet to the beginning of a curve concave to the north having a radius of 2,782.47 feet;
Thence northwesterly 113.96 feet along said curve through a central angle of 2°20'10";

Thence North 86°15'03" West a distance of 141.48 feet;
Thence North 03°44'56" East a distance of 30.00 feet;
Thence North 86°15'03" West a distance of 516.09 feet to the TRUE POINT OF BEGINNING.

Together with an easement beginning at said Point "A"; Thence South a distance of 35.00 feet to the centerline of said dike road and the beginning of this easement description being 20 feet in width and lying 10 feet on each side of the following described centerline: Following westerly and northwesterly on and along the centerline of said dike road to a point due South of said Northwest corner of Section 21; Thence North 38°03'10" West leaving said dike road centerline a distance of 432.82 feet to a concrete monument with brass cap located in the centerline of Index Street as shown on Record of Survey recorded in Book 14 at Page 50, Records of Clark County, Washington, and the terminus of this easement description.

Parcel Boundary

Elevation Contours

31 Foot Contour

Other Contours (1 foot)

N
W E
S

0 Feet 200

1:2,400

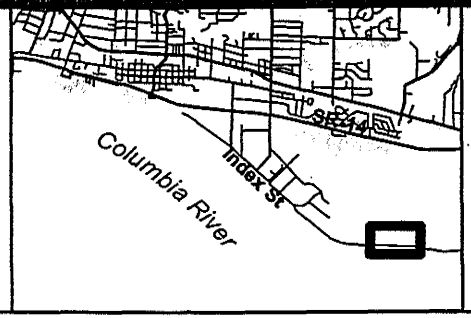


Figure 1

Proposed Location for Test Wells

PgG

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INTERIM INTERTIE AGREEMENT

City of Camas and City of Washougal

Currently, no formal agreement between the Cities of Camas and Washougal exist concerning the emergency interties between the two water systems. Camas and Washougal are working to develop an intertie agreement that satisfies both parties involved. Upon approval by both the City of Camas and City of Washougal, the Department of Health will be forwarded a copy of said agreement.

In the interim, the City of Camas and City of Washougal have an understanding that allows the City of Camas to provide supply to the City of Washougal. This understanding exists under the conditions that the two cities share operation and maintenance expenses for the interties, and that the City of Washougal pay the existing Camas water rate. The emergency interties exist at the following locations:

Intertie Location	Type
SE Shepherd Street	Normally closed one-way PRV station
Intersection of SE 3rd Street and Whitney Street	Normally closed one-way PRV station

Appendix H

Coliform Monitoring Plan

APPENDIX H

TABLE H-1

City of Camas Water System Coliform Monitoring Plan Sample Stations

No.	Address	Description/ Pressure Zone	Sample Point	Upstream Repeat	Downstream Repeat
1	NW 24th Avenue and NW Elgin Street	Hydrant/852	Sample Station (Hydrant Leg)	2424 NW Elgin Garage Wash Sink	636 NW 24th Laundry Room Wash Sink
2	NW 24th Avenue and NW Maryland Street	Distribution Piping 852	Sample Station	3555 NW 24th Circle Kitchen or Bathroom Sink	2427 NW Maryland Hose Bibb Left Side of House
3	600 NW 18th Loop	Lower Prune Hill Booster Station/697	Sample Station	1815 NW Fargo Hose Bibb	461 NW 17th 440 NW 17th Hose Bibbs
4	2822 NW 18th Avenue	Upper Prune Hill Booster Station/852	Sample Station	LDS Church Hose Bibb on West side by Step Tank Box	2612 NW 18th Back of House Hose Bibb
5	NW 9th Avenue and NW Hoquiam Court	Distribution Piping/ 852	Sample Station	1034 Hoquiam Upstairs Laundry Rm Wash Sink	3323 NW 9th Garage Wash Sink
6	418 NW 6th Avenue	Forest Home Booster Station/455	Sample Station	None Available	None Available
7	200 NE 23rd Avenue	Angelo Booster Station/455	Sample Station	Well 13 or Washougal Wellfield	Lower Prune Hill Booster
8	1707 NE Ione Street	Camas School District Bus Shop/343	Wash Sink Paint Room	1617 Ione Loop Rd Hose Bibb	1608 Ione Loop Hose Bibb
9	616 NE 4th Avenue	Fire Station 41/343	Wash Sink Fire Bay	Lutz Hardware Storeroom Wash Sink Library Janitor Closet Sink	713 NE 4th Camas Family Doctor Hand Wash Sink

TABLE H-1 – (continued)

City of Camas Water System Coliform Monitoring Plan Sample Stations

No.	Address	Description/ Pressure Zone	Sample Point	Upstream Repeat	Downstream Repeat
10	NE 2nd Avenue and SE Yale Street	Distribution System/ 343	Sample Station	2815 E 1st Garage Sink	2709 NW Lake Road Wash Sink (833-0775)
11	26306 SE 15th Street	Butler Booster Station/ 542	Sample Station	Gregg Booster (Old or New)	535 NE 43rd Garage Hose Bibb
12	27200 SE Robinson Road	Residence/542	Sample Station	27224 SE Robinson Rd Hose Bibb	27117 SE Robinson Rd Hose Bibb
13	26306 SE 15th Street	Gregg Booster Station (Old or New)/542	Sample Station	945 NE 43rd Hose Bibb	Butler Booster
14	2600 NW Lake Road	Underwriters Laboratory/544	Loading Dock Entry Wash Sink	3008 NW Lake Rd Bathroom Sink	2709 NW Lake Rd (833-0775)
15	4302 NW Dahlia Drive	Residence/544	Sample Station (Meter Box)	2630 NW 44th Laundry Room Wash Sink	4069 NW Dahlia Loop Jim Schubert (210-7563
16	4620 NW Sierra Street	Lacamas Booster Station/544	Hose Bibb (Inside Back Wall)	1826 NW 45th Wash Sink	Heritage Park Restroom Janitor's Wash Sink
17	SE 46th Way and SE Grand Ridge Drive	Grand Ridge Phase 4/ 852	Sample Station	None Available	None Available
18	SE 11th Avenue and SE Polk Street	Distribution System/ 343	Sample Station	Wastewater Treatment Plant Lab Room Sink	1718 SE 11th River Place Apts Hose Bibb by Garbage Bins
19	3263 NW 45th Avenue	Residence/544	Sample Station	None Available	None Available
20	4231 NW Parker Street	Fire Station 42/544	Wash Sink	Grass Valley Park Utility Rm Wash Sink	Skyridge School Janitor Rm Wash Sink

TABLE H-1 – (continued)

City of Camas Water System Coliform Monitoring Plan Sample Stations

No.	Address	Description/ Pressure Zone	Sample Point	Upstream Repeat	Downstream Repeat
21	NE Everett Street & NE 15th Avenue	Crown Park / 455	Sample Station	None Available	None Available
22	2702 SW 6th Avenue	West End / 455	Sample Station	None Available	None Available
23	NE Adams Street & SE Leadbetter Road	Deerhaven / 455	Sample Station	None Available	None Available

ROUTINE COLIFORM MONITORING PROCEDURES

As shown in Table H-1 as well as the Figure at the end of this Appendix, the City of Camas has 24 sampling locations in its distribution system for its total coliform monitoring program.

The City is required to collect 20 samples per month in its distribution system. Sample sites are rotated seasonally within each pressure zone. See rotation schedules below.

TABLE H-2

Coliform Sampling Station Rotations by Zone

No.	Address or Facility	Rotation
Butler Zone (343)		
8	1707 NE Ione	Spare
9	616 NE 4th	Winter
10	NE 2nd and Yale	Summer
11	Butler Booster Station	Winter
18	SE 11th and Polk	Summer
Lower Prune Hill Zone (455)		
6	Forest Home Booster Station	Spare
7	Angelo Booster Station	Summer and Winter
21	Crown Park	Spare
22	SW 6th West End	DOH Compliance Samples (non-coliform water quality testing)
23	Deerhaven	Not in Use(1)
Gregg Zone (542)		
12	27200 SE Robinson Road	Summer and Winter
13	Gregg Booster	Winter
Lacamas Zone (544)		
14	Underwriters Lab	Winter
15	4302 NW Dahlia	Summer
16	Lacamas Booster Station	Winter
19	3263 NW 45th Court	Not in Use(1)
20	Station 42 (Parker Street)	Summer and Winter
Upper Prune Hill Zone (852)		
1	NW 24th and Elgin	Summer
2	NW 24th and Maryland	Summer
3	Lower Prune Hill Booster Station	Winter
4	Upper Prune Hill Booster Station	Winter
5	NW 9th and Hoquiam	Summer
17	SE Grandridge	Not in Use(1)

(1) Normally not used because of low water use.

FOLLOW-UP COLIFORM SAMPLING FOR UNSATISFACTORY SAMPLE

If a routine total coliform sample is positive, follow-up sampling is required within 24 hours for each source per Ground Water Rule as well as distribution system samples upstream, downstream and at the sampling location that tests positive for total coliform.

Below is a list of sources and the zones served for those sources:

BOULDER AND JONES CREEKS (S01 AND S02)

These sources run from November 1 to May 15. Water from these sources can go to all zones.

WELL NO. 5 (S06)

This source feeds the 343 Zone. With Forrest Home Booster Station in operation, it will also feed the 455 Zone. If the Lower Prune Hill Booster Station is in operation with the Forrest Home Booster Station is in operation, it will feed the 852 Zone.

WASHOUGAL WELLFIELD

Well No. 6 (S07), Well No. 7 (S08), Well No. 8 (S09), Well No. 10 (S15), Well No. 11 (S13), Well No. 12 (S14) and Well No. 13 (S16) feed the entire distribution system.

WELL NO. 9

Well No. 9 (S11) feeds Zone 544.

For distribution system samples that test positive, three upstream and three downstream samples must be collected along with three samples from the location that tested positive. Also a sample is taken before treatment at each source that was running during this time.

In addition to taking the samples described above, a thorough inspection of the distribution system is required to determine the potential source of contamination, including “openings” in the system and/or treatment equipment failure.

Review of sampling procedures is also required to verify samples are taken correctly to avoid the possibility of cross contamination.

EMERGENCY NOTIFICATIONS

The list on the following page shall be used as needed to contact business that may be impacted by a water outage or contamination incident.

MEDICAL FACILITIES

Camas Hearing Clinic
605 NE 5th Avenue, Camas, WA, 98607
(360) 833-0609

Community Pregnancy Clinic of Camas Washougal
1542 NE 3rd Avenue, Camas, WA, 98607
(360) 834-2829

Columbia Medical Group
3400 SE 196th Avenue, Suite 101, Camas, WA, 98607
(360) 834-6700

Pacific Dermatology PC
3400 SE 196th Avenue, Camas, WA, 98607
(360) 834-2000

Elite Laser Spa
3400 SE 196th Avenue, Camas, WA, 98607
(360) 834-6740

Camas Vision Centre
225 NE 4th Avenue, Camas, WA, 98607
(360) 834-2063

Vancouver Vision Clinic
405 NE 6th Avenue, Camas, WA, 98607
(360) 834-4802

Beri Eye Care Associates, PC
19301 SE 34th Street, Suite 104, Camas, WA, 98607
(360) 817-2700

Lacamas Medical Group PC
3240 NE 3rd Avenue, Camas, WA, 98607
(360) 838-2440

Adventist Health/Medical Clinics
411 NE 6th Avenue, Camas, WA, 98607
(360) 834-2863

Supplement Clinic
30201 NE Stauffer Road, Camas, WA, 98607
(360) 210-7117

Blossom Natural Health & Wellness
417 NE Birch Street, Camas, WA, 98607
(360) 834-2732

Allen, Trevor W DMD PC
736 NE 6th Avenue, Camas, WA, 98607
(360) 859-9115

Design Dentistry
531 NE Everett Street, Camas, WA, 98607
(360) 834-4990

Align Orthodontics
19301 SE 34th Street, #101, Camas, WA, 98607
(360) 817-2747

Harris, Bryan D
316 NE Cedar Street, Camas, WA, 98607
(360) 834-2682

Messinger Eric P DDS PS
4400 NW Pacific Rim Boulevard, Camas, WA, 98607
(360) 834-3533

Gessford Orlan J
506 NE Everett Street, Camas, WA, 98607
(360) 834-3963

Nevin Robert B Dntst
2462 SE 11th Avenue, Camas, WA, 98607
(360) 834-7653.

Nevin H R DDS Jr
1636 NE Ione Loop, Camas, WA, 98607
(360) 834-3546

Nevin Robert B Dntst
403 NE 6th Avenue, Camas, WA, 98607
(360) 834-2182

Premier Dental
19221 SE 34th Street, Suite 106, Camas, WA, 98607
(360) 882-9595

RESTAURANTS

Angelo's Pizza
3136 NE 3rd Avenue, Camas, WA, 98607
(360) 835-1205

Big Lou's Texas BBQ
1924 NE 3rd Avenue, Camas, WA, 98607
(360) 834-4114

KFC
3545 NE 3rd, Camas, WA, 98607
(360) 835-2434

Pizza Palace Inc
3136 NE 3rd Avenue, Camas, WA, 98607
(360) 835-3313

Kop Chai
325 NE Cedar Street, Camas, WA, 98607
(360) 834-5287

Burgerville No 24
518 NE 3rd Avenue, Camas, WA, 98607
(360) 834-3289

Papa Murphy's Take 'N' Bake Pizza
2406 SE 8th Avenue North, Camas, WA, 98607
(360) 834-6907

Domino's Pizza
3512 NE 3rd Avenue, Camas, WA, 98607
(360) 835-1500

Subway Restaurant
602 NE 3rd Avenue, Suite B, Camas, WA, 98607
(360) 834-0210

Old Fashion Maid Drive-In
3414 NE 3rd Avenue, Camas, WA, 98607
(360) 835-3434

Mill Corner
204 NE 4th Avenue, Camas, WA, 98607
(360) 833-0474

Smittys
1816 NE 3rd Avenue, Camas, WA, 98607
(360) 834-4257

Camas Thai Cuisine
308 NE 5th Avenue, Camas, WA, 98607
(360) 833-1175

Taco Bell
3405 NE 3rd Avenue, Camas, WA, 98607
(360) 835-9201

Roots Restaurant and Bar
19215 SE 34th Street, Camas, WA, 98607
(360) 260-3001

Top Burger Restaurant
1436 NE Everett Street, Camas, WA, 98607
(360) 834-3867

Lakeside Chalet
3533 NE Everett Street, Camas, WA, 98607
(360) 834-3430

Mill Corner
204 NE 4th Avenue, Camas, WA, 98607
(360) 833-0474

El Rancho Viejo
231 NE 3rd Avenue, Camas, WA, 98607
(360) 834-5856

Jorcody Restaurants Vncvr
2013 NW Lacamas Drive, Camas, WA, 98607
(360) 833-2927

Rice Time
412 NE 4th Avenue, Camas, WA, 98607
(360) 833-9111

McDonald's
3354 NE 3rd Avenue, Camas, WA, 98607
(360) 835-8958

Prune Hill Cafe
228 NE 4th Avenue, Camas, WA, 98607
(360) 907-7899

Piccolo Paradiso
309 NE Birch Street, Camas, WA, 98607
(360) 834-7044

ELDER CARE FACILITIES

Mountainview House
2647 NW Kent Street, Camas, WA, 98607
(360) 834-3988

Prune Hill Adult Family Home
2247 NW Cascade Street, Camas, WA, 98607
(360) 834-5556

Heart Two Heart Care LLC
1745 Division Street, Camas, WA, 98607
(360) 210-7883

Lacamas Adult Family Home LLC
2746 NW 20th Avenue, Camas, WA, 98607
(360) 210-5761

Assisted Living Concepts
2647 NW Kent Street, Camas, WA, 98607
(360) 834-3988

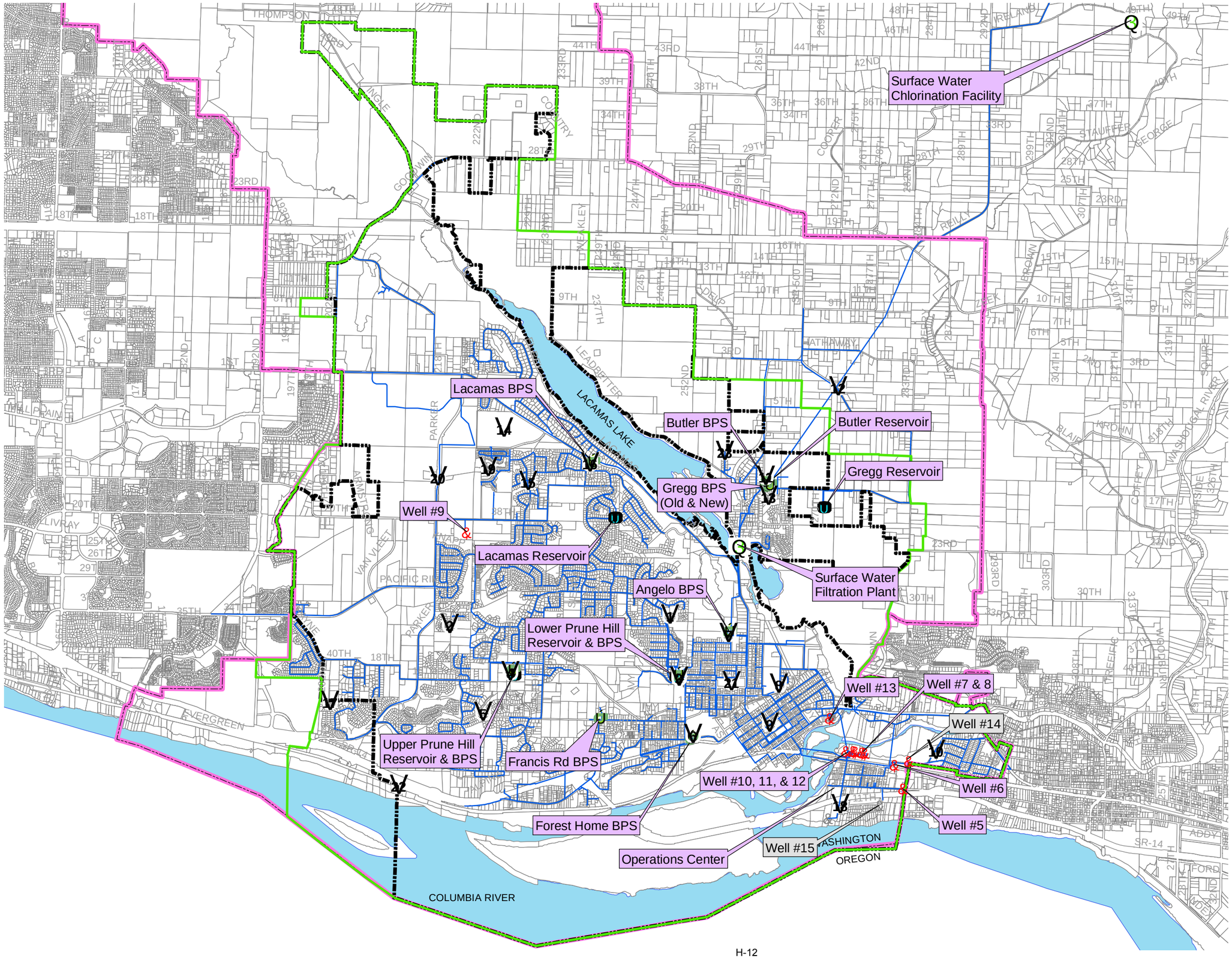
Highland Terrace Nursing Center
640 NE Everett Street, Camas, WA, 98607
(360) 834-5055

CHILD CARE FACILITIES

Camas School District 117 - School Districts, Camas Childcare
1919 NE Ione Street, Camas, WA, 98607
(360) 817-4400

Parkside Christian Preschool and Day Care
1243 E 1st Avenue, Camas, WA, 98607
(360) 834-4002

Children's Villiage At
3500 SE 196th Avenue, Camas, WA, 98607
(360) 833-1230



3

0 4,000 8,000 Feet

LEGEND:

20 monthly samples are required
- 1 from the Surface Water Filtration Plant, when in operation
- 19 from the other 19 sites

If repeat samples are required, they are taken within 5 services upstream and 5 services downstream of the positive location.

- Booster Pump Station
- Reservoir
- Water Treatment
- Well
- In Use
- Future
- Urban Growth Boundary
- City Limits
- Water Service Boundary
- WaterLines
- Parcels
- Sample Station
- Existing Facilites
- Future Facilities

SOURCE: CITY OF CAMAS

CITY OF CAMAS WASHINGTON

WATER SYSTEM O&M MANUAL

COLIFORM MONITORING STATIONS

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Appendix I

Volatile Organic Chemical Test Results

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0708094
Project:	Camas/108002/07AL0803	**Date Collected:**	09/05/2007
Sample Matrix:	Drinking water	**Date Received:**	09/08/2007

Volatile Organic Compounds

Sample Name:	Well 9	**Units:**	ug/L
Lab Code:	K0708094-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Chloromethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Vinyl Chloride	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Bromomethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Chloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Trichlorofluoromethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1-Dichloroethene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Methylene Chloride	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
trans-1,2-Dichloroethene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
2,2-Dichloropropane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
cis-1,2-Dichloroethene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Methyl tert-Butyl Ether	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1-Dichloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Chloroform	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Bromochloromethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1,1-Trichloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1-Dichloropropene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Carbon Tetrachloride	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Benzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2-Dichloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Trichloroethene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2-Dichloropropane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Bromodichloromethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Dibromomethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
cis-1,3-Dichloropropene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Toluene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
trans-1,3-Dichloropropene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1,2-Trichloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Tetrachloroethene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,3-Dichloropropane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2,3-Trichlorobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Dibromochloromethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0708094
Project:	Camas/108002/07AL0803	**Date Collected:**	09/05/2007
Sample Matrix:	Drinking water	**Date Received:**	09/08/2007

Volatile Organic Compounds

Sample Name:	Well 9	**Units:**	ug/L
Lab Code:	K0708094-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Chlorobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Ethylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1,1,2-Tetrachloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Styrene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
m,p-Xylenes	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
o-Xylene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Bromoform	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Isopropylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,1,2,2-Tetrachloroethane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2,3-Trichloropropane	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Bromobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
n-Propylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,3,5-Trimethylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
2-Chlorotoluene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
4-Chlorotoluene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
tert-Butylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2,4-Trimethylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
sec-Butylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
p-Isopropyltoluene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,3-Dichlorobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,4-Dichlorobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
n-Butylbenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2-Dichlorobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2-Dibromo-3-chloropropane (DBCP	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
1,2,4-Trichlorobenzene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Hexachlorobutadiene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	
Naphthalene	ND	U	0.50	1	09/12/07	09/12/07	KWG0709880	

Comments:

0012

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0705532
Project:	Camas/108002	**Date Collected:**	06/26/2007
Sample Matrix:	Drinking water	**Date Received:**	06/27/2007

Volatile Organic Compounds

Sample Name:	Well Field-11 & 12	**Units:**	ug/L
Lab Code:	K0705532-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Chloromethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Vinyl Chloride	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Bromomethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Chloroethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Trichlorofluoromethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,1-Dichloroethene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Methylene Chloride	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
trans-1,2-Dichloroethene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
2,2-Dichloropropane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
cis-1,2-Dichloroethene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Methyl tert-Butyl Ether	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,1-Dichloroethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Chloroform	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Bromochloromethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,1,1-Trichloroethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,1-Dichloropropene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Carbon Tetrachloride	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Benzene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,2-Dichloroethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Trichloroethene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,2-Dichloropropane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Bromodichloromethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Dibromomethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
cis-1,3-Dichloropropene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Toluene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
trans-1,3-Dichloropropene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,1,2-Trichloroethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Tetrachloroethene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,3-Dichloropropane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,2,3-Trichlorobenzene	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
Dibromochloromethane	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	07/02/07	07/02/07	KWG0707328	

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: AddyLab, LLC
Project: Camas/108002
Sample Matrix: Drinking water

Service Request: K0703045
Date Collected: 04/11/2007
Date Received: 04/12/2007

Volatile Organic Compounds

Sample Name: Boulder - Jones Creek
Lab Code: K0703045-001

Units: ug/L
Basis: NA

Extraction Method: METHOD
Analysis Method: 524.2

Level: Low

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Chloromethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Vinyl Chloride	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Bromomethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Chloroethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Trichlorofluoromethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,1-Dichloroethene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Methylene Chloride	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
trans-1,2-Dichloroethene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
2,2-Dichloropropane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
cis-1,2-Dichloroethene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Methyl tert-Butyl Ether	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,1-Dichloroethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Chloroform	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Bromochloromethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,1,1-Trichloroethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,1-Dichloropropene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Carbon Tetrachloride	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Benzene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,2-Dichloroethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Trichloroethene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,2-Dichloropropane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Bromodichloromethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Dibromomethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
cis-1,3-Dichloropropene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Toluene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
trans-1,3-Dichloropropene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,1,2-Trichloroethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Tetrachloroethene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,3-Dichloropropane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,2,3-Trichlorobenzene	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
Dibromochloromethane	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	04/18/07	04/18/07	KWG0704727	

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: AddyLab, LLC
Project: Drinking Water
Sample Matrix: Drinking water

Service Request: K0702509
Date Collected: 03/28/2007
Date Received: 03/28/2007

Volatile Organic Compounds

Sample Name: City Camas
Lab Code: K0702509-001

Units: ug/L
Basis: NA

Extraction Method: METHOD
Analysis Method: 524.2

Level: Low

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Chloromethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Vinyl Chloride	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Bromomethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Chloroethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Trichlorofluoromethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,1-Dichloroethene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Methylene Chloride	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
trans-1,2-Dichloroethene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
2,2-Dichloropropane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
cis-1,2-Dichloroethene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Methyl tert-Butyl Ether	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,1-Dichloroethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Chloroform	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Bromochloromethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,1,1-Trichloroethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,1-Dichloropropene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Carbon Tetrachloride	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Benzene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,2-Dichloroethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Trichloroethene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,2-Dichloropropane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Bromodichloromethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Dibromomethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
cis-1,3-Dichloropropene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Toluene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
trans-1,3-Dichloropropene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,1,2-Trichloroethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Tetrachloroethene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,3-Dichloropropane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,2,3-Trichlorobenzene	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
Dibromochloromethane	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	03/29/07	03/29/07	KWG0704139	

Comments:

00012

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0701023
Project:	Hunter Ridge-Camas	**Date Collected:**	02/07/2007
Sample Matrix:	Drinking water	**Date Received:**	02/08/2007

Volatile Organic Compounds

Sample Name:	West 17th, Lot 23	**Units:**	ug/L
Lab Code:	K0701023-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Chloromethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Vinyl Chloride	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Bromomethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Chloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Trichlorofluoromethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1-Dichloroethene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Methylene Chloride	**1.2**		0.50	1	02/15/07	02/15/07	KWG0702461	
trans-1,2-Dichloroethene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
2,2-Dichloropropane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
cis-1,2-Dichloroethene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Methyl tert-Butyl Ether	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1-Dichloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Chloroform	**130**	D	2.5	5	02/15/07	02/15/07	KWG0702461	
Bromochloromethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1,1-Trichloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1-Dichloropropene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Carbon Tetrachloride	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Benzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2-Dichloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Trichloroethene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2-Dichloropropane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Bromodichloromethane	**2.8**		0.50	1	02/15/07	02/15/07	KWG0702461	
Dibromomethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
cis-1,3-Dichloropropene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Toluene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
trans-1,3-Dichloropropene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1,2-Trichloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Tetrachloroethene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,3-Dichloropropane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2,3-Trichlorobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Dibromochloromethane	**0.86**		0.50	1	02/15/07	02/15/07	KWG0702461	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0701023
Project:	Hunter Ridge-Camas	**Date Collected:**	02/07/2007
Sample Matrix:	Drinking water	**Date Received:**	02/08/2007

Volatile Organic Compounds

Sample Name:	West 17th, Lot 23	**Units:**	ug/L
Lab Code:	K0701023-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Chlorobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Ethylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1,1,2-Tetrachloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Styrene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
m,p-Xylenes	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
o-Xylene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Bromoform	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Isopropylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,1,2,2-Tetrachloroethane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2,3-Trichloropropane	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Bromobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
n-Propylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,3,5-Trimethylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
2-Chlorotoluene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
4-Chlorotoluene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
tert-Butylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2,4-Trimethylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
sec-Butylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
p-Isopropyltoluene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,3-Dichlorobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,4-Dichlorobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
n-Butylbenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2-Dichlorobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2-Dibromo-3-chloropropane (DBCP	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
1,2,4-Trichlorobenzene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Hexachlorobutadiene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	
Naphthalene	ND	U	0.50	1	02/15/07	02/15/07	KWG0702461	

Comments:

00010

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: AddyLab, LLC
Project: City of Camas/10802
Sample Matrix: Drinking water

Service Request: K0605566
Date Collected: 07/06/2006
Date Received: 07/07/2006

Volatile Organic Compounds

Sample Name: Filter Plant
Lab Code: K0605566-001

Extraction Method: METHOD
Analysis Method: 524.2

Units: ug/L
Basis: NA
Level: Low

State Regulatory Level

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Chloromethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Vinyl Chloride	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Bromomethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Chloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Trichlorofluoromethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1-Dichloroethene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Methylene Chloride	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
trans-1,2-Dichloroethene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
2,2-Dichloropropane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
cis-1,2-Dichloroethene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Methyl tert-Butyl Ether	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1-Dichloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Chloroform	7.6		0.50	1	07/11/06	07/11/06	KWG0611226	
Bromochloromethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1,1-Trichloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1-Dichloropropene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Carbon Tetrachloride	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Benzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2-Dichloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Trichloroethene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2-Dichloropropane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Bromodichloromethane	0.75		0.50	1	07/11/06	07/11/06	KWG0611226	
Dibromomethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
cis-1,3-Dichloropropene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Toluene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
trans-1,3-Dichloropropene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1,2-Trichloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Tetrachloroethene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,3-Dichloropropane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2,3-Trichlorobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Dibromochloromethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Chlorobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	

7.6 micrograms per liter

Comments:

00008

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0605566
Project:	City of Camas/10802	**Date Collected:**	07/06/2006
Sample Matrix:	Drinking water	**Date Received:**	07/07/2006

Volatile Organic Compounds

Sample Name:	Filter Plant	**Units:**	ug/L
Lab Code:	K0605566-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Ethylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1,1,2-Tetrachloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Styrene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
m,p-Xylenes	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
o-Xylene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Bromoform	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Isopropylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,1,2,2-Tetrachloroethane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2,3-Trichloropropane	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Bromobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
n-Propylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,3,5-Trimethylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
2-Chlorotoluene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
4-Chlorotoluene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
tert-Butylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2,4-Trimethylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
sec-Butylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
p-Isopropyltoluene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,3-Dichlorobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,4-Dichlorobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
n-Butylbenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2-Dichlorobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2-Dibromo-3-chloropropane (DBCP	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
1,2,4-Trichlorobenzene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Hexachlorobutadiene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	
Naphthalene	ND	U	0.50	1	07/11/06	07/11/06	KWG0611226	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
4-Bromofluorobenzene	99	82-110	07/11/06	Acceptable
Dibromofluoromethane	106	83-121	07/11/06	Acceptable
Toluene-d8	115	89-117	07/11/06	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0611093
Project:	City of Camas	**Date Collected:**	12/19/2006
Sample Matrix:	Drinking water	**Date Received:**	12/20/2006

Volatile Organic Compounds

Sample Name:	Well Field-Well 10	**Units:**	ug/L
Lab Code:	K0611093-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Dichlorodifluoromethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Chloromethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Vinyl Chloride	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Bromomethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Chloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Trichlorofluoromethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1-Dichloroethene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Methylene Chloride	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
trans-1,2-Dichloroethene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
2,2-Dichloropropane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
cis-1,2-Dichloroethene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Methyl tert-Butyl Ether	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1-Dichloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Chloroform	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Bromochloromethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1,1-Trichloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1-Dichloropropene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Carbon Tetrachloride	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Benzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2-Dichloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Trichloroethene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2-Dichloropropane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Bromodichloromethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Dibromomethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
cis-1,3-Dichloropropene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Toluene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
trans-1,3-Dichloropropene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1,2-Trichloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Tetrachloroethene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,3-Dichloropropane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2,3-Trichlorobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Dibromochloromethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2-Dibromoethane (EDB)	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Chlorobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	AddyLab, LLC	**Service Request:**	K0611093
Project:	City of Camas	**Date Collected:**	12/19/2006
Sample Matrix:	Drinking water	**Date Received:**	12/20/2006

Volatile Organic Compounds

Sample Name:	Well Field-Well 10	**Units:**	ug/L
Lab Code:	K0611093-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	524.2		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Ethylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1,1,2-Tetrachloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Styrene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
m,p-Xylenes	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
o-Xylene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Bromoform	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Isopropylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,1,2,2-Tetrachloroethane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2,3-Trichloropropane	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Bromobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
n-Propylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,3,5-Trimethylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
2-Chlorotoluene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
4-Chlorotoluene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
tert-Butylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2,4-Trimethylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
sec-Butylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
p-Isopropyltoluene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,3-Dichlorobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,4-Dichlorobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
n-Butylbenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2-Dichlorobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2-Dibromo-3-chloropropane (DBCP	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
1,2,4-Trichlorobenzene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Hexachlorobutadiene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	
Naphthalene	ND	U	0.50	1	12/27/06	12/27/06	KWG0622068	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
4-Bromofluorobenzene	99	82-110	12/27/06	Acceptable
Dibromofluoromethane	99	83-121	12/27/06	Acceptable
Toluene-d8	95	89-117	12/27/06	Acceptable

Comments:

Columbia Analytical Services, Inc.
1317 South 13th Avenue
Kelso, WA 98626

State of Washington

VOLATILE ORGANIC CHEMICALS (VOCS) REPORT
EPA TEST METHOD - 524.2

System ID No.:	**10800Z**	DOH Source No:	Lab Sample No.: **01746951**
System Name:	**Camas Municipal Water-Sewer System**		Date Collected: **6/7/2006**
Multiple Source Nos:	**S-09, S-15**		Date Received: **6/8/2006**
Sample Type: **A**	Purpose: **C**	Date Analyzed: **6/9/06**	Analyst: **N. Hyde**
County: **Clark**		Date Reported: **6/12/06**	Supervisor: **Jeff Grindstaff**
Specific Collection Location:	**Well #8 and Well #10**		
Sent Report To:			
Bill To:			

DOH #	ANALYTES	LAB MDL	RESULTS	UNITS	SRL	TRIGGER	MCL	ANALYST/METHOD
			EPA REGULATED					
45	Vinyl Chloride	0.5	ND	ug/l	0.5	0.5	2	N. Hyde / 524.2
46	1,1 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	7	N. Hyde / 524.2
47	1,1,1 - Trichloroethane	0.5	ND	ug/l	0.5	0.5	200	N. Hyde / 524.2
48	Carbon Tetrachloride	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
49	Benzene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
50	1,2 - Dichloroethane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
51	Trichloroethylene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
52	P - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5	75	N. Hyde / 524.2
56	Methylene Chloride	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
57	T - 1,2 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
60	CIS - 1,2 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	70	N. Hyde / 524.2
63	1,2-Dichloropropane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
66	Toluene	0.5	ND	ug/l	0.5	0.5	1000	N. Hyde / 524.2
67	1,1,2-Trichloroethane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
68	Tetrachloroethylene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
71	Chlorobenzene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
73	Ethylbenzene	0.5	ND	ug/l	0.5	0.5	700	N. Hyde / 524.2
76	Styrene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
84	1,2 - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5	600	N. Hyde / 524.2
95	1,2,4-Trichlorobenzene	0.5	ND	ug/l	0.5	0.5	70	N. Hyde / 524.2
160	Total Xylenes	0.5	ND	ug/l	0.5	0.5	10000	N. Hyde / 524.2
			EPA UNREGULATED					
27	Chloroform	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
28	Bromodichloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
29	Dibromochloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
30	Bromoform	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
53	Chloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
54	Bromomethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
55	Chloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
58	1,1-Dichloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
59	2,2 Dichloropropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2

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DOH #	ANALYTES	LAB MDL	RESULTS	UNITS	SRL	TRIGGER	MCL	ANALYST/METHOD
			EPA UNREGULATED					
62	1,1 - Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
70	1,3 - Dichloropropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
71	Chlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
72	1,1,1,2 - Tetrachloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
78	Bromobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
80	1,1,2,2-Tetrachloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
81	O - Chlorotoluene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
82	P - Chlorotoluene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
83	M - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
97	Hexachlorobutadiene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
98	1,2,3 - Trichlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
154	1,3-Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
158	Dichlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
162	Dichlorodifluoromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
75	O - Xylene (MCL for Total)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
			STATE REGULATED					
102	EDB (Scan Confirm By 504.1)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
103	DBCP (Scan Confirm By 504.1)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
64	Dibromomethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
65	CIS - 1,3 - Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
69	TRANS - 1,3 - Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
74	M/P Xylenes (MCL for Total)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
79	1,2,3 - Trichloropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
85	Trichlorofluoromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
86	Bromochloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
87	Isopropylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
88	N - Propylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
89	1,3,5 Trimethylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
90	Tert - Butylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
91	1,2,4 - Trimethylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
92	Sec - Butylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
93	P - Isopropyltoluene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
94	N - Butylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
96	Naphthalene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
	MTBE	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

Trigger Level: DOH Drinking Water Response Level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.

MCL (Maximum Contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

NA (Not Analyzed): in the amount column indicates this compound was not included in the current analysis.

ND (Not Detected): in the amount column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

<0.001: indicates the compound was not detected in the sample. It also indicates that the laboratory used a method detection level (lab mdl) lower than the SRL.

Comments:

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Columbia Analytical Services, Inc.
1317 South 13th Avenue
Kelso, WA 98626

State of Washington

VOLATILE ORGANIC CHEMICALS (VOCS) REPORT
EPA TEST METHOD - 524.2

n ID No.:	10800Z	DOH Source No:	Lab Sample No.: 01746952
m Name:	Camas Municipal Water-Sewer System		Date Collected: 6/7/2006
iple Source Nos:	S-08, S-13		Date Received: 6/8/2006
ple Type: A	Purpose: C	Date Analyzed: 6/9/06	Analyst: N. Hyde
nty: Clark		Date Reported: 6/12/06	Supervisor: Jeff Grindstaff
ecific Collection Location:	Well #7 and Well #11		
nt Report To:			
ill To:			

DOH #	ANALYTES	LAB MDL	RESULTS	UNITS	SRL	TRIGGER	MCL	ANALYST/METHOD
			EPA REGULATED					
45	Vinyl Chloride	0.5	ND	ug/l	0.5	0.5	2	N. Hyde / 524.2
46	1,1 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	7	N. Hyde / 524.2
47	1,1,1 - Trichloroethane	0.5	ND	ug/l	0.5	0.5	200	N. Hyde / 524.2
48	Carbon Tetrachloride	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
49	Benzene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
50	1,2 - Dichloroethane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
51	Trichloroethylene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
52	P - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5	75	N. Hyde / 524.2
56	Methylene Chloride	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
57	T - 1,2 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
60	CIS - 1,2 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	70	N. Hyde / 524.2
63	1,2-Dichloropropane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
66	Toluene	0.5	ND	ug/l	0.5	0.5	1000	N. Hyde / 524.2
67	1,1,2-Trichloroethane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
68	Tetrachloroethylene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
71	Chlorobenzene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
73	Ethylbenzene	0.5	ND	ug/l	0.5	0.5	700	N. Hyde / 524.2
76	Styrene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
84	1,2 - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5	600	N. Hyde / 524.2
95	1,2,4-Trichlorobenzene	0.5	ND	ug/l	0.5	0.5	70	N. Hyde / 524.2
160	Total Xylenes	0.5	ND	ug/l	0.5	0.5	10000	N. Hyde / 524.2
			EPA UNREGULATED					
27	Chloroform	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
28	Bromodichloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
29	Dibromochloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
30	Bromoform	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
53	Chloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
54	Bromomethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
55	Chloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
58	1,1-Dichloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
59	2,2 Dichloropropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2

00013

Columbia Analytical Services, Inc.
1317 South 13th Avenue
Kelso, WA 98626

State of Washington

VOLATILE ORGANIC CHEMICALS (VOCS) REPORT
EPA TEST METHOD - 524.2

System ID No.: 10800Z	DOH Source No: S07	Lab Sample No.: 01746953	
System Name: Camas Municipal Water-Sewer System		Date Collected: 6/7/2006	
Multiple Source Nos:		Date Received: 6/8/2006	
Sample Type: A	Purpose: C	Date Analyzed: 6/9/06	Analyst: N. Hyde
County: Clark		Date Reported: 6/12/06	Supervisor: Jeff Grindstaff
Specific Collection Location: Well #6			
Sent Report To:			
Bill To:			

DOH #	ANALYTES	LAB MDL	RESULTS	UNITS	SRL	TRIGGER	MCL	ANALYST/METHOD
EPA REGULATED								
45	Vinyl Chloride	0.5	ND	ug/l	0.5	0.5	2	N. Hyde / 524.2
46	1,1 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	7	N. Hyde / 524.2
47	1,1,1 - Trichloroethane	0.5	ND	ug/l	0.5	0.5	200	N. Hyde / 524.2
48	Carbon Tetrachloride	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
49	Benzene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
50	1,2 - Dichloroethane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
51	Trichloroethylene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
52	P - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5	75	N. Hyde / 524.2
56	Methylene Chloride	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
57	T - 1,2 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
60	CIS - 1,2 - Dichloroethylene	0.5	ND	ug/l	0.5	0.5	70	N. Hyde / 524.2
63	1,2-Dichloropropane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
66	Toluene	0.5	ND	ug/l	0.5	0.5	1000	N. Hyde / 524.2
67	1,1,2-Trichloroethane	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
68	Tetrachloroethylene	0.5	ND	ug/l	0.5	0.5	5	N. Hyde / 524.2
71	Chlorobenzene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
73	Ethylbenzene	0.5	ND	ug/l	0.5	0.5	700	N. Hyde / 524.2
76	Styrene	0.5	ND	ug/l	0.5	0.5	100	N. Hyde / 524.2
84	1,2 - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5	600	N. Hyde / 524.2
95	1,2,4-Trichlorobenzene	0.5	ND	ug/l	0.5	0.5	70	N. Hyde / 524.2
160	Total Xylenes	0.5	ND	ug/l	0.5	0.5	10000	N. Hyde / 524.2
EPA UNREGULATED								
27	Chloroform	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
28	Bromodichloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
29	Dibromochloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
30	Bromoform	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
53	Chloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
54	Bromomethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
55	Chloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
58	1,1-Dichloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
59	2,2 Dichloropropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2

00015

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DOH #	ANALYTES	LAB MDL	RESULTS	UNITS	SRL	TRIGGER	MCL	ANALYST/METHOD
				EPA UNREGULATED				
62	1,1 - Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
70	1,3 - Dichloropropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
71	Chlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
72	1,1,1,2 - Tetrachloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
78	Bromobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
80	1,1,2,2-Tetrachloroethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
81	O - Chlorotoluene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
82	P - Chlorotoluene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
83	M - Dichlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
97	Hexachlorobutadiene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
98	1,2,3 - Trichlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
154	1,3-Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
158	Dichlorobenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
162	Dichlorodifluoromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
75	O - Xylene (MCL for Total)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
				STATE REGULATED				
102	EDB (Scan Confirm By 504.1)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
103	DBCP (Scan Confirm By 504.1)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
64	Dibromomethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
65	CIS - 1,3 - Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
69	TRANS - 1,3 - Dichloropropene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
74	M/P Xylenes (MCL for Total)	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
79	1,2,3 - Trichloropane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
85	Trichlorofluoromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
86	Bromochloromethane	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
87	Isopropylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
88	N - Propylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
89	1,3,5 Trimethylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
90	Tert - Butylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
91	1,2,4 - Trimethylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
92	Sec - Butylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
93	P - Isopropyltoluene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
94	N - Butylbenzene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
96	Naphthalene	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2
	MTBE	0.5	ND	ug/l	0.5	0.5		N. Hyde / 524.2

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

Trigger Level: DOH Drinking Water Response Level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.

MCL (Maximum Contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

NA (Not Analyzed): in the amount column indicates this compound was not included in the current analysis.

ND (Not Detected): in the amount column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.

<0.001: indicates the compound was not detected in the sample. It also indicates that the laboratory used a method detection level (lab mdl) lower than the SRL.

Comments:

00016

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Appendix J

Lead and Copper Test Results

EDGE ANALYTICAL
The lab you can trust!

Burlington WA | 1620 S Walnut St - 98233
Corporate Office | 800.755.9295 • 360.757.1400 • 360.757.1402fax
Bellingham WA | 805 Orchard Dr Suite 4 - 98225
Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT FOR LEAD & COPPER

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 06-15702
Project: City of Camas Lead & Copper

System Name:
System ID Number:
DOH Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: B
County:

Analyst mvp
Date Received: 12/5/2006
Report Date: 12/11/2006

Supervisor:

			DOH#	23 (Copper)	9 (Lead)
			SRL	0.02 mg/L	0.002 mg/L
			AL	1.3 mg/L	0.015 mg/L
Lab Number	Date Collected	Site / Location		Copper mg/L	Lead mg/L	METHOD
04633867	11/30/06	638 SE Polk		0.312	ND	200.8
04633868	11/30/06	777 SE Polk St		0.266	ND	200.8
04633869	11/30/06	623 SE Tampa St		0.216	ND	200.8
04633870	11/30/06	1234 NE 6th Ave		0.172	0.002	200.8
04633871	12/1/06	2232 NE 3rd Lp		0.048	0.002	200.8
04633872	12/1/06	103 NE 14th Ave		ND	ND	200.8
04633873	12/1/06	5220 NW 16th		0.140	ND	200.8
04633874	11/29/06	2538 NW Ivy St		0.099	ND	200.8
04633875	11/30/06	2621 NW Walden		0.025	ND	200.8
04633876	12/1/06	2826 NW LaCamas		0.040	ND	200.8
04633877	11/30/06	2549 NW LaCamas		0.176	ND	200.8
04633878	11/30/06	1811 NW Hood St		0.168	ND	200.8
04633879	11/30/06	850 NW Viewridge		0.056	ND	200.8
04633880	11/30/06	429 NW Viewridge		0.142	ND	200.8
04633881	11/30/06	2127 NW Couch		0.110	ND	200.8
04633882	11/30/06	1429 NW Ash St		0.040	ND	200.8
04633883	11/30/06	2535 NW Ivy St		0.347	ND	200.8
04633884	12/1/06	2708 NW Ivy St		0.043	ND	200.8
04633885	11/30/06	544 NW View Rd		0.307	ND	200.8
04633886	11/29/06	635 NW Viewridge		0.264	ND	200.8

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A 'ank MCL value indicates a level is not currently established.

L (Federal Action Level): 0.015mg/L for Lead and 1.3 mg/L for Copper. If the compounds detected at concentration in excess of this level, contact your regional DOH office for further information.

ND (Not Detected): Indicates that the compound was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this compound was not analyzed.

Comments:

FORM: Pb&Cu

EDGE ANALYTICAL
The lab you can trust!

Burlington WA | 1620 S Walnut St - 98233
Corporate Office | 800.755.9295 • 360.757.1400 • 360.757.1402fax
Bellingham WA | 805 Orchard Dr Suite 4 - 98225
Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT FOR LEAD & COPPER

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 06-15702
Project: City of Camas Lead & Copper

System Name:
System ID Number:
DOH Source Number:
Multiple Sources:
Sample Type:
Sample Purpose: B
County:

Analyst mvp
Date Received: 12/5/2006
Report Date: 12/11/2006

			DOH#	23 (Copper)	9 (Lead)	
			SRL	0.02 mg/L	0.002 mg/L	
			AL	1.3 mg/L	0.015 mg/L	
Lab Number	Date Collected	Site / Location		Copper mg/L	Lead mg/L	METHOD
04633887	11/30/06	2209 NW Douglas		0.098	ND	200.8
04633888	12/1/06	2816 NW 11th Ave		0.209	ND	200.8
04633889	11/30/06	2606 NW 15th Cir		0.057	ND	200.8
04633890	11/30/06	1635 NW Deerfern		0.106	ND	200.8
04633891	11/29/06	223 NE 22nd Ave		ND	ND	200.8
04633892	11/3/06	355 NE Oak St		0.273	ND	200.8
04633893	11/30/06	1921 NW 40th Ave		0.282	ND	200.8
04633894	11/30/06	2450 NW 15th Cir		0.362	0.002	200.8
04633895	11/30/06	2822 NW 9th Ave		0.023	ND	200.8
04633896	11/30/06	1925 NW 30th Cir		0.591	ND	200.8
04633897	12/1/06	5005 NW Sierra		0.283	ND	200.8

NOTES:

SRL (State Reporting Level): Indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

AL (Federal Action Level): 0.015mg/L for Lead and 1.3 mg/L for Copper. If the compounds detected at concentration in excess of this level, contact your regional DOH office for further information.

ND (Not Detected): Indicates that the compound was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): Indicates that this compound was not analyzed.

Comments:

FORM: Pb&Cu

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab@wa-net.co

06-15702
33367 - 33397

CHAIN OF CUSTODY REPORT 06AL0954

CLIENT:

REPORT TO:

ADDRESS: ADDY LAB

PHONE: FAX:

INVOICE TO: ADDY LAB

P.O. NUMBER:

PROJECT NAME: CITY of COMAS

PROJECT NUMBER:

SAMPLED BY:

TURNAROUND REQUEST in Business Days*

Organic & Inorganic Analyses: 10 | 7 | 5 | 4 | 3 | 2 | 1 | <1 (STD.)

Petroleum Hydrocarbon Analyses: 5 (STD.) | 4 | 3 | 2 | 1 | <1

OTHER Please Specify

*Turnaround Requests less than standard may incur Rush Charges.

REQUESTED ANALYSES: Pb/Cu

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	Pb/Cu	MATRIX (W, S, O)	# OF CONT.	COMMENTS
1	1. 1038 SE POLK	8:45 / 11.30.06	X	W		
2	2. 777 SE POLK ST	10:15 / 11.30.06	X			
4	3. 1023 SE TAMPA ST	430 / 11.30.06	X			
5	4. 1234 NE 10TH AVE	9:00 / "	X			
6	5. 2232 NE 3RD LP	10:00 / "	X			
7	6. 103 NE 14TH AVE	5:30 / 12/1/06	X			
8	7. 5220 NW 16TH CIR	7:00 / "	X			
9	8. 2538 NW IVY ST	14:30 / 11-29-06	X			
10	9. 2621 NW WALDEN	7:20 / 11.30.06	X			
11	10. 2826 NW LAGAMAS	10:30 / 17.1.06	X			
12	11. 2545 NW LAGAMAS	8:30 / 11.30.06	X			
13	12. 1811 NW HOOD ST	10:20 / "	X			
14	13. 850 NW VIEW DR	18:00 / "	X			

RELINQUISHED BY:	DATE:	RECEIVED BY: Edward Newman	DATE: 12/1/06
PRINT NAME:	FIRM: TIME:	PRINT NAME: E NEWMAN	FIRM: TIME: 1100
RELINQUISHED BY: Edward Newman	DATE: 12/1/06	RECEIVED BY:	DATE: 12/5/06
PRINT NAME: E NEWMAN	FIRM: TIME: 1700	PRINT NAME: C DeVeiteo	FIRM: Edge TIME: 1200

TEMP: 14°C 10°C

PAGE 1 OF 3

CC REV 06/04

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab@wa-net.com

06-15702
33867 - 33897

CHAIN OF CUSTODY REPORT 06AL0954

CLIENT:

REPORT TO:

ADDRESS: ADDY LAB

PHONE: FAX:

INVOICE TO: ADDY LAB

P.O. NUMBER:

PROJECT NAME: City of Camas

PROJECT NUMBER:

SAMPLED BY:

TURNAROUND REQUEST in Business Days*

Organic & Inorganic Analyses: 10 | 7 | 5 | 4 | 3 | 2 | 1 | <1 (STD.)

Petroleum Hydrocarbon Analyses: 5 (STD.) | 4 | 3 | 2 | 1 | <1

OTHER — Please Specify

*Turnaround Requests less than standard may incur Rush Charges.

REQUESTED ANALYSES: PB/Cu

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	PB/Cu	MATRIX (W, S, O)	# OF CONT.	COMMENTS
15	1. 429 NW New Rite	11.30.06 6:00	X	W		
16	2. 2127 NW Couch	" 9:30	X			
17	3. 1429 NW Ash St	" 9:05	X			
18	4. 2539 NW Ivy St	" 7:30	X			
19	5. 2708 NW Ivy St	12.1.06 5:00	X			
20	6. 544 NW View Rd	11.30.06 7:55	X			
21	7. 1035 NW View Birch	11.29.06 8:15	X			
23	8. 2209 NW Douglas	11.30.06 8:17	X			
25	9. 2816 NW 11th Ave	12.1.06 7:00	X			
26	10. 2606 NW 15th Cir	11.30.06 6:00	X			
27	11. 1635 NW Deerfern	" 11:35	X			
29	12. 223 NE 22nd Ave	11.29.06 6:05	X			
33	13. 335 NE Oak St	11.30.06 8:00	X			

RELINQUISHED BY	DATE	RECEIVED BY	DATE	TEMP
Ed Senecy	12-1-06	Gwendolyn Newman	12/1/06	14°C 10°C
PRINT NAME: ED Senecy FIRM: City of Camas	TIME: 10:53 AM	PRINT NAME: E NEWMAN FIRM:	TIME: 1100	
Gwendolyn Newman	12/1/06		12/5/06	PAGE 2 OF 3
PRINT NAME: E NEWMAN FIRM:	TIME: 1700	PRINT NAME: C DeVeiteo FIRM: Edge	TIME: 1200	REV 06/04

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab@wa-net.com

06-15702
33867 - 33897

CHAIN OF CUSTODY REPORT 06AL0954

CLIENT:

REPORT TO:

ADDRESS: ADDY LAB

PHONE: FAX:

INVOICE TO: ADDY LAB

P.O. NUMBER:

PROJECT NAME: City of Camas

PROJECT NUMBER:

SAMPLED BY:

TURNAROUND REQUEST in Business Days*

Organic & Inorganic Analyses: 10 | 7 | 5 | 4 | 3 | 2 | 1 | <1 (STD.)

Petroleum Hydrocarbon Analyses: 5 (STD.) | 4 | 3 | 2 | 1 | <1

OTHER Please Specify

*Turnaround Requests less than standard may incur Rush Charges.

REQUESTED ANALYSES: Pb/Cu

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	Pb/Cu	MATRIX (W, S, O)	# OF CONT.	COMMENTS
31	1. 1921 NW 40TH AVE	11-30-06 6:00	X	W		
32	2. 2450 NW 15TH Cir	" 11:30	X			
33	3. 2822 NW 9TH AVE	" 5:15	X			
34	4. 1925 NW 34TH Cir	" 7:00	X			
35	5. 5205 NW Sierra	12/1/06 7:00	X			
	6.					
	7.					
	8.					
	9.					
	10.					
	11.					
	12.					
	13.					

RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE: 12/1/06	TEMP: 14°C 10°C
PRINT NAME: FIRM:	TIME:	PRINT NAME: E NEWMAN FIRM:	TIME: 1100	
RELINQUISHED BY:	DATE: 12/1/06	RECEIVED BY:	DATE: 12/5/06	PAGE 3 OF 3
PRINT NAME: E NEWMAN FIRM:	TIME: 1700	PRINT NAME: CDeVeiteo FIRM: Edge	TIME: 1200	REV 06/04

Appendix K

Inorganic Compound Test Results

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 4/18/07	System Group Type (Circle one) (A) B Other: Specify
Water System ID No. **108002**	System Name: **City of Camas - Wells 10,11,12**
Lab Number **14490244**	County: Clark
Sample Location Hose Bib	Source Numbers: S-13 S-14 S-15 ____ ____
	Date Received: (MM/DD/YY) 4/18/07
	Date Analyzed: (MM/DD/YY) 4/18/07; 4/19/07; 4/20/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 4/23/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☒ Post-treatment/Raw ☐ Unknown
Sample Composition: Check appropriate box ☐ S - Single Source ☒ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) ____ Phone: ____ Comments: 07AL0309; 14470075
Send Report to: City of Camas 1620 SE 8th Ave. Camas, WA 98607	Bill to: invoice

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**1.06**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.01**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.91**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.31**	NTU	0.1	1.0	1.0	not exceeded	EPA 180.1	DKD

EPA Regulated (Secondary)

0021	Chloride	**5.14**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**3.70**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**< 5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**144**	uS/cm	10	700	700	not exceeded	EPA 120.1	DKD

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: All analytes are within acceptable EPA limits.

Reviewed by: TAN Date: 4/24/07

State County (Customer) File

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Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-04688
Project: 108002 Camas

System Name: CAMAS MUNICIPAL WATER-SEWER SYSTEM
System ID Number: 108002
DOH Source Number: 96 - Blended Sample
Multiple Sources: 131415
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: Hose bib
County: Clark

Sample Number: Wells 10-11-12
Lab Number: 04610702
Collect Date: 4/18/2007
Date Received: 4/19/2007
Report Date: 4/25/2007
Sampled By: Nelson
Sampler Phone: 360-817-1563
Supervisor: JH

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	0.00049	mg/L	0.0002	0.002	0.002	so	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	bj	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	15.6	mg/L	5.0			bj	200.7	
15	HARDNESS	35.6	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 4/18/07	System Group Type (Circle one) (A) B Other: Specify
Water System ID No. **108002**	System Name: **City of Camas - Wells 7-8**
Lab Number **14490245**	County: Clark
Sample Location Hose Bib	Source Numbers: S-08 S-09
	Date Received: (MM/DD/YY) 4/18/07
	Date Analyzed: (MM/DD/YY) 4/18/07; 4/19/07; 4/20/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 4/23/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☒ Post-treatment/Raw ☐ Unknown
Sample Composition: Check appropriate box ☐ S - Single Source ☒ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) Phone: Comments: 07AL0309; 14470076
Send Report to: City of Camas 1620 SE 8th Ave. Camas, WA 98607	Bill to: invoice

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**1.05**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.01**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.44**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.36**	NTU	0.1	1.0	1.0	not exceeded	EPA 180.1	DKD

EPA Regulated (Secondary)

0021	Chloride	**3.36**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**2.26**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**< 5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**108**	uS/cm	10	700	700	not exceeded	EPA 120.1	DKD

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: All analytes are within acceptable EPA limits.

Reviewed by: TRW Date: 4/24/07

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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-04688
Project: 108002 Camas

System Name: CAMAS MUNICIPAL WATER-SEWER SYSTEM
System ID Number: 108002
DOH Source Number: 96 - Blended Sample
Multiple Sources: 0809
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: Hose bib
County: Clark

Sample Number: Wells 7-8
Lab Number: 04610703
Collect Date: 4/18/2007
Date Received: 4/19/2007
Report Date: 4/25/2007
Sampled By: Nelson
Sampler Phone: 360-817-1563
Supervisor: JAN

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	0.00099	mg/L	0.0002	0.002	0.002	so	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	bj	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	11.8	mg/L	5.0			bj	200.7	
15	HARDNESS	25.0	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 3/28/07	System Group Type (Circle one) (A) B Other: Specify
Water System ID No. **10800**	System Name: **City of Camas - 10 Well**
Lab Number **14490184**	County: Clark
Sample Location	Source Numbers: S-15
	Date Received: (MM/DD/YY) 3/28/07
	Date Analyzed: (MM/DD/YY) 3/28/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 3/29/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☒ Post-treatment/Raw ☐ Unknown
Sample Composition: Check appropriate box ☒ S - Single Source ☐ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) Phone: Comments: 07AL0237; 14470060
Send Report to: Mike Nelson 1620 SE 8th Ave. Camas, WA 98607	Bill to: Bill

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**1.08**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.10**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.58**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.50**	NTU	0.1	1.0	1.0	not exceeded	EPA 180.1	DKD

EPA Regulated (Secondary)

0021	Chloride	**4.32**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**2.49**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**< 5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**105.0**	uS/cm	10	700	700	not exceeded	EPA 120.1	DKD

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: Your test results are below the EPA maximum contaminant levels in drinking water for all analytes.

Reviewed by: Carl L Eddy Date: 3/29/07

State County (Customer) File

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Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-03767
Project: City of Camas IOCTOT

System Name: CAMAS MUNICIPAL WATER-SEWER SYSTEM
System ID Number: 108002
DOH Source Number: 15
Multiple Sources:
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: Well Field #10 Running
County: Clark

Sample Number: 108002 S15
Lab Number: 04608575
Collect Date: 3/28/2007
Date Received: 3/30/2007
Report Date: 4/9/2007
Sampled By: Mike Nelson
Sampler Phone: 360-817-1563
Supervisor:

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	ND	mg/L	0.0002	0.002	0.002	so	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	bj	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	13.2	mg/L	5.0			bj	200.7	
15	HARDNESS	25.2	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 3/28/07	System Group Type (Circle one) (A) B Other: Specify
Water System ID No. **10800**	System Name: **City of Camas - Cl2 Plant**
Lab Number **14490182**	County: Clark
Sample Location	Source Numbers: SO1 SO2 96
	Date Received: (MM/DD/YY) 3/28/07
	Date Analyzed: (MM/DD/YY) 3/28/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 3/29/07 Sample Type: (Check one) ☒ Pre-treatment/Raw ☐ Post-treatment/Raw ☐ Unknown
Sample Composition: Check appropriate box ☐ S - Single Source ☒ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) Phone: Comments: 07AL0237; 14470058
Send Report to: Mike Nelson 1620 SE 8th Ave. Camas, WA 98607	Bill to: Bill

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**ND, <0.10**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.10**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.28**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.88**	NTU	0.1	1.0	1.0	not exceeded	EPA 180.1	DKD

EPA Regulated (Secondary)

0021	Chloride	**1.42**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**0.56**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**23.4**	uS/cm	10	700	700	not exceeded	EPA 120.1	DKD

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: Your test results are below the EPA maximum contaminant levels in drinking water for all analytes.

Reviewed by: Carl R. Ashby Date: 3-29-07

State County (Customer) File

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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-03767
Project: City of Camas IOCTOT

System Name: CAMAS MUNICIPAL WATER-SEWER SYSTEM
System ID Number: 108002
DOH Source Number: 96 - Blended Sample
Multiple Sources: 0102
Sample Type: B - Before treatment
Sample Purpose: C - Compliance
Sample Location: CL2 Plant
County: Clark

Sample Number: 108002 S01/S02
Lab Number: 04608573
Collect Date: 3/28/2007
Date Received: 3/30/2007
Report Date: 4/9/2007
Sampled By: Mike Nelson
Sampler Phone: 360-817-1563
Supervisor: [illegible]

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	ND	mg/L	0.0002	0.002	0.002	so	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	bj	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	ND	mg/L	5.0			bj	200.7	
15	HARDNESS	ND	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 3/28/07	System Group Type (Circle one) (A) B Other: Specify
Water System ID No. **10800**	System Name **City of Camas - Well Field Lot 11**
Lab Number **14490183**	County: Clark
Sample Location	Source Numbers: 96 S13 S16
	Date Received: (MM/DD/YY) 3/28/07
	Date Analyzed: (MM/DD/YY) 3/28/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 3/29/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☒ Post-treatment/Raw ☐ Unknown
Sample Composition: Check appropriate box ☐ S - Single Source ☒ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) Phone: Comments: 07AL0237; 14470059
Send Report to: Mike Nelson 1620 SE 8th Ave. Camas, WA 98607	Bill to: Bill

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**1.01**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.10**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.73**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.38**	NTU	0.1	1.0	1.0	not exceeded	EPA 180.1	DKD

EPA Regulated (Secondary)

0021	Chloride	**4.62**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**2.81**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**< 5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**110.8**	uS/cm	10	700	700	not exceeded	EPA 120.1	DKD

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: Your test results are below the EPA maximum contaminant levels in drinking water for all analytes.

Reviewed by: Carl L Cuddy Date: 3-29-07

State County Customer File

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Bellingham WA | 805 Orchard Dr Suite 4 - 98225
Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-03767
Project: City of Camas IOCTOT

System Name: CAMAS MUNICIPAL WATER-SEWER SYSTEM
System ID Number: 108002
DOH Source Number: 96 - Blended Sample
Multiple Sources: 1315
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: Well Field #10 & 11 Running
County: Clark

Sample Number: 108002 S13, S15
Lab Number: 04608574
Collect Date: 3/28/2007
Date Received: 3/30/2007
Report Date: 4/9/2007
Sampled By: Mike Nelson
Sampler Phone: 360-817-1563
Supervisor: jm

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	ND	mg/L	0.0002	0.002	0.002	so	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	bj	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	14.0	mg/L	5.0			bj	200.7	
15	HARDNESS	28.4	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 4/11/07	System Group Type (Circle one) (A) B Other: Specify
Water System ID No. **00504P**	System Name **City of Camas - Boulder - Jones Crk.**
Lab Number **14490225**	County: Clark
Sample Location Boulder - Jones Creek	Source Numbers: SO1 SO2 ____ ____ ____
	Date Received: (MM/DD/YY) 4/11/07
	Date Analyzed: (MM/DD/YY) 4/11/07; 4/12/07; 4/13/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 4/16/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☐ Post-treatment/Raw ☒ Unknown
Sample Composition: Check appropriate box ☐ S - Single Source ☒ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) ____ Phone: ____ Comments: 07AL0290; 14470066
Send Report to: City of Camas 1620 SE 8th Ave. Camas, WA 98607	Bill to: invoice

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**ND**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.25**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.87**	NTU	0.1	1.0	1.0	not exceeded	EPA 180.1	DKD

EPA Regulated (Secondary)

0021	Chloride	**1.44**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**0.55**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**< 5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016								EPA 120.1	

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: All analytes are within acceptable EPA limits.

Reviewed by: TAN Date: 4/16/07

State County (Customer) File

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 6/06/07	System Group Type (Circle one) A B Other: Specify
Water System ID No. **108002**	System Name: **City of Camas - Well #9**
Lab Number **14490405**	County: Clark
Sample Location Well #9	Source Numbers: S11 ____ ____ ____ ____
	Date Received: (MM/DD/YY) 6/06/07
	Date Analyzed: (MM/DD/YY) 6/06/07; 6/07/07; 6/08/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 6/11/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☐ Post-treatment/Raw ☒ Unknown
Sample Composition: Check appropriate box ☒ S - Single Source ☐ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) ____ Phone: ____ Comments: 07AL0468; 14470126
Send Report to: City of Camas 1620 SE 8th Ave. Camas, WA 98607	Bill to: Bill

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**0.71**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.10**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.44**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.20**	NTU	0.1	0.1	1.0	exceeded	EPA 180.1	CLA

EPA Regulated (Secondary)

0021	Chloride	**2.57**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**1.06**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**<5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**242**	uS/cm	10	700	700	not exceeded	EPA 120.1	CLA

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: Your test results are below the EPA maximum contaminant level for all analytes in drinking water.

Reviewed by: DA Nerum Date: 6/11/07

State County Customer File

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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-07180
Project: 108002 Camas

System Name: CITY OF CAMAS
System ID Number: 108002
DOH Source Number: 11
Multiple Sources:
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: #9 well sample tap
County: Clark

Sample Number:
Lab Number: 04616610
Collect Date: 6/6/2007
Date Received: 6/7/2007
Report Date: 6/20/2007
Sampled By: Mike Nelson
Sampler Phone: 817-1563
Supervisor:

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	ND	mg/L	0.0002	0.002	0.002	lih	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	kiv	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	9.45	mg/L	5.0			bj	200.7	
15	HARDNESS	107	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

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Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-07180
Project: 108002 Camas

System Name: CITY OF CAMAS
System ID Number: 108002
DOH Source Number: 06
Multiple Sources:
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: #5 well
County: Clark

Sample Number:
Lab Number: 04616608
Collect Date: 6/6/2007
Date Received: 6/7/2007
Report Date: 6/20/2007
Sampled By: Mike Nelson
Sampler Phone: 817-1563
Supervisor:

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	ND	mg/L	0.0002	0.002	0.002	ljh	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	kjv	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	29.5	mg/L	5.0			bj	200.7	
15	HARDNESS	54.9	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	—
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 6/06/07	System Group Type (Circle one) A B Other: Specify
Water System ID No. **108002**	System Name: **City of Camas - Well #5**
Lab Number **14490403**	County: Clark
Sample Location Well #5	Source Numbers: SO6
	Date Received: (MM/DD/YY) 6/06/07
	Date Analyzed: (MM/DD/YY) 6/06/07; 6/07/07; 6/08/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 6/11/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☐ Post-treatment/Raw ☒ Unknown
Sample Composition: Check appropriate box ☒ S - Single Source ☐ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) Phone: Comments: 07AL0468; 14470124
Send Report to: City of Camas 1620 SE 8th Ave. Camas, WA 98607	Bill to: Bill

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**0.76**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.10**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**1.68**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.31**	NTU	0.1	0.1	1.0	exceeded	EPA 180.1	CLA

EPA Regulated (Secondary)

0021	Chloride	**4.16**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**5.91**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**<5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**239**	uS/cm	10	700	700	not exceeded	EPA 120.1	CLA

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: Your test results are below the EPA maximum contaminant level for all analytes in drinking water.

Reviewed by: [signature] Date: 6/11/07

State County Customer File

2517 E. Evergreen Blvd.
Vancouver, WA. 98661

AddyLab

Phone: 360-750-0055
Fax: 360-750-0057
Email: addylab.wa-net.com

INORGANIC CHEMICALS (IOC) REPORT

Date Collected (MM/DD/YY) 6/06/07	System Group Type (Circle one) A B Other: Specify
Water System ID No. **108002**	System Name: **City of Camas - Well #6**
Lab Number **14490404**	County: Clark
Sample Location Well #6	Source Numbers: S07
	Date Received: (MM/DD/YY) 6/06/07
	Date Analyzed: (MM/DD/YY) 6/06/07; 6/07/07; 6/08/07
Sample Purpose: Check appropriate box ☒ RC - Routine Compliance ☐ C - Confirmation ☐ I - Investigative ☐ O - Other (specify)	Date Reported: (MM/DD/YY) 6/11/07 Sample Type: (Check one) ☐ Pre-treatment/Raw ☐ Post-treatment/Raw ☒ Unknown
Sample Composition: Check appropriate box ☒ S - Single Source ☐ B - Blended (List Multiple Source Numbers in Source #s field) ☐ C - Composite (Specify in Comments field) ☐ D - Distribution sample	Sample Collected by: (Name) Phone: Comments: 07AL0468; 14470125
Send Report to: City of Camas 1620 SE 8th Ave. Camas, WA 98607	Bill to: Bill

EPA/State Regulated

DOH #	ANALYTE	RESULTS	UNITS	SRL	TRIGGER	MCL	MCL Exceeded?	Method	Analyst's Initials
0019	Fluoride	**0.68**	mg/L	0.2	2.0	4.0	not exceeded	EPA 300.0	DKD
0114	Nitrite	**ND, <0.10**	mg/L	0.5	0.5	1.0	not exceeded	EPA 300.0	DKD
0020	Nitrate	**0.71**	mg/L	0.5	5.0	10.0	not exceeded	EPA 300.0	DKD
0017	Turbidity	**0.28**	NTU	0.1	0.1	1.0	exceeded	EPA 180.1	CLA

EPA Regulated (Secondary)

0021	Chloride	**2.30**	mg/L	20	250	250	not exceeded	EPA 300.0	DKD
0022	Sulfate	**5.62**	mg/L	10	250	250	not exceeded	EPA 300.0	DKD
0018	Color	**<5**	std color units	5	15	15	not exceeded	EPA 110.2	DKD
0016	Conductivity	**163**	uS/cm	10	700	700	not exceeded	EPA 120.1	CLA

Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.
SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (maximum contaminant level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.
NA (Not Analyzed): in the results column indicates this compound was not included in the current analysis.
ND (Not Detected): in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.
< (0.001) : indicates the compound was not detected in the sample at or above the concentration indicated.
J The result is an estimate as it is greater than the method detection limit but less than the practical reporting limit.

Comments: Your test results are below the EPA maximum contaminant level for all analytes in drinking water.

Reviewed by: TM Date: 7/6/07

State County Customer File

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Bellingham WA | 805 Orchard Dr Suite 4 - 98225
Microbiology | 360.671.0688 • 360.671.1577fax

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-07180
Project: 108002 Camas

System Name: CITY OF CAMAS
System ID Number: 108002
DOH Source Number: 07
Multiple Sources:
Sample Type: A - After treatment
Sample Purpose: C - Compliance
Sample Location: #6 well sample tap
County: Clark

Sample Number:
Lab Number: 04616609
Collect Date: 6/6/2007
Date Received: 6/7/2007
Report Date: 6/20/2007
Sampled By: Mike Nelson
Sampler Phone: 817-1563
Supervisor:

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	EPA Regulated								
4	ARSENIC	ND	mg/L	0.002	0.010	0.010	mvp	200.8	
5	BARIUM	ND	mg/L	0.100	2	2	mvp	200.8	
6	CADMIUM	ND	mg/L	0.002	0.005	0.005	mvp	200.8	
7	CHROMIUM	ND	mg/L	0.010	0.1	0.1	mvp	200.8	
11	MERCURY	ND	mg/L	0.0002	0.002	0.002	ljh	245.1	
12	SELENIUM	ND	mg/L	0.005	0.05	0.05	mvp	200.8	
110	BERYLLIUM	ND	mg/L	0.003	0.004	0.004	mvp	200.8	
111	NICKEL	ND	mg/L	0.040	0.1	0.1	mvp	200.8	
112	ANTIMONY	ND	mg/L	0.005	0.006	0.006	mvp	200.8	
113	THALLIUM	ND	mg/L	0.002	0.002	0.002	mvp	200.8	
116	CYANIDE, FREE	ND	mg/L	0.050	0.2	0.2	kjv	SM4500-CN F	
	EPA Regulated (Secondary)								
8	IRON	ND	mg/L	0.100	0.3	0.3	bj	200.7	
10	MANGANESE	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
13	SILVER	ND	mg/L	0.010	0.05	0.05	mvp	200.8	
24	ZINC	ND	mg/L	0.200	5	5	mvp	200.8	
	State Regulated								
14	SODIUM	16.3	mg/L	5.0			bj	200.7	
15	HARDNESS	42.8	mg/L	10			bj	200.7	
	State Unregulated								
9	LEAD	ND	mg/L	0.002		0.015	mvp	200.8	
23	COPPER	ND	mg/L	0.020		1.3	mvp	200.8	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

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INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Addy Lab
2517 E Evergreen Blvd
Vancouver, WA 98661

Reference Number: 07-01943
Project: City of Camas

System Name: CAMAS MUNICIPAL WATER-SEWER SYSTEM
System ID Number: 108002
DOH Source Number:
Multiple Sources:
Sample Type: A - After treatment
Sample Purpose: Investigative or Other
Sample Location: Well field
County: Clark

Sample Number: City of Camas
Lab Number: 04604331
Collect Date: 2/14/2007
Date Received: 2/16/2007
Report Date: 2/21/2007
Sampled By:
Sampler Phone:
Supervisor: JN

DOH#	ANALYTES	RESULTS	UNITS	SRL	Trigger	MCL	Analyst	METHOD	COMMENT
	State Regulated								
15	HARDNESS	33.4	mg/L	3.30			bj	200.7	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).

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Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).

NA (Not Analyzed): indicates that this parameter was not analyzed.

Comments:

FORM: IOC_ST

Appendix L

Water Modeling Results

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J-5115	9.13	617	674.7	25
J3-570	9.13	448	505.7	25
J2-206	6.05	389	446.81	25.05
J2-205	6.05	385	445.28	26.12
J3-929	9.13	752	816.63	28
J3-930	9.13	746	816.53	30.56
J3-928	9.13	746	816.81	30.68
J3-932	9.13	746	817.25	30.87
J-5116	6.05	445	517.31	31.33
J-517	10.48	350	422.72	31.51
J3-533	7.2	744	817.83	31.99
J3-373	9.13	750	824.33	32.21
J3-372	9.13	750	824.66	32.35
J3-370	9.13	751	826.44	32.69
J3-853	7.2	742	818.33	33.07
J2-555	6.05	370	446.37	33.09
J2-207	6.05	369	445.61	33.19
J4-424	6.05	344	422.73	34.11
J3-1020	0	745	824.2	34.32
J3-855	7.2	742	821.32	34.37
J3-606	7.2	740	820.42	34.85
J3-367	9.13	749	829.85	35.03
J3-377	9.13	740	821.09	35.14
J3-366	9.13	749	830.12	35.15
J3-776	9.13	610	692.41	35.71
J3-775	9.13	610	692.41	35.71
J4-690	11.45	441	525.01	36.4
J3-376	9.13	736	820.11	36.45
J2-669	6.05	338	422.65	36.68
J1-157	7.29	220	305.16	36.9
J3-354	9.13	738	823.92	37.23
J3-355	9.13	738	823.95	37.24
J1-159	7.29	219	305.09	37.3
J1-158	22.91	219	305.1	37.31
J3-371	9.13	739	825.11	37.31
J2-659	6.05	336	422.52	37.49
J3-787	9.13	419	505.57	37.51
J3-933	9.13	732	818.58	37.51
J3-564	9.13	605	691.91	37.66
J3-369	9.13	740	827.64	37.97
J3-368	9.13	740	827.64	37.98
J3-360	9.13	737	824.66	37.98
J3-935	9.13	736	824.34	38.28
J1-160	7.29	215	305.09	39.03
J1-794	7.29	215	305.1	39.04
J3-374	9.13	733	823.71	39.31
J4-691	11.45	434	525.01	39.43
J3-358	9.13	732	824.17	39.94
J1-153	7.29	213	305.2	39.95
J1-811	7.29	213	305.31	40
J1-155	10.09	213	305.31	40
J1-154	10.09	213	305.31	40
J3-774	9.13	600	692.36	40.02
J3-931	9.13	724	816.41	40.04
J3-356	9.13	731	823.7	40.17
J4-425	6.05	330	422.84	40.23
J3-936	9.13	731	824.18	40.38
J3-562	9.13	730	823.45	40.49
J3-938	9.13	730	824.18	40.81
J3-352	9.13	729	823.45	40.93
J3-777	9.13	598	692.47	40.94
J3-402	9.13	559	653.71	41.04
J5-842	7.36	440	534.82	41.08
J3-362	9.13	732	826.93	41.13
J1-163	7.29	210	305.09	41.2
J1-152	22.91	210	305.11	41.21
J1-145	7.29	210	305.19	41.25
J3-397	9.13	662	758.85	41.96
J1-151	7.29	208	305.14	42.09
J1-793	7.29	207	305.12	42.51
J3-927	9.13	718	816.31	42.6
J3-353	9.13	725	823.79	42.81
J-529	407.2	723	821.87	42.84
J3-375	9.13	724	823.15	42.96
J4-756	11.45	428	527.61	43.16
J3-357	9.13	724	823.75	43.22

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J3-778	9.13	592	692.47	43.53
J2-654	6.05	290	390.74	43.65
J3-347	9.13	722	822.89	43.72
J3-345	9.13	721	822.55	44
J1-123	7.29	201	302.86	44.14
J3-348	9.13	721	822.91	44.16
J1-164	7.29	203	305.08	44.23
J3-940	9.13	722	824.41	44.37
J2-833	6.05	320	422.7	44.5
J5-832	6.05	320	422.7	44.5
J2-208	6.05	343	446.26	44.74
J3-709	9.13	655	758.85	45
J-5123	9.13	554	657.85	45
J-5131	9.13	576	679.85	45
J1-162	7.29	201	305.1	45.11
J1-150	7.29	201	305.17	45.14
J5-638	7.36	430	534.59	45.32
J-5109	6.05	412	517.31	45.63
J4-700	9.13	400	505.66	45.78
J3-571	9.13	400	505.67	45.78
J1-148	7.29	199	305.13	45.99
J2-190	6.05	340	446.89	46.31
J1-149	22.91	198	305.12	46.42
J2-204	6.05	337	445	46.8
J3-941	9.13	716	824.41	46.97
J5-639	7.36	426	534.6	47.06
J3-378	9.13	715	823.66	47.08
J3-351	9.13	713	823.15	47.73
J5-841	7.36	424	534.63	47.94
J3-297	9.13	633	745.08	48.57
J3-506	7.2	541	653.72	48.84
J3-383	9.13	710	823.67	49.25
J3-939	9.13	710	823.8	49.31
J5-640	7.36	420	534.6	49.66
J3-343	9.13	706	820.87	49.77
J1-147	7.29	190	305.16	49.9
J3-708	9.13	634	749.39	50
J3-580	9.13	588	703.39	50
J2-183	6.05	331	446.47	50.03
J3-346	9.13	707	822.55	50.07
J3-334	9.13	705	820.83	50.19
J-532	7.2	705	820.85	50.2
J3-329	9.13	705	820.94	50.24
J2-670	6.05	306	422.47	50.47
J3-344	9.13	705	821.76	50.59
J3-917	9.13	575	692.52	50.92
J-5118	9.13	575	692.7	51
J-5117	9.13	575	692.72	51.01
J3-333	9.13	702	820.4	51.3
J3-937	9.13	705	823.8	51.48
J3-385	9.13	702	821.24	51.67
J3-332	9.13	701	820.4	51.74
J3-324	9.13	701	820.46	51.76
J3-934	9.13	704	823.71	51.87
J-5129	9.13	560	679.84	51.93
J3-387	9.13	701	820.85	51.93
J2-554	6.05	325	445.34	52.14
J3-712	9.13	650	772.32	53
J2-660	6.05	300	422.48	53.07
J2-662	6.05	300	422.49	53.08
J3-994	9.13	383	505.57	53.11
J3-995	9.13	383	505.57	53.11
J5-637	7.36	411	534.68	53.59
J1-146	7.29	181	305.19	53.81
J3-790	9.13	700	824.64	54.01
J3-381	9.13	699	823.67	54.02
J4-843	6.05	298	422.8	54.07
J-5126	9.13	555	679.83	54.09
J3-325	9.13	695	820.46	54.36
J3-905	9.13	566	691.8	54.51
J3-300	9.13	621	746.95	54.57
J3-330	9.13	694	820.27	54.71
J3-380	9.13	697	823.66	54.88
J3-401	9.13	527	653.72	54.91
J4-622	11.45	400	526.74	54.92
J-5110	6.05	390	517.31	55.16

J3-942	9.13	696	823.67	55.32	J3-748	11.45	450	598.44	64.32
J4-414	11.45	401	528.84	55.39	J3-951	9.13	675	823.66	64.42
J3-331	9.13	692	820.14	55.52	J4-410	11.45	380	528.88	64.51
J3-323	9.13	692	820.21	55.56	J3-906	9.13	542	691.8	64.91
J2-671	6.05	294	422.47	55.66	J-518	6.05	273	423.01	65
J4-619	11.45	398	526.62	55.73	J-5087	9.13	564	714.92	65.39
J2-191	6.05	317	445.67	55.75	J3-599	9.13	664	815	65.43
J-5125	9.13	550	679.83	56.26	J2-838	6.05	295	446.4	65.6
J3-335	9.13	690	820.4	56.5	J1-106	7.29	153	304.64	65.71
J3-755	11.45	468	598.45	56.52	J1-858	7.29	153	304.65	65.71
J3-386	9.13	690	820.85	56.7	J3-876	9.13	540	691.81	65.78
J4-740	322.24	395	526.08	56.8	J3-392	9.13	669	820.81	65.78
J2-181	6.05	315	446.28	56.88	J4-409	11.45	377	528.91	65.82
J4-694	11.45	393	525.01	57.2	J3-920	9.13	540	692.31	66
J3-326	9.13	688	820.21	57.29	J3-919	9.13	540	692.31	66
J-5095	6.05	290	422.46	57.4	J1-85	7.29	152	304.58	66.11
J3-759	11.45	395	527.6	57.46	J3-361	9.13	672	824.63	66.14
J5-633	7.36	402	534.78	57.53	J1-105	7.29	152	304.64	66.14
J3-713	9.13	639	771.96	57.61	J-5086	9.13	562	714.92	66.26
J3-359	9.13	690	823.46	57.83	J3-314	9.13	667	820.3	66.42
J-5085	9.13	535	668.86	58	J3-382	9.13	670	823.64	66.57
J3-781	9.13	560	694.54	58.3	J3-598	9.13	660	813.75	66.62
J3-591	9.13	562	696.73	58.38	J3-785	9.13	537	691.06	66.75
J4-620	11.45	392	526.75	58.39	J3-780	9.13	540	694.54	66.96
J1-108	7.29	170	304.77	58.4	J3-561	9.13	665	819.55	66.97
J1-107	7.29	170	304.77	58.4	J4-796	11.45	372	526.76	67.06
J5-634	7.36	400	535.05	58.52	J4-615	11.45	372	526.84	67.09
J-5089	9.13	580	715.08	58.53	J4-411	11.45	374	528.86	67.1
J1-161	7.29	170	305.14	58.56	J4-696	11.45	370	525.04	67.18
J3-316	9.13	685	820.74	58.81	J3-789	9.13	670	825.47	67.37
J3-779	9.13	557	692.9	58.89	J3-715	9.13	616	771.6	67.42
J4-738	11.45	390	526.02	58.94	J-513	9.13	603	758.84	67.52
J3-388	9.13	684	820.73	59.24	J2-182	6.05	290	446.15	67.66
J3-865	11.45	390	526.74	59.25	J2-230	6.05	290	446.36	67.75
J3-587	9.13	560	696.87	59.3	J3-960	9.13	615	771.54	67.83
J3-954	9.13	686	823.61	59.63	J3-959	9.13	615	771.54	67.83
J-853	0	685	822.86	59.74	J4-419	11.45	372	528.55	67.83
J-516	9.13	527	665.47	60	J-5046	9.13	540	696.94	68
J3-703	11.45	460	598.47	60	J3-973	6.05	265	422.72	68.34
J3-384	9.13	685	823.59	60.05	J3-339	9.13	661	819.54	68.7
J4-618	11.45	388	526.75	60.12	J4-418	11.45	370	528.59	68.72
J3-391	9.13	682	820.83	60.16	J4-417	11.45	370	528.66	68.75
J3-327	9.13	681	820.21	60.32	J3-786	9.13	532	691.05	68.92
J3-328	9.13	681	820.46	60.43	J3-600	9.13	655	814.19	68.98
J2-664	6.05	283	422.7	60.53	J3-753	11.45	439	598.45	69.09
J2-184	6.05	306	446.25	60.77	J2-702	6.05	263	422.47	69.1
J3-315	9.13	680	820.3	60.79	J3-318	9.13	660	819.61	69.16
J3-918	9.13	552	692.37	60.82	J1-109	7.29	145	304.64	69.17
J3-915	9.13	674	815.56	61.34	J4-616	11.45	367	526.84	69.26
J4-750	11.45	386	527.61	61.36	J3-272	9.13	505	665.47	69.53
J3-322	9.13	678	819.69	61.39	J2-656	6.05	262	422.47	69.53
J3-904	9.13	550	691.8	61.44	J2-657	6.05	262	422.48	69.54
J3-527	12.96	679	820.82	61.45	J4-752	11.45	367	527.61	69.59
J3-299	9.13	603	744.93	61.5	J1-111	7.29	144	304.64	69.61
J4-408	11.45	386	528.31	61.66	J3-568	9.13	530	691	69.76
J3-349	9.13	680	822.4	61.7	J4-420	11.45	367	528.38	69.93
J3-389	9.13	677	820.68	62.26	J3-956	9.13	610	771.44	69.95
J3-714	9.13	628	771.7	62.27	J2-661	6.05	261	422.49	69.97
J4-844	6.05	279	422.79	62.31	J3-916	9.13	654	815.58	70.01
J4-617	11.45	383	526.8	62.31	J3-597	9.13	651	812.61	70.03
J3-338	9.13	675	819.66	62.68	J3-871	9.13	530	691.75	70.09
J4-434	11.45	383	527.83	62.76	J3-907	9.13	530	691.8	70.11
J3-336	9.13	675	820.05	62.85	J3-390	9.13	659	820.83	70.12
J2-189	6.05	301	446.15	62.9	J3-1005	7.36	380	541.9	70.15
J3-993	9.13	570	715.4	63	J3-393	9.13	658	820.67	70.49
J3-826	7.2	670	815.61	63.09	J4-621	11.45	364	526.79	70.54
J3-784	9.13	545	691.13	63.32	J4-695	11.45	362	525.04	70.64
J3-716	9.13	625	771.57	63.51	J3-321	9.13	656	819.49	70.84
J3-379	9.13	677	823.66	63.55	J3-1007	7.36	378	541.9	71.02
J3-589	9.13	553	700.03	63.71	J3-567	9.13	527	691.29	71.19
J-5088	9.13	568	715.08	63.73	J3-394	9.13	656	820.67	71.35
J3-758	11.45	451	598.46	63.89	J4-625	11.45	360	524.99	71.49
J4-749	11.45	380	527.61	63.96	J2-180	6.05	281	446.26	71.61
J3-953	9.13	676	823.62	63.96	J3-596	9.13	647	812.61	71.76
J4-412	11.45	381	528.85	64.06	J3-311	9.13	655	820.71	71.8
J1-527	12.96	220	368.14	64.19	J4-436	11.45	362	527.81	71.85
J4-610	11.45	361	526.87	71.87	J4-762	11.45	349	527.6	77.39

J2-197	6.05	279	445.03	71.94	J-5083	9.13	490	668.75	77.45
J4-773	11.45	361	527.64	72.2	J3-902	9.13	512	690.95	77.54
J1-110	7.29	138	304.64	72.21	J4-746	11.45	450	629.3	77.69
J4-439	11.45	361	527.68	72.22	J-5120	9.13	535	714.68	77.86
J3-273	9.13	527	693.69	72.23	J2-188	6.05	266	445.7	77.87
J4-416	11.45	362	528.74	72.25	J3-996	7.36	362	541.83	77.92
J3-566	9.13	525	691.79	72.27	J3-966	11.45	350	530.25	78.1
J3-565	9.13	525	691.79	72.27	J5-797	7.36	362	542.4	78.17
J4-428	11.45	358	524.99	72.36	J3-302	9.13	640	820.71	78.3
J4-693	11.45	358	525	72.36	J2-231	6.05	265	446.36	78.58
J4-430	260.64	358	525.03	72.37	J2-840	6.05	265	446.4	78.6
J5-815	7.36	375	542.4	72.53	J3-955	9.13	590	771.45	78.62
J4-421	11.45	361	528.52	72.59	J3-957	9.13	590	771.47	78.63
J2-203	6.05	277	444.61	72.62	J3-317	9.13	638	819.65	78.71
J4-415	11.45	362	529.7	72.66	J3-584	9.13	518	699.66	78.71
J1-122	7.29	135	302.87	72.74	J3-870	9.13	510	691.78	78.77
J3-289	9.13	575	743.02	72.8	J4-427	11.45	343	525	78.86
J2-178	6.05	278	446.24	72.9	J2-658	6.05	240	422.53	79.09
J3-559	11.45	430	598.45	72.99	J1-104	7.29	122	304.65	79.14
J3-717	9.13	603	771.59	73.05	J3-967	11.45	350	532.75	79.18
J4-429	260.64	356	524.97	73.21	J4-614	11.45	344	526.92	79.26
J3-604	9.13	522	691.18	73.31	J-5067	11.45	342	524.95	79.27
J3-726	9.13	650	819.61	73.49	J-5084	9.13	485	668.75	79.62
J4-413	11.45	359	528.84	73.59	J4-609	11.45	343	526.86	79.67
J5-636	7.36	365	534.97	73.65	J3-290	9.13	560	744.17	79.8
J-514	9.13	573	743.01	73.67	J3-341	9.13	635	819.54	79.96
J3-727	9.13	649	819.04	73.68	J1-447	7.29	120	304.63	80
J3-575	9.13	521	691.18	73.74	J-5128	9.13	495	679.84	80.09
J4-426	11.45	355	525.23	73.76	J3-280	9.13	557	741.86	80.1
J3-782	9.13	524	694.54	73.89	J1-119	7.29	118	302.87	80.11
J3-590	9.13	526	696.55	73.9	J3-1006	7.36	357	541.95	80.14
J4-770	11.45	357	527.55	73.9	J1-844	7.29	120	305.14	80.22
J4-435	11.45	357	527.6	73.92	J-5080	9.13	483	668.58	80.41
J4-757	11.45	357	527.61	73.93	J3-894	9.13	320	505.58	80.41
J4-771	11.45	357	527.7	73.96	J2-187	6.05	260	445.71	80.47
J4-441	11.45	354	524.91	74.06	J2-179	6.05	260	446.15	80.66
J3-574	9.13	520	691.24	74.2	J3-921	9.13	506	692.18	80.67
J3-337	9.13	648	819.59	74.35	J3-303	9.13	634	820.29	80.72
J3-909	9.13	520	691.78	74.43	J1-114	7.29	118	304.63	80.87
J5-799	7.36	370	542.22	74.62	J3-396	9.13	634	820.67	80.88
J4-765	11.45	355	527.57	74.78	J3-301	9.13	634	820.73	80.91
J4-438	11.45	355	527.65	74.81	J3-281	9.13	507	694.03	81.04
J3-971	6.05	250	422.72	74.84	J2-650	7.36	357	544.19	81.11
J2-665	6.05	250	422.75	74.85	J4-772	11.45	340	527.56	81.27
J3-601	9.13	641	813.76	74.86	J3-970	6.05	235	422.72	81.34
J4-422	11.45	356	528.76	74.86	J4-528	12.96	337	524.99	81.46
J3-277	9.13	521	694.09	75	J4-692	11.45	337	524.99	81.46
J3-296	9.13	571	744.61	75.22	J3-751	11.45	410	598.45	81.65
J3-557	9.13	569	743	75.4	J-5079	9.13	480	668.58	81.71
J3-922	9.13	518	692.24	75.5	J3-903	9.13	502	690.95	81.87
J4-624	11.45	355	529.84	75.76	J5-644	7.36	355	544.29	82.02
J-5091	11.45	350	524.97	75.82	J4-769	11.45	338	527.53	82.12
J3-313	9.13	645	820.01	75.83	J3-585	9.13	510	699.7	82.2
J2-651	7.36	369	544.27	75.95	J3-1003	7.36	352	541.93	82.3
J2-192	6.05	270	445.27	75.95	J3-312	9.13	630	820.19	82.41
J4-764	11.45	352	527.63	76.1	J3-891	9.13	500	690.95	82.74
J-5010	9.13	640	816.08	76.3	J3-320	9.13	628	819.22	82.85
J3-979	9.13	568	744.34	76.41	J3-579	9.13	500	691.23	82.86
J2-839	6.05	270	446.36	76.42	J4-768	11.45	336	527.55	83
J3-958	9.13	595	771.5	76.48	J2-252	6.05	255	446.84	83.12
J3-908	9.13	515	691.8	76.61	J4-698	11.45	333	525.07	83.22
J3-291	9.13	567	744.26	76.81	J3-754	11.45	406	598.45	83.39
J2-556	6.05	340	517.31	76.83	J-5113	9.13	620	812.47	83.4
J2-196	6.05	268	445.37	76.86	J3-593	9.13	620	812.5	83.41
J3-364	11.45	360	537.46	76.89	J4-766	11.45	335	527.56	83.44
J3-560	9.13	642	819.48	76.9	J1-83	7.29	112	304.6	83.45
J2-193	6.05	268	445.57	76.94	J2-663	6.05	230	422.65	83.47
J4-437	11.45	350	527.61	76.96	J3-969	11.45	340	532.75	83.52
J3-962	11.45	350	527.61	76.96	J3-276	9.13	501	694.01	83.63
J4-527	12.96	351	528.69	76.99	J4-697	11.45	332	525.06	83.65
J-5090	9.13	643	820.71	77	J2-175	6.05	253	446.07	83.66
J-5124	9.13	480	657.85	77.06	J2-185	6.05	252	445.86	84
J4-423	11.45	350	528	77.13	J2-449	6.05	252	446	84.06
J3-342	9.13	641	819.51	77.35	J3-558	9.13	549	743.15	84.12
J3-913	9.13	637	815.56	77.37	J2-652	7.36	350	544.17	84.13
J3-743	9.13	577	771.35	84.21	J4-2017	11.45	320	527.44	89.88
J3-582	9.13	505	699.45	84.25	J4-2016	11.45	320	527.44	89.88

J1-5104	7.29	110	304.69	84.36	J4-2015	11.45	320	527.44	89.88
J-527	12.96	347	541.75	84.39	J4-2014	11.45	320	527.45	89.89
J1-5105	7.29	110	304.81	84.41	J4-2018	11.45	320	527.45	89.89
J1-5106	7.29	110	304.82	84.42	J4-2013	11.45	320	527.45	89.89
J1-5108	7.29	110	304.84	84.42	J4-2012	11.45	320	527.46	89.89
J1-5107	7.29	110	304.84	84.42	J4-2010	11.45	320	527.46	89.89
J1-115	7.29	109	304.24	84.6	J4-2000	11.45	320	527.47	89.89
J-5114	9.13	617	812.47	84.7	J-5073	11.45	320	527.49	89.91
J4-767	11.45	332	527.55	84.73	J3-963	11.45	320	527.61	89.96
J3-952	9.13	628	823.66	84.78	J2-198	6.05	236	443.74	90.01
J-5037	9.13	500	695.68	84.79	J4-530	12.96	317	524.99	90.12
J3-977	9.13	548	744.32	85.07	J1-120	7.29	94	302.48	90.33
J3-975	9.13	548	744.32	85.07	J1-102	7.29	96	304.65	90.41
J3-288	9.13	546	742.45	85.12	J3-988	9.13	610	818.71	90.43
J3-890	9.13	494	690.95	85.34	J3-294	9.13	533	741.87	90.5
J4-611	11.45	330	527.01	85.36	J3-856	9.13	615	823.9	90.52
J3-602	9.13	494	691.03	85.37	J3-857	9.13	615	823.91	90.52
J3-926	9.13	495	692.15	85.42	J3-888	9.13	482	690.95	90.54
J4-741	11.45	328	525.16	85.43	J2-450	6.05	237	446	90.56
J4-2011	11.45	330	527.49	85.57	J4-612	11.45	318	527.14	90.62
J3-594	9.13	615	812.59	85.61	J3-744	9.13	562	771.34	90.71
J4-763	11.45	330	527.6	85.62	J1-101	7.29	95	304.61	90.82
J2-553	6.05	247	444.72	85.67	J3-998	7.36	332	541.63	90.83
J2-666	6.05	225	422.74	85.68	J4-608	11.45	317	526.98	90.98
J2-738	6.05	207	404.93	85.76	J2-653	6.05	195	405.48	91.2
J3-968	11.45	332	530.25	85.9	J3-987	9.13	608	818.73	91.31
J3-976	9.13	546	744.32	85.93	J3-363	9.13	610	820.92	91.39
J3-974	9.13	546	744.32	85.93	J3-901	9.13	480	690.95	91.4
J3-783	9.13	496	694.53	86.02	J2-202	6.05	232	443.24	91.53
J2-667	6.05	224	422.73	86.11	J1-736	7.29	92	303.59	91.68
J3-398	9.13	620	819.01	86.23	J3-946	9.13	480	692.11	91.91
J3-893	9.13	306	505.58	86.48	J3-923	9.13	480	692.13	91.92
J-531	7.2	223	422.59	86.48	J2-551	6.05	231	443.55	92.1
J-5127	9.13	480	679.83	86.59	J3-886	9.13	478	690.94	92.27
J3-282	9.13	494	694.01	86.66	J-5082	9.13	455	668.48	92.5
J4-742	11.45	325	525.1	86.7	J-5077	9.13	455	668.48	92.5
J3-573	9.13	491	691.15	86.72	J-5076	9.13	455	668.5	92.51
J2-649	7.36	344	544.28	86.78	J2-212	6.05	233	446.92	92.69
J4-739	11.45	325	525.82	87.02	J2-552	6.05	230	444.56	92.97
J1-112	7.29	103	304.64	87.37	J1-82	7.29	90	304.6	92.99
J1-103	7.29	103	304.65	87.38	J2-226	6.05	232	446.61	92.99
J3-878	9.13	490	691.76	87.42	J2-195	6.05	230	444.72	93.04
J3-1002	7.36	340	541.86	87.46	J2-668	6.05	208	422.73	93.04
J1-400	7.29	182	384.02	87.54	J4-2002	11.45	312	527.41	93.34
J3-925	9.13	490	692.14	87.59	J3-912	9.13	600	815.55	93.4
J3-307	9.13	618	820.17	87.6	J5-856	3.78	310	525.57	93.41
J5-643	7.36	342	544.29	87.65	J3-586	9.13	482	697.76	93.49
J4-747	11.45	426	629.3	88.09	J2-194	6.05	229	444.93	93.56
J3-892	9.13	302	505.59	88.21	J3-595	9.13	594	810	93.59
J3-964	11.45	324	527.61	88.22	J3-718	9.13	555	771.59	93.85
J3-911	9.13	490	694.53	88.62	J2-222	6.05	230	446.64	93.87
J3-997	7.36	337	541.66	88.68	J3-309	9.13	603	819.86	93.96
J3-985	9.13	614	818.7	88.7	J1-729	6.05	185	401.97	94.01
J3-319	9.13	614	819.22	88.92	J3-947	9.13	475	692.11	94.08
J3-914	9.13	610	815.55	89.07	J2-730	6.05	185	402.15	94.09
J3-961	11.45	322	527.61	89.09	J1-84	7.29	87	304.59	94.28
J2-186	6.05	240	445.96	89.24	J3-701	9.13	590	807.71	94.33
J3-603	9.13	485	691.19	89.34	J1-118	7.29	85	303.14	94.52
J2-234	6.05	240	446.27	89.38	J3-1008	7.36	324	542.21	94.55
J3-279	9.13	535	741.54	89.49	J3-983	9.13	600	818.7	94.76
J3-395	9.13	614	820.67	89.55	J3-984	9.13	600	818.75	94.79
J3-910	9.13	485	691.8	89.61	J3-278	9.13	522	741.55	95.13
J3-887	9.13	484	690.94	89.67	J4-613	11.45	308	527.62	95.16
J3-924	9.13	485	692.13	89.75	J-5021	9.13	605	824.69	95.19
J3-578	9.13	484	691.18	89.77	J3-879	9.13	472	691.75	95.22
J4-2009	11.45	320	527.38	89.86	J4-607	11.45	307	526.8	95.24
J-5072	11.45	320	527.38	89.86	J3-581	9.13	480	699.93	95.3
J4-2008	11.45	320	527.38	89.86	J2-172	6.05	226	445.97	95.31
J4-2007	11.45	320	527.38	89.86	J3-305	9.13	600	820.01	95.33
J4-2005	11.45	320	527.38	89.86	J1-100	7.29	84	304.67	95.62
J4-2006	11.45	320	527.38	89.86	J3-877	9.13	471	691.76	95.66
J4-2004	11.45	320	527.38	89.86	J3-872	9.13	471	691.77	95.66
J4-2003	11.45	320	527.39	89.86	J3-1009	7.36	321	541.93	95.73
J4-2001	11.45	320	527.41	89.87	J3-900	9.13	470	690.94	95.73
J3-896	9.13	470	690.95	95.74	J1-137	7.29	64	304.68	104.29
J2-170	6.05	225	445.97	95.75	J3-898	9.13	450	690.94	104.4
J3-719	9.13	550	771.44	95.95	J3-899	9.13	450	690.94	104.4
J2-221	6.05	225	446.64	96.04	J2-237	6.05	205	446.29	104.55

J4-606	11.45	305	526.7	96.06
J3-875	9.13	470	691.77	96.09
J3-873	9.13	470	691.78	96.1
J3-950	9.13	470	692.07	96.22
J3-944	9.13	470	692.12	96.24
J1-116	7.29	81	303.32	96.33
J2-199	6.05	221	443.46	96.39
J-5023	9.13	600	822.51	96.41
J3-965	11.45	305	527.61	96.46
J2-250	6.05	224	446.85	96.56
J3-889	9.13	468	690.95	96.6
J3-1001	7.36	318	541.61	96.89
J3-999	7.36	318	541.61	96.89
J1-99	7.29	81	304.68	96.92
J3-990	9.13	595	818.87	97
J1-86	7.29	80	304.65	97.34
J1-113	7.29	80	304.65	97.34
J3-588	9.13	473	697.76	97.39
J-5068	11.45	300	524.88	97.44
J2-647	7.36	319	544.22	97.59
J3-1000	7.36	316	541.6	97.75
J3-897	9.13	465	690.94	97.9
J2-238	6.05	220	446.29	98.05
J3-724	9.13	545	771.34	98.07
J3-723	9.13	545	771.35	98.08
J2-254	6.05	220	446.41	98.1
J2-251	6.05	220	446.84	98.29
J3-885	9.13	465	692.18	98.44
J2-169	6.05	218	445.97	98.78
J1-737	65.41	72	300.49	99.01
J3-304	9.13	591	820.01	99.23
J2-729	7.36	315	544.28	99.35
J5-845	7.36	315	544.29	99.35
J3-978	9.13	515	744.31	99.36
J1-94	7.29	75	304.89	99.61
J2-173	6.05	216	445.97	99.64
J3-948	9.13	462	692.11	99.71
J1-445	7.29	74	304.66	99.94
J3-986	9.13	588	818.73	99.97
J1-446	7.29	73	304.82	100.45
J3-991	9.13	587	818.87	100.47
J4-830	11.45	295	527.44	100.72
J1-97	7.29	72	304.87	100.9
J3-576	9.13	457	691.02	101.4
J1-98	7.29	70	304.86	101.77
J1-91	7.29	70	305.03	101.84
J1-92	7.29	70	305.03	101.84
J3-943	9.13	457	692.05	101.85
J1-95	7.29	70	305.08	101.86
J2-176	6.05	211	446.15	101.89
J1-121	7.29	67	302.33	101.97
J1-130	7.29	69	304.35	101.98
J1-129	7.29	69	304.35	101.98
J-5121	9.13	433	668.46	102.03
J3-572	9.13	270	505.64	102.1
J-5122	9.13	433	668.86	102.2
J3-895	9.13	455	690.94	102.23
J2-177	6.05	210	446.25	102.37
J2-235	6.05	210	446.26	102.37
J2-451	6.05	210	446.32	102.4
J1-117	7.29	67	303.78	102.6
J4-858	11.45	290	526.99	102.69
J1-143	7.29	68	305.07	102.72
J1-142	7.29	68	305.13	102.75
J3-350	9.13	585	822.4	102.86
J3-874	9.13	454	691.78	103.03
J1-982	7.29	66	304.84	103.49
J1-96	7.29	66	305.04	103.58
J3-577	9.13	452	691.14	103.62
J1-124	7.29	62	301.36	103.71
J1-134	7.29	65	304.67	103.85
J1-133	7.29	65	304.67	103.85
J-5074	11.45	287	527.49	104.21
J1-795	7.29	47	307.02	112.67
J1-10	7.29	47	307.08	112.69
J-5026	9.13	560	820.25	112.77
J1-9	7.29	46	307.13	113.15
J-5031	9.13	560	821.37	113.25

J-5024	9.13	580	821.41	104.6
J1-139	7.29	67	308.65	104.71
J4-433	11.45	285	526.72	104.74
J2-174	6.05	204	446.07	104.89
J1-135	7.29	62	304.19	104.94
J1-136	7.29	62	304.19	104.94
J1-132	7.29	62	304.48	105.07
J1-90	7.29	62	305.26	105.4
J2-233	6.05	203	446.26	105.41
J-5078	9.13	425	668.48	105.5
J-5075	9.13	425	668.49	105.5
J1-93	7.29	62	305.57	105.54
J3-569	9.13	448	691.83	105.65
J-5044	9.13	450	694.69	106.03
J-5130	9.13	576	821.24	106.26
J3-583	9.13	454	699.61	106.42
J1-125	65.41	57	302.79	106.5
J2-268	6.05	200	445.98	106.58
J2-167	6.05	200	446	106.59
J2-232	6.05	198	446.26	107.57
J1-138	7.29	60	308.64	107.74
J1-88	7.29	56	304.65	107.74
J-5119	9.13	570	818.85	107.83
J1-128	7.29	55	303.92	107.86
J1-131	7.29	55	303.98	107.88
J2-448	6.05	197	445.98	107.88
J1-89	7.29	56	305.23	107.99
J2-224	6.05	197	446.71	108.2
J1-126	65.41	54	303.81	108.24
J1-127	65.41	54	303.96	108.31
J2-166	6.05	196	445.97	108.31
J2-168	6.05	195	445.97	108.74
J1-69	7.29	53	304.65	109.04
J-519	11.45	273	524.92	109.16
J1-27	7.29	54	306.58	109.44
J3-274	9.13	441	693.75	109.51
J3-100	11.45	272	524.86	109.57
J-5069	11.45	272	524.87	109.57
J3-869	9.13	440	693.12	109.68
J3-884	9.13	440	693.23	109.72
J2-646	7.36	291	544.27	109.74
J3-722	9.13	518	771.41	109.8
J1-28	7.29	53	306.59	109.88
J1-29	7.29	53	306.59	109.88
J1-30	7.29	53	306.59	109.88
J1-444	65.41	50	304.07	110.09
J3-592	9.13	558	812.48	110.27
J1-31	7.29	52	306.59	110.31
J2-264	6.05	191	446.07	110.52
J1-26	7.29	51	306.58	110.74
J1-23	7.29	51	306.58	110.74
J1-24	7.29	51	306.59	110.75
J1-34	7.29	51	306.59	110.75
J3-881	9.13	436	691.8	110.84
J3-310	9.13	564	819.85	110.86
J3-292	9.13	566	821.92	110.89
J1-25	7.29	50	306.59	111.18
J1-35	7.29	50	306.62	111.19
J1-140	7.29	52	308.77	111.26
J1-981	7.29	48	304.84	111.29
J3-992	9.13	562	819	111.36
J1-22	7.29	49	306.74	111.68
J1-21	7.29	49	306.75	111.68
J1-141	7.29	51	308.78	111.69
J2-253	6.05	189	446.93	111.76
J3-745	9.13	513	771.35	111.94
J2-219	6.05	188	446.82	112.15
J1-20	7.29	48	307.04	112.24
J1-1	7.29	48	307.08	112.26
J1-2	7.29	48	307.08	112.26
J1-3	7.29	48	307.09	112.26
J1-791	7.29	48	307.11	112.27
J1-5102	7.29	110	384.6	118.98
J1-40	7.29	39	313.62	118.99
J1-42	7.29	39	313.62	118.99
J1-5101	7.29	110	384.65	119

J-5030	9.13	560	821.37	113.25
J3-880	9.13	430	691.81	113.44
J4-431	260.64	263	524.88	113.47
J1-11	7.29	45	307.12	113.58
J2-648	7.36	282	544.21	113.62
J4-2022	9.13	562	824.29	113.65
J1-17	7.29	44	306.6	113.79
J1-16	7.29	44	306.8	113.87
J3-862	9.13	430	693.12	114.01
J3-883	9.13	430	693.23	114.06
J1-76	7.29	41	304.71	114.27
J1-15	7.29	43	306.85	114.33
J1-19	7.29	42	305.86	114.33
J1-14	7.29	43	307.07	114.42
J1-4	7.29	43	307.25	114.5
J1-81	7.29	40	304.63	114.66
J1-75	7.29	40	304.69	114.69
J1-63	7.29	46	310.71	114.7
J1-441	7.29	46	310.73	114.71
J1-980	7.29	40	304.85	114.76
J3-972	11.45	260	524.86	114.76
J1-6	7.29	42	307.25	114.93
J1-5	7.29	42	307.25	114.93
J1-57	7.29	49	314.79	115.17
J3-306	9.13	554	819.89	115.21
J2-236	6.05	180	446.25	115.37
J1-7	7.29	41	307.3	115.39
J3-860	9.13	426	692.34	115.4
J2-248	6.05	180	446.61	115.52
J2-223	6.05	180	446.71	115.56
J1-18	7.29	39	305.86	115.63
J-5070	11.45	258	524.87	115.63
J3-275	9.13	427	693.87	115.63
J1-12	7.29	40	307.14	115.75
J-5013	7.36	274	541.55	115.93
J2-225	6.05	179	446.6	115.95
J-5081	9.13	400	668.47	116.33
J1-80	7.29	36	304.83	116.48
J-5040	9.13	425	693.91	116.52
J-5043	9.13	425	693.91	116.52
J-5039	9.13	425	693.91	116.52
J1-847	7.29	42	311.26	116.67
J1-56	7.29	45	314.79	116.9
J3-308	9.13	550	819.87	116.93
J3-861	9.13	423	692.92	116.96
J1-852	7.29	48	318.56	117.23
J1-733	6.05	175	445.99	117.42
J1-854	7.29	46	317.23	117.52
J2-837	6.05	175	446.51	117.65
J1-39	7.29	49	320.6	117.68
J2-249	6.05	175	446.76	117.75
J1-49	7.29	43	314.8	117.77
J1-1015	7.29	40	311.8	117.77
J1-51	7.29	43	314.84	117.79
J3-788	9.13	419	690.94	117.83
J2-165	6.05	174	445.98	117.85
J1-13	7.29	35	307.11	117.91
J1-848	7.29	45	317.16	117.93
J1-440	7.29	35	307.16	117.93
J1-54	7.29	45	317.16	117.93
J1-59	7.29	39	311.53	118.09
J1-1014	7.29	40	312.54	118.09
J1-850	7.29	46	318.56	118.1
J1-1013	7.29	40	312.58	118.11
J1-1012	7.29	40	312.58	118.11
J1-1011	7.29	40	312.74	118.18
J1-50	7.29	42	314.81	118.21
J1-44	7.29	40	313.01	118.29
J1-58	7.29	38	311.73	118.61
J1-172	0	110	384.02	118.73
J1-5103	7.29	110	384.47	118.93
J1-442	7.29	39	313.55	118.96
J4-432	11.45	227	524.5	128.9
J2-243	6.05	146	447.32	130.56
J3-868	9.13	390	693.11	131.34
J-5016	7.36	238	541.55	131.53
J-5011	9.13	512	816.08	131.76
J-5060	11.45	220	524.5	131.94
J1-5100	7.29	110	384.78	119.06
J2-220	6.05	172	446.86	119.1
J1-5099	7.29	110	384.87	119.1
J1-5098	7.29	110	384.92	119.12
J1-5097	7.29	110	384.93	119.13
J4-699	50.81	250	525.07	119.19
J3-293	9.13	547	822.35	119.31
J3-295	7.08	547	822.43	119.34
J1-47	7.29	37	312.78	119.49
J1-48	7.29	37	313.08	119.63
J-5064	11.45	248	524.54	119.82
J3-1010	7.36	265	541.86	119.96
J-5071	11.45	248	524.86	119.97
J2-211	6.05	170	446.93	119.99
J2-209	6.05	170	446.94	120
J2-210	6.05	170	446.95	120
J2-214	6.05	170	447	120.03
J1-41	7.29	40	317.22	120.12
J-5014	7.36	264	541.55	120.26
J-5065	11.45	247	524.55	120.26
J4-847	11.45	247	524.57	120.27
J-530	7.2	52	330.32	120.59
J-5028	9.13	540	818.59	120.71
J-5062	11.45	245	524.56	121.13
J1-77	7.29	25	304.71	121.2
J2-246	6.05	167	446.77	121.22
J2-239	6.05	166	446.32	121.46
J3-725	9.13	491	771.34	121.47
J-5041	9.13	540	821.36	121.91
J3-882	9.13	412	693.77	122.09
J3-864	9.13	410	692.34	122.34
J-523	6.05	110	392.59	122.45
J3-866	9.13	410	693.11	122.67
J2-247	6.05	163	446.77	122.96
J3-858	9.13	408	692.34	123.21
J-5063	11.45	240	524.55	123.29
J1-71	7.29	20	304.64	123.33
J-5066	11.45	240	524.65	123.34
J1-72	7.29	20	304.65	123.34
J1-79	7.29	20	304.76	123.39
J1-70	7.29	20	305.23	123.59
J-5015	7.36	256	541.55	123.73
J-5019	7.36	256	541.55	123.73
J-5020	7.36	256	541.56	123.73
J1-78	7.29	19	304.71	123.8
J3-283	9.13	408	694	123.92
J2-263	6.05	160	446.08	123.96
J2-241	6.05	160	446.23	124.02
JF-102	11.45	238	524.64	124.2
J1-165	0	25	311.8	124.27
J2-255	6.05	159	446.21	124.45
J3-867	9.13	405	693.12	124.84
J2-258	6.05	158	446.15	124.86
J3-101	11.45	235	524.86	125.6
J2-240	6.05	155	446.23	126.19
J1-443	7.29	20	311.8	126.44
J3-863	9.13	400	691.85	126.46
J2-245	6.05	155	446.93	126.49
J2-260	6.05	154	446.13	126.58
J2-256	6.05	154	446.16	126.59
J3-859	9.13	400	692.34	126.67
J4-440	11.45	232	524.56	126.77
J2-257	6.05	153	446.15	127.02
J3-815	9.13	400	693.77	127.29
J4-501	7.36	250	544.21	127.48
J-5061	11.45	230	524.49	127.6
J-5009	11.45	230	524.5	127.61
JF-101	11.45	230	524.6	127.65
J2-244	6.05	152	446.94	127.8
JF-100	0	228	524.6	128.52
J2-266	6.05	149	446.03	128.7
J2-218	6.05	150	447.26	128.8

J2-836	6.05	140	446.17	132.66
J2-259	6.05	137	446.13	133.95
J2-215	6.05	135	448.13	135.68
J2-213	6.05	130	447.6	137.62
J2-262	6.05	128	446.08	137.82
J2-265	6.05	127	446	138.22
J3-405	9.13	499	818.52	138.45
J-5033	9.13	500	821.36	139.24
J2-267	6.05	124	445.98	139.52
J-5050	11.45	200	524.49	140.6
J-5051	11.45	200	524.49	140.6
J-5052	11.45	200	524.49	140.6
J-5059	11.45	200	524.49	140.6
J-5058	11.45	200	524.49	140.6
J-5049	11.45	200	524.49	140.6
J-5057	11.45	200	524.49	140.6
J-5056	11.45	200	524.49	140.6
J-5055	11.45	200	524.49	140.6
J-5048	11.45	200	524.49	140.6
J-5054	11.45	200	524.5	140.61
J-5047	11.45	200	524.51	140.61
J-5042	9.13	495	821.36	141.41
J1-812	7.29	54	383.76	142.89
J2-217	6.05	122	453.99	143.85
J-5017	7.36	209	541.55	144.09
J2-271	0	110	443.31	144.42
J2-216	6.05	121	454.68	144.58
J1-686	7.29	50	385	145.15
J1-808	7.29	50	385.33	145.3
J2-270	6.05	110	445.96	145.57
J-526	6.05	110	445.96	145.57
J-525	6.05	110	446.07	145.62
J1-810	7.29	48	385.33	146.17
J-5035	9.13	484	821.35	146.17
J1-1019	7.29	46	384.95	146.87
J1-1020	7.29	46	384.98	146.88
J1-87	7.29	45	384.26	147
J1-851	7.29	46	385.33	147.03
J1-1022	7.29	46	385.33	147.03
J1-64	7.29	46	385.33	147.03
J1-688	7.29	45	385	147.32
J1-806	7.29	44	384.92	147.72
J1-1021	7.29	44	385.33	147.9
J1-1016	7.29	44	387.34	148.77
J3-404	9.13	470	818.52	151.02
J1-60	7.29	35	385.33	151.8
J2-269	6.05	90	445.96	154.24
J-5018	7.36	185	541.54	154.49
J1-700	0	20	384.02	157.73
J-528	12.96	454	824.44	160.51
J1-815	7.29	0	383.81	166.3
J1-816	7.29	0	384.06	166.41
J1-900	7.29	0	384.23	166.49
J1-401	7.29	0	384.46	166.59
J2-261	6.05	50	446.13	171.64
J-5053	11.45	110	524.49	179.6
J-5096	7.36	110	535.06	184.18
J-5093	7.36	110	544.22	188.15
J-5092	7.36	110	544.27	188.17
J-524	9.13	110	741.83	273.77
J-515	9.13	110	742.99	274.28
J-5025	9.13	110	821.41	308.25
J-5045	9.13	110	824.62	309.64
J-854	407.2	110	825.33	309.95

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow (gpm)
J1-107	2,003.52	J1-108	-134.09	-139.47	730.28	729.28	J1-108	20.07	730.30	730.28
J1-160	2,003.52	J1-160	-18.69	171.87	812.30	808.39	J1-160	20.08	812.32	812.30
J1-146	2,003.52	J1-146	-50.96	63.39	949.12	947.08	J1-146	20.09	949.12	949.12
J1-85	2,003.52	J1-85	-135	-159.57	1,014.12	1,013.24	J1-85	20.1	1,014.12	1,014.12
J1-145	2,003.52	J1-145	-8.13	191.24	1,015.63	1,010.69	J1-145	20.1	1,015.64	1,015.63
J1-123	2,003.52	J1-123	-43.31	101.05	1,177.18	1,175.26	J1-123	20.12	1,177.15	1,177.15
J1-794	2,003.52	J1-794	7.63	232.6	1,252.84	1,243.47	J1-794	20.12	1,252.86	1,252.84
J1-84	2,003.52	J1-85	-60.42	12.55	1,266.49	1,554.04	J1-85	-8.01	1,266.48	1,266.48
J1-159	2,003.52	J1-159	12.98	248.95	1,385.07	1,370.83	J1-159	20.14	1,385.12	1,385.07
J1-70	2,003.52	J1-70	-84.97	-176.11	1,421.34	1,420.42	J1-70	20.14	1,421.34	1,421.34
J1-149	2,012.73	J1-149	5.44	210.56	1,426.99	1,420.35	J1-149	20.14	1,426.99	1,426.99
J1-122	2,003.52	J1-123	-4.77	190	1,513.18	2,067.96	J1-123	-8.39	1,513.16	1,513.16
J1-22	2,003.52	J1-22	-27.06	-13.45	1,552.53	1,550.86	J1-22	20.15	1,552.53	1,552.53
J1-158	2,012.73	J1-158	15.69	255.21	1,562.42	1,544.47	J1-158	20.15	1,562.44	1,562.42
J1-81	2,003.52	J1-81	-39.09	-50.21	1,583.01	1,581.80	J1-81	20.16	1,583.06	1,583.01
J1-793	2,003.52	J1-793	14.27	239.92	1,631.40	1,619.89	J1-793	20.16	1,631.41	1,631.40
J1-443	2,003.52	J1-443	-40.11	-72.58	1,643.55	1,642.51	J1-443	20.16	1,643.60	1,643.55
J1-23	2,003.52	J1-23	-13.15	20.64	1,654.37	1,652.48	J1-23	20.16	1,654.37	1,654.37
J1-157	2,003.52	J1-157	17.67	260.77	1,708.55	1,685.66	J1-157	20.17	1,708.56	1,708.55
J1-109	2,003.52	J1-109	2.53	150.83	1,754.42	1,751.87	J1-109	20.17	1,754.52	1,754.42
J1-164	2,003.52	J1-159	18.21	261.03	1,775.64	1,983.72	J1-159	18.38	1,775.65	1,775.64
J1-57	2,003.52	J1-57	-5.32	36.73	1,794.63	1,793.07	J1-57	20.18	1,794.63	1,794.63
J1-89	2,003.52	J1-89	-1.88	51.66	1,804.23	1,802.53	J1-89	20.18	1,804.25	1,804.23
J1-152	2,012.73	J1-152	17.66	250.77	1,815.66	1,799.85	J2-206	20.17	1,980.19	1,815.66
J1-163	2,003.52	J1-163	18.06	251.67	1,835.51	1,819.16	J2-206	20.15	1,973.13	1,835.51
J1-83	2,003.52	J1-83	8.45	131.5	1,856.73	1,854.32	J1-83	20.19	1,856.77	1,856.73
J1-82	2,003.52	J1-85	11.81	179.26	1,867.74	2,286.67	J1-85	-6.64	1,867.78	1,867.74
J1-151	2,003.52	J1-151	18.75	251.27	1,898.71	1,882.55	J2-206	20.08	1,970.56	1,898.71
J1-56	2,003.52	J1-57	8.45	68.5	1,900.06	1,914.14	J1-57	18.46	1,900.05	1,900.05
J1-26	2,003.52	J1-26	12.7	80.31	1,908.88	1,906.32	J1-26	20.19	1,908.85	1,908.85
J1-1013	2,003.52	J1-1013	12.96	69.9	1,946.85	1,945.26	J1-1013	20.19	1,946.85	1,946.85
J1-162	2,003.52	J2-206	19.96	435.06	1,973.74	2,285.04	J1-163	17.27	2,027.76	1,973.74
J1-119	2,003.52	J1-123	19.01	244.88	1,974.09	3,001.24	J1-123	-15.67	1,974.09	1,974.09
J1-148	2,003.52	J2-206	19.96	435.06	1,975.34	2,547.46	J2-206	19.34	1,975.34	1,975.34
J1-161	2,003.52	J2-206	19.96	435.07	1,975.84	5,049.05	J1-163	6.42	3,264.48	1,975.84
J1-147	2,003.52	J2-206	19.96	435.07	1,976.43	4,884.80	J1-159	11.79	3,219.58	1,976.43
J1-150	2,003.52	J2-206	19.96	435.07	1,977.14	4,573.04	J1-159	15.2	3,456.32	1,977.14
J1-153	2,003.52	J2-206	19.96	435.07	1,978.73	4,089.60	J2-206	17.11	1,978.73	1,978.73
J1-138	2,003.52	J2-206	21.2	437.93	6,346.97	2,129.40	J1-138	20.21	2,131.76	2,131.76
J1-49	2,003.52	J2-206	21.2	437.94	6,535.82	2,292.20	J1-57	17.63	2,266.39	2,266.39
J1-120	2,003.52	J2-228	20.72	438.82	3,508.99	3,218.86	J1-123	0.2	2,355.21	2,355.21
J1-1015	2,003.52	J2-206	21.2	437.94	6,535.83	2,451.04	J1-1015	20.24	2,453.52	2,453.52
J1-41	2,003.52	J2-206	21.2	437.94	6,535.83	2,465.71	J1-41	20.25	2,468.08	2,468.08
J1-78	2,003.52	J2-206	21.2	437.94	6,200.29	2,477.77	J1-78	20.25	2,480.90	2,480.90
J1-118	2,003.52	J2-228	20.77	438.94	3,768.72	4,735.67	J1-123	-26.38	2,507.95	2,507.95
J1-1012	2,003.52	J2-206	21.2	437.94	6,535.83	2,505.85	J1-1013	20.25	2,508.42	2,508.42
J1-1014	2,003.52	J2-206	21.2	437.94	6,535.83	2,537.44	J1-1014	20.25	2,540.08	2,540.08
J1-1011	2,003.52	J2-206	21.2	437.94	6,535.83	2,565.40	J1-1011	20.26	2,568.08	2,568.08
J1-110	2,003.52	J2-228	20.99	439.45	4,652.57	2,581.93	J1-110	20.26	2,589.48	2,589.48
J1-44	2,003.52	J2-206	21.2	437.94	6,535.83	2,604.48	J1-44	20.26	2,607.23	2,607.23
J1-116	2,003.52	J2-228	20.79	438.98	3,850.19	5,001.55	J1-123	-25.98	2,611.68	2,611.68
J1-121	2,003.52	J2-228	20.69	438.74	3,397.01	4,513.01	J1-123	-13.93	2,644.79	2,644.79
J1-40	2,003.52	J2-206	21.2	437.94	6,535.83	2,671.78	J1-40	20.27	2,674.64	2,674.64
J1-42	2,003.52	J2-206	21.2	437.94	6,535.83	2,697.66	J1-40	20.27	2,700.58	2,700.58
J1-27	2,003.52	J2-206	21.21	437.95	6,493.46	2,700.60	J1-27	20.27	2,705.65	2,705.65
J1-442	2,003.52	J2-206	21.2	437.94	6,535.83	2,703.05	J1-442	20.27	2,705.98	2,705.98
J1-48	2,003.52	J2-206	21.2	437.94	6,535.83	2,758.49	J1-48	20.28	2,761.54	2,761.54
J1-737	2,036.34	J2-228	20.45	438.19	2,799.98	4,801.45	J1-123	4.11	3,727.71	2,799.98
J1-47	2,003.52	J2-206	21.2	437.94	6,535.83	2,799.63	J1-47	20.28	2,802.78	2,802.78
J1-50	2,003.52	J2-206	21.2	437.94	6,535.82	2,878.64	J1-57	17.25	2,841.02	2,841.02
J1-111	2,003.52	J2-228	20.99	439.45	4,652.84	2,856.08	J1-111	20.29	2,865.20	2,865.20
J1-124	2,003.52	J2-228	20.56	438.44	2,950.59	5,371.11	J1-123	-8.24	3,694.89	2,950.59

J1-14	2,003.52	J2-206	21.21	437.95	6,507.03	2,952.59	J1-14	20.29	2,958.45	2,958.45
J1-736	2,003.52	J2-228	20.84	439.09	4,067.29	3,807.49	J1-123	9.93	3,021.08	3,021.08
J1-11	2,003.52	J2-206	21.21	437.95	6,507.57	3,028.49	J1-11	20.3	3,034.76	3,034.76
J1-79	2,003.52	J2-206	21.2	437.94	6,215.57	3,058.24	J1-79	20.31	3,062.97	3,062.97
J1-58	2,003.52	J2-206	21.2	437.94	6,535.83	3,067.87	J1-58	20.31	3,071.62	3,071.62
J1-13	2,003.52	J2-206	21.21	437.95	6,507.53	3,069.93	J1-13	20.31	3,073.92	3,073.92
J1-12	2,003.52	J2-206	21.21	437.95	6,507.68	3,166.42	J1-12	20.32	3,170.73	3,170.73
J1-19	2,003.52	J2-206	21.21	437.95	6,414.97	3,238.66	J1-19	20.32	3,244.85	3,244.85
J1-5	2,003.52	J2-206	21.21	437.95	6,507.67	3,254.61	J1-5	20.33	3,259.19	3,259.19
J1-848	2,003.52	J2-206	21.2	437.94	6,535.82	3,344.06	J1-848	20.33	3,349.26	3,349.26
J1-112	2,003.52	J2-228	20.99	439.45	4,656.64	3,545.83	J1-111	15.36	3,372.85	3,372.85
J1-21	2,003.52	J2-206	21.21	437.95	6,499.86	3,408.19	J1-22	20.34	3,413.37	3,413.37
J1-77	2,003.52	J2-206	21.2	437.94	6,200.29	3,472.79	J1-77	20.35	3,479.65	3,479.65
J1-125	2,036.34	J2-228	20.75	438.89	3,489.93	6,339.64	J1-123	-18.72	4,200.12	3,489.93
J1-35	2,003.52	J2-206	21.21	437.95	6,496.44	3,517.55	J1-35	20.35	3,523.11	3,523.11
J1-31	2,003.52	J2-206	21.21	437.95	6,493.71	3,626.93	J1-31	20.36	3,632.92	3,632.92
J1-28	2,003.52	J2-206	21.21	437.95	6,493.46	3,653.41	J1-27	19.93	3,652.32	3,652.32
J1-71	2,003.52	J2-228	20.99	439.45	4,741.35	5,680.17	J1-85	-36.63	3,662.07	3,662.07
J1-34	2,003.52	J2-206	21.21	437.95	6,493.98	3,680.84	J1-34	20.37	3,686.99	3,686.99
J1-80	2,003.52	J2-206	21.21	437.94	6,252.46	4,475.26	J1-5108	-5.62	3,693.74	3,693.74
J1-29	2,003.52	J2-206	21.21	437.95	6,493.52	3,697.90	J1-29	20.37	3,704.16	3,704.16
J1-440	2,003.52	J2-206	21.21	437.95	6,507.82	3,701.19	J1-440	20.37	3,706.99	3,706.99
J1-117	2,003.52	J2-228	20.87	439.16	4,123.80	6,093.93	J1-123	-17.65	3,722.04	3,722.04
J1-24	2,003.52	J2-206	21.21	437.95	6,492.68	3,724.13	J1-23	20.37	3,730.43	3,730.43
J1-30	2,003.52	J2-206	21.21	437.95	6,493.48	3,731.00	J1-30	20.37	3,737.37	3,737.37
J1-9	2,003.52	J2-206	21.21	437.95	6,507.24	3,799.64	J1-9	20.38	3,806.81	3,806.81
J1-400	2,003.52	J2-206	21.21	437.95	6,757.41	3,859.42	J1-400	20.39	3,872.95	3,872.95
J1-25	2,003.52	J2-206	21.21	437.95	6,492.54	3,970.92	J1-23	20.16	3,974.29	3,974.29
J1-51	2,003.52	J2-206	21.2	437.94	6,535.82	4,151.39	J1-57	17.81	4,102.62	4,102.62
J1-126	2,036.34	J2-228	20.9	439.24	4,104.45	7,215.61	J1-123	-27.7	4,544.67	4,104.45
J1-128	2,003.52	J2-228	20.92	439.28	4,137.88	7,252.59	J1-123	-28.2	4,501.41	4,137.88
J1-10	2,003.52	J2-206	21.21	437.95	6,505.71	4,173.75	J1-10	20.42	4,182.60	4,182.60
J1-131	2,003.52	J2-228	20.93	439.31	4,200.13	7,082.93	J1-123	-22.51	4,539.12	4,200.13
J1-127	2,036.34	J2-228	20.93	439.31	4,223.15	7,065.24	J1-123	-21.47	4,573.44	4,223.15
J1-18	2,003.52	J2-206	21.21	437.95	6,414.97	4,274.40	J1-19	19.13	4,255.67	4,255.67
J1-136	2,003.52	J2-228	20.95	439.35	4,299.29	7,260.65	J1-123	-27.39	4,442.53	4,299.29
J1-135	2,003.52	J2-228	20.95	439.35	4,299.48	7,262.70	J1-123	-27.45	4,441.71	4,299.48
J1-444	2,036.34	J2-228	20.97	439.4	4,367.91	5,041.66	J1-123	17.53	4,706.76	4,367.91
J1-115	2,003.52	J2-228	20.91	439.26	4,383.82	3,798.62	J2-228	20.2	4,384.08	4,383.82
J1-76	2,003.52	J2-206	21.2	437.93	6,185.51	5,110.85	J1-5105	-0.12	4,389.49	4,389.49
J1-130	2,003.52	J2-228	20.97	439.39	4,411.72	7,266.35	J1-123	-25.4	4,472.68	4,411.72
J1-129	2,003.52	J2-228	20.97	439.39	4,416.00	7,506.29	J1-123	-30.93	4,467.16	4,416.00
J1-132	2,003.52	J2-228	20.98	439.41	4,426.12	6,825.81	J1-123	-13.16	4,608.57	4,426.12
J1-75	2,003.52	J2-228	21.19	439.91	5,003.42	5,463.48	J1-5104	-9.79	4,442.77	4,442.77
J1-134	2,003.52	J2-228	21	439.46	4,524.74	7,353.55	J1-123	-22.52	4,651.98	4,524.74
J1-133	2,003.52	J2-228	21	439.47	4,526.51	7,397.06	J1-123	-23.47	4,650.91	4,526.51
J1-137	2,003.52	J2-228	21.01	439.48	4,548.82	5,535.11	J1-123	11.35	4,678.13	4,548.82
J1-101	2,003.52	J2-228	20.98	439.43	4,576.08	6,130.85	J1-123	1.88	4,658.89	4,576.08
J1-99	2,003.52	J2-228	21	439.47	4,586.33	7,700.19	J1-123	-28.62	4,690.96	4,586.33
J1-100	2,003.52	J2-228	21	439.46	4,608.37	7,624.39	J1-123	-26.06	4,723.97	4,608.37
J1-98	2,003.52	J2-228	21.02	439.52	4,611.23	7,928.40	J1-123	-32.94	4,723.48	4,611.23
J1-114	2,003.52	J2-228	20.98	439.42	4,631.45	6,760.19	J1-123	-6.75	4,771.49	4,631.45
J1-447	2,003.52	J2-228	20.98	439.42	4,635.16	6,753.72	J1-123	-6.42	4,781.91	4,635.16
J1-104	2,003.52	J2-228	20.99	439.44	4,638.88	6,859.28	J1-123	-8.65	4,779.83	4,638.88
J1-143	2,003.52	J2-228	21.04	439.56	4,639.46	7,993.64	J1-123	-33.24	4,757.42	4,639.46
J1-105	2,003.52	J2-228	20.99	439.43	4,639.84	6,130.58	J1-123	4.39	4,788.13	4,639.84
J1-103	2,003.52	J2-228	20.99	439.44	4,640.44	7,271.32	J1-123	-17.11	4,776.47	4,640.44
J1-102	2,003.52	J2-228	20.99	439.45	4,644.07	7,387.75	J1-123	-19.44	4,780.37	4,644.07
J1-142	2,003.52	J2-228	21.04	439.57	4,647.79	8,003.86	J1-123	-33.1	4,767.21	4,647.79
J1-445	2,003.52	J2-228	20.99	439.45	4,655.38	7,737.98	J1-123	-26.66	4,791.92	4,655.38
J1-97	2,003.52	J2-228	21.03	439.52	4,655.77	6,850.35	J1-123	-8.53	4,781.29	4,655.77
J1-96	2,003.52	J2-228	21.04	439.55	4,678.31	6,402.82	J1-123	0.07	4,808.17	4,678.31
J1-446	2,003.52	J2-228	21.02	439.5	4,681.18	6,619.47	J1-123	-3.26	4,809.79	4,681.18
J1-113	2,003.52	J2-228	20.99	439.45	4,684.19	7,385.61	J1-123	-18.47	4,824.23	4,684.19

J1-94	2,003.52	J2-228	21.03	439.53	4,689.43	6,056.14	J1-123	6.15	4,819.86	4,689.43
J1-86	2,003.52	J2-228	20.99	439.45	4,695.68	7,287.41	J1-123	-16.19	4,837.15	4,695.68
J1-88	2,003.52	J2-228	20.99	439.45	4,695.68	6,958.73	J1-123	-9.66	4,837.15	4,695.68
J1-69	2,003.52	J2-228	20.99	439.45	4,726.01	7,481.92	J1-85	-21.95	5,625.48	4,726.01
J1-91	2,003.52	J2-228	21.04	439.56	4,731.28	5,740.81	J1-123	11.82	4,867.49	4,731.28
J1-92	2,003.52	J2-228	21.04	439.56	4,732.37	6,276.48	J1-123	3.71	4,870.74	4,732.37
J1-95	2,003.52	J2-228	21.05	439.57	4,736.49	6,284.11	J1-123	3.65	4,875.55	4,736.49
J1-72	2,003.52	J2-228	20.99	439.45	4,741.35	7,802.75	J1-85	-36.42	5,471.43	4,741.35
J1-90	2,003.52	J2-228	21.06	439.6	4,783.75	4,677.16	J2-228	20.03	4,783.75	4,783.75
J1-93	2,003.52	J2-228	21.08	439.66	4,850.98	5,726.51	J1-123	14.27	5,011.43	4,850.98
J1-17	2,003.52	J2-206	21.21	437.95	6,486.31	4,880.30	J1-27	19.36	4,864.73	4,864.73
J1-54	2,003.52	J2-206	21.2	437.94	6,535.82	5,136.88	J1-854	20.08	5,139.17	5,139.17
J1-4	2,003.52	J2-206	21.21	437.95	6,507.67	5,375.28	J1-791	19.63	5,365.96	5,365.96
J1-139	2,003.52	J2-206	21.2	437.93	6,346.97	8,741.95	J1-123	-31.3	5,378.85	5,378.85
J1-140	2,003.52	J2-206	21.2	437.93	6,358.45	9,067.67	J1-123	-37.21	5,400.09	5,400.09
J1-141	2,003.52	J2-206	21.2	437.93	6,359.31	9,095.23	J1-123	-37.71	5,401.39	5,401.39
J1-87	2,003.52	J2-206	21.21	437.95	6,760.63	10,921.54	J1-527	-43.58	5,533.35	5,533.35
J1-16	2,003.52	J2-206	21.21	437.95	6,495.85	4,977.87	J2-228	20.22	5,534.22	5,534.22
J1-15	2,003.52	J2-206	21.21	437.95	6,499.73	4,690.36	J2-228	20.35	5,541.30	5,541.30
J1-795	2,003.52	J2-206	21.21	437.95	6,503.82	4,728.67	J2-228	20.34	5,549.89	5,549.89
J1-20	2,003.52	J2-206	21.21	437.95	6,504.04	5,089.52	J2-228	20.18	5,550.52	5,550.52
J1-2	2,003.52	J2-206	21.21	437.95	6,504.86	5,125.58	J2-228	20.16	5,552.96	5,552.96
J1-1	2,003.52	J2-206	21.21	437.95	6,504.86	4,990.58	J2-228	20.22	5,552.96	5,552.96
J1-3	2,003.52	J2-206	21.21	437.95	6,505.23	5,205.24	J2-228	20.13	5,554.06	5,554.06
J1-791	2,003.52	J2-206	21.21	437.95	6,505.54	5,217.42	J2-228	20.12	5,554.98	5,554.98
J1-6	2,003.52	J2-206	21.21	437.95	6,507.95	4,512.06	J2-228	20.43	5,562.31	5,562.31
J1-7	2,003.52	J2-206	21.21	437.95	6,508.58	4,854.56	J2-228	20.29	5,564.23	5,564.23
J1-806	2,003.52	J2-206	21.21	437.95	6,743.65	11,378.90	J1-527	-47.4	5,589.71	5,589.71
J1-688	2,003.52	J2-206	21.21	437.95	6,738.88	9,658.43	J1-527	-27.36	5,606.30	5,606.30
J1-686	2,003.52	J2-206	21.21	437.95	6,738.88	9,833.22	J1-527	-29.74	5,606.30	5,606.30
J1-64	2,003.52	J2-206	21.21	437.95	6,717.42	11,161.34	J1-527	-45.15	5,675.05	5,675.05
J1-60	2,003.52	J2-206	21.21	437.95	6,679.79	9,827.97	J1-527	-27.76	5,788.28	5,788.28
J1-847	2,003.52	J2-206	21.2	437.94	6,535.82	7,941.86	J1-123	-6.27	5,824.82	5,824.82
J1-63	2,003.52	J2-206	21.2	437.94	6,535.82	9,741.40	J1-123	-38.21	5,824.82	5,824.82
J1-441	2,003.52	J2-206	21.2	437.94	6,535.82	9,725.10	J1-123	-37.9	5,824.82	5,824.82
J1-59	2,003.52	J2-206	21.2	437.94	6,535.82	6,102.52	J1-123	17.72	5,824.82	5,824.82
J1-39	2,003.52	J2-206	21.21	437.96	6,544.28	7,554.58	J1-123	0.92	5,981.24	5,981.24
J1-806	2,003.52	J1-157	36.95	305.28	0.00	12,401.32	J1-123	-30.42	8,029.19	8,029.19
J1-87	2,003.52	J1-157	36.95	305.28	0.00	12,016.46	J1-123	-22.6	8,118.58	8,118.58

ID	Total Demand (gpm)	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant	Critical Node 2 ID	Critical Node 2	Adjusted Available Flow	Design Flow (gpm)
J2-659	2,003.36	J2-659	-77.37	157.45	705.45	703.89	J2-659	20.07	705.45	705.45
J2-670	2,003.36	J2-670	-56.43	175.77	992.09	990.32	J2-670	20.1	992.09	992.09
J-5095	2,003.36	J-5095	-74.08	119.04	995.45	994.00	J-5095	20.1	995.45	995.45
J2-230	2,003.36	J2-555	-4.39	359.87	1,034.15	2,008.13	J2-555	-4.55	1,034.18	1,034.15
J2-231	2,003.36	J2-231	-19.83	219.23	1,501.49	1,499.16	J2-555	10.28	1,034.18	1,034.18
J2-669	2,003.36	J2-669	-15.88	301.35	1,039.24	1,035.69	J2-669	20.1	1,039.24	1,039.24
J2-838	2,003.36	J2-555	-3.54	361.84	1,050.42	2,239.66	J2-555	-11.57	1,050.41	1,050.41
J2-671	2,003.36	J2-671	-54.73	167.68	1,063.72	1,061.98	J2-671	20.11	1,063.72	1,063.72
J2-660	2,003.36	J2-660	-47.38	190.66	1,073.13	1,071.21	J2-660	20.11	1,073.13	1,073.13
J2-839	2,003.36	J2-555	-1.4	366.78	1,092.39	2,476.61	J2-555	-17.26	1,092.35	1,092.35
J2-658	2,003.36	J2-659	-11.87	308.61	1,094.58	2,218.36	J2-659	-21.38	1,094.58	1,094.58
J2-662	2,003.36	J2-662	-43.18	200.35	1,098.32	1,096.31	J2-659	19.95	1,094.58	1,094.58
J2-661	2,003.36	J2-659	-11.87	308.61	1,094.58	1,760.77	J2-659	-2.55	1,094.58	1,094.58
J2-840	2,003.36	J2-555	-1.18	367.29	1,097.54	2,653.06	J2-555	-23.58	1,097.50	1,097.50
J2-204	2,003.36	J2-206	17.78	430.03	1,112.24	4,441.21	J2-206	7.09	1,112.24	1,112.24
J2-270	2,003.36	J2-270	-217.72	-392.47	1,116.65	1,116.00	J2-270	20.11	1,116.61	1,116.61
J2-702	2,003.36	J2-670	-27.01	243.67	1,175.33	1,528.03	J2-670	1.52	1,175.33	1,175.33
J2-656	2,003.36	J2-671	-30.23	224.24	1,214.51	1,453.82	J2-670	5.74	1,175.33	1,175.33
J2-234	2,003.36	J2-555	3.28	377.57	1,200.65	2,521.06	J2-555	-11.77	1,200.64	1,200.64
J2-268	2,003.36	J2-268	-107.44	-47.95	1,212.55	1,211.46	J2-268	20.12	1,212.50	1,212.50
J2-252	2,003.36	J2-252	-73.59	85.16	1,212.81	1,211.36	J2-252	20.12	1,212.78	1,212.78
J2-235	2,003.36	J2-555	3.86	378.91	1,215.85	2,460.95	J2-555	-9.02	1,215.84	1,215.84
J2-233	2,003.36	J2-555	3.86	378.91	1,215.85	2,784.98	J2-555	-19.56	1,215.84	1,215.84
J2-232	2,003.36	J2-555	4.14	379.56	1,223.52	2,894.91	J2-555	-22.85	1,223.52	1,223.52
J2-657	2,003.36	J2-670	-19.22	261.65	1,243.17	1,623.97	J2-670	1.1	1,243.17	1,243.17
J2-236	2,003.36	J2-555	5.56	382.82	1,263.44	3,187.13	J2-555	-30.28	1,263.43	1,263.43
J2-238	2,003.36	J2-238	-7.27	203.21	1,697.67	1,695.49	J2-555	12.97	1,287.87	1,287.87
J2-237	2,003.36	J2-555	6.36	384.68	1,287.88	2,752.81	J2-555	-14	1,287.87	1,287.87
J2-269	2,003.36	J2-270	-133.75	-198.67	1,289.80	1,337.81	J2-270	11.47	1,289.78	1,289.78
J2-241	2,003.36	J2-555	6.47	384.93	1,291.23	3,345.90	J2-555	-33.86	1,291.23	1,291.23
J2-239	2,003.36	J2-555	6.51	385.03	1,292.69	3,521.19	J2-555	-40.32	1,292.69	1,292.69
J2-240	2,003.36	J2-555	6.65	385.34	1,296.83	3,420.99	J2-555	-36.17	1,296.83	1,296.83
J2-837	2,003.36	J2-555	6.78	385.66	1,300.76	4,058.23	J2-555	-61.16	1,300.76	1,300.76
J2-263	2,003.36	J2-555	6.77	385.64	1,301.00	2,306.56	J2-555	-0.64	1,301.00	1,301.00
J2-264	2,003.36	J2-264	4.08	200.41	1,831.27	1,829.09	J2-555	10.59	1,301.00	1,301.00
J2-266	2,003.36	J2-266	-0.06	148.86	1,824.36	1,822.56	J2-555	10.76	1,302.41	1,302.41
J2-262	2,003.36	J2-555	6.87	385.86	1,304.20	2,546.42	J2-555	-7.03	1,304.19	1,304.19
J2-257	2,003.36	J2-555	7.08	386.35	1,311.02	2,881.93	J2-555	-16.7	1,311.02	1,311.02
J2-260	2,003.36	J2-260	-34.78	73.74	1,594.19	1,592.77	J2-555	15.43	1,311.75	1,311.75
J2-259	2,003.36	J2-555	7.11	386.4	1,311.75	1,973.20	J2-555	7.78	1,311.75	1,311.75
J2-258	2,003.36	J2-555	7.11	386.4	1,311.75	2,828.80	J2-555	-15	1,311.75	1,311.75
J2-261	2,003.36	J2-555	7.11	386.4	1,311.75	2,050.00	J2-260	4.67	1,903.64	1,311.75
J2-256	2,003.36	J2-555	7.11	386.41	1,311.92	2,949.79	J2-555	-18.8	1,311.91	1,311.91
J2-255	2,003.36	J2-555	7.19	386.6	1,314.65	3,138.01	J2-555	-24.82	1,314.65	1,314.65
J2-225	2,003.36	J2-555	8.91	390.57	1,374.72	4,220.48	J2-555	-60.17	1,374.72	1,374.72
J2-226	2,003.36	J2-555	9.22	391.28	1,383.63	3,108.18	J2-555	-19.35	1,383.63	1,383.63
J2-267	2,003.36	J2-268	-60.17	61.13	1,391.82	1,665.33	J2-268	-12.76	1,391.79	1,391.79
J2-248	2,003.36	J2-555	9.57	392.09	1,400.07	4,068.09	J2-555	-51.81	1,400.07	1,400.07
J2-254	2,003.36	J2-555	9.77	392.55	1,406.15	2,072.41	J2-555	8.36	1,406.14	1,406.14
J2-221	2,003.36	J2-555	10.41	394.02	1,428.40	3,096.32	J2-555	-16.36	1,428.40	1,428.40
J2-222	2,003.36	J2-555	10.41	394.02	1,428.40	2,177.63	J2-555	6.86	1,428.40	1,428.40
J2-223	2,003.36	J2-555	10.87	395.1	1,450.11	4,288.92	J2-555	-55.15	1,450.11	1,450.11
J2-224	2,003.36	J2-555	10.87	395.1	1,450.11	2,512.61	J2-555	-0.07	1,450.11	1,450.11
J3-973	2,003.36	J3-973	-12.19	236.87	1,535.73	1,533.08	J3-855	20.06	13,259.03	1,535.73
J2-265	2,003.36	J2-268	-31.12	128.19	1,547.94	1,839.76	J2-268	-11.45	1,547.93	1,547.93
J2-220	2,003.36	J2-555	13.47	401.08	1,568.88	4,643.04	J2-555	-57.45	1,568.89	1,568.88
J2-249	2,003.36	J2-555	13.53	401.24	1,572.07	3,271.53	J2-555	-14.13	1,572.08	1,572.07
J2-247	2,003.36	J2-555	13.59	401.37	1,575.52	3,735.39	J2-555	-27.07	1,575.55	1,575.52
J2-246	2,003.36	J2-555	13.76	401.75	1,583.82	3,675.52	J2-555	-24.81	1,583.86	1,583.82
J2-663	2,003.36	J2-669	14.58	371.66	1,611.42	3,574.83	J2-669	-26.44	1,611.42	1,611.42
J2-219	2,003.36	J2-555	14.67	403.86	1,624.97	3,932.07	J2-555	-29	1,624.86	1,624.86
J2-212	2,003.36	J2-212	-13.29	202.34	1,626.00	1,623.84	J2-212	20.16	1,626.01	1,626.00
J3-971	2,003.36	J3-973	-3.84	256.13	1,627.16	1,700.71	J3-973	13.67	1,627.16	1,627.16
J2-250	2,003.36	J2-555	14.69	403.91	1,634.19	2,709.14	J2-555	1.57	1,634.30	1,634.19
J2-251	2,003.36	J2-252	-8.03	236.46	1,636.28	1,840.55	J2-252	5.02	1,636.29	1,636.28
J2-245	2,003.36	J2-555	14.94	404.48	1,647.90	3,818.45	J2-555	-25.42	1,648.03	1,647.90
J2-253	2,003.36	J2-555	15.1	404.85	1,657.25	3,306.91	J2-555	-11.38	1,657.39	1,657.25
J2-244	2,003.36	J2-555	15.12	404.9	1,658.42	3,891.79	J2-555	-26.96	1,658.56	1,658.42
J2-207	2,003.36	J2-206	19.57	434.16	1,686.80	5,181.54	J2-206	12.68	1,686.80	1,686.80

J3-970	2,003.36	J3-973	4.84	276.17	1,702.53	1,960.15	J3-973	7.2	1,702.52	1,702.52
J2-554	2,003.36	J2-206	19.65	434.34	1,734.80	9,533.78	J2-206	-1.68	1,734.80	1,734.80
J2-203	2,003.36	J2-206	19.67	434.4	1,744.95	12,637.56	J2-206	-11.3	1,744.95	1,744.95
J2-243	2,003.36	J2-555	17	409.24	1,776.88	4,625.20	J2-555	-41.96	1,776.88	1,776.88
J2-197	2,003.36	J2-206	19.78	434.65	1,825.11	14,243.39	J2-206	-15.78	1,825.11	1,825.11
J2-218	2,003.36	J2-555	17.77	411.01	1,828.85	5,475.92	J2-555	-65.02	1,829.00	1,828.85
J2-551	2,003.36	J2-206	19.81	434.73	1,845.54	13,767.78	J2-206	-11.33	1,845.54	1,845.54
J2-202	2,003.36	J2-206	19.84	434.79	1,866.96	13,178.98	J2-206	-7.8	1,866.96	1,866.96
J2-198	2,003.36	J2-206	19.85	434.81	1,877.05	9,790.54	J2-206	2.39	1,877.05	1,877.05
J2-213	2,003.36	J2-555	18.75	413.28	1,903.79	5,969.35	J2-555	-76.92	1,903.92	1,903.79
J2-553	2,003.36	J2-553	16.88	285.97	1,951.72	1,948.08	J2-553	20.19	1,951.54	1,951.54
J2-192	2,003.36	J2-206	19.98	435.12	1,997.17	13,872.31	J2-206	-9.56	1,997.17	1,997.17
J2-199	2,003.36	J2-206	19.98	435.12	1,998.35	5,315.67	J2-206	15.05	1,998.18	1,998.18
J2-211	2,003.36	J2-555	20.24	416.71	2,026.83	4,859.08	J2-555	-31.61	2,026.86	2,026.83
J2-215	2,003.36	J2-555	20.52	417.35	2,048.84	6,154.93	J2-555	-71.07	2,048.98	2,048.84
J2-196	2,003.36	J2-206	20.07	435.32	2,085.46	13,728.81	J2-206	-6.99	2,085.46	2,085.46
J2-552	2,003.36	J2-206	20.08	435.33	2,091.94	4,976.19	J2-206	15.94	2,091.94	2,091.94
J2-208	2,003.36	J2-206	20.09	435.37	2,111.14	8,767.77	J2-206	7.23	2,111.14	2,111.14
J2-210	2,003.36	J2-206	20.85	437.13	3,895.18	5,315.17	J2-555	-38.16	2,111.82	2,111.82
J2-217	2,003.36	J2-206	20.9	437.23	4,324.83	4,874.91	J2-555	-24.02	2,166.04	2,166.04
J2-195	2,003.36	J2-206	20.15	435.5	2,172.11	3,972.34	J2-553	13.03	3,750.86	2,172.11
J2-216	2,003.36	J2-206	20.9	437.24	4,359.47	4,798.46	J2-555	-21.46	2,180.27	2,180.27
J2-668	2,003.36	J3-855	19.58	787.18		2,603.78	J3-973	2.48	2,192.54	2,192.54
J2-664	2,003.36	J3-855	19.6	787.23	13,266.10	3,524.72	J2-669	-3.49	2,201.06	2,201.06
J2-193	2,003.36	J2-206	20.19	435.61	2,232.46	13,502.97	J2-206	-3.6	2,232.46	2,232.46
J2-194	2,003.36	J2-206	20.21	435.63	2,244.20	3,696.45	J2-206	18.34	2,244.20	2,244.20
J2-188	2,003.36	J2-206	20.27	435.77	2,329.27	13,810.53	J2-206	-2.93	2,329.27	2,329.27
J2-833	2,003.36	J3-855	19.6	787.24	13,258.75	2,836.46	J2-669	13.37	2,366.25	2,366.25
J5-832	2,003.36	J3-855	19.6	787.24	13,261.41	2,842.61	J2-669	13.41	2,374.01	2,374.01
J2-667	2,003.36	J3-855	19.58	787.18		2,800.36	J3-973	3.06	2,375.45	2,375.45
J2-191	2,003.36	J2-206	20.3	435.86	2,377.98	2,739.48	J2-206	19.65	2,377.98	2,377.98
J2-665	2,003.36	J3-855	19.58	787.18		4,076.45	J2-669	-3.91	2,567.14	2,567.14
J4-425	2,003.36	J3-855	19.57	787.16	13,258.55	2,944.30	J4-424	16.68	2,603.55	2,603.55
J2-187	2,003.36	J2-206	20.44	436.18	2,626.10	6,982.46	J2-206	14.91	2,626.10	2,626.10
J4-844	2,003.36	J3-855	19.57	787.17	13,268.96	3,779.46	J2-669	4.08	2,667.57	2,667.57
J4-843	2,003.36	J3-855	19.57	787.17	13,267.65	3,419.50	J2-669	10.14	2,676.68	2,676.68
J2-189	2,003.36	J2-206	20.48	436.26	2,694.34	11,980.49	J2-206	6.49	2,694.34	2,694.34
J2-666	2,003.36	J3-855	19.58	787.18	13,264.34	3,214.27	J3-973	2.99	2,735.95	2,735.95
J2-653	2,003.36	J2-206	20.65	436.66	2,820.01	8,053.55	J2-654	-20.36	5,885.59	2,820.01
J2-214	2,003.36	J2-206	20.85	437.12	3,841.63	7,803.16	J2-555	-46.96	2,903.00	2,903.00
J2-185	2,003.36	J2-206	20.59	436.51	2,949.76	6,157.11	J2-206	16.89	2,949.73	2,949.73
J2-209	2,003.36	J2-206	20.85	437.11	3,826.82	8,750.29	J2-555	-61.55	3,021.10	3,021.10
J2-186	2,003.36	J2-206	20.71	436.8	3,294.33	5,039.38	J2-206	18.61	3,294.33	3,294.33
J2-184	2,003.36	J2-206	20.73	436.85	3,352.97	2,873.70	J2-206	20.28	3,353.14	3,352.97
J2-172	2,003.36	J2-206	20.73	436.85	3,354.41	4,791.79	J2-206	18.91	3,354.52	3,354.41
J2-170	2,003.36	J2-206	20.73	436.85	3,357.65	4,465.65	J2-206	19.18	3,357.78	3,357.65
J2-449	2,003.36	J2-206	20.73	436.85	3,357.98	4,391.11	J2-206	19.24	3,358.11	3,357.98
J2-169	2,003.36	J2-206	20.73	436.85	3,360.41	3,639.60	J2-206	19.8	3,360.55	3,360.41
J2-173	2,003.36	J2-206	20.73	436.85	3,360.71	2,951.44	J2-206	20.24	3,360.85	3,360.71
J2-168	2,003.36	J2-206	20.73	436.85	3,361.58	3,888.06	J2-206	19.62	3,361.72	3,361.58
J2-166	2,003.36	J2-206	20.74	436.86	3,366.40	4,784.89	J2-206	18.92	3,366.56	3,366.40
J2-448	2,003.36	J2-206	20.74	436.86	3,367.70	4,771.10	J2-206	18.94	3,367.86	3,367.70
J2-450	2,003.36	J2-206	20.74	436.86	3,371.74	4,780.30	J2-206	18.93	3,371.92	3,371.74
J2-165	2,003.36	J2-206	20.74	436.86	3,372.28	4,076.66	J2-206	19.49	3,372.45	3,372.28
J1-733	2,003.36	J2-206	20.74	436.86	3,374.32	4,082.93	J2-206	19.49	3,374.51	3,374.32
J2-167	2,003.36	J2-206	20.74	436.87	3,379.62	4,870.86	J2-206	18.87	3,379.81	3,379.62
J2-175	2,003.36	J2-206	20.75	436.88	3,406.34	4,254.80	J2-206	19.39	3,406.56	3,406.34
J2-174	2,003.36	J2-206	20.75	436.89	3,410.20	4,816.84	J2-206	18.95	3,410.42	3,410.20
J2-182	2,003.36	J2-206	20.75	436.9	3,421.54	3,827.98	J2-206	19.71	3,421.74	3,421.54
J2-179	2,003.36	J2-206	20.76	436.9	3,430.61	4,725.36	J2-181	18.88	4,643.11	3,430.61
J2-176	2,003.36	J2-206	20.76	436.91	3,444.81	4,963.08	J2-181	16.99	4,738.27	3,444.81
J2-181	2,003.36	J2-206	20.76	436.91	3,445.77	3,790.00	J2-206	19.76	3,445.94	3,445.77
J2-178	2,003.36	J2-206	20.76	436.92	3,453.94	4,180.72	J2-206	19.48	3,454.13	3,453.94
J2-180	2,003.36	J2-206	20.76	436.92	3,455.70	4,202.21	J2-206	19.47	3,455.88	3,455.70
J2-177	2,003.36	J2-206	20.77	436.93	3,481.57	5,414.39	J2-181	11.93	4,816.56	3,481.57
J2-451	2,003.36	J2-206	20.78	436.96	3,521.17	5,610.44	J2-181	12.91	5,055.93	3,521.17
J2-183	2,003.36	J2-206	20.79	436.97	3,534.40	4,238.58	J2-206	19.51	3,534.41	3,534.40
J2-190	2,003.36	J2-206	20.88	437.18	3,940.07	12,389.83	J2-555	12.13	9,307.59	3,940.07
J4-424	2,003.36	J3-855	19.61	787.26	13,264.07	2,416.13	J3-855	19.23	13,264.06	13,264.06
J2-185	2,003.36	J2-206	21.65	438.96	5,491.22	6,258.31	J2-206	19.36	5,491.22	5,491.22
J2-214	2,003.36	J2-206	21.79	439.3	7,239.09	7,845.49	J2-838	-14.38	5,807.15	5,807.15

J2-209	2,003.36	J2-206	21.79	439.29	7,210.68	8,805.19	J2-838	-29.18	5,956.52	5,956.52
J2-190	2,003.36	J2-206	21.83	439.39	7,423.60	12,987.69	J2-206	15.56	7,423.71	7,423.60
J2-186	2,003.36	J2-206	21.71	439.09	6,075.84	5,091.55	J2-186	20.51	5,113.86	5,113.86
J2-451	2,003.36	J2-206	21.73	439.14	6,337.90	5,653.58	J2-181	13.6	5,151.92	5,151.92
J2-189	2,003.36	J2-206	21.64	438.94	5,228.21	12,675.96	J2-206	11.14	5,228.21	5,228.21
J2-185	2,003.36	J2-206	21.66	438.99	5,544.79	6,257.92	J2-206	19.42	5,545.02	5,544.79
J1-8	2,005.67	J2-206	22.15	440.13	9,922.41	6,112.30	J1-8	20.61	6,125.98	6,125.98
J2-190	2,003.36	J2-206	21.85	439.42	7,491.36	12,991.27	J2-555	12.14	9,933.13	7,491.36
J1-855	2,000.00	J2-206	22.11	440.03	9,860.82	8,644.12	J2-206	20.72	9,860.85	9,860.82

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow (gpm)
J5-638	2,004.09	J5-638	-437.78	-580.34	399.68	399.34	J5-638	20.04	399.68	399.68
J5-640	2,004.09	J5-640	-309.43	-294.12	509.07	508.59	J5-638	19.1	498.94	498.94
J5-639	2,004.09	J5-638	-270.83	-195.04	498.94	516.93	J5-638	18.32	498.94	498.94
J5-841	2,004.09	J5-638	-215.32	-66.93	553.11	583.17	J5-638	17.45	553.11	553.11
J5-637	2,004.09	J5-638	-168.32	41.55	615.53	718.70	J5-638	11.83	615.53	615.53
J2-652	2,004.09	J2-652	-354.36	-467.82	697.46	697.05	J2-652	20.07	697.46	697.46
J5-842	2,004.09	J5-842	-70.31	277.73	788.94	787.30	J5-842	20.08	788.94	788.94
J2-650	2,004.09	J2-650	-100.01	126.20	1,087.55	1,086.47	J2-650	20.11	1,087.55	1,087.55
J5-636	2,004.09	J5-842	6.71	455.48	1,504.40	2,562.78	J5-842	-12.26	1,504.40	1,504.40
J5-644	2,004.09	J5-644	2.89	361.67	1,736.98	1,734.13	J5-644	20.17	1,736.98	1,736.98
J4-501	2,004.09	J4-501	14.76	284.06	1,950.38	1,948.35	J4-501	20.19	1,950.37	1,950.37
J3-1001	2,004.09	J3-1001	19.12	362.13	1,990.79	1,987.79	J3-1001	20.2	1,990.79	1,990.79
J2-648	2,004.09	J2-206	21.21	437.94	12,066.71	2,108.38	J2-648	20.21	2,111.10	2,111.10
J-5013	2,004.09	J2-206	21.21	437.95	12,481.21	2,148.02	J-5013	20.21	2,150.77	2,150.77
J-5014	2,004.09	J2-206	21.21	437.95	12,481.21	2,252.13	J-5013	15.89	2,198.90	2,198.90
J-5017	2,004.09	J2-206	21.21	437.95	12,481.20	2,468.87	J-5013	3.95	2,261.87	2,261.87
J-5016	2,004.09	J2-206	21.21	437.95	12,481.21	2,415.75	J-5013	8.19	2,261.87	2,261.87
J-5015	2,004.09	J2-206	21.21	437.95	12,481.21	2,361.51	J-5013	12.44	2,261.87	2,261.87
J3-999	2,004.09	J2-206	21.21	437.95	12,481.22	2,278.41	J3-1001	20.23	2,282.30	2,282.30
J3-1000	2,004.09	J2-206	21.21	437.95	12,481.22	2,278.69	J3-1000	20.23	2,282.54	2,282.54
J-5020	2,004.09	J2-206	21.21	437.95	12,481.21	2,421.34	J3-1000	11.55	2,282.54	2,282.54
J-5019	2,004.09	J2-206	21.21	437.95	12,481.21	2,390.00	J-5013	12.44	2,289.30	2,289.30
J3-998	2,004.09	J2-206	21.21	437.95	12,481.22	2,290.48	J3-998	20.23	2,294.77	2,294.77
J3-997	2,004.09	J2-206	21.21	437.95	12,481.22	2,372.60	J3-997	20.24	2,377.32	2,377.32
J2-651	2,004.09	J2-206	21.21	437.94	12,066.71	2,553.90	J2-651	20.25	2,560.55	2,560.55
J-5092	2,004.09	J2-206	21.21	437.94	12,066.71	4,108.40	J2-651	-56.85	2,560.55	2,560.55
J3-1007	2,004.09	J2-206	21.21	437.95	12,481.23	2,614.16	J3-1007	20.26	2,621.84	2,621.84
J-527	2,007.20	J2-206	21.21	437.95	12,484.34	2,644.70	J-527	20.26	2,650.86	2,650.86
J2-647	2,004.09	J2-206	21.21	437.94	12,066.71	3,103.66	J2-650	3.84	2,723.93	2,723.93
J3-1005	2,004.09	J2-206	21.21	437.95	12,481.23	2,782.35	J3-1005	20.28	2,791.13	2,791.13
J3-1010	2,004.09	J2-206	21.21	437.95	12,481.23	2,797.02	J3-1010	20.28	2,801.36	2,801.36
J3-996	2,004.09	J2-206	21.21	437.95	12,481.23	2,835.47	J3-996	20.28	2,843.31	2,843.31
J5-815	2,004.09	J2-206	21.21	437.95	12,481.24	2,866.29	J5-815	20.29	2,874.94	2,874.94
J3-1002	2,004.09	J2-206	21.21	437.95	12,481.23	3,128.01	J3-996	14.58	2,975.96	2,975.96
J3-1003	2,004.09	J2-206	21.21	437.95	12,481.23	3,340.09	J3-1005	12.97	3,106.75	3,106.75
J3-1009	2,004.09	J2-206	21.21	437.95	12,481.23	3,104.42	J3-1005	20.07	3,106.75	3,106.75
J3-1006	2,004.09	J2-206	21.21	437.95	12,481.23	3,460.81	J3-1005	10.37	3,142.46	3,142.46
J3-1008	2,004.09	J2-206	21.21	437.95	12,481.24	3,609.09	J3-1008	20.36	3,618.49	3,618.49
J2-649	2,004.09	J2-206	21.21	437.94	12,066.71	3,973.53	J2-651	9.56	3,626.25	3,626.25
J2-646	2,004.09	J2-206	21.21	437.94	12,066.71	5,659.39	J2-650	-8.04	4,644.25	4,644.25
J5-799	2,004.09	J2-206	21.21	437.95	12,481.24	4,937.53	J3-1005	16.11	4,750.60	4,750.60
J5-634	2,004.09	J2-206	21.22	437.97	18,308.44	8,653.54	J5-842	3.5	6,563.83	6,563.83
J5-633	2,004.09	J2-206	21.22	437.98	19,751.76	6,532.16	J5-633	20.65	6,590.07	6,590.07
J2-729	2,004.09	J2-206	21.21	437.94	12,066.71	7,658.41	J2-650	2.55	6,720.59	6,720.59
J5-797	2,004.09	J2-206	21.21	437.95	12,481.24	7,828.51	J3-1005	12.91	7,319.01	7,319.01
J5-643	2,004.09	J2-206	21.21	437.94	12,066.71	8,245.34	J3-1005	8.43	7,405.96	7,405.96
J5-634	2,004.09	J5-842	41.04	534.72	12,598.01	10,954.48	J5-634	21.1	11,123.76	11,123.76

2009 FF 542 Zone
After Improvements

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow	Available Flow at	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow
J5-638	2,004.09	J5-638	-207.89	-49.78	562.08	561.36	J5-638	20.06	562.08	562.08
J2-652	2,004.09	J2-652	-356.11	-471.85	677.65	677.25	J2-652	20.07	677.68	677.65
J5-640	2,004.09	J5-640	-79.54	236.44	882.92	881.48	J5-640	20.09	882.99	882.92
J5-639	2,004.09	J5-638	-40.94	335.52	1,006.22	1,043.19	J5-638	18.37	1,006.13	1,006.13
J2-650	2,004.09	J2-650	-101.75	122.16	1,069.42	1,068.29	J2-650	20.11	1,069.42	1,069.42
J5-842	2,004.09	J5-842	-1.76	435.94	1,342.40	1,337.36	J5-842	20.13	1,342.33	1,342.33
J5-644	2,004.09	J5-644	0.92	357.12	1,716.66	1,713.85	J5-644	20.17	1,716.66	1,716.66
J5-637	2,004.09	J5-637	11.82	438.27	1,773.57	1,768.25	J5-637	20.18	1,773.55	1,773.55
J5-841	2,004.09	J5-638	14.57	463.63	1,796.27	1,891.36	J5-638	17.58	1,796.24	1,796.24
J4-501	2,004.09	J4-501	13.01	280.03	1,934.08	1,932.08	J4-501	20.19	1,934.07	1,934.07
J3-1001	2,004.09	J3-1001	15.91	354.72	1,944.99	1,942.10	J3-1001	20.19	1,944.99	1,944.99
J-5092	2,004.09	J5-638	19.91	475.96	2,000.49	5,412.69	J5-638	-111.6	2,000.37	2,000.37
J2-648	2,004.09	J2-648	26.35	342.81	2,086.00	2,083.32	J2-648	20.21	2,086.00	2,086.00
J-5013	2,004.09	J-5013	27.84	338.26	2,104.63	2,101.96	J-5013	20.21	2,104.63	2,104.63
J-5014	2,004.09	J4-690	28	505.63		2,201.97	J-5013	15.89	2,149.81	2,149.81
J-5017	2,004.09	J4-690	28	505.63		2,418.04	J-5013	3.5	2,208.88	2,208.88
J-5016	2,004.09	J4-690	28	505.63		2,361.97	J-5013	8.04	2,208.88	2,208.88
J-5015	2,004.09	J4-690	28	505.63		2,306.75	J-5013	12.43	2,208.88	2,208.88
J3-999	2,004.09	J4-690	28	505.63		2,210.67	J3-1001	20.22	2,214.40	2,214.40
J3-1000	2,004.09	J4-690	28	505.63		2,211.66	J3-1000	20.22	2,215.35	2,215.35
J-5020	2,004.09	J4-690	28	505.63		2,363.00	J3-1000	10.79	2,215.35	2,215.35
J3-998	2,004.09	J4-690	28	505.63		2,215.80	J3-998	20.22	2,219.90	2,219.90
J2-651	2,004.09	J5-638	24.24	485.94	2,221.07	3,159.10	J5-638	-2.78	2,221.04	2,221.04
J-5019	2,004.09	J4-690	28	505.63		2,333.53	J-5013	12.43	2,234.61	2,234.61
J5-636	2,004.09	J5-842	24.06	495.54	2,262.80	3,249.79	J5-842	0.55	2,262.80	2,262.80
J3-997	2,004.09	J4-690	28	505.63		2,288.43	J3-997	20.23	2,292.94	2,292.94
J3-1007	2,004.09	J4-690	28	505.63		2,472.64	J3-1007	20.25	2,479.83	2,479.83
J-527	2,007.20	J4-690	28	505.63		2,529.46	J-527	20.25	2,535.32	2,535.32
J3-1005	2,004.09	J4-690	28	505.63		2,617.58	J3-1005	20.26	2,625.78	2,625.78
J2-647	2,004.09	J4-690	28	505.63		3,036.60	J2-650	3.83	2,652.97	2,652.97
J3-996	2,004.09	J4-690	28	505.63		2,686.63	J3-996	20.27	2,694.03	2,694.03
J3-1010	2,004.09	J4-690	28	505.63		2,713.52	J3-1010	20.27	2,717.74	2,717.74
J5-815	2,004.09	J4-690	28	505.63		2,739.87	J5-815	20.27	2,748.23	2,748.23
J3-1002	2,004.09	J4-690	28	505.63		2,972.29	J3-996	14.21	2,812.08	2,812.08
J3-1003	2,004.09	J4-690	28	505.63		3,149.48	J3-1005	12.46	2,901.83	2,901.83
J3-1009	2,004.09	J4-690	28	505.63		2,968.05	J3-1005	18.03	2,901.83	2,901.83
J3-1006	2,004.09	J4-690	28	505.63		3,250.20	J3-1005	10.35	2,933.23	2,933.23
J2-649	2,004.09	J4-690	28	505.63		4,503.73	J5-638	-10.47	2,937.50	2,937.50
J3-1008	2,004.09	J4-690	28	505.63		3,426.68	J3-1008	20.34	3,435.72	3,435.72
J5-799	2,004.09	J4-690	28	505.63		4,517.23	J3-1005	16.07	4,325.85	4,325.85
J2-646	2,004.09	J4-690	28	505.63		5,648.80	J2-650	-8.05	4,561.37	4,561.37
J2-729	2,004.09	J4-690	28	505.63		7,874.00	J5-638	-16.63	4,898.09	4,898.09
J5-643	2,004.09	J4-690	28	505.63		8,342.74	J5-638	-12.03	5,420.91	5,420.91
J5-797	2,004.09	J4-690	28	505.63		7,880.33	J5-638	-2.25	5,657.26	5,657.26
J5-633	2,004.09	J4-690	28	505.63		6,285.72	J5-633	20.63	6,344.07	6,344.07
J5-634	2,004.09	J4-690	28	505.63		8,387.49	J5-842	5.63	6,350.27	6,350.27

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow
J4-690	2,006.36	J4-690	-13.12	410.71	423.45	419.52	J4-690	20.04	423.44	423.44
J4-691	2,006.36	J4-690	-12.5	412.16	426.92	650.88	J4-690	17.31	426.92	426.92
J4-692	2,006.36	J4-690	-12.14	412.98	428.92	2,042.87	J4-690	-13.23	428.91	428.91
J4-528	2,007.20	J4-690	-12.19	412.87	429.5	2,024.99	J4-690	-12.72	429.49	429.49
J4-530	2,007.20	J4-690	-12.19	412.87	429.50	1,935.94	J4-690	-10.1	429.49	429.49
J4-693	2,006.36	J4-690	-11.98	413.35	429.86	1,908.72	J4-690	-9.14	429.85	429.85
J4-694	2,006.36	J4-690	-11.82	413.71	430.8	1,503.61	J4-690	1.54	430.79	430.79
J4-695	2,006.36	J4-690	-10.56	416.63	439.29	2,082.38	J4-690	-12.74	439.28	439.28
J4-696	2,006.36	J4-690	-10.66	416.39	439.53	2,002.71	J4-690	-10.56	439.53	439.53
J4-697	2,006.36	J4-690	-9.44	419.2	447.26	2,484.05	J4-690	-23.65	447.25	447.25
J4-698	4,006.36	J4-690	-76.72	263.95	451.61	2,592.05	J4-690	-26.55	451.61	451.61
J4-742	2,006.36	J4-690	-7.92	422.73	460.71	2,752.96	J4-690	-30	460.7	460.7
J4-741	4,006.36	J4-690	-67.38	285.5	475.6	2,800.78	J4-690	-28.7	475.6	475.6
J4-699	2,028.23	J4-690	-7.92	422.73	482.57	3,016.88	J4-690	-37.68	482.57	482.57
J4-739	2,006.36	J4-690	9.05	461.89	736.97	5,022.80	J4-690	-29.88	736.97	736.97
J4-738	2,006.36	J4-690	13.24	471.55	908.66	4,168.83	J4-690	-1.83	908.66	908.66
J4-414	2,006.36	J4-414	-34.11	322.28	1,013.14	1,010.55	J4-414	20.1	1,013.14	1,013.14
J4-756	2,006.36	J4-756	-0.34	427.23	1,039.62	1,032.98	J4-756	20.1	1,039.62	1,039.62
J4-747	2,006.36	J4-747	-0.18	425.59	1,074.41	1,067.87	J4-747	20.11	1,074.41	1,074.41
J4-746	2,006.36	J4-747	-0.18	425.59	1,074.41	-86.16	J2-229	21.16	65,399.08	1,074.41
J4-740	2,179.02	J4-690	14.43	474.29	1,154.40	4,733.61	J4-690	0.37	1,154.29	1,154.29
J4-619	2,006.36	J4-690	17.33	481	1,286.89	9,376.18	J4-690	2.07	1,286.89	1,286.89
J4-618	2,006.36	J4-690	17.58	481.58	1,322.78	7,721.55	J4-690	7.15	1,322.78	1,322.78
J4-620	2,006.36	J4-690	17.61	481.63	1,326.11	3,582.04	J4-690	13.12	1,326.11	1,326.11
J4-622	2,006.36	J4-622	17.29	439.9	1,872.47	1,863.01	J4-690	18.15	1,326.11	1,326.11
J3-865	2,006.36	J3-865	13.95	422.2	1,778.90	1,771.92	J4-690	18.49	1,326.11	1,326.11
J4-796	2,006.36	J4-690	17.62	481.66	1,327.87	4,498.65	J4-690	12.37	1,327.87	1,327.87
J4-621	2,006.36	J4-690	17.66	481.75	1,333.82	8,861.05	J4-690	4.84	1,333.81	1,333.81
J4-617	2,006.36	J4-690	17.71	481.88	1,343.92	5,333.51	J4-690	11.43	1,343.92	1,343.92
J4-616	2,006.36	J4-690	17.73	481.92	1,347.20	6,031.89	J4-690	10.46	1,347.19	1,347.19
J4-615	2,006.36	J4-690	17.76	481.98	1,351.60	5,804.24	J4-690	10.82	1,351.60	1,351.60
J4-614	2,006.36	J4-690	17.77	482	1,352.18	10,105.80	J4-690	2.28	1,352.18	1,352.18
J4-610	2,006.36	J4-690	17.81	482.1	1,360.86	6,639.34	J4-690	9.54	1,360.86	1,360.86
J3-748	2,006.36	J3-748	-1.17	481.3	1,362.59	1,357.49	J3-748	20.14	1,362.59	1,362.59
J4-611	2,006.36	J4-690	17.84	482.18	1,364.92	10,863.84	J4-690	-0.11	1,364.92	1,364.92
J4-609	2,006.36	J4-690	17.86	482.21	1,369.52	7,471.45	J4-690	8	1,369.52	1,369.52
J4-608	2,006.36	J4-690	17.88	482.27	1,373.65	8,618.62	J4-690	5.79	1,373.65	1,373.65
J4-607	2,006.36	J4-690	17.89	482.3	1,378.59	10,467.36	J4-690	0.36	1,378.59	1,378.59
J4-612	2,006.36	J4-690	17.93	482.37	1,379.76	11,329.96	J4-690	-1.69	1,379.76	1,379.76
J4-606	2,006.36	J4-690	17.91	482.33	1,384.51	15,865.90	J4-690	-31.57	1,384.51	1,384.51
J3-759	2,006.36	J3-759	-1.04	392.6	1,406.85	1,402.22	J3-759	20.14	1,406.90	1,406.85
J3-965	2,006.36	J4-690	18.1	482.78	1,412.31	3,708.66	J4-690	13.19	1,412.31	1,412.31
J3-967	2,006.36	J4-690	18.1	482.78	1,412.31	2,510.46	J4-690	16.24	1,412.31	1,412.31
J3-364	2,006.36	J4-690	18.1	482.78	1,412.31	2,119.26	J4-690	17.71	1,412.31	1,412.31
J3-966	2,006.36	J4-690	18.1	482.78	1,412.31	2,730.72	J4-690	15.36	1,412.31	1,412.31
J3-968	2,006.36	J4-690	18.1	482.78	1,412.31	4,315.16	J3-364	8.29	3,617.13	1,412.31
J4-613	2,006.36	J4-690	18.1	482.78	1,412.31	10,754.10	J3-364	-1.48	8,097.83	1,412.31
J3-969	2,006.36	J4-690	18.1	482.78	1,412.31	3,101.51	J3-364	11.64	2,773.40	1,412.31
J3-961	2,006.36	J4-690	18.2	483	1,431.44	9,713.16	J4-690	4.54	1,431.44	1,431.44
J3-963	2,006.36	J4-690	18.2	483	1,431.44	2,761.53	J4-690	15.39	1,431.44	1,431.44
J4-433	2,006.36	J4-690	18.28	483.2	1,458.72	17,319.34	J4-690	-35.43	1,458.60	1,458.60
J3-964	2,006.36	J4-690	18.34	483.32	1,460.72	3,167.76	J4-690	13.96	1,460.72	1,460.72
J3-962	2,006.36	J4-690	18.34	483.32	1,460.72	8,081.04	J4-690	7.97	1,460.72	1,460.72
J4-858	2,006.36	J4-690	18.48	483.66	1,508.15	17,134.34	J4-690	-30.46	1,508.08	1,508.08
J4-749	2,006.36	J4-690	18.64	484.01	1,533.04	6,577.18	J4-690	10.71	1,532.95	1,532.95
J5-856	2,002.10	J4-690	18.66	484.06	1,542.49	11,125.48	J4-430	1.59	8,541.32	1,542.49
JF-102	2,006.36	J4-690	18.81	484.41	1,586.13	7,212.70	J4-690	10.16	1,586.08	1,586.08
JF-101	2,006.36	J4-690	18.81	484.41	1,586.10	11,137.96	J4-441	-16.69	7,320.91	1,586.10
J-5064	2,006.36	J-5064	1.62	251.75	1,805.14	1,803.08	J4-690	19.4	1,586.11	1,586.11
J4-847	2,006.36	J4-690	18.81	484.41	1,586.16	7,249.61	J4-690	10.11	1,586.11	1,586.11
J-5063	2,006.36	J4-690	18.81	484.41	1,586.16	3,380.15	J4-690	13.92	1,586.11	1,586.11
J-5065	2,006.36	J4-690	18.81	484.41	1,586.16	2,428.83	J4-690	17.47	1,586.11	1,586.11
J-5062	2,006.36	J4-690	18.81	484.41	1,586.16	4,794.89	J4-690	12.75	1,586.11	1,586.11
J4-440	2,006.36	J4-690	18.81	484.41	1,586.18	7,869.87	J4-690	9.22	1,586.14	1,586.14
J-5061	2,006.36	J4-690	18.81	484.41	1,586.28	2,310.74	J4-690	17.86	1,586.23	1,586.23
J-5060	2,006.36	J4-690	18.81	484.41	1,586.28	3,399.43	J4-690	13.84	1,586.23	1,586.23
J4-432	2,006.36	J4-690	18.81	484.41	1,586.28	3,339.47	J4-690	14.08	1,586.23	1,586.23
J-5009	2,006.36	J4-690	18.81	484.41	1,586.28	5,007.11	J4-690	12.59	1,586.23	1,586.23
J-5047	2,006.36	J4-690	18.81	484.41	1,586.28	7,248.72	J-5061	7.72	6,743.44	1,586.28
J-5048	2,006.36	J4-690	18.81	484.41	1,586.43	6,391.32	J4-690	11.2	1,586.39	1,586.39
J-5049	2,006.36	J4-690	18.81	484.41	1,586.52	6,258.80	J4-690	11.36	1,586.47	1,586.47

J-5051	2,006.36	J4-690	18.81	484.41	1,586.59	6,298.98	J4-690	11.31	1,586.54	1,586.54
J-5050	2,006.36	J4-690	18.81	484.41	1,586.61	6,162.83	J4-690	11.47	1,586.56	1,586.56
J-5052	2,006.36	J4-690	18.81	484.41	1,586.61	6,196.75	J4-690	11.43	1,586.56	1,586.56
J-5059	2,006.36	J4-690	18.81	484.41	1,586.62	5,973.36	J4-690	11.68	1,586.57	1,586.57
J-5058	2,006.36	J4-690	18.81	484.41	1,586.62	6,246.21	J4-690	11.37	1,586.57	1,586.57
J-5057	2,006.36	J4-690	18.81	484.41	1,586.63	6,028.83	J4-690	11.62	1,586.59	1,586.59
J-5056	2,006.36	J4-690	18.81	484.41	1,586.63	6,346.12	J4-690	11.26	1,586.59	1,586.59
J-5055	2,006.36	J4-690	18.81	484.41	1,586.64	5,724.10	J4-690	11.94	1,586.60	1,586.60
J-5053	2,006.36	J4-690	18.81	484.41	1,586.61	7,297.52	J-5059	-8.89	6,351.80	1,586.61
J-5054	2,006.36	J4-690	18.81	484.41	1,586.65	6,455.26	J4-690	11.13	1,586.61	1,586.61
J-5066	2,006.36	J4-690	18.81	484.42	1,586.99	8,421.87	J4-690	8.46	1,586.94	1,586.94
J4-441	2,006.36	J4-690	18.82	484.42	1,587.74	7,099.98	J4-690	10.32	1,587.69	1,587.69
J-5068	2,006.36	J4-690	18.83	484.45	1,591.24	3,733.86	J4-690	13.28	1,591.19	1,591.19
J-5071	2,006.36	J4-690	18.83	484.45	1,591.24	3,043.82	J4-690	15.29	1,591.19	1,591.19
J3-100	2,006.36	J4-690	18.83	484.45	1,591.23	3,186.83	J4-690	14.74	1,591.19	1,591.19
J3-101	2,006.36	J4-690	18.83	484.45	1,591.23	2,873.39	J4-690	15.93	1,591.19	1,591.19
J-5069	2,006.36	J4-690	18.83	484.45	1,591.24	3,306.57	J4-690	14.26	1,591.19	1,591.19
J3-972	2,006.36	J4-690	18.83	484.45	1,591.23	2,881.61	J4-690	15.9	1,591.19	1,591.19
J-5067	2,006.36	J4-690	18.83	484.45	1,591.23	6,026.56	J4-690	11.64	1,591.19	1,591.19
J-5070	2,006.36	J4-690	18.83	484.45	1,591.23	3,111.08	J4-690	15.03	1,591.19	1,591.19
J-5091	2,006.36	J4-690	18.83	484.47	1,592.68	7,649.19	J4-690	9.6	1,592.63	1,592.63
J4-427	2,006.36	J4-690	18.86	484.54	1,600.25	7,827.17	J4-690	9.41	1,600.21	1,600.21
J4-428	2,006.36	J4-690	18.86	484.54	1,600.25	3,474.06	J4-690	13.67	1,600.21	1,600.21
J4-625	2,006.36	J4-690	18.86	484.54	1,600.25	2,797.54	J4-690	16.27	1,600.21	1,600.21
J4-830	2,006.36	J4-690	18.87	484.54	1,609.63	17,295.67	J4-690	-27.04	1,609.60	1,609.60
J-5073	2,006.36	J4-690	19.03	484.92	1,657.22	7,012.56	J4-690	10.25	1,657.20	1,657.20
J-5074	2,006.36	J4-690	19.03	484.92	1,657.22	17,878.89	J4-690	-29.94	1,657.20	1,657.20
J4-426	2,006.36	J4-690	19.08	485.03	1,657.72	6,465.55	J4-690	11.5	1,657.69	1,657.69
J4-412	2,006.36	J4-414	12.09	428.9	1,690.60	2,026.97	J4-414	11.53	1,690.60	1,690.60
J4-413	2,006.36	J4-414	12.09	428.9	1,690.60	1,939.73	J4-414	13.85	1,690.60	1,690.60
J4-750	2,006.36	J4-747	16.7	464.54	1,698.25	3,018.07	J4-747	2.97	1,698.41	1,698.25
J4-752	2,006.36	J4-690	19.18	485.27	1,699.41	10,938.40	J4-756	-5.34	3,303.49	1,699.41
J4-430	2,144.80	J4-690	18.79	484.37	1,720.24	7,598.46	J4-690	9.79	1,720.22	1,720.22
J4-431	2,144.80	J4-690	18.81	484.41	1,724.40	10,679.22	J4-441	-9.96	7,469.42	1,724.40
J4-429	2,144.80	J4-690	18.82	484.44	1,728.64	7,526.72	J4-690	9.94	1,728.62	1,728.62
J4-2016	2,006.36	J4-690	19.37	485.71	1,757.04	4,623.79	J4-690	13.07	1,757.04	1,757.04
J4-2017	2,006.36	J4-690	19.47	485.94	1,791.42	3,525.90	J4-690	14.87	1,791.42	1,791.42
J4-2015	2,006.36	J4-690	19.47	485.94	1,791.42	4,964.28	J4-690	12.92	1,791.42	1,791.42
J4-757	2,006.36	J4-690	19.46	485.91	1,793.60	14,854.85	J4-756	-8.89	3,692.10	1,793.60
J4-762	2,006.36	J4-690	19.57	486.16	1,829.70	10,726.81	J4-690	6.06	1,829.70	1,829.70
J4-2014	2,006.36	J4-690	19.58	486.19	1,830.66	5,923.56	J4-690	12.23	1,830.66	1,830.66
J4-763	2,006.36	J4-690	19.59	486.22	1,838.56	4,840.29	J4-690	13.02	1,838.56	1,838.56
J4-2013	2,006.36	J4-690	19.61	486.27	1,843.41	6,413.56	J4-690	11.78	1,843.41	1,843.41
J4-2018	2,006.36	J4-690	19.61	486.27	1,843.41	3,662.45	J4-690	14.74	1,843.41	1,843.41
J4-2012	2,006.36	J4-690	19.64	486.33	1,853.96	6,907.47	J4-690	11.28	1,853.96	1,853.96
J4-435	2,006.36	J4-690	19.64	486.33	1,856.16	9,418.28	J4-690	8.2	1,856.16	1,856.16
J4-2010	2,006.36	J4-690	19.66	486.37	1,860.37	7,254.27	J4-690	10.91	1,860.37	1,860.37
J4-2006	2,006.36	J4-690	19.67	486.4	1,865.44	3,805.15	J4-690	14.39	1,865.44	1,865.44
J4-2001	2,006.36	J4-690	19.67	486.4	1,865.44	5,083.04	J4-690	12.96	1,865.44	1,865.44
J4-2002	2,006.36	J4-690	19.67	486.4	1,865.44	3,725.17	J4-690	14.66	1,865.44	1,865.44
J4-2004	2,006.36	J4-690	19.67	486.4	1,865.44	3,823.87	J4-690	14.32	1,865.44	1,865.44
J4-2007	2,006.36	J4-690	19.67	486.4	1,865.44	3,601.25	J4-690	15.09	1,865.44	1,865.44
J4-2008	2,006.36	J4-690	19.67	486.4	1,865.44	3,686.11	J4-690	14.8	1,865.44	1,865.44
J4-2009	2,006.36	J4-690	19.67	486.4	1,865.44	3,577.45	J4-690	15.16	1,865.44	1,865.44
J4-2000	2,006.36	J4-690	19.67	486.4	1,865.44	7,558.55	J4-690	10.57	1,865.44	1,865.44
J4-2003	2,006.36	J4-690	19.67	486.4	1,865.44	4,209.09	J4-690	13.3	1,865.44	1,865.44
J4-2005	2,006.36	J4-690	19.67	486.4	1,865.44	3,622.82	J4-690	15.01	1,865.44	1,865.44
J-5072	2,006.36	J4-690	19.67	486.4	1,865.44	3,635.33	J4-690	14.97	1,865.44	1,865.44
J4-2011	2,006.36	J4-690	19.69	486.44	1,872.37	7,614.64	J4-690	10.54	1,872.37	1,872.37
J4-765	2,006.36	J4-690	19.7	486.47	1,878.89	8,235.96	J4-690	9.86	1,878.89	1,878.89
J4-772	2,006.36	J4-690	19.7	486.48	1,879.20	4,458.20	J4-690	13.26	1,879.20	1,879.20
J4-766	2,006.36	J4-690	19.7	486.48	1,879.20	3,546.52	J4-690	15.33	1,879.20	1,879.20
J4-767	2,006.36	J4-690	19.71	486.48	1,879.74	3,477.18	J4-690	15.57	1,879.74	1,879.74
J4-769	2,006.36	J4-690	19.71	486.49	1,881.12	7,875.15	J4-690	10.29	1,881.11	1,881.11
J4-768	2,006.36	J4-690	19.71	486.49	1,881.17	8,552.36	J4-690	9.53	1,881.17	1,881.17
J4-770	2,006.36	J4-690	19.74	486.55	1,891.97	6,352.46	J4-690	11.98	1,891.97	1,891.97
J4-764	2,006.36	J4-690	19.77	486.63	1,906.87	2,166.48	J4-690	19.39	1,907.02	1,906.87
J4-773	2,006.36	J4-690	19.77	486.63	1,906.87	5,507.74	J4-690	12.66	1,907.02	1,906.87
J4-437	2,006.36	J4-690	19.82	486.73	1,924.14	6,217.96	J4-690	12.2	1,924.24	1,924.14
J4-438	2,006.36	J4-690	19.87	486.85	1,947.06	5,960.44	J4-690	12.47	1,947.08	1,947.06
J4-439	2,006.36	J4-690	19.9	486.93	1,961.38	4,402.88	J4-690	13.3	1,961.36	1,961.36
J3-751	2,006.36	J3-748	19.56	529.14	1,997.81	2,625.45	J3-748	-16.57	1,997.76	1,997.76
J4-771	2,006.36	J4-690	20.01	487.19	2,013.00	6,793.48	J4-690	12.11	2,012.94	2,012.94

J4-436	2,006.36	J4-690	20.04	487.26	2,027.74	5,637.61	J4-690	12.87	2,027.69	2,027.69
J4-434	2,006.36	J4-690	20.09	487.36	2,046.03	12,513.13	J4-690	4.22	2,046.01	2,046.01
J3-755	2,006.36	J2-229	21.16	443.82		2,053.26	J3-755	20.2	2,056.92	2,056.92
J4-411	2,006.36	J2-229	21.13	443.77	50,750.93	2,671.04	J4-414	8.56	2,114.82	2,114.82
J4-420	2,006.36	J4-690	20.51	488.34	2,280.59	5,817.60	J4-690	13.04	2,280.59	2,280.59
J3-753	2,006.36	J2-229	21.16	443.82		2,652.39	J3-748	0.76	2,283.98	2,283.98
J3-754	2,006.36	J2-229	21.16	443.82		2,631.45	J3-755	3.77	2,329.53	2,329.53
J3-559	2,006.36	J2-229	21.16	443.82		2,631.24	J3-755	3.8	2,329.53	2,329.53
J4-421	2,006.36	J4-690	20.66	488.69	2,371.23	4,912.70	J4-690	13.55	2,371.24	2,371.23
J4-422	2,006.36	J4-690	20.75	488.88	2,374.31	9,931.26	J4-690	10.62	2,374.31	2,374.31
J4-419	2,006.36	J4-690	20.69	488.76	2,391.83	5,733.22	J4-690	13.15	2,391.84	2,391.83
J4-418	2,006.36	J4-690	20.72	488.82	2,403.21	6,298.21	J4-690	12.9	2,403.22	2,403.21
J4-417	2,006.36	J4-690	20.77	488.93	2,427.27	6,992.50	J4-690	12.6	2,427.27	2,427.27
J3-758	2,006.36	J2-229	21.16	443.82		2,684.67	J3-748	5.97	2,439.35	2,439.35
J4-527	2,007.20	J4-690	20.86	489.15	2,494.72	5,764.26	J4-690	13.18	2,494.73	2,494.72
J4-416	2,006.36	J4-690	20.97	489.4	2,576.29	7,741.59	J4-690	12.46	2,576.31	2,576.29
J4-624	2,006.36	J2-229	21.13	443.76	43,440.28	12,659.38	J4-690	8.52	2,838.98	2,838.98
J4-410	2,006.36	J2-229	21.13	443.77	50,750.90	3,427.40	J4-414	11.24	2,840.14	2,840.14
J4-415	2,006.36	J2-229	21.13	443.76	44,302.91	12,250.35	J4-690	8.99	2,855.57	2,855.57
J4-409	2,006.36	J2-229	21.13	443.77	50,750.88	12,518.31	J4-690	8.59	2,915.79	2,915.79
J4-408	2,006.36	J2-229	21.14	443.78	65,365.75	16,283.55	J4-690	3.81	3,134.71	3,134.71
J4-408	2,006.36	J4-690	21.6	490.85	3,135.52	16,277.34	J4-690	3.81	3,135.54	3,135.52
J1-8	2,005.67	J4-690	23.12	494.35	42,151,177.91	5,308.79	J1-8	20.53	5,322.02	5,322.02

2009 FF 544 Zone
After Improvements

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow (gpm)
J4-414	2,006.36	J4-414	-31.82	327.57	1,062.07	1,059.46	J4-414	20.11	1,062.07	1,062.07
J4-756	2,006.36	J4-756	4.33	438	1,253.17	1,245.70	J4-756	20.12	1,253.17	1,253.17
J3-748	2,006.36	J3-748	-1.17	481.3	1,362.59	1,357.49	J3-748	20.14	1,362.59	1,362.59
J3-759	2,006.36	J3-759	3.77	403.69	1,537.56	1,532.59	J3-759	20.15	1,537.58	1,537.56
J4-746	2,006.36	J4-746	-42.2	352.62	1,604.48	1,643.73	J4-746	20.16	1,604.47	1,604.47
J4-412	2,006.36	J4-414	14.38	434.2	1,779.10	2,114.07	J4-414	11.54	1,779.18	1,779.10
J4-413	2,006.36	J4-414	14.38	434.2	1,779.10	1,999.93	J4-414	14.55	1,779.18	1,779.10
J4-747	2,006.36	J4-746	-1.11	447.43	1,811.68	1,931.84	J4-746	9.79	1,811.68	1,811.68
J-5064	2,006.36	J-5064	3.64	256.41	1,829.51	1,827.46	J-5064	20.18	1,829.51	1,829.51
J3-751	2,006.36	J3-748	19.56	529.14	1,997.81	2,560.12	J3-748	-16.58	1,997.76	1,997.76
J3-865	2,006.36	J3-865	20.09	436.37	2,009.91	2,002.19	J3-865	20.2	2,010.06	2,009.91
J3-755	2,006.36	J2-229	20.55	442.43		2,053.26	J3-755	20.2	2,056.92	2,056.92
J4-622	2,006.36	J2-229	20.54	442.4	38,907.73	2,175.49	J4-622	20.22	2,186.56	2,186.56
J4-411	2,006.36	J2-229	20.53	442.38	27,792.58	2,819.97	J4-414	8.58	2,250.02	2,250.02
J3-753	2,006.36	J2-229	20.55	442.43		2,578.43	J3-748	0.76	2,283.98	2,283.98
J4-764	2,006.36	J2-229	20.54	442.39	36,159.03	2,285.16	J4-764	20.23	2,291.63	2,291.63
J-5061	2,006.36	J2-229	20.53	442.39	35,286.18	2,324.17	J-5061	20.23	2,327.25	2,327.25
J3-559	2,006.36	J2-229	20.55	442.43		2,559.97	J3-755	3.79	2,328.15	2,328.15
J3-754	2,006.36	J2-229	20.55	442.43		2,564.68	J3-755	3.29	2,328.15	2,328.15
J3-758	2,006.36	J2-229	20.55	442.43		2,606.74	J3-748	5.96	2,377.60	2,377.60
J-5065	2,006.36	J2-229	20.53	442.39	35,288.49	2,454.89	J-5065	20.24	2,458.61	2,458.61
J3-101	2,006.36	J2-229	20.53	442.39	35,218.89	2,985.04	J3-101	20.3	2,990.24	2,990.24
J3-972	2,006.36	J2-229	20.53	442.39	35,218.89	3,009.80	J3-972	20.3	3,015.80	3,015.80
J3-963	2,006.36	J2-229	20.54	442.4	38,585.78	3,026.95	J3-963	20.3	3,035.50	3,035.50
J4-625	2,006.36	J2-229	20.53	442.39	35,003.70	3,066.31	J4-625	20.31	3,079.46	3,079.46
J4-410	2,006.36	J2-229	20.53	442.38	27,792.57	3,729.60	J4-414	11.27	3,118.46	3,118.46
J-5071	2,006.36	J2-229	20.53	442.39	35,218.90	3,178.89	J-5071	20.32	3,185.19	3,185.19
J4-530	2,007.20	J2-229	20.55	442.43	48,275.39	3,178.01	J4-530	20.32	3,186.25	3,186.25
J4-750	2,006.36	J2-229	20.54	442.4	37,149.32	3,505.94	J3-759	16.45	3,262.30	3,262.30
J-5070	2,006.36	J2-229	20.53	442.39	35,218.90	3,260.81	J-5070	20.33	3,267.80	3,267.80
J-5060	2,006.36	J2-229	20.53	442.39	35,286.18	3,387.80	J-5061	16	3,312.40	3,312.40
J4-432	2,006.36	J2-229	20.53	442.39	35,286.18	3,329.60	J-5061	19.1	3,312.40	3,312.40
J-5063	2,006.36	J2-229	20.53	442.39	35,288.49	3,400.14	J-5064	16.87	3,335.39	3,335.39
J3-100	2,006.36	J2-229	20.53	442.39	35,218.89	3,358.45	J3-100	20.34	3,366.46	3,366.46
J-5069	2,006.36	J2-229	20.53	442.39	35,218.90	3,492.88	J-5069	20.35	3,501.54	3,501.54
J3-964	2,006.36	J2-229	20.54	442.4	38,290.91	3,514.28	J3-964	20.35	3,526.19	3,526.19
J4-691	2,006.36	J2-229	20.55	442.43	48,401.40	3,498.47	J4-691	20.35	3,533.04	3,533.04
J4-528	2,007.20	J2-229	20.55	442.43	48,275.40	4,033.45	J4-691	15.83	3,689.22	3,689.22
J4-692	2,006.36	J2-229	20.55	442.43	48,252.88	4,116.76	J4-691	15.06	3,718.73	3,718.73
J4-767	2,006.36	J2-229	20.54	442.39	35,413.47	3,744.08	J4-767	20.37	3,758.68	3,758.68
J3-966	2,006.36	J2-229	20.54	442.4	41,468.09	3,761.31	J3-966	20.38	3,769.47	3,769.47
J4-2017	2,006.36	J2-229	20.54	442.39	35,894.63	3,790.87	J4-2017	20.38	3,804.49	3,804.49
J4-693	2,006.36	J2-229	20.55	442.43	48,191.29	4,354.91	J4-691	12.86	3,810.57	3,810.57
J4-766	2,006.36	J2-229	20.54	442.39	35,430.83	3,833.82	J4-766	20.38	3,849.52	3,849.52
J4-2009	2,006.36	J2-229	20.54	442.39	35,404.05	3,837.63	J4-2009	20.38	3,851.71	3,851.71
J4-428	2,006.36	J2-229	20.53	442.39	35,003.70	3,904.75	J4-625	19.52	3,879.11	3,879.11
J4-2007	2,006.36	J2-229	20.54	442.39	35,404.05	3,865.28	J4-2007	20.39	3,879.55	3,879.55
J4-694	2,006.36	J2-229	20.55	442.42	48,145.96	4,334.92	J4-691	14.21	3,888.32	3,888.32
J4-2005	2,006.36	J2-229	20.54	442.39	35,404.05	3,890.31	J4-2005	20.39	3,904.77	3,904.77
J-5072	2,006.36	J2-229	20.54	442.39	35,404.05	3,904.99	J-5072	20.39	3,919.56	3,919.56
J4-2018	2,006.36	J2-229	20.54	442.39	35,545.48	3,938.94	J4-2018	20.39	3,953.65	3,953.65
J3-967	2,006.36	J2-229	20.54	442.4	43,074.67	3,957.20	J3-967	20.4	3,961.59	3,961.59
J4-2008	2,006.36	J2-229	20.54	442.39	35,404.05	3,964.25	J4-2008	20.4	3,979.27	3,979.27
J4-2002	2,006.36	J2-229	20.54	442.39	35,404.05	3,990.77	J4-2002	20.4	4,005.05	4,005.05
J-5068	2,006.36	J2-229	20.53	442.39	35,218.90	4,002.92	J-5068	20.4	4,016.43	4,016.43
J4-690	2,006.36	J2-229	20.55	442.43	48,807.38	4,003.19	J4-690	20.4	4,043.79	4,043.79
J4-2006	2,006.36	J2-229	20.54	442.39	35,404.05	4,103.69	J4-2006	20.41	4,119.77	4,119.77
J4-620	2,006.36	J2-229	20.54	442.4	38,907.73	4,409.42	J4-622	16.97	4,125.88	4,125.88
J3-965	2,006.36	J2-229	20.54	442.4	38,834.04	4,120.85	J3-965	20.41	4,134.97	4,134.97
J4-2004	2,006.36	J2-229	20.54	442.39	35,404.05	4,125.52	J4-2004	20.41	4,141.76	4,141.76
J3-364	2,006.36	J2-229	20.54	442.4	45,317.14	4,360.11	J3-364	20.44	4,358.43	4,358.43
J4-695	2,006.36	J2-229	20.55	442.42	47,734.91	5,724.77	J4-690	1.94	4,437.32	4,437.32
J4-696	2,006.36	J2-229	20.55	442.42	47,701.64	5,991.34	J4-690	-1.92	4,483.26	4,483.26
J4-2003	2,006.36	J2-229	20.54	442.39	35,404.05	4,568.13	J4-2009	20.45	4,587.93	4,587.93
J4-697	2,006.36	J2-229	20.54	442.41	47,296.20	5,974.68	J4-690	0.32	4,613.17	4,613.17
J-5062	2,006.36	J2-229	20.53	442.39	35,288.49	4,643.41	J-5064	19.16	4,619.25	4,619.25
J4-698	4,006.36	J2-229	20.54	442.4	46,985.02	6,816.24	J4-690	-12.26	4,738.88	4,738.88
J-5009	2,006.36	J2-229	20.53	442.39	35,286.18	4,748.15	J-5061	20.47	4,761.05	4,761.05
J4-742	2,006.36	J2-229	20.54	442.41	46,502.01	6,983.79	J4-690	-12.1	4,906.05	4,906.05
J4-772	2,006.36	J2-229	20.54	442.39	35,430.83	4,900.43	J4-772	20.49	4,927.09	4,927.09
J4-699	2,028.23	J2-229	20.54	442.41	46,523.92	5,142.14	J4-690	17.28	4,927.92	4,927.92
J4-439	2,006.36	J2-229	20.53	442.39	34,375.39	4,957.58	J4-439	20.5	4,991.07	4,991.07
J4-2016	2,006.36	J2-229	20.54	442.39	36,141.63	4,990.53	J4-2016	20.5	5,013.99	5,013.99
J4-741	4,006.36	J2-229	20.54	442.4	45,821.91	6,943.10	J4-690	-6.85	5,139.70	5,139.70
J4-796	2,006.36	J2-229	20.54	442.4	38,894.42	5,130.16	J4-622	20.25	5,160.69	5,160.69
J3-969	2,006.36	J2-229	20.54	442.4	43,074.67	5,411.25	J3-967	16.21	5,223.83	5,223.83

J-5053	2,006.36	J2-229	20.53	442.39	35,284.27	6,604.29	J-5059	-10.54	5,763.17	5,763.17
J-5047	2,006.36	J2-229	20.53	442.39	35,286.18	6,414.85	J-5061	7.64	5,999.40	5,999.40
J4-752	2,006.36	J2-229	20.54	442.4	37,149.83	12,667.62	J4-756	-5.17	6,067.95	6,067.95
J3-968	2,006.36	J2-229	20.54	442.4	41,468.09	6,568.50	J3-966	12.86	6,153.19	6,153.19
J4-847	2,006.36	J2-229	20.53	442.39	35,288.49	6,453.20	J-5064	20.21	6,461.60	6,461.60
J4-440	2,006.36	J2-229	20.53	442.39	35,287.30	6,699.42	J-5064	20.03	6,700.71	6,700.71
J4-749	2,006.36	J2-229	20.54	442.4	37,843.70	7,793.63	J4-756	16.64	6,807.65	6,807.65
J3-962	2,006.36	J2-229	20.54	442.4	38,290.91	9,735.12	J4-756	15.44	7,234.88	7,234.88
J4-757	2,006.36	J2-229	20.54	442.4	36,845.81	18,157.87	J4-756	-7.9	7,405.62	7,405.62
J3-961	2,006.36	J2-229	20.54	442.4	38,585.78	11,798.26	J4-756	12.65	7,443.82	7,443.82
J4-427	2,006.36	J2-229	20.53	442.39	35,003.70	8,381.56	J4-625	13.47	7,644.15	7,644.15
J4-739	2,006.36	J2-229	20.54	442.4	42,279.93	8,478.67	J4-738	14.82	7,675.48	7,675.48
J-5074	2,006.36	J2-229	20.54	442.4	37,160.67	21,147.97	J4-756	-22.07	7,679.76	7,679.76
J4-762	2,006.36	J2-229	20.54	442.39	36,262.14	11,685.72	J4-756	12.44	7,843.43	7,843.43
J-5091	2,006.36	J2-229	20.53	442.39	35,174.00	8,221.58	J4-625	17.11	7,861.66	7,861.66
J4-769	2,006.36	J2-229	20.54	442.39	35,311.63	8,409.13	J4-770	15.22	7,933.19	7,933.19
J4-830	2,006.36	J2-229	20.54	442.4	37,233.25	20,483.55	J4-756	-16.49	7,946.04	7,946.04
J4-431	2,144.80	J2-229	20.53	442.39	35,449.18	11,165.58	J4-441	-8.3	8,027.50	8,027.50
J4-435	2,006.36	J2-229	20.54	442.39	35,922.42	10,217.67	J4-756	15.76	8,056.77	8,056.77
J4-2011	2,006.36	J2-229	20.54	442.39	35,362.65	8,114.33	J4-770	19.52	8,064.63	8,064.63
J4-429	2,144.80	J2-229	20.53	442.39	35,373.10	8,093.68	J4-625	19.82	8,074.28	8,074.28
J4-434	2,006.36	J2-229	20.54	442.4	36,390.36	14,813.94	J4-756	7.46	8,247.65	8,247.65
J4-765	2,006.36	J2-229	20.54	442.39	35,444.51	8,854.69	J4-756	18.39	8,267.48	8,267.48
J4-621	2,006.36	J2-229	20.54	442.4	38,861.71	10,616.05	J4-622	11.15	8,475.72	8,475.72
J4-618	2,006.36	J2-229	20.54	442.4	38,925.62	9,679.53	J4-622	16.33	8,706.58	8,706.58
J4-768	2,006.36	J2-229	20.54	442.39	35,355.85	9,053.39	J4-770	16.94	8,715.91	8,715.91
J4-858	2,006.36	J2-229	20.54	442.39	37,408.36	20,302.53	J4-756	-13.4	9,056.23	9,056.23
J5-856	2,002.10	J2-229	20.53	442.39	35,940.38	11,994.53	J4-430	1.85	9,429.36	9,429.36
J4-614	2,006.36	J2-229	20.54	442.4	38,787.22	12,096.10	J4-622	10.24	9,540.91	9,540.91
J4-433	2,006.36	J2-229	20.54	442.39	37,593.60	20,610.88	J4-756	-13.87	9,612.58	9,612.58
J4-608	2,006.36	J2-229	20.54	442.4	38,660.77	9,640.08	J4-756	20.3	9,835.88	9,835.88
J4-611	2,006.36	J2-229	20.54	442.4	38,759.27	13,156.89	J4-622	8.8	10,132.41	10,132.41
J4-607	2,006.36	J2-229	20.54	442.4	38,605.88	11,683.67	J4-756	18.31	10,499.28	10,499.28
J4-612	2,006.36	J2-229	20.54	442.4	38,751.91	13,912.02	J4-622	8.74	10,726.35	10,726.35
J4-422	2,006.36	J2-229	20.53	442.38	26,939.68	10,949.92	J4-756	20.13	11,043.24	11,043.24
J4-613	2,006.36	J2-229	20.54	442.4	38,834.04	13,287.61	J3-966	10.3	12,045.43	12,045.43
J4-409	2,006.36	J2-229	20.53	442.38	27,792.56	14,912.85	J4-414	11.08	12,336.00	12,336.00
J4-408	2,006.36	J2-229	20.54	442.4	37,194.07	19,328.26	J4-756	9.81	12,346.61	12,346.61
J4-619	2,006.36	J2-229	20.54	442.4	39,334.57	12,741.11	J4-756	19.23	12,376.90	12,376.90
J4-415	2,006.36	J2-229	20.53	442.37	23,689.40	14,611.94	J4-414	15.65	13,086.12	13,086.12
J4-624	2,006.36	J2-229	20.53	442.37	23,002.55	15,113.87	J4-414	14.59	13,210.62	13,210.62
J4-606	2,006.36	J2-229	20.54	442.4	38,305.15	19,147.52	J4-622	-8.08	14,237.74	14,237.74
J4-416	2,006.36	J2-229	20.53	442.38	28,177.17	8,609.78	J2-229	20.47	28,177.08	28,177.08
J4-527	2,007.20	J2-229	20.53	442.38	28,741.71	6,396.85	J2-229	20.5	28,741.58	28,741.58
J4-417	2,006.36	J2-229	20.53	442.38	28,788.36	7,882.45	J2-229	20.49	28,788.26	28,788.26
J4-418	2,006.36	J2-229	20.53	442.38	29,333.32	7,133.37	J2-229	20.5	29,333.20	29,333.20
J4-771	2,006.36	J2-229	20.53	442.38	29,610.88	7,521.98	J2-229	20.5	29,610.99	29,610.88
J4-419	2,006.36	J2-229	20.53	442.38	29,759.20	6,546.39	J2-229	20.51	29,759.08	29,759.08
J4-421	2,006.36	J2-229	20.53	442.38	29,821.49	5,529.33	J2-229	20.52	29,821.38	29,821.38
J4-420	2,006.36	J2-229	20.53	442.38	30,978.68	6,576.67	J2-229	20.51	30,978.67	30,978.67
J4-436	2,006.36	J2-229	20.53	442.39	33,839.86	6,289.44	J2-229	20.51	33,838.69	33,838.69
J4-426	2,006.36	J2-229	20.53	442.39	33,946.41	7,060.85	J2-229	20.51	33,948.00	33,946.41
J4-438	2,006.36	J2-229	20.53	442.39	34,593.11	6,561.79	J2-229	20.51	34,593.00	34,593.00
J4-437	2,006.36	J2-229	20.53	442.39	34,746.05	6,795.93	J2-229	20.51	34,746.09	34,746.05
J4-770	2,006.36	J2-229	20.53	442.39	35,150.34	6,979.02	J2-229	20.51	35,150.77	35,150.33
J-5067	2,006.36	J2-229	20.53	442.39	35,218.91	6,506.31	J2-229	20.51	35,222.39	35,218.91
J4-441	2,006.36	J2-229	20.53	442.39	35,275.67	7,653.51	J2-229	20.5	35,275.68	35,275.67
J-5066	2,006.36	J2-229	20.53	442.39	35,283.03	7,118.27	J2-229	20.51	35,283.04	35,283.03
J-5054	2,006.36	J2-229	20.53	442.39	35,284.20	5,837.44	J2-229	20.52	35,284.20	35,284.20
J-5055	2,006.36	J2-229	20.53	442.39	35,284.21	5,309.38	J2-229	20.52	35,284.21	35,284.21
J-5056	2,006.36	J2-229	20.53	442.39	35,284.21	5,759.18	J2-229	20.52	35,284.23	35,284.21
J-5057	2,006.36	J2-229	20.53	442.39	35,284.22	5,532.70	J2-229	20.52	35,284.23	35,284.22
J-5058	2,006.36	J2-229	20.53	442.39	35,284.24	5,687.77	J2-229	20.52	35,284.25	35,284.24
J-5059	2,006.36	J2-229	20.53	442.39	35,284.25	5,491.77	J2-229	20.52	35,284.25	35,284.25
J-5052	2,006.36	J2-229	20.53	442.39	35,284.26	5,652.29	J2-229	20.52	35,284.27	35,284.26
J-5050	2,006.36	J2-229	20.53	442.39	35,284.27	5,628.02	J2-229	20.52	35,284.28	35,284.27
J-5051	2,006.36	J2-229	20.53	442.39	35,284.31	5,724.56	J2-229	20.52	35,284.32	35,284.31
J-5049	2,006.36	J2-229	20.53	442.39	35,284.57	5,700.40	J2-229	20.52	35,284.57	35,284.57
JF-101	2,006.36	J2-229	20.53	442.39	35,284.61	6,004.14	J2-229	20.52	35,284.61	35,284.61
J-5048	2,006.36	J2-229	20.53	442.39	35,285.00	5,804.92	J2-229	20.52	35,285.01	35,285.00
JF-102	2,006.36	J2-229	20.53	442.39	35,291.36	6,786.13	J2-229	20.51	35,291.36	35,291.36
J4-2000	2,006.36	J2-229	20.54	442.39	35,404.05	8,017.59	J2-229	20.5	35,404.79	35,404.05
J4-2001	2,006.36	J2-229	20.54	442.39	35,404.05	5,476.57	J2-229	20.52	35,404.79	35,404.05
J4-2010	2,006.36	J2-229	20.54	442.39	35,436.38	7,708.49	J2-229	20.5	35,437.17	35,436.38
J4-2012	2,006.36	J2-229	20.54	442.39	35,477.51	7,353.41	J2-229	20.51	35,478.36	35,477.51
J4-430	2,144.80	J2-229	20.53	442.39	35,521.84	8,200.19	J2-229	20.5	35,521.86	35,521.84
J4-2013	2,006.36	J2-229	20.54	442.39	35,545.48	6,845.85	J2-229	20.51	35,546.42	35,545.48
J4-2014	2,006.36	J2-229	20.54	442.39	35,628.57	6,340.93	J2-229	20.52	35,629.62	35,628.57

J4-2015	2,006.36	J2-229	20.54	442.39	35,894.63	5,347.06	J2-229	20.52	35,896.09	35,894.63
J4-763	2,006.36	J2-229	20.54	442.39	36,149.64	5,255.57	J2-229	20.52	36,151.70	36,149.64
J4-773	2,006.36	J2-229	20.54	442.39	36,173.44	6,119.49	J2-229	20.52	36,174.50	36,173.44
J-5073	2,006.36	J2-229	20.54	442.4	37,145.65	7,408.25	J2-229	20.51	37,145.68	37,145.65
J4-609	2,006.36	J2-229	20.54	442.4	38,644.26	8,334.97	J2-229	20.52	38,644.34	38,644.26
J4-610	2,006.36	J2-229	20.54	442.4	38,709.76	7,493.50	J2-229	20.52	38,709.85	38,709.76
J4-615	2,006.36	J2-229	20.54	442.4	38,768.38	6,547.49	J2-229	20.52	38,768.46	38,768.38
J4-616	2,006.36	J2-229	20.54	442.4	38,794.96	6,722.37	J2-229	20.52	38,795.05	38,794.96
J4-617	2,006.36	J2-229	20.54	442.4	38,817.16	6,169.41	J2-229	20.52	38,817.25	38,817.16
J4-740	2,179.02	J2-229	20.54	442.4	40,927.50	7,161.03	J2-229	20.52	40,927.52	40,927.50
J4-738	2,006.36	J2-229	20.54	442.4	41,198.29	6,713.62	J2-229	20.52	41,198.36	41,198.28

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant (gpm)	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow
J3-912	2,005.07	J3-916	-11.77	592.83	0	1,283.20	J3-916	11.46	0	853.61
J3-565	2,005.07	J3-916	27.1	682.53	0	7,105.39	J3-916	7.43	0	3,792.11
J3-915	2,005.07	J3-915	-30.52	549.57	0	808.29	J3-915	20.08	0	889.22
J3-876	2,005.07	J3-916	27.17	682.72	0	7,103.19	J3-916	6.71	0	808.87
J3-272	2,005.07	J3-272	-802.56	-1,347.21	614.46	613.78	J3-272	20.06	614.45	614.45
J3-273	2,005.07	J3-273	-709.9	-1,111.35	621.73	621.72	J3-273	20.06	621.72	621.72
J3-274	2,005.07	J3-273	-642.34	-955.43	664.19	801.67	J3-273	-17.19	664.19	664.19
J3-275	2,005.07	J3-273	-554.18	-751.97	710.26	877.48	J3-273	-23.27	710.21	710.21
J3-871	2,005.07	J3-871	-248.74	-44.06	730.41	729.85	J3-871	20.07	730.41	730.41
J-5082	2,005.07	J-5082	-117.87	182.97	733.7	731.51	J-5082	20.07	733.7	733.7
J3-276	2,005.07	J3-273	-486.09	-594.83	752.96	814.42	J3-273	8.77	752.94	752.94
J3-283	2,005.07	J3-283	-494.09	-732.29	896.88	911.23	J3-273	-16.38	756.73	756.73
J3-282	2,005.07	J3-273	-480.41	-581.72	756.75	823.02	J3-273	7.61	756.73	756.73
J3-281	2,005.07	J3-281	-478.53	-597.38	787.13	803.84	J3-273	13.46	760.03	760.03
J3-377	2,005.07	J3-377	-36.09	656.71	761.64	834.98	J3-377	20.08	761.64	761.64
J3-557	2,005.07	J3-557	-365.7	-274.98	768.47	789.9	J3-557	20.08	768.44	768.44
J-515	2,005.07	J3-557	-365.7	-274.98	768.47	1,377.30	J3-557	-131.17	768.44	768.44
J3-916	2,005.07	J3-916	-35.22	538.72	781.92	779.3	J3-916	20.08	781.91	781.91
J3-289	2,005.07	J3-289	-333.2	-193.98	786.78	809.64	J3-289	20.08	786.74	786.74
J3-297	2,005.07	J3-297	-217.25	131.63	799.92	833.18	J3-297	20.08	799.91	799.91
J3-299	2,005.07	J3-297	-215.79	134.98	801.76	910.64	J3-297	9.84	801.75	801.75
J3-296	2,005.07	J3-297	-211.63	144.59	808.42	1,008.85	J3-297	-3.25	808.42	808.42
J3-927	2,005.07	J3-927	-57.48	532.33	812.18	845.25	J3-927	20.08	812.19	812.18
J3-280	2,005.07	J3-280	-339.11	-225.62	813.58	835.47	J3-280	20.08	813.56	813.56
J3-279	2,005.07	J3-279	-355.93	-286.43	833.13	853.62	J3-297	19.68	816.26	816.26
J3-288	2,005.07	J3-280	-249.99	-19.95	914.66	965.21	J3-297	4.54	816.26	816.26
J3-294	2,005.07	J3-280	-265.03	-54.66	894.63	976.05	J3-297	2.99	816.26	816.26
J3-290	2,005.07	J3-297	-206.49	156.45	816.26	1,030.59	J3-297	-5.01	816.26	816.26
J3-558	2,005.07	J3-289	-236.49	29.21	899.93	994.4	J3-297	0.34	816.26	816.26
J-5076	2,005.07	J-5076	-102.64	218.12	816.61	813.9	J-5076	20.08	816.62	816.61
J3-291	2,005.07	J3-297	-203.89	162.46	820.21	1,012.09	J3-297	-1.52	820.21	820.21
J3-402	2,005.07	J3-402	-93.95	342.18	822.47	820.74	J3-402	20.08	822.47	822.47
J3-979	2,005.07	J3-297	-202.11	166.55	822.98	1,010.56	J3-297	-0.79	822.97	822.97
J3-978	2,005.07	J3-978	-242.91	-45.6	1,006.10	1,030.28	J3-297	-3.68	822.97	822.97
J3-976	2,005.07	J3-297	-202.11	166.55	822.98	1,049.46	J3-297	-6.53	822.97	822.97
J3-977	2,005.07	J3-977	-204.85	75.24	1,007.90	1,035.95	J3-297	-4.52	822.97	822.97
J3-975	2,005.07	J3-297	-202.11	166.55	822.98	1,042.07	J3-297	-5.42	822.97	822.97
J3-974	2,005.07	J3-297	-202.11	166.55	822.98	1,053.57	J3-297	-7.15	822.97	822.97
J-5075	2,005.07	J-5076	-100.73	222.53	828.97	1,186.04	J-5076	7.69	828.97	828.97
J3-932	2,005.07	J3-927	-48.7	552.61	835.53	917.87	J3-927	16.59	835.54	835.53
J3-928	2,005.07	J3-927	-48.7	552.61	835.53	870.05	J3-927	20.09	835.54	835.53
J3-933	2,005.07	J3-933	-57.98	521.18	856.62	888.17	J3-927	18.77	835.54	835.54
J-5077	2,005.07	J-5082	-99.2	226.07	839.46	836.59	J-5082	20.08	839.46	839.46
J3-598	2,005.07	J3-598	-46.34	553.05	851.22	885.11	J3-598	20.09	851.22	851.22
J3-929	2,005.07	J3-927	-37.15	579.26	870.38	938.53	J3-927	17.92	870.39	870.38
J-5078	2,005.07	J-5082	-94.96	235.84	870.53	1,260.43	J-5082	7.13	870.53	870.53
J3-913	2,005.07	J3-916	-21.94	569.38	873.8	870.49	J3-916	20.09	873.77	873.77
J3-300	2,005.07	J3-297	-175.04	229.03	876.48	957.96	J3-297	14.62	876.48	876.48
J3-930	2,005.07	J3-927	-29.94	595.9	894.72	965.63	J3-927	17.92	894.73	894.72
J3-931	2,005.07	J3-927	-19.5	620	934.27	1,087.90	J3-927	15.77	934.27	934.27
J3-914	2,005.07	J3-914	-27.27	547.07	945.71	942.84	J3-914	20.09	945.71	945.71
J3-599	2,005.07	J3-927	-7.62	647.41	1,025.55	1,306.94	J3-927	15.35	1,025.48	1,025.48
J3-601	2,005.07	J3-598	-10.54	635.66	1,054.41	1,523.74	J3-598	11.92	1,054.35	1,054.35
J3-596	2,005.07	J3-596	-24.48	590.5	1,070.41	1,096.34	J3-596	20.11	1,070.41	1,070.41
J-513	2,005.07	J-513	-91.89	390.93	1,108.64	1,107.25	J-513	20.11	1,108.64	1,108.64
J3-600	2,005.07	J3-600	-13.16	624.63	1,116.33	1,151.33	J3-600	20.11	1,116.32	1,116.32
J3-376	2,005.07	J3-377	3.19	747.36	1,122.70	1,343.26	J3-377	18.4	1,122.65	1,122.65
J3-593	2,005.07	J3-598	-9.67	637.69	1,142.19	1,529.73	J3-598	13.68	1,142.18	1,142.18
J3-594	2,005.07	J3-598	-9.67	637.69	1,142.19	1,808.19	J3-598	4.18	1,142.18	1,142.18
J3-592	2,005.07	J3-592	-11.43	531.61	1,686.06	1,708.77	J3-598	10.27	1,142.18	1,142.18
J3-597	2,005.07	J3-597	-13.95	618.81	1,171.33	1,204.65	J3-597	20.12	1,171.33	1,171.33
J3-909	2,005.07	J3-909	-50.6	403.23	1,233.00	1,231.41	J3-909	20.12	1,232.91	1,232.91
J3-781	2,005.07	J3-916	8.77	640.24	1,282.25	2,743.71	J3-916	-5.73	1,282.25	1,282.25
J3-776	2,005.07	J3-776	8.58	629.8	1,311.48	1,305.76	J3-776	20.13	1,311.56	1,311.48
J3-401	2,005.07	J3-402	-30.8	487.93	1,311.57	1,715.63	J3-402	6.3	1,311.65	1,311.57
J3-956	2,005.07	J3-956	-53.5	486.54	1,327.66	1,378.64	J3-956	20.14	1,327.64	1,327.64
J3-392	2,005.07	J3-392	-23.35	615.11	1,345.82	1,427.06	J3-392	20.14	1,345.81	1,345.81
J-5081	2,005.07	J-5082	-61.05	314.1	1,353.30	1,709.37	J-5082	-3.67	1,353.30	1,353.30
J3-743	2,005.07	J3-743	-63.18	431.18	1,353.41	1,397.12	J3-743	20.14	1,353.40	1,353.40
J3-595	2,005.07	J3-597	-9.56	628.93	1,364.74	1,875.27	J3-597	0.12	1,364.74	1,364.74
J3-994	2,005.07	J3-994	-8.39	363.65	1,430.73	1,427.38	J3-994	20.14	1,430.73	1,430.73

J3-315	2,005.07	J3-315	-7.02	663.79	1,448.53	1,550.82	J3-315	20.15	1,448.52	1,448.52
J3-744	2,005.07	J3-744	-46.72	454.18	1,454.44	1,499.64	J3-744	20.15	1,454.43	1,454.43
J3-960	2,005.07	J3-960	-21.95	564.33	1,497.92	1,560.89	J3-960	20.16	1,497.89	1,497.89
J3-995	2,005.07	J3-994	-0.55	381.72	1,540.60	1,536.71	J3-994	20.15	1,540.60	1,540.60
J3-879	2,005.07	J3-879	-19.07	428	1,569.33	1,567.35	J3-879	20.16	1,569.30	1,569.30
J-5080	2,005.07	J-5080	-42.71	384.43	1,579.28	1,577.53	J-5080	20.16	1,579.20	1,579.20
J3-724	2,005.07	J3-744	-20.61	514.42	1,597.71	1,718.42	J3-743	12.08	1,582.97	1,582.97
J3-745	2,005.07	J3-745	-20.69	465.24	1,656.93	1,701.43	J3-743	13.83	1,582.97	1,582.97
J3-723	2,005.07	J3-743	-19.44	532.14	1,582.98	1,773.81	J3-743	6.31	1,582.97	1,582.97
J3-725	2,005.07	J3-744	-20.61	514.42	1,597.71	1,838.85	J3-744	-0.71	1,597.70	1,597.70
J-5079	2,005.07	J-5080	-36.53	398.69	1,609.50	1,635.45	J-5080	18.86	1,609.50	1,609.50
J3-309	2,005.07	J3-309	-9.79	580.41	1,613.32	1,680.43	J3-309	20.17	1,613.32	1,613.32
J3-716	2,005.07	J3-716	-4.5	614.62	1,617.24	1,692.83	J3-716	20.17	1,617.21	1,617.21
J3-717	2,005.07	J3-716	-2.76	618.63	1,633.62	1,812.28	J3-716	12.59	1,633.58	1,633.58
J3-955	2,005.07	J3-956	-5.66	596.93	1,633.77	1,809.25	J3-956	11.51	1,633.75	1,633.75
J3-718	2,005.07	J3-718	-16.52	516.87	1,635.25	1,687.12	J3-718	20.17	1,635.24	1,635.24
J3-957	2,005.07	J3-956	-2.92	603.26	1,658.11	1,813.35	J3-716	12.78	1,636.81	1,636.81
J3-958	2,005.07	J3-716	-2.27	619.77	1,638.45	1,798.86	J3-716	14.01	1,638.41	1,638.41
J3-959	2,005.07	J3-960	-2.92	608.25	1,650.08	1,723.06	J3-716	19.72	1,639.61	1,639.61
J3-325	2,005.07	J3-325	11.16	720.75	1,641.91	1,786.86	J3-325	20.18	1,641.87	1,641.87
J3-715	2,005.07	J3-716	-1.67	621.14	1,644.20	1,767.34	J3-716	16.84	1,644.17	1,644.17
J3-875	2,005.07	J3-875	-10.6	445.53	1,644.57	1,642.43	J3-875	20.16	1,644.54	1,644.54
J3-783	2,005.07	J3-916	17.35	660.04	1,653.79	3,189.08	J3-916	3.07	1,653.80	1,653.79
J3-782	2,005.07	J3-916	17.35	660.04	1,653.79	3,281.53	J3-916	1.59	1,653.80	1,653.79
J3-911	2,005.07	J3-916	17.35	660.04	1,653.80	2,699.85	J3-916	10.09	1,653.80	1,653.80
J3-780	2,005.07	J3-916	17.35	660.04	1,653.80	4,141.40	J3-916	-14.26	1,653.80	1,653.80
J3-719	2,005.07	J3-956	-3.09	602.86	1,656.51	2,015.09	J3-956	-3.99	1,656.49	1,656.49
J3-722	2,005.07	J3-956	-3.09	602.86	1,656.51	2,058.52	J3-956	-7.91	1,656.49	1,656.49
J3-714	2,005.07	J3-714	0.53	629.23	1,661.31	1,741.51	J3-714	20.17	1,661.27	1,661.27
J3-713	2,005.07	J3-713	3.58	647.26	1,674.65	1,762.15	J3-713	20.18	1,674.60	1,674.60
J3-405	2,005.07	J3-405	-13.55	467.72	1,710.42	1,755.31	J3-405	20.18	1,710.42	1,710.42
J-5084	2,005.07	J-5084	-14.7	451.08	1,718.90	1,761.48	J-5084	20.18	1,718.90	1,718.90
J3-397	2,005.07	J3-397	10.7	686.7	1,728.03	1,839.12	J3-397	20.18	1,728.01	1,728.01
J-5083	2,005.07	J-5083	-12.02	462.26	1,730.22	1,773.98	J-5083	20.18	1,730.22	1,730.22
J3-588	2,005.07	J3-588	4.29	482.9	1,802.11	1,803.77	J3-588	20.18	1,802.11	1,802.11
J3-389	2,005.07	J3-389	17.56	717.53	1,803.59	1,944.92	J3-389	20.19	1,803.54	1,803.54
J3-394	2,005.07	J3-389	17.56	717.53	1,803.59	2,048.95	J3-389	15.6	1,803.54	1,803.54
J3-395	2,005.07	J3-389	17.56	717.53	1,803.59	2,174.17	J3-389	9.82	1,803.54	1,803.54
J3-396	2,005.07	J3-389	17.56	717.53	1,803.59	2,075.55	J3-389	14.4	1,803.54	1,803.54
J3-393	2,005.07	J3-389	17.56	717.53	1,803.59	2,028.16	J3-389	16.53	1,803.54	1,803.54
J-5089	2,005.07	J-5089	17.72	620.9	1,900.27	1,974.87	J-5089	20.2	1,900.23	1,900.23
J-5087	2,005.07	J-5087	18.65	607.03	1,917.28	1,987.31	J-5087	20.2	1,917.24	1,917.24
J3-327	2,005.07	J3-327	23.27	734.7	1,926.31	2,085.39	J3-327	20.21	1,926.31	1,926.31
J3-590	2,005.07	J3-916	19.92	665.98	1,964.04	4,277.21	J3-916	-7.88	1,964.03	1,964.03
J-5086	2,005.07	J-5087	22.97	617.01	1,965.04	2,048.01	J-5087	19.34	1,965.04	1,965.04
J3-305	2,005.07	J3-305	24.63	656.84	1,977.58	2,068.89	J3-305	20.21	1,977.58	1,977.58
J3-591	2,005.07	J3-916	20.05	666.28	1,982.90	2,556.02	J3-916	15.57	1,982.79	1,982.79
J3-587	2,005.07	J3-916	20.11	666.41	1,990.77	2,311.79	J3-916	17.82	1,990.76	1,990.76
J-5088	2,005.07	J-5089	25.41	638.63	1,992.66	2,139.05	J-5089	15.01	1,992.66	1,992.66
J-5035	2,005.07	J-5035	22.3	535.48	2,008.17	2,022.74	J-5035	20.2	2,008.18	2,008.17
J3-586	2,005.07	J3-916	20.28	666.81	2,016.89	2,574.57	J3-916	15.78	2,016.89	2,016.89
J3-589	2,005.07	J3-916	20.37	667.01	2,030.71	3,372.34	J3-916	7.64	2,030.71	2,030.71
J3-582	2,005.07	J3-916	20.42	667.13	2,037.09	2,543.23	J3-916	16.25	2,037.09	2,037.09
J3-584	2,005.07	J3-916	20.43	667.14	2,038.11	2,474.80	J3-916	16.89	2,038.11	2,038.11
J3-585	2,005.07	J3-916	20.43	667.15	2,039.08	2,461.99	J3-916	17	2,038.89	2,038.89
J3-583	2,005.07	J3-916	20.44	667.16	2,039.53	2,350.54	J3-916	17.94	2,039.53	2,039.53
J3-581	2,005.07	J3-916	20.47	667.23	2,044.48	2,646.51	J3-916	15.41	2,044.48	2,044.48
J3-576	2,005.07	J3-576	24.33	513.15	2,071.61	2,068.48	J3-576	20.21	2,071.61	2,071.61
J3-892	2,005.07	J3-994	22.5	434.92	2,092.84	3,096.65	J3-994	-14.79	2,092.84	2,092.84
J3-893	2,005.07	J3-994	22.5	434.92	2,092.84	2,399.51	J3-994	10.58	2,092.84	2,092.84
J3-894	2,005.07	J3-994	22.5	434.92	2,092.84	2,127.46	J3-994	18.99	2,092.84	2,092.84
J3-578	2,005.07	J3-578	25.06	541.84	2,098.86	2,095.06	J3-578	20.21	2,098.86	2,098.86
J3-346	2,005.07	J3-346	28.03	771.69	2,120.01	2,316.20	J3-346	20.23	2,120.02	2,120.01
J-5124	2,005.07	J3-372	31.2	822.01	3,287.89	2,183.77	J-5124	20.22	2,125.34	2,125.34
J3-786	2,005.07	J3-786	25.05	589.81	2,151.18	2,145.16	J3-786	20.21	2,151.19	2,151.18
J3-404	2,005.07	J3-372	31.2	822.01	3,287.15	2,347.08	J3-405	7.67	2,159.22	2,159.22
J-5125	2,005.07	J-5125	26.25	610.58	2,197.53	2,214.11	J-5125	20.22	2,197.53	2,197.53
J3-577	2,005.07	J3-916	27.09	682.53	6,213.23	2,254.70	J3-577	20.22	2,258.31	2,258.31
J3-775	2,005.07	J3-776	22.3	661.46	2,299.35	2,286.20	J3-776	20.23	2,299.28	2,299.28
J3-903	2,005.07	J3-916	27.09	682.53	6,194.47	2,294.70	J3-903	20.23	2,299.96	2,299.96
J-5128	2,005.07	J3-372	31.21	822.02	3,288.71	2,379.03	J-5128	20.24	2,305.11	2,305.11
J3-779	2,005.07	J3-916	22.15	671.13	2,310.85	4,448.65	J3-916	0.19	2,310.75	2,310.75
J-5127	2,005.07	J3-372	31.21	822.02	3,288.71	2,403.14	J-5127	20.24	2,331.64	2,331.64

J3-989	2,005.07	J3-372	31.2	822.01	3,287.15	2,483.50	J3-989	20.25	2,356.04	2,356.04
J3-886	2,005.07	J3-916	27.09	682.53	6,197.70	2,361.16	J3-886	20.24	2,365.82	2,365.82
J-5126	2,005.07	J3-372	31.21	822.02	3,288.71	2,477.72	J-5126	20.25	2,378.95	2,378.95
J3-987	2,005.07	J3-372	31.2	822.01	3,287.15	2,508.96	J3-987	20.25	2,381.04	2,381.04
J3-884	2,005.07	J3-916	23.14	673.41	2,712.81	2,385.18	J3-884	20.24	2,386.49	2,386.49
J3-936	2,005.07	J3-936	30.04	800.33	2,405.59	2,689.55	J3-936	20.27	2,405.69	2,405.59
J3-860	2,005.07	J3-916	27.17	682.71	0.00	2,404.88	J3-860	20.24	2,408.36	2,408.36
J3-378	2,005.07	J3-377	27.36	803.14	2,424.84	3,884.12	J3-377	8.54	2,424.84	2,424.84
J3-373	2,005.07	J3-373	27.56	813.61	2,447.66	2,822.83	J3-373	20.28	2,447.66	2,447.66
J3-941	2,005.07	J3-377	28.46	805.68	2,605.10	2,652.65	J3-941	20.26	2,474.20	2,474.20
J3-390	2,005.07	J3-372	31.2	822.01	3,287.98	2,673.28	J3-390	20.27	2,475.09	2,475.09
J3-887	2,005.07	J3-916	27.09	682.53	6,197.70	2,473.46	J3-887	20.25	2,478.70	2,478.70
J3-988	2,005.07	J3-372	31.2	822.01	3,287.15	2,622.01	J3-988	20.26	2,482.90	2,482.90
J3-985	2,005.07	J3-372	31.2	822.01	3,287.15	2,628.22	J3-985	20.26	2,485.08	2,485.08
J-5117	2,005.07	J3-916	23.02	673.12	2,498.76	3,381.61	J3-916	13.85	2,498.76	2,498.76
J3-898	2,005.07	J3-916	27.09	682.53	6,183.10	2,495.16	J3-898	20.25	2,499.44	2,499.44
J3-372	2,005.07	J3-372	27.91	814.4	2,500.28	2,894.51	J3-372	20.29	2,500.29	2,500.28
J-5118	2,005.07	J3-916	23.06	673.23	2,511.10	3,367.74	J3-916	14.1	2,511.11	2,511.10
J3-388	2,005.07	J3-372	31.2	822.01	3,287.99	2,782.44	J3-388	20.28	2,515.00	2,515.00
J3-328	2,005.07	J3-372	31.2	822.01	3,287.16	3,081.91	J3-325	14.24	2,532.51	2,532.51
J3-308	2,005.07	J3-372	31.2	822.01	3,287.85	3,089.22	J3-309	-2.66	2,537.84	2,537.84
J3-331	2,005.07	J3-372	31.2	822	3,286.55	2,833.08	J3-331	20.28	2,542.96	2,542.96
J3-314	2,005.07	J3-372	31.2	822.01	3,287.82	3,057.51	J3-315	14.67	2,590.47	2,590.47
J3-815	2,005.07	J3-916	22.7	672.39	2,590.47	3,392.46	J3-916	14.92	2,590.48	2,590.47
J3-882	2,005.07	J3-916	22.7	672.39	2,590.47	3,857.46	J3-916	10.87	2,590.48	2,590.47
J-5129	2,005.07	J3-372	31.21	822.02	3,288.71	2,711.37	J-5129	20.27	2,595.54	2,595.54
J3-345	2,005.07	J3-372	31.17	821.93	3,275.65	2,947.64	J3-345	20.29	2,597.37	2,597.37
J3-352	2,005.07	J3-373	31.08	821.74	3,243.58	2,945.77	J3-352	20.29	2,599.86	2,599.86
J3-383	2,005.07	J3-377	30.8	811.08	3,116.96	2,854.34	J3-383	20.28	2,601.46	2,601.46
J3-940	2,005.07	J3-377	28.46	805.68	2,605.10	3,669.05	J3-377	14.08	2,605.11	2,605.10
J3-917	2,005.07	J3-916	23.42	674.05	2,610.44	4,065.30	J3-916	8.98	2,610.44	2,610.44
J3-777	2,005.07	J3-916	23.83	675	2,708.58	3,031.25	J3-776	17.03	2,626.48	2,626.48
J3-986	2,005.07	J3-372	31.2	822.01	3,287.15	2,955.87	J3-987	11.63	2,629.16	2,629.16
J3-983	2,005.07	J3-372	31.2	822.01	3,287.15	2,884.03	J3-985	15.97	2,633.69	2,633.69
J3-391	2,005.07	J3-372	31.2	822.01	3,287.98	2,926.59	J3-391	20.29	2,644.07	2,644.07
J3-937	2,005.07	J3-377	31.01	811.58	3,191.50	2,907.03	J3-937	20.29	2,678.39	2,678.39
J3-380	2,005.07	J3-377	30.09	809.45	2,965.03	2,895.03	J3-380	20.29	2,691.49	2,691.49
J3-304	2,005.07	J3-372	31.2	822.01	3,287.94	2,936.51	J3-305	16.39	2,705.95	2,705.95
J3-568	2,005.07	J3-916	27.09	682.53	6,202.08	2,699.78	J3-568	20.27	2,708.68	2,708.68
J3-883	2,005.07	J3-916	23.14	673.41	2,712.81	3,814.67	J3-916	12.93	2,712.82	2,712.81
J3-778	2,005.07	J3-916	23.91	675.18	2,716.05	3,482.93	J3-776	14.99	2,804.62	2,716.05
J3-351	2,005.07	J3-373	31.12	821.83	3,258.70	3,024.44	J3-351	20.3	2,729.51	2,729.51
J3-785	2,005.07	J3-916	27.09	682.53	6,207.70	2,727.25	J3-785	20.27	2,736.97	2,736.97
J3-784	2,005.07	J3-916	27.09	682.53	6,213.32	2,774.94	J3-784	20.28	2,785.87	2,785.87
J3-984	2,005.07	J3-372	31.2	822.01	3,287.15	3,104.31	J3-985	14.24	2,792.38	2,792.38
J3-332	2,005.07	J3-372	31.2	822	3,286.35	3,186.10	J3-332	20.32	2,797.26	2,797.26
J3-774	2,005.07	J3-916	24.7	677.01	2,974.78	3,252.95	J3-776	16.87	2,804.98	2,804.98
J3-918	2,005.07	J3-916	24.17	675.78	2,805.77	4,006.58	J3-916	11.4	2,805.77	2,805.77
J3-890	2,005.07	J3-916	27.09	682.53	6,197.70	3,118.84	J3-568	11.89	2,833.91	2,833.91
J3-888	2,005.07	J3-916	27.09	682.53	6,197.70	3,066.82	J3-568	13.43	2,833.91	2,833.91
J3-889	2,005.07	J3-916	27.09	682.53	6,197.70	2,967.71	J3-568	16.29	2,833.91	2,833.91
J3-326	2,005.07	J3-372	31.2	822	3,286.93	3,175.05	J3-326	20.32	2,836.49	2,836.49
J3-952	2,005.07	J3-377	30.39	810.14	3,036.87	2,957.84	J3-952	20.3	2,837.38	2,837.38
J3-575	2,005.07	J3-916	27.09	682.53	6,219.60	2,841.61	J3-575	20.28	2,850.36	2,850.36
J3-991	2,005.07	J3-372	31.2	822.01	3,287.15	3,007.46	J3-991	20.3	2,855.21	2,855.21
J3-902	2,005.07	J3-916	27.09	682.53	6,194.47	2,855.30	J3-902	20.29	2,863.53	2,863.53
J3-942	2,005.07	J3-377	29.71	808.58	2,873.01	4,446.50	J3-377	10.94	2,873.03	2,873.01
J3-338	2,005.07	J3-372	31.2	822	3,286.89	3,172.11	J3-338	20.32	2,873.26	2,873.26
J3-920	2,005.07	J3-916	24.37	676.25	2,873.73	3,186.11	J3-916	18.4	2,873.73	2,873.73
J3-919	2,005.07	J3-916	24.37	676.25	2,873.73	4,141.19	J3-916	10.95	2,873.73	2,873.73
J3-354	2,005.07	J3-373	29.82	818.82	2,877.51	3,636.05	J3-373	18.11	2,877.52	2,877.51
J3-891	2,005.07	J3-916	27.09	682.53	6,196.13	3,023.56	J3-568	16.25	2,886.00	2,886.00
J3-878	2,005.07	J3-916	27.14	682.64	0.00	2,906.97	J3-878	20.29	2,914.02	2,914.02
J3-333	2,005.07	J3-372	31.2	822	3,286.39	3,387.74	J3-333	20.34	2,950.87	2,950.87
J-5042	2,005.07	J-5082	33.44	532.19	0.00	2,985.33	J-5042	20.3	2,958.20	2,958.20
J3-379	2,005.07	J3-377	30.09	809.45	2,965.03	4,341.37	J3-380	11.77	3,534.64	2,965.03
J3-562	2,005.07	J3-373	31.08	821.74	3,243.58	3,419.99	J3-562	20.34	2,971.49	2,971.49
J3-347	2,005.07	J3-372	31.16	821.92	3,274.42	3,426.09	J3-347	20.34	2,983.63	2,983.63
J3-922	2,005.07	J3-916	24.65	676.89	2,984.73	4,457.01	J3-916	9.45	2,984.73	2,984.73
J3-324	2,005.07	J3-372	31.2	822.01	3,287.16	3,436.11	J3-324	20.34	2,986.58	2,986.58
J3-375	2,005.07	J3-373	31.12	821.83	3,258.70	3,432.03	J3-375	20.34	3,003.64	3,003.64
J3-951	2,005.07	J3-377	30.39	810.14	3,036.87	4,217.92	J3-377	15.36	3,036.91	3,036.87
J3-348	2,005.07	J3-373	31.15	821.88	3,267.72	3,508.82	J3-348	20.35	3,066.35	3,066.35

J-5090	2,005.07	J3-372	31.2	822.01	3,288.35	3,332.86	J-5090	20.33	3,070.20	3,070.20
J3-334	2,005.07	J3-372	31.2	822	3,286.15	3,563.79	J3-334	20.36	3,074.94	3,074.94
J3-901	2,005.07	J3-916	27.09	682.53	6,186.68	3,291.99	J3-902	13.77	3,086.93	3,086.93
J3-330	2,005.07	J3-372	31.2	822	3,286.61	3,578.62	J3-333	20.15	3,089.61	3,089.61
J3-343	2,005.07	J3-372	31.19	821.99	3,285.05	3,579.95	J3-343	20.36	3,093.96	3,093.96
J3-921	2,005.07	J3-916	24.87	677.39	3,096.55	4,650.77	J3-916	9.17	3,096.55	3,096.55
J3-900	2,005.07	J3-916	27.09	682.53	6,185.20	3,109.45	J3-902	20.04	3,109.84	3,109.84
J3-353	2,005.07	J3-373	30.68	820.8	3,111.21	3,752.58	J3-373	19.7	3,111.24	3,111.21
J3-899	2,005.07	J3-916	27.09	682.53	6,183.98	3,267.69	J3-902	15.45	3,115.07	3,115.07
J3-897	2,005.07	J3-916	27.09	682.53	6,183.10	3,146.77	J3-902	19.11	3,115.77	3,115.77
J3-381	2,005.07	J3-377	30.8	811.08	3,116.96	4,337.23	J3-377	15.54	3,117.01	3,116.96
J-5028	2,005.07	J-5082	33.44	532.19	0.00	3,153.04	J-5028	20.31	3,119.05	3,119.05
J3-895	2,005.07	J3-916	27.09	682.53	6,180.73	3,411.45	J3-902	11.18	3,121.19	3,121.19
J3-938	2,005.07	J3-372	31.16	821.9	3,272.81	3,608.18	J3-936	19.93	3,121.89	3,121.89
J3-896	2,005.07	J3-916	27.09	682.53	6,185.80	3,430.19	J3-902	11.01	3,133.36	3,133.36
J3-934	2,005.07	J3-377	30.81	811.11	3,134.22	4,730.54	J3-377	12.62	3,134.28	3,134.22
J-5033	2,005.07	J-5082	33.44	532.19	0.00	3,200.22	J-5041	18.34	3,136.92	3,136.92
J-5041	2,005.07	J-5082	33.44	532.19	0.00	3,150.35	J-5041	20.31	3,136.92	3,136.92
J3-386	2,005.07	J3-372	31.2	822.01	3,287.98	3,584.70	J3-386	20.36	3,154.17	3,154.17
J3-374	2,005.07	J3-373	31.02	821.6	3,222.29	3,662.51	J3-374	20.37	3,157.89	3,157.89
J3-990	2,005.07	J3-372	31.2	822.01	3,287.15	3,585.58	J3-985	12.1	3,157.91	3,157.91
J3-323	2,005.07	J3-372	31.2	822	3,286.93	3,707.71	J3-324	19.56	3,158.45	3,158.45
J3-926	2,005.07	J3-916	24.97	677.62	3,162.59	4,319.99	J3-916	12.73	3,162.30	3,162.30
J-5031	2,005.07	J-5082	33.44	532.19	0.00	3,178.07	J-5031	20.32	3,162.74	3,162.74
J3-925	2,005.07	J3-916	24.97	677.64	3,169.02	4,385.81	J3-916	12.29	3,168.75	3,168.75
J3-382	2,005.07	J3-377	31.03	811.6	3,178.40	4,183.74	J3-377	17.46	3,178.47	3,178.40
J3-344	2,005.07	J3-372	31.18	821.96	3,280.13	3,614.64	J3-344	20.36	3,180.35	3,180.35
J3-924	2,005.07	J3-916	24.99	677.68	3,182.40	4,612.91	J3-916	10.6	3,182.25	3,182.25
J3-726	2,005.07	J3-372	31.2	822	3,286.63	4,178.59	J3-333	12.34	3,190.49	3,190.49
J3-866	2,005.07	J3-916	27.24	682.86	6,759.49	3,185.39	J3-866	20.32	3,190.75	3,190.75
J3-939	2,005.07	J3-377	31.01	811.58	3,191.50	4,132.49	J3-377	17.95	3,191.57	3,191.50
J3-337	2,005.07	J3-372	31.2	822	3,286.73	4,215.69	J3-333	11.84	3,196.92	3,196.92
J3-355	2,005.07	J3-372	31.13	821.84	3,259.89	3,825.84	J3-355	20.38	3,206.60	3,206.60
J3-371	2,005.07	J3-372	30.92	821.37	3,207.24	4,389.17	J3-372	16.4	3,207.29	3,207.24
J3-341	2,005.07	J3-372	31.2	822	3,286.85	4,337.40	J3-333	10.02	3,210.04	3,210.04
J3-953	2,005.07	J3-377	31.16	811.9	3,210.52	4,124.81	J3-377	18.3	3,210.59	3,210.52
J3-342	2,005.07	J3-372	31.2	822	3,286.87	4,064.24	J3-333	14.84	3,213.32	3,213.32
J3-560	2,005.07	J3-372	31.2	822	3,286.89	3,914.51	J3-333	17.42	3,216.58	3,216.58
J3-313	2,005.07	J3-372	31.2	822.01	3,287.58	3,750.86	J3-315	17.5	3,218.99	3,218.99
J3-322	2,005.07	J3-372	31.2	822	3,286.93	3,828.99	J3-333	18.94	3,221.91	3,221.91
J3-561	2,005.07	J3-372	31.2	822	3,286.94	3,958.31	J3-333	16.91	3,225.58	3,225.58
J3-923	2,005.07	J3-916	25.05	677.82	3,231.31	5,231.02	J3-916	5.91	3,231.54	3,231.31
J3-321	2,005.07	J3-372	31.2	822.01	3,286.99	4,135.96	J3-333	14.15	3,234.42	3,234.42
J3-318	2,005.07	J3-372	31.2	822.01	3,287.00	3,879.52	J3-333	18.45	3,236.62	3,236.62
J3-329	2,005.07	J3-372	31.2	822.01	3,287.77	3,803.47	J3-329	20.38	3,241.59	3,241.59
J3-336	2,005.07	J3-372	31.2	822	3,286.44	3,876.64	J3-331	17.11	3,244.99	3,244.99
J3-387	2,005.07	J3-372	31.2	822.01	3,287.91	3,792.04	J3-387	20.38	3,253.37	3,253.37
J3-935	2,005.07	J3-372	31.1	821.77	3,253.79	4,121.61	J3-372	18.69	3,253.83	3,253.79
J3-320	2,005.07	J3-372	31.2	822.01	3,287.12	4,122.09	J3-333	15.03	3,260.19	3,260.19
J3-335	2,005.07	J3-372	31.2	822	3,286.13	3,703.20	J3-335	20.37	3,264.11	3,264.11
J3-398	2,005.07	J3-372	31.2	822.01	3,287.15	3,849.01	J3-333	19.57	3,265.36	3,265.36
J3-992	2,005.07	J3-372	31.2	822.01	3,287.18	4,499.67	J3-333	8.91	3,271.93	3,271.93
J3-349	2,005.07	J3-372	31.16	821.92	3,274.45	3,779.40	J3-348	20.12	3,272.48	3,272.48
J3-350	2,005.07	J3-372	31.16	821.92	3,274.45	3,574.67	J3-350	20.36	3,424.27	3,274.45
J3-885	2,005.07	J3-916	24.86	677.38	3,275.41	5,193.31	J3-916	7.62	3,275.41	3,275.41
J3-319	2,005.07	J3-372	31.2	822.01	3,287.21	4,234.12	J3-333	13.64	3,278.94	3,278.94
J3-356	2,005.07	J3-372	31.19	821.98	3,281.40	3,934.03	J3-372	20.19	3,281.45	3,281.40
J3-385	2,005.07	J3-372	31.2	822.01	3,288.13	3,913.45	J3-329	19.56	3,282.44	3,282.44
J3-339	2,005.07	J3-372	31.2	822	3,286.91	3,625.98	J3-339	20.36	3,294.70	3,286.91
J3-317	2,005.07	J3-372	31.2	822.01	3,287.33	3,867.48	J3-333	20.18	3,305.99	3,287.33
J3-310	2,005.07	J3-372	31.2	822.01	3,287.74	3,842.06	J3-309	19.39	3,564.04	3,287.74
J3-312	2,005.07	J3-372	31.2	822.01	3,287.88	3,878.19	J3-312	20.39	3,575.41	3,287.88
J3-307	2,005.07	J3-372	31.2	822.01	3,287.91	3,889.06	J3-307	20.39	3,606.55	3,287.91
J3-295	2,003.94	J3-372	31.21	822.02	3,288.02	6,760.10	J3-387	-17.18	3,469.86	3,288.02
J3-303	2,005.07	J3-372	31.2	822.01	3,288.06	3,764.73	J3-303	20.38	3,465.79	3,288.06
J3-316	2,005.07	J3-372	31.2	822.01	3,288.06	4,110.98	J3-387	16.34	3,304.96	3,288.06
J3-877	2,005.07	J3-916	27.14	682.64	0.00	3,514.38	J3-878	12.12	3,288.30	3,288.30
J3-302	2,005.07	J3-372	31.2	822.01	3,288.35	4,964.62	J3-387	3.13	3,360.95	3,288.35
J3-292	2,005.07	J3-372	31.21	822.02	3,288.97	6,380.41	J3-387	-12.71	3,446.34	3,288.97
J3-293	2,005.07	J3-372	31.21	822.02	3,289.13	6,753.40	J3-387	-17.29	3,467.31	3,289.13
J4-2022	2,005.07	J3-372	31.21	822.03	3,289.99	7,586.23	J3-329	-24.63	3,500.22	3,289.99
J3-857	2,005.07	J3-372	31.21	822.03	3,290.14	6,579.97	J3-329	-10.5	3,513.45	3,290.14
J3-856	2,005.07	J3-372	31.21	822.03	3,290.14	6,592.12	J3-329	-10.72	3,513.90	3,290.14

J3-384	2,005.07	J3-372	31.21	822.03	3,290.32	4,746.23	J3-329	12.28	3,526.57	3,290.32
J3-954	2,005.07	J3-372	31.21	822.04	3,291.24	4,835.46	J3-356	12	3,384.32	3,291.24
J3-948	2,005.07	J3-916	25.16	678.06	3,345.80	5,763.07	J3-916	2.95	3,345.80	3,345.80
J3-602	2,005.07	J3-916	27.09	682.53	6,197.61	3,350.61	J3-602	20.33	3,360.41	3,360.41
J3-944	2,005.07	J3-916	25.06	677.83	3,364.38	5,540.73	J3-916	5.64	3,364.39	3,364.38
J-5030	2,005.07	J-5082	33.44	532.19	0.00	3,411.11	J-5031	20.34	3,369.21	3,369.21
J3-947	2,005.07	J3-916	25.12	677.98	3,385.81	4,574.44	J3-916	13.29	3,385.81	3,385.81
J3-946	2,005.07	J3-916	25.12	677.98	3,385.81	5,130.89	J3-916	9.16	3,385.81	3,385.81
J3-357	2,005.07	J3-373	31.49	822.69	3,414.54	3,984.34	J3-357	20.4	3,705.87	3,414.54
J3-604	2,005.07	J3-916	27.09	682.53	6,219.60	3,402.44	J3-604	20.34	3,415.18	3,415.18
J3-950	2,005.07	J3-916	25.22	678.22	3,439.80	5,316.49	J3-916	8.24	3,439.81	3,439.80
J3-360	2,005.07	J3-373	32.39	824.75	3,832.77	3,723.78	J3-360	20.37	3,453.22	3,453.22
J3-358	2,005.07	J3-373	32.07	824.01	3,670.85	3,728.65	J3-358	20.37	3,467.98	3,467.98
J3-943	2,005.07	J3-916	25.31	678.42	3,531.95	6,116.86	J3-916	2.83	3,531.96	3,531.95
J-5026	2,005.07	J-5082	33.44	532.19	0.00	3,604.74	J-5026	20.36	3,559.23	3,559.23
J3-359	2,005.07	J3-373	31.83	823.47	3,560.80	4,841.43	J3-358	11.75	3,771.59	3,560.80
J3-370	2,005.07	J3-370	31.64	824.02	3,621.70	4,225.28	J3-370	20.42	3,621.78	3,621.70
J3-573	2,005.07	J3-916	27.09	682.53	6,213.23	3,998.62	J3-784	14	3,674.71	3,674.71
J3-572	2,005.07	J3-916	25.81	679.56	4,261.43	4,714.21	J3-994	-28.5	3,682.73	3,682.73
J3-363	2,005.07	J3-373	32.11	824.1	3,687.91	5,219.71	J3-360	9.07	3,802.25	3,687.91
J3-790	2,005.07	J3-373	32.43	824.84	3,852.90	4,263.73	J3-360	18.16	3,720.87	3,720.87
J3-603	2,005.07	J3-916	27.09	682.53	6,219.85	4,125.56	J3-784	13	3,743.06	3,743.06
J3-908	2,005.07	J3-916	26.81	681.87	6,133.17	5,378.34	J3-377	17.04	3,760.29	3,760.29
J3-907	2,005.07	J3-916	26.92	682.13	6,170.40	5,090.52	J3-377	18.28	3,770.97	3,770.97
J3-905	2,005.07	J3-916	27.06	682.44	0.00	3,745.27	J3-905	20.37	3,771.12	3,771.12
J3-566	2,005.07	J3-916	27.09	682.53	0.00	7,088.22	J3-377	7.66	3,792.11	3,792.11
J3-881	2,005.07	J3-916	27.12	682.6	0.00	7,005.62	J3-377	8.26	3,794.03	3,794.03
J3-874	2,005.07	J3-916	27.14	682.63	0.00	6,345.30	J3-377	12.97	3,795.19	3,795.19
J3-579	2,005.07	J3-916	27.09	682.53	6,224.79	4,306.88	J3-784	10.64	3,795.64	3,795.64
J3-873	2,005.07	J3-916	27.14	682.64	0.00	6,107.33	J3-377	14.34	3,795.70	3,795.70
J3-574	2,005.07	J3-916	27.09	682.53	6,225.63	4,101.22	J3-784	14.72	3,805.52	3,805.52
J3-858	2,005.07	J3-916	27.17	682.71	0.00	7,272.57	J3-377	7.24	3,807.02	3,807.02
J3-861	2,005.07	J3-916	27.22	682.83	0.00	6,506.02	J3-377	12.73	3,816.19	3,816.19
J3-862	2,005.07	J3-916	27.24	682.86	0.00	6,238.56	J3-377	13.88	3,818.94	3,818.94
J3-869	2,005.07	J3-916	27.24	682.86	6,759.49	4,970.44	J3-377	18.93	3,818.94	3,818.94
J-5043	2,005.07	J3-916	27.29	682.98	0.00	5,130.01	J3-377	18.35	3,823.90	3,823.90
J-5039	2,005.07	J3-916	27.29	682.98	6,896.93	5,975.45	J3-377	15	3,823.90	3,823.90
J-5037	2,005.07	J3-916	29.76	688.68	7,133.05	4,888.64	J3-377	19.3	3,833.33	3,833.33
J3-567	2,005.07	J3-916	27.09	682.53	6,230.37	4,281.21	J3-784	12.6	3,866.54	3,866.54
J3-361	2,005.07	J3-373	32.59	825.21	3,939.85	5,184.81	J3-360	11.8	3,939.46	3,939.46
J-5024	2,005.07	J-5082	33.44	532.19	0.00	4,048.61	J-5024	20.4	3,989.22	3,989.22
J-5025	2,005.07	J-5082	33.44	532.19	0.00	6,427.62	J-5024	-98.83	3,989.22	3,989.22
J4-700	2,005.07	J3-916	25.81	679.56	4,261.43	4,110.73	J4-700	20.41	4,116.37	4,116.37
J3-789	2,005.07	J3-373	32.9	825.92	4,121.41	5,101.01	J3-360	16.64	4,261.11	4,121.41
J3-571	2,005.07	J3-916	25.81	679.56	4,261.43	4,122.45	J4-700	20.41	4,128.11	4,128.11
J3-868	2,005.07	J3-916	27.24	682.86	0.00	4,413.93	J3-866	11.77	4,231.43	4,231.43
J-5040	2,005.07	J3-916	27.29	682.98	0.00	4,287.10	J-5040	20.43	4,274.38	4,274.38
J3-872	2,005.07	J3-916	27.14	682.64	0.00	4,630.33	J3-878	12.23	4,336.10	4,336.10
J3-859	2,005.07	J3-916	27.17	682.71	0.00	4,350.77	J3-859	20.43	4,360.42	4,360.42
J-5023	2,005.07	J-5082	33.44	532.19	0.00	4,510.26	J-5023	20.45	4,434.01	4,434.01
J3-362	2,005.07	J3-373	33.42	827.14	4,445.87	5,376.58	J3-360	19.69	4,836.62	4,445.87
J3-368	2,005.07	J-5082	33.44	532.19	0.00	5,979.03	J3-373	18.8	4,861.52	4,861.52
J3-369	2,005.07	J-5082	33.44	532.19	0.00	5,972.71	J3-373	18.86	4,869.26	4,869.26
J3-906	2,005.07	J3-916	27.03	682.37	0.00	5,319.15	J3-905	15.22	4,876.81	4,876.81
J3-867	2,005.07	J3-916	27.24	682.86	0.00	5,013.68	J3-866	18.33	4,949.78	4,949.78
J3-904	2,005.07	J3-916	27.07	682.47	0.00	5,525.57	J3-905	14.32	4,991.51	4,991.51
J3-367	2,005.07	J-5082	33.44	532.19	0.00	6,228.39	J3-370	19.1	5,216.58	5,216.58
J3-864	2,005.07	J3-916	27.17	682.71	0.00	5,490.41	J3-860	13.62	5,290.42	5,290.42
J3-366	2,005.07	J-5082	33.44	532.19	0.00	6,348.32	J3-370	19.06	5,317.40	5,317.40
J-5044	2,005.07	J3-916	27.69	683.91	7,006.67	5,540.62	J-5037	14.98	5,320.39	5,320.39
J1-8	2,005.67	J-5082	33.44	532.19	0.00	5,308.79	J1-8	20.53	5,322.02	5,322.02
J3-870	2,005.07	J3-916	27.14	682.64	0.00	5,843.89	J3-871	11.91	5,323.21	5,323.21
J-5021	2,005.07	J-5082	33.44	532.19	0.00	8,189.90	J3-369	5.95	5,514.90	5,514.90
J3-910	2,005.07	J3-916	26.53	681.23	5,970.05	6,832.63	J3-916	7.41	5,970.05	5,970.05
J3-880	2,005.07	J3-916	27.1	682.55	0.00	8,459.67	J3-784	-23.95	6,702.57	6,702.57
J3-863	2,005.07	J3-916	27.11	682.56	0.00	8,702.06	J3-784	-29.54	6,737.20	6,737.20
J-5045	2,005.07	J-5082	33.44	532.19	0.00	16,579.47	J-5023	-190.67	7,845.78	7,845.78

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow	Available Flow at	Critical Node 2 ID	Critical Node 2	Adjusted Available	Design Flow
J3-274	2,005.07	J-516	-240.87	-28.9	898.33	1,144.10	J-516	-17.16	898.35	898.33
J3-506	2,007.20	J3-402	-59.06	422.69	1,020.04	1,208.46	J3-402	12.32	1,020.08	1,020.04
J3-929	2,005.07	J3-929	2.93	758.77	1,023.53	1,172.13	J3-929	20.12	1,023.49	1,023.49
J-515	2,005.07	J3-557	-137.12	252.55	1,030.15	1,827.62	J3-557	-98.37	1,030.15	1,030.15
J3-557	2,005.07	J3-557	-137.12	252.55	1,030.15	1,029.05	J3-557	20.10	1,030.15	1,030.15
J3-930	2,005.07	J3-929	4.66	762.75	1,056.76	1,319.77	J3-929	18.29	1,056.72	1,056.72
J3-995	2,005.07	J3-787	-16.15	381.72	1,087.01	1,536.71	J3-787	4.55	1,087.04	1,087.01
J3-994	2,005.07	J3-787	-16.15	381.72	1,087.01	1,427.38	J3-787	8.72	1,087.04	1,087.01
J3-928	2,005.07	J3-929	6.28	766.5	1,087.69	1,375.97	J3-929	18.10	1,087.64	1,087.64
J3-275	2,005.07	J-516	-152.71	174.57	1,096.30	1,411.78	J-516	-23.22	1,096.29	1,096.29
J3-927	2,005.07	J3-929	6.72	767.5	1,100.08	1,814.02	J3-929	10.51	1,100.02	1,100.02
J3-932	2,005.07	J3-929	7.10	768.39	1,107.05	1,390.80	J3-929	18.29	1,106.99	1,106.99
J-513	2,005.07	J-513	-92.46	389.62	1,108.64	1,107.25	J-513	20.11	1,108.64	1,108.64
J3-915	2,005.07	J3-915	-9.62	651.79	1,450.02	1,502.62	J3-929	16.42	1,108.82	1,108.82
J3-914	2,005.07	J3-914	-3.26	602.48	1,675.38	1,713.69	J3-929	12.68	1,108.82	1,108.82
J3-916	2,005.07	J3-929	7.08	768.33	1,108.88	2,024.77	J3-929	6.68	1,108.82	1,108.82
J3-931	2,005.07	J3-929	7.27	768.79	1,112.19	1,874.98	J3-929	9.81	1,112.14	1,112.14
J3-600	2,005.07	J3-929	7.79	769.98	1,125.77	2,724.26	J3-929	-5.93	1,125.71	1,125.71
J3-289	2,005.07	J3-289	-104.62	333.56	1,128.89	1,127.52	J3-289	20.11	1,128.91	1,128.89
J3-596	2,005.07	J3-929	7.90	770.23	1,129.24	2,105.11	J3-929	5.93	1,129.17	1,129.17
J3-597	2,005.07	J3-929	7.90	770.23	1,129.24	2,535.70	J3-929	-1.14	1,129.17	1,129.17
J3-595	2,005.07	J3-929	8.01	770.48	1,132.27	3,360.41	J3-929	-11.21	1,132.20	1,132.20
J3-594	2,005.07	J3-929	8.11	770.72	1,135.30	3,352.35	J3-929	-10.80	1,135.24	1,135.24
J3-593	2,005.07	J3-929	8.11	770.72	1,135.30	2,368.44	J3-929	0.76	1,135.24	1,135.24
J3-592	2,005.07	J3-929	8.11	770.72	1,135.30	2,207.45	J3-929	4.11	1,135.24	1,135.24
J3-601	2,005.07	J3-929	8.15	770.81	1,136.69	3,012.95	J3-929	-8.40	1,136.63	1,136.63
J3-598	2,005.07	J3-598	0.51	661.19	1,604.93	1,659.14	J3-929	14.46	1,136.63	1,136.63
J3-599	2,005.07	J3-929	8.19	770.91	1,137.63	2,822.42	J3-929	-8.91	1,137.57	1,137.57
J3-279	2,005.07	J3-279	-127.35	241.1	1,157.29	1,156.21	J3-279	20.12	1,157.31	1,157.29
J3-280	2,005.07	J3-280	-110.53	301.91	1,161.97	1,160.71	J3-280	20.12	1,161.99	1,161.97
J3-933	2,005.07	J3-929	9.49	773.91	1,173.62	1,794.07	J3-929	13.19	1,173.53	1,173.53
J3-909	2,005.07	J3-909	-50.59	403.26	1,235.19	1,233.69	J3-909	20.12	1,235.19	1,235.19
J3-401	2,005.07	J3-402	-32.31	484.43	1,304.39	1,704.37	J3-402	6.30	1,304.39	1,304.39
J3-956	2,005.07	J3-956	-55.40	482.14	1,313.02	1,364.15	J3-956	20.14	1,312.99	1,312.99
J3-776	2,005.07	J3-776	8.83	630.38	1,321.42	1,315.56	J3-776	20.13	1,321.41	1,321.41
J3-276	2,005.07	J-516	-84.62	331.71	1,334.48	1,444.17	J-516	8.83	1,334.49	1,334.48
J3-392	2,005.07	J3-392	-23.92	613.8	1,338.01	1,419.70	J3-392	20.14	1,338.01	1,338.01
J3-743	2,005.07	J3-743	-65.12	426.71	1,340.60	1,384.46	J3-743	20.14	1,340.59	1,340.59
J3-282	2,005.07	J-516	-78.94	344.82	1,359.17	1,450.58	J-516	11.19	1,359.17	1,359.17
J3-283	2,005.07	J3-283	-92.62	194.25	1,469.56	1,492.63	J-516	6.32	1,359.17	1,359.17
J3-281	2,005.07	J3-281	-77.06	329.15	1,402.93	1,417.19	J-516	17.50	1,381.07	1,381.07
J3-581	2,005.07	J3-929	18.31	794.25	1,400.41	2,803.47	J3-929	14.81	1,400.30	1,400.30
J3-585	2,005.07	J3-929	18.41	794.48	1,420.35	2,617.81	J3-929	15.84	1,420.33	1,420.33
J3-583	2,005.07	J3-929	18.40	794.48	1,421.62	2,446.95	J3-929	16.60	1,421.60	1,421.60
J3-584	2,005.07	J3-929	18.42	794.52	1,423.60	2,642.99	J3-929	15.75	1,423.58	1,423.58
J3-582	2,005.07	J3-929	18.49	794.66	1,435.81	2,703.71	J3-929	15.49	1,435.81	1,435.81
J3-589	2,005.07	J3-929	18.71	795.19	1,437.00	3,908.44	J3-929	8.34	1,437.00	1,437.00
J3-315	2,005.07	J3-315	-7.60	662.45	1,438.66	1,541.33	J3-315	20.15	1,438.65	1,438.65
J3-744	2,005.07	J3-744	-48.66	449.71	1,440.99	1,486.27	J3-744	20.15	1,440.98	1,440.98
J3-376	2,005.07	J3-929	15.91	788.72	1,450.05	2,153.49	J3-929	13.83	1,449.99	1,449.99
J3-894	2,005.07	J3-787	6.90	434.92	1,476.45	2,127.46	J3-787	3.39	1,476.46	1,476.45
J3-892	2,005.07	J3-787	6.90	434.92	1,476.45	3,096.65	J3-787	-30.39	1,476.46	1,476.45
J3-893	2,005.07	J3-787	6.90	434.92	1,476.45	2,399.51	J3-787	-5.02	1,476.46	1,476.45
J3-960	2,005.07	J3-960	-23.78	560.12	1,480.12	1,543.09	J3-960	20.15	1,480.09	1,480.09
J3-377	2,005.07	J3-929	16.85	790.89	1,494.90	1,890.79	J3-929	18.30	1,494.76	1,494.76
J3-294	2,005.07	J3-280	-36.45	472.87	1,501.94	1,644.40	J3-280	9.76	1,501.94	1,501.94
J3-586	2,005.07	J3-929	19.09	796.05	1,531.20	2,714.43	J3-929	16.03	1,531.19	1,531.19
J3-588	2,005.07	J3-588	9.04	493.87	1,865.75	1,873.81	J3-929	19.76	1,531.19	1,531.19
J-5082	2,005.07	J-5082	-29.67	386.54	1,533.96	1,529.19	J-5082	20.15	1,533.96	1,533.96
J3-912	2,005.07	J3-915	-1.04	671.6	1,549.71	2,015.58	J3-915	-1.65	1,549.69	1,549.69
J3-913	2,005.07	J3-915	-1.04	671.6	1,549.71	1,913.30	J3-915	4.16	1,549.69	1,549.69
J3-297	2,005.07	J3-297	-8.01	614.51	1,561.04	1,644.60	J3-297	20.16	1,561.04	1,561.04
J3-723	2,005.07	J3-743	-21.37	527.67	1,566.24	1,757.15	J3-743	6.31	1,566.22	1,566.22
J3-724	2,005.07	J3-744	-22.55	509.95	1,581.91	1,702.66	J3-743	11.99	1,566.22	1,566.22
J3-725	2,005.07	J3-744	-22.55	509.95	1,581.91	1,824.41	J3-743	-0.90	1,566.22	1,566.22
J3-745	2,005.07	J3-745	-22.63	460.77	1,643.31	1,687.80	J3-743	13.51	1,566.22	1,566.22
J-5080	2,005.07	J-5080	-22.34	431.44	1,567.88	1,566.22	J-5080	20.16	1,567.88	1,567.88
J3-879	2,005.07	J3-879	-19.06	428.02	1,569.42	1,567.44	J3-879	20.16	1,569.39	1,569.39
J3-299	2,005.07	J3-297	-4.82	621.87	1,577.74	1,743.48	J3-297	15.36	1,577.83	1,577.74
J3-288	2,005.07	J3-280	-21.41	507.59	1,588.29	1,677.76	J3-280	16.65	1,588.26	1,588.26
J3-716	2,005.07	J3-716	-6.32	610.42	1,595.64	1,671.08	J3-716	20.17	1,595.60	1,595.60
J3-309	2,005.07	J3-309	-10.37	579.07	1,606.93	1,674.19	J3-309	20.17	1,606.92	1,606.92
J3-587	2,005.07	J3-929	19.64	797.32	1,607.63	2,509.43	J3-929	17.65	1,607.68	1,607.63
J3-717	2,005.07	J3-716	-4.58	614.44	1,611.66	1,791.07	J3-716	12.52	1,611.62	1,611.62
J3-955	2,005.07	J3-956	-7.57	592.53	1,612.87	1,788.31	J3-956	11.51	1,612.84	1,612.84
J3-957	2,005.07	J3-956	-4.82	598.87	1,636.72	1,792.67	J3-716	12.68	1,614.89	1,614.89

J3-958	2,005.07	J3-716	-4.07	615.6	1,616.54	1,778.16	J3-716	13.92	1,616.50	1,616.50
J3-959	2,005.07	J3-960	-4.75	604.03	1,629.06	1,701.90	J3-716	19.65	1,617.72	1,617.72
J3-718	2,005.07	J3-718	-18.32	512.72	1,620.53	1,672.39	J3-718	20.17	1,620.53	1,620.53
J3-715	2,005.07	J3-716	-3.48	616.98	1,622.17	1,745.48	J3-716	16.82	1,622.13	1,622.13
J3-591	2,005.07	J3-929	19.78	797.65	1,627.08	2,804.43	J3-929	16.48	1,627.12	1,627.08
J3-325	2,005.07	J3-325	10.57	719.39	1,627.68	1,772.80	J3-325	20.18	1,627.64	1,627.64
J3-719	2,005.07	J3-956	-5.00	598.46	1,635.07	1,993.85	J3-956	-4.00	1,635.05	1,635.05
J3-722	2,005.07	J3-956	-5.00	598.46	1,635.07	2,039.13	J3-956	-8.08	1,635.05	1,635.05
J-5079	2,005.07	J-5085	-20.03	488.78	1,635.88	1,706.75	J-5085	17.84	1,635.76	1,635.76
J3-296	2,005.07	J3-297	-0.17	632.6	1,635.95	2,022.18	J3-297	-1.50	1,635.81	1,635.81
J-5076	2,005.07	J-5085	-20.03	488.78	1,636.37	1,815.93	J-5085	4.59	1,636.32	1,636.32
J-5075	2,005.07	J-5085	-20.03	488.78	1,636.38	1,889.28	J-5085	-4.70	1,636.33	1,636.33
J-5077	2,005.07	J-5085	-20.03	488.78	1,636.43	1,800.26	J-5085	6.54	1,636.39	1,636.39
J-5078	2,005.07	J-5085	-20.03	488.78	1,636.43	1,899.22	J-5085	-5.99	1,636.40	1,636.40
J-5081	2,005.07	J-5085	-20.03	488.78	1,636.51	1,968.96	J-5085	-15.16	1,636.48	1,636.48
J-5083	2,005.07	J-5085	-20.03	488.78	1,638.57	1,766.67	J-5085	10.66	1,638.57	1,638.57
J-5084	2,005.07	J-5085	-20.03	488.78	1,638.57	1,754.37	J-5085	12.15	1,638.57	1,638.57
J3-714	2,005.07	J3-714	-1.21	625.21	1,639.28	1,719.29	J3-714	20.17	1,639.23	1,639.23
J3-875	2,005.07	J3-875	-10.59	445.55	1,644.67	1,642.52	J3-875	20.16	1,644.63	1,644.63
J3-713	2,005.07	J3-713	1.95	643.51	1,652.14	1,739.42	J3-713	20.17	1,652.08	1,652.08
J3-558	2,005.07	J3-289	-7.91	556.74	1,657.41	1,840.61	J3-289	8.90	1,657.37	1,657.37
J3-590	2,005.07	J3-929	20.35	798.96	1,666.94	4,790.53	J3-929	5.11	1,666.94	1,666.94
J3-978	2,005.07	J3-978	-12.08	487.11	1,702.71	1,753.90	J3-978	20.17	1,702.71	1,702.71
J3-405	2,005.07	J3-405	-14.51	465.52	1,703.48	1,748.43	J3-405	20.17	1,703.48	1,703.48
J3-397	2,005.07	J3-397	10.13	685.39	1,718.06	1,829.23	J3-397	20.18	1,718.02	1,718.02
J3-290	2,005.07	J3-297	8.50	652.63	1,732.09	2,177.96	J3-297	-3.93	1,731.96	1,731.96
J3-395	2,005.07	J3-389	16.99	716.22	1,790.73	2,164.59	J3-389	9.68	1,790.69	1,790.69
J3-393	2,005.07	J3-389	16.99	716.22	1,790.73	2,016.49	J3-389	16.48	1,790.69	1,790.69
J3-394	2,005.07	J3-389	16.99	716.22	1,790.73	2,037.29	J3-389	15.55	1,790.69	1,790.69
J3-389	2,005.07	J3-389	16.99	716.22	1,790.73	1,932.01	J3-389	20.19	1,790.69	1,790.69
J3-396	2,005.07	J3-389	16.99	716.22	1,790.73	2,065.42	J3-389	14.28	1,790.69	1,790.69
J3-291	2,005.07	J3-297	14.46	666.36	1,809.12	2,254.52	J3-297	-2.38	1,809.02	1,809.02
J3-977	2,005.07	J3-297	14.67	666.85	1,812.05	2,070.22	J3-297	10.44	1,811.95	1,811.95
J3-974	2,005.07	J3-297	14.67	666.85	1,812.05	2,167.73	J3-297	3.90	1,811.95	1,811.95
J3-975	2,005.07	J3-297	14.67	666.85	1,812.05	2,112.53	J3-297	7.64	1,811.95	1,811.95
J3-979	2,005.07	J3-297	14.67	666.85	1,812.05	2,171.76	J3-297	3.63	1,811.95	1,811.95
J3-976	2,005.07	J3-297	14.67	666.85	1,812.05	2,137.87	J3-297	5.93	1,811.95	1,811.95
J3-300	2,005.07	J3-300	14.50	654.47	1,824.72	1,921.48	J3-300	20.19	1,824.67	1,824.67
J-5089	2,005.07	J-5089	17.07	619.4	1,892.41	1,967.00	J-5089	20.20	1,892.36	1,892.36
J-5087	2,005.07	J-5087	18.00	605.54	1,909.90	1,979.93	J-5087	20.20	1,909.87	1,909.87
J3-327	2,005.07	J2-206	20.83	437.07		2,069.56	J3-327	20.21	1,910.70	1,910.70
J3-882	2,005.07	J2-206	20.83	437.07		3,948.28	J3-929	13.66	1,924.70	1,924.70
J3-815	2,005.07	J2-206	20.83	437.07		3,453.01	J3-929	15.78	1,924.70	1,924.70
J3-911	2,005.07	J2-206	20.83	437.07		2,779.64	J3-929	18.09	1,925.16	1,925.16
J3-781	2,005.07	J2-206	20.83	437.07		2,924.30	J3-929	17.58	1,925.16	1,925.16
J3-782	2,005.07	J2-206	20.83	437.07		3,467.99	J3-929	15.26	1,925.16	1,925.16
J3-783	2,005.07	J2-206	20.83	437.07		3,328.14	J3-929	15.90	1,925.16	1,925.16
J3-780	2,005.07	J2-206	20.83	437.07		4,514.93	J3-929	9.67	1,925.16	1,925.16
J-5086	2,005.07	J2-206	20.83	437.07		2,040.35	J-5087	19.34	1,957.41	1,957.41
J3-305	2,005.07	J2-206	20.83	437.07		2,060.50	J3-305	20.21	1,969.30	1,969.30
J-5088	2,005.07	J2-206	20.83	437.07		2,130.67	J-5089	15.01	1,984.25	1,984.25
J-5035	2,005.07	J2-206	20.83	437.07		2,018.00	J-5035	20.20	2,003.02	2,003.02
J3-883	2,005.07	J2-206	20.83	437.07		3,894.01	J3-929	14.16	2,011.45	2,011.45
J3-576	2,005.07	J2-206	20.83	437.07		2,068.61	J3-576	20.21	2,071.74	2,071.74
J3-346	2,005.07	J2-206	20.83	437.07		2,293.74	J3-346	20.23	2,097.66	2,097.66
J3-578	2,005.07	J2-206	20.83	437.07		2,095.22	J3-578	20.21	2,099.02	2,099.02
J-5124	2,005.07	J2-206	20.83	437.07		2,178.40	J-5124	20.22	2,120.06	2,120.06
J3-404	2,005.07	J2-206	20.83	437.07		2,337.00	J3-405	7.67	2,149.21	2,149.21
J3-786	2,005.07	J2-206	20.83	437.07		2,145.42	J3-786	20.21	2,151.44	2,151.44
J-5125	2,005.07	J2-206	20.83	437.07		2,214.11	J-5125	20.22	2,190.64	2,190.64
J3-378	2,005.07	J2-206	20.83	437.07		4,144.09	J3-929	7.05	2,230.40	2,230.40
J3-577	2,005.07	J2-206	20.83	437.07		2,254.85	J3-577	20.22	2,258.45	2,258.45
J-5128	2,005.07	J2-206	20.83	437.07		2,372.89	J-5128	20.24	2,299.20	2,299.20
J3-903	2,005.07	J2-206	20.83	437.07		2,294.91	J3-903	20.23	2,300.17	2,300.17
J-5127	2,005.07	J2-206	20.83	437.07		2,397.21	J-5127	20.24	2,325.95	2,325.95
J3-373	2,005.07	J2-206	20.83	437.07		2,698.43	J3-373	20.27	2,326.93	2,326.93
J-5117	2,005.07	J2-206	20.83	437.07		3,577.96	J3-929	16.13	2,339.91	2,339.91
J3-989	2,005.07	J2-206	20.83	437.07		2,467.07	J3-989	20.25	2,340.18	2,340.18
J-5118	2,005.07	J2-206	20.83	437.07		3,558.08	J3-929	16.32	2,344.45	2,344.45
J3-940	2,005.07	J2-206	20.83	437.07		3,824.86	J3-929	12.47	2,355.96	2,355.96
J3-987	2,005.07	J2-206	20.83	437.07		2,492.86	J3-987	20.25	2,365.52	2,365.52
J3-886	2,005.07	J2-206	20.83	437.07		2,361.35	J3-886	20.24	2,366.03	2,366.03
J3-936	2,005.07	J2-206	20.83	437.07		2,653.15	J3-936	20.26	2,370.00	2,370.00
J-5126	2,005.07	J2-206	20.83	437.07		2,469.55	J-5126	20.25	2,371.14	2,371.14
J3-775	2,005.07	J2-206	20.83	437.07		2,347.46	J3-776	20.23	2,379.34	2,379.34
J3-885	2,005.07	J2-206	20.83	437.07		5,321.63	J3-929	8.62	2,385.88	2,385.88
J3-372	2,005.07	J2-206	20.83	437.07		2,789.66	J3-372	20.28	2,397.67	2,397.67
J3-860	2,005.07	J2-206	20.83	437.07		2,404.99	J3-860	20.24	2,408.47	2,408.47

J3-884	2,005.07	J2-206	20.83	437.07	2,407.31	J3-884	20.24	2,411.05	2,411.05
J3-918	2,005.07	J2-206	20.83	437.07	4,203.13	J3-929	13.70	2,417.20	2,417.20
J3-920	2,005.07	J2-206	20.83	437.07	3,260.46	J3-929	18.79	2,429.09	2,429.09
J3-919	2,005.07	J2-206	20.83	437.07	4,321.85	J3-929	13.22	2,429.09	2,429.09
J3-944	2,005.07	J2-206	20.83	437.07	5,685.29	J3-929	6.95	2,431.53	2,431.53
J3-922	2,005.07	J2-206	20.83	437.07	4,621.29	J3-929	11.92	2,444.68	2,444.68
J3-946	2,005.07	J2-206	20.83	437.07	5,261.41	J3-929	9.19	2,447.90	2,447.90
J3-947	2,005.07	J2-206	20.83	437.07	4,673.91	J3-929	12.02	2,447.90	2,447.90
J3-921	2,005.07	J2-206	20.83	437.07	4,805.03	J3-929	11.15	2,456.00	2,456.00
J3-390	2,005.07	J2-206	20.83	437.07	2,655.39	J3-390	20.27	2,458.14	2,458.14
J3-926	2,005.07	J2-206	20.83	437.07	4,436.46	J3-929	12.96	2,460.72	2,460.72
J3-925	2,005.07	J2-206	20.83	437.07	4,501.52	J3-929	12.66	2,461.07	2,461.07
J3-924	2,005.07	J2-206	20.83	437.07	4,736.74	J3-929	11.57	2,461.92	2,461.92
J3-923	2,005.07	J2-206	20.83	437.07	5,383.02	J3-929	8.40	2,464.37	2,464.37
J3-988	2,005.07	J2-206	20.83	437.07	2,604.30	J3-988	20.26	2,465.93	2,465.93
J3-948	2,005.07	J2-206	20.83	437.07	5,917.26	J3-929	5.73	2,467.34	2,467.34
J3-985	2,005.07	J2-206	20.83	437.07	2,609.74	J3-985	20.26	2,467.37	2,467.37
J3-950	2,005.07	J2-206	20.83	437.07	5,444.23	J3-929	8.40	2,472.78	2,472.78
J3-887	2,005.07	J2-206	20.83	437.07	2,473.67	J3-887	20.25	2,479.03	2,479.03
J3-943	2,005.07	J2-206	20.83	437.07	6,265.51	J3-929	4.21	2,488.75	2,488.75
J3-388	2,005.07	J2-206	20.83	437.07	2,758.36	J3-388	20.28	2,492.48	2,492.48
J3-898	2,005.07	J2-206	20.83	437.07	2,495.33	J3-898	20.25	2,499.72	2,499.72
J3-328	2,005.07	J2-206	20.83	437.07	3,053.44	J3-325	14.24	2,505.36	2,505.36
J3-331	2,005.07	J2-206	20.83	437.07	2,803.69	J3-331	20.28	2,515.49	2,515.49
J3-308	2,005.07	J2-206	20.83	437.07	3,077.02	J3-309	-2.66	2,525.70	2,525.70
J3-941	2,005.07	J2-206	20.83	437.07	2,725.87	J3-941	20.27	2,545.11	2,545.11
J3-352	2,005.07	J2-206	20.83	437.07	2,893.56	J3-352	20.29	2,549.71	2,549.71
J3-942	2,005.07	J2-206	20.83	437.07	4,495.51	J3-929	9.91	2,556.60	2,556.60
J3-345	2,005.07	J2-206	20.83	437.07	2,907.48	J3-345	20.29	2,559.12	2,559.12
J3-314	2,005.07	J2-206	20.83	437.07	3,033.27	J3-315	14.67	2,567.44	2,567.44
J-5129	2,005.07	J2-206	20.83	437.07	2,701.87	J-5129	20.27	2,586.58	2,586.58
J3-383	2,005.07	J2-206	20.83	437.07	2,844.93	J3-383	20.28	2,591.84	2,591.84
J3-572	2,005.07	J2-206	20.83	437.07	4,738.94	J3-787	-44.10	2,602.29	2,602.29
J3-986	2,005.07	J2-206	20.83	437.07	2,937.07	J3-987	11.63	2,611.00	2,611.00
J3-983	2,005.07	J2-206	20.83	437.07	2,863.95	J3-985	15.95	2,614.15	2,614.15
J3-391	2,005.07	J2-206	20.83	437.07	2,901.16	J3-391	20.29	2,620.44	2,620.44
J3-951	2,005.07	J2-206	20.83	437.07	4,222.07	J3-929	13.50	2,656.50	2,656.50
J3-937	2,005.07	J2-206	20.83	437.07	2,890.03	J3-937	20.29	2,661.32	2,661.32
J3-351	2,005.07	J2-206	20.83	437.07	2,984.54	J3-351	20.30	2,691.14	2,691.14
J3-304	2,005.07	J2-206	20.83	437.07	2,922.86	J3-305	16.39	2,692.98	2,692.98
J3-380	2,005.07	J2-206	20.83	437.07	2,903.64	J3-380	20.29	2,698.95	2,698.95
J3-381	2,005.07	J2-206	20.83	437.07	4,325.12	J3-929	13.37	2,698.96	2,698.96
J3-568	2,005.07	J2-206	20.83	437.07	2,700.13	J3-568	20.27	2,709.55	2,709.55
J3-354	2,005.07	J2-206	20.83	437.07	3,440.25	J3-373	18.26	2,709.64	2,709.64
J3-934	2,005.07	J2-206	20.83	437.07	4,710.87	J3-929	10.76	2,714.18	2,714.18
J3-382	2,005.07	J2-206	20.83	437.07	4,164.05	J3-929	14.99	2,736.07	2,736.07
J3-785	2,005.07	J2-206	20.83	437.07	2,727.63	J3-785	20.27	2,737.96	2,737.96
J3-939	2,005.07	J2-206	20.83	437.07	4,102.82	J3-929	15.52	2,748.00	2,748.00
J3-953	2,005.07	J2-206	20.83	437.07	4,097.40	J3-929	15.69	2,757.15	2,757.15
J3-332	2,005.07	J2-206	20.83	437.07	3,147.65	J3-332	20.31	2,762.12	2,762.12
J3-984	2,005.07	J2-206	20.83	437.07	3,082.73	J3-985	14.23	2,771.72	2,771.72
J3-777	2,005.07	J2-206	20.83	437.07	3,196.38	J3-776	17.15	2,779.26	2,779.26
J3-910	2,005.07	J2-206	20.83	437.07	6,976.27	J3-929	2.00	2,779.45	2,779.45
J3-954	2,005.07	J2-206	20.83	437.07	4,783.58	J3-929	11.29	2,786.98	2,786.98
J3-784	2,005.07	J2-206	20.83	437.07	2,775.36	J3-784	20.28	2,787.07	2,787.07
J3-384	2,005.07	J2-206	20.83	437.07	4,694.59	J3-929	11.94	2,788.98	2,788.98
J3-385	2,005.07	J2-206	20.83	437.07	3,863.41	J3-929	17.57	2,793.58	2,793.58
J3-316	2,005.07	J2-206	20.83	437.07	4,074.83	J3-929	16.21	2,793.71	2,793.71
J3-303	2,005.07	J2-206	20.83	437.07	3,738.97	J3-929	18.35	2,793.75	2,793.75
J3-386	2,005.07	J2-206	20.83	437.07	3,546.55	J3-929	19.54	2,793.87	2,793.87
J3-387	2,005.07	J2-206	20.83	437.07	3,744.06	J3-929	18.32	2,794.00	2,794.00
J3-307	2,005.07	J2-206	20.83	437.07	3,864.38	J3-929	17.57	2,794.05	2,794.04
J3-312	2,005.07	J2-206	20.83	437.07	3,851.64	J3-929	17.65	2,794.10	2,794.10
J3-329	2,005.07	J2-206	20.83	437.07	3,752.93	J3-929	18.27	2,794.29	2,794.29
J3-310	2,005.07	J2-206	20.83	437.07	3,823.63	J3-929	17.83	2,794.38	2,794.38
J3-317	2,005.07	J2-206	20.83	437.07	3,837.69	J3-929	17.75	2,795.16	2,795.16
J3-398	2,005.07	J2-206	20.83	437.07	3,819.23	J3-929	17.87	2,795.53	2,795.53
J3-318	2,005.07	J2-206	20.83	437.07	3,842.81	J3-929	17.72	2,795.82	2,795.82
J3-322	2,005.07	J2-206	20.83	437.07	3,786.55	J3-929	18.08	2,795.96	2,795.96
J3-323	2,005.07	J2-206	20.83	437.07	3,663.05	J3-929	18.84	2,795.97	2,795.97
J3-339	2,005.07	J2-206	20.83	437.07	3,592.30	J3-929	19.28	2,796.00	2,796.00
J3-330	2,005.07	J2-206	20.83	437.07	3,535.71	J3-929	19.63	2,796.61	2,796.61
J3-335	2,005.07	J2-206	20.83	437.07	3,659.46	J3-929	18.88	2,797.57	2,797.57
J3-334	2,005.07	J2-206	20.83	437.07	3,516.93	J3-929	19.75	2,797.57	2,797.57
J3-343	2,005.07	J2-206	20.83	437.07	3,531.80	J3-929	19.68	2,799.74	2,799.74
J3-326	2,005.07	J2-206	20.83	437.07	3,141.95	J3-326	20.31	2,806.03	2,806.03
J3-356	2,005.07	J2-206	20.83	437.07	3,867.85	J3-929	17.63	2,807.86	2,807.86
J3-344	2,005.07	J2-206	20.83	437.07	3,568.72	J3-929	19.54	2,809.89	2,809.89

J3-350	2,005.07	J2-206	20.83	437.07	3,557.63	J3-929	19.70	2,822.02	2,822.02
J3-349	2,005.07	J2-206	20.83	437.07	3,743.12	J3-929	18.58	2,822.02	2,822.02
J3-938	2,005.07	J2-206	20.83	437.07	3,551.62	J3-929	19.74	2,824.07	2,824.07
J3-890	2,005.07	J2-206	20.83	437.07	3,119.39	J3-568	11.90	2,835.02	2,835.02
J3-888	2,005.07	J2-206	20.83	437.07	3,067.26	J3-568	13.43	2,835.02	2,835.02
J3-889	2,005.07	J2-206	20.83	437.07	2,968.00	J3-568	16.29	2,835.02	2,835.02
J3-952	2,005.07	J2-206	20.83	437.07	2,958.14	J3-952	20.30	2,837.50	2,837.50
J3-991	2,005.07	J2-206	20.83	437.07	2,989.77	J3-991	20.30	2,838.44	2,838.44
J3-338	2,005.07	J2-206	20.83	437.07	3,141.55	J3-338	20.31	2,844.96	2,844.96
J3-355	2,005.07	J2-206	20.83	437.07	3,744.14	J3-929	18.70	2,848.17	2,848.17
J3-575	2,005.07	J2-206	20.83	437.07	2,841.94	J3-575	20.28	2,851.40	2,851.40
J3-908	2,005.07	J2-206	20.83	437.07	5,395.62	J3-929	12.35	2,851.95	2,851.95
J3-935	2,005.07	J2-206	20.83	437.07	4,033.22	J3-929	17.01	2,861.12	2,861.12
J3-902	2,005.07	J2-206	20.83	437.07	2,855.62	J3-902	20.29	2,864.53	2,864.53
J3-907	2,005.07	J2-206	20.83	437.07	5,100.87	J3-929	14.04	2,884.20	2,884.20
J3-374	2,005.07	J2-206	20.83	437.07	3,576.36	J3-929	20.05	2,885.00	2,885.00
J3-891	2,005.07	J2-206	20.83	437.07	3,024.00	J3-568	16.25	2,887.22	2,887.22
J3-562	2,005.07	J2-206	20.83	437.07	3,351.89	J3-562	20.33	2,907.71	2,907.71
J3-333	2,005.07	J2-206	20.83	437.07	3,344.87	J3-333	20.33	2,912.13	2,912.13
J3-906	2,005.07	J2-206	20.83	437.07	5,328.97	J3-929	13.13	2,914.23	2,914.23
J3-878	2,005.07	J2-206	20.83	437.07	2,907.22	J3-878	20.29	2,914.80	2,914.80
J3-353	2,005.07	J2-206	20.83	437.07	3,645.09	J3-373	18.99	2,920.47	2,920.47
J3-905	2,005.07	J2-206	20.83	437.07	3,749.00	J3-929	20.11	2,923.45	2,923.44
J3-904	2,005.07	J2-206	20.83	437.07	5,536.70	J3-929	12.20	2,926.67	2,926.67
J3-347	2,005.07	J2-206	20.83	437.07	3,375.24	J3-347	20.34	2,936.19	2,936.19
J3-566	2,005.07	J2-206	20.83	437.07	7,241.57	J3-929	0.84	2,940.10	2,940.10
J3-565	2,005.07	J2-206	20.83	437.07	7,259.67	J3-929	0.70	2,940.87	2,940.87
J3-881	2,005.07	J2-206	20.83	437.07	7,113.56	J3-929	1.80	2,945.09	2,945.09
J3-324	2,005.07	J2-206	20.83	437.07	3,393.44	J3-324	20.34	2,948.18	2,948.18
J3-874	2,005.07	J2-206	20.83	437.07	6,411.36	J3-929	7.37	2,948.72	2,948.72
J-5042	2,005.07	J2-206	20.83	437.07	2,975.92	J-5042	20.30	2,948.95	2,948.95
J3-375	2,005.07	J2-206	20.83	437.07	3,373.83	J3-375	20.34	2,949.07	2,949.07
J3-873	2,005.07	J2-206	20.83	437.07	6,114.28	J3-929	9.45	2,950.04	2,950.04
J3-870	2,005.07	J2-206	20.83	437.07	5,850.63	J3-929	10.81	2,952.09	2,952.09
J3-876	2,005.07	J2-206	20.83	437.07	7,271.71	J3-929	0.50	2,958.28	2,958.28
J3-859	2,005.07	J2-206	20.83	437.07	4,351.85	J3-929	17.91	2,970.30	2,970.30
J3-858	2,005.07	J2-206	20.83	437.07	7,359.32	J3-929	0.91	2,970.31	2,970.31
J3-864	2,005.07	J2-206	20.83	437.07	5,490.35	J3-929	12.70	2,970.33	2,970.33
J3-774	2,005.07	J2-206	20.83	437.07	3,421.27	J3-776	17.08	2,970.48	2,970.48
J3-861	2,005.07	J2-206	20.83	437.07	6,511.63	J3-929	7.60	2,988.77	2,988.77
J3-869	2,005.07	J2-206	20.83	437.07	4,966.61	J3-929	15.30	2,994.44	2,994.44
J3-862	2,005.07	J2-206	20.83	437.07	6,241.37	J3-929	9.05	2,994.44	2,994.44
J3-867	2,005.07	J2-206	20.83	437.07	5,010.41	J3-929	15.10	2,994.44	2,994.44
J3-778	2,005.07	J2-206	20.83	437.07	3,736.05	J3-776	15.18	3,006.69	3,006.69
J-5039	2,005.07	J2-206	20.83	437.07	5,974.90	J3-929	10.52	3,011.84	3,011.84
J-5040	2,005.07	J2-206	20.83	437.07	4,281.61	J3-929	18.39	3,011.84	3,011.84
J-5043	2,005.07	J2-206	20.83	437.07	5,125.48	J3-929	14.65	3,011.84	3,011.84
J3-348	2,005.07	J2-206	20.83	437.07	3,453.63	J3-348	20.34	3,014.83	3,014.83
J-5044	2,005.07	J2-206	20.83	437.07	5,536.12	J3-929	12.77	3,027.94	3,027.94
J3-370	2,005.07	J2-206	20.83	437.07	4,101.94	J3-929	17.91	3,033.94	3,033.94
J-5037	2,005.07	J2-206	20.83	437.07	4,878.54	J3-929	15.92	3,039.14	3,039.14
J-5090	2,005.07	J2-206	20.83	437.07	3,310.71	J-5090	20.33	3,049.88	3,049.88
J-5046	2,005.07	J2-206	20.83	437.07	4,460.62	J3-929	17.84	3,052.43	3,052.43
J3-371	2,005.07	J2-206	20.83	437.07	4,272.88	J3-372	16.11	3,059.71	3,059.71
J3-901	2,005.07	J2-206	20.83	437.07	3,292.72	J3-902	13.77	3,088.34	3,088.34
J-5028	2,005.07	J2-206	20.83	437.07	3,134.93	J-5028	20.31	3,101.12	3,101.12
J3-900	2,005.07	J2-206	20.83	437.07	3,109.91	J3-902	20.04	3,111.29	3,111.29
J3-360	2,005.07	J2-206	20.83	437.07	3,379.44	J3-360	20.34	3,114.26	3,114.26
J3-899	2,005.07	J2-206	20.83	437.07	3,268.27	J3-902	15.45	3,116.53	3,116.53
J3-897	2,005.07	J2-206	20.83	437.07	3,147.25	J3-902	19.11	3,117.24	3,117.24
J3-358	2,005.07	J2-206	20.83	437.07	3,372.01	J3-358	20.34	3,117.63	3,117.63
J3-895	2,005.07	J2-206	20.83	437.07	3,412.22	J3-902	11.19	3,122.66	3,122.66
J-5033	2,005.07	J2-206	20.83	437.07	3,195.20	J-5041	18.30	3,130.90	3,130.90
J-5041	2,005.07	J2-206	20.83	437.07	3,143.74	J-5041	20.31	3,130.90	3,130.90
J3-990	2,005.07	J2-206	20.83	437.07	3,560.95	J3-985	12.10	3,134.50	3,134.50
J3-896	2,005.07	J2-206	20.83	437.07	3,431.06	J3-902	11.01	3,134.86	3,134.86
J3-726	2,005.07	J2-206	20.83	437.07	4,138.65	J3-333	12.20	3,146.37	3,146.37
J3-337	2,005.07	J2-206	20.83	437.07	4,179.30	J3-333	11.70	3,152.67	3,152.67
J-5031	2,005.07	J2-206	20.83	437.07	3,170.70	J-5031	20.32	3,155.87	3,155.87
J3-341	2,005.07	J2-206	20.83	437.07	4,304.59	J3-333	9.84	3,165.49	3,165.49
J3-342	2,005.07	J2-206	20.83	437.07	4,029.34	J3-333	14.59	3,168.69	3,168.69
J3-560	2,005.07	J2-206	20.83	437.07	3,881.51	J3-333	17.13	3,171.87	3,171.87
J3-561	2,005.07	J2-206	20.83	437.07	3,918.18	J3-333	16.73	3,180.76	3,180.76
J3-313	2,005.07	J2-206	20.83	437.07	3,722.07	J3-315	17.34	3,186.60	3,186.60
J3-321	2,005.07	J2-206	20.83	437.07	4,095.78	J3-333	13.98	3,189.43	3,189.43
J3-917	2,005.07	J2-206	20.83	437.07	4,342.28	J3-776	11.37	3,190.35	3,190.35
J3-866	2,005.07	J2-206	20.83	437.07	3,185.55	J3-866	20.32	3,191.10	3,191.10
J3-336	2,005.07	J2-206	20.83	437.07	3,834.36	J3-331	17.05	3,204.05	3,204.05

J3-320	2,005.07	J2-206	20.83	437.07	4,092.07	J3-333	14.78	3,214.83	3,214.83
J3-779	2,005.07	J2-206	20.83	437.07	4,738.52	J3-776	8.17	3,223.59	3,223.59
J3-992	2,005.07	J2-206	20.83	437.07	4,476.34	J3-333	8.53	3,226.37	3,226.37
J3-319	2,005.07	J2-206	20.83	437.07	4,206.92	J3-333	13.34	3,233.27	3,233.27
J3-877	2,005.07	J2-206	20.83	437.07	3,515.24	J3-878	12.12	3,289.66	3,289.66
J3-302	2,005.07	J2-206	20.83	437.07	4,935.94	J3-387	2.89	3,322.47	3,322.47
J3-790	2,005.07	J2-206	20.83	437.07	3,977.89	J3-360	16.90	3,325.32	3,325.32
J-5030	2,005.07	J2-206	20.83	437.07	3,388.38	J-5031	20.34	3,347.07	3,347.07
J3-357	2,005.07	J2-206	20.83	437.07	3,618.22	J3-357	20.36	3,349.07	3,349.07
J3-602	2,005.07	J2-206	20.83	437.07	3,351.51	J3-602	20.33	3,362.11	3,362.11
J3-359	2,005.07	J2-206	20.83	437.07	4,416.80	J3-358	11.73	3,362.58	3,362.58
J3-363	2,005.07	J2-206	20.83	437.07	4,707.08	J3-360	9.98	3,391.68	3,391.68
J3-292	2,005.07	J2-206	20.83	437.07	6,337.74	J3-387	-13.03	3,400.46	3,400.46
J3-604	2,005.07	J2-206	20.83	437.07	3,403.67	J3-604	20.34	3,417.43	3,417.43
J3-293	2,005.07	J2-206	20.83	437.07	6,712.28	J3-387	-17.63	3,421.13	3,421.13
J3-295	2,003.94	J2-206	20.83	437.07	6,718.99	J3-387	-17.52	3,423.63	3,423.63
J4-2022	2,005.07	J2-206	20.83	437.07	7,536.48	J3-329	-24.82	3,452.72	3,452.72
J3-857	2,005.07	J2-206	20.83	437.07	6,522.30	J3-329	-10.60	3,466.56	3,466.56
J3-856	2,005.07	J2-206	20.83	437.07	6,534.33	J3-329	-10.81	3,467.05	3,467.05
J3-361	2,005.07	J2-206	20.83	437.07	4,858.15	J3-360	10.38	3,503.61	3,503.61
J-5026	2,005.07	J2-206	20.83	437.07	3,579.73	J-5026	20.36	3,535.05	3,535.05
J3-379	2,005.07	J2-206	20.83	437.07	4,359.56	J3-380	11.77	3,550.74	3,550.74
J3-573	2,005.07	J2-206	20.83	437.07	4,000.56	J3-784	14.02	3,678.36	3,678.36
J3-603	2,005.07	J2-206	20.83	437.07	4,127.63	J3-784	13.02	3,746.91	3,746.91
J3-789	2,005.07	J2-206	20.83	437.07	4,856.97	J3-360	14.36	3,789.85	3,789.85
J3-579	2,005.07	J2-206	20.83	437.07	4,309.53	J3-784	10.65	3,799.63	3,799.63
J3-574	2,005.07	J2-206	20.83	437.07	4,103.91	J3-784	14.73	3,809.55	3,809.55
J4-700	2,005.07	J2-206	20.83	437.07	4,132.45	J3-787	12.17	3,812.37	3,812.37
J3-571	2,005.07	J2-206	20.83	437.07	4,144.43	J3-787	12.17	3,869.74	3,869.74
J3-567	2,005.07	J2-206	20.83	437.07	4,284.50	J3-784	12.60	3,870.73	3,870.73
J-5024	2,005.07	J2-206	20.83	437.07	4,014.99	J-5024	20.40	3,956.92	3,956.92
J-5025	2,005.07	J2-206	20.83	437.07	6,405.25	J-5024	-99.38	3,956.92	3,956.92
J3-368	2,005.07	J2-206	20.83	437.07	5,686.80	J3-929	17.13	4,174.76	4,174.76
J3-369	2,005.07	J2-206	20.83	437.07	5,683.58	J3-929	17.16	4,178.09	4,178.09
J-5021	2,005.07	J2-206	20.83	437.07	8,062.16	J3-929	4.15	4,178.09	4,178.09
J3-868	2,005.07	J2-206	20.83	437.07	4,410.10	J3-866	11.77	4,229.13	4,229.13
J3-367	2,005.07	J2-206	20.83	437.07	5,982.95	J3-929	16.48	4,308.97	4,308.97
J3-872	2,005.07	J2-206	20.83	437.07	4,632.82	J3-878	12.23	4,339.27	4,339.27
J-5023	2,005.07	J2-206	20.83	437.07	4,465.49	J-5023	20.45	4,390.26	4,390.26
J3-366	2,005.07	J2-206	20.83	437.07	6,101.72	J3-929	16.44	4,393.75	4,393.75
J3-362	2,005.07	J2-206	20.83	437.07	5,039.48	J3-360	18.91	4,434.81	4,434.81
J3-880	2,005.07	J2-206	20.83	437.07	8,641.60	J3-784	-23.70	6,845.20	6,845.20
J3-863	2,005.07	J2-206	20.83	437.07	8,883.08	J3-784	-28.82	6,881.46	6,881.46
J-5045	2,005.07	J2-206	20.83	437.07	16,466.96	J-5023	-190.69	7,725.24	7,725.24

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant (gpm)	Critical Node 2 ID	Critical Node 2	Critcal Node 2	Adjusted Available	Design Flow (gpm)
J1-108	2,004.43	J1-108	-126.99	-123.07	852.02	851.02	J1-108	20.08	216.35	852.04	852.02
J1-107	2,004.43	J1-108	-124.63	-117.63	857.92	856.9	J1-108	20.09	216.35	857.94	857.92
J1-123	2,004.43	J1-123	-63	55.61	919.49	918.06	J1-123	20.09	247.37	919.51	919.49
J1-400	2,004.43	J1-400	-77.26	3.69	990.99	989.79	J1-400	20.1	228.38	990.99	990.99
J1-85	2,004.43	J1-400	-77.11	4.04	991.6	1,167.52	J1-400	7.12	198.43	991.6	991.6
J1-737	2,036.34	J2-228	19.01	434.87	1,013.01	2,938.42	J1-123	-19.41	156.21	2,196.30	1,013.01
J1-124	2,004.43	J2-228	19.12	435.13	1,036.38	3,042.38	J1-123	-28.58	135.04	2,164.39	1,036.38
J1-146	2,004.43	J1-146	-41.11	86.12	1,146.57	1,144.48	J1-146	20.11	227.42	1,146.57	1,146.57
J1-122	2,004.43	J1-123	-24.42	144.63	1,153.77	1,723.07	J1-123	-8.43	181.55	1,153.73	1,153.73
J1-125	2,036.34	J2-228	19.23	435.38	1,155.57	3,212.19	J1-123	-35.21	119.74	2,083.61	1,155.57
J1-128	2,004.43	J2-228	19.3	435.54	1,188.85	3,276.31	J1-123	-39.28	110.34	2,020.72	1,188.85
J1-131	2,004.43	J2-228	19.3	435.55	1,191.85	3,259.80	J1-123	-37.73	113.93	2,020.78	1,191.85
J1-136	2,004.43	J2-228	19.32	435.58	1,202.89	3,249.78	J1-123	-37.02	115.56	2,006.76	1,202.89
J1-135	2,004.43	J2-228	19.32	435.58	1,202.90	3,249.97	J1-123	-37.04	115.52	2,006.64	1,202.90
J1-132	2,004.43	J2-228	19.33	435.6	1,209.70	3,210.31	J1-123	-33.2	124.39	2,016.53	1,209.70
J1-130	2,004.43	J2-228	19.33	435.6	1,212.35	3,220.30	J1-123	-34.36	121.7	2,000.36	1,212.35
J1-129	2,004.43	J2-228	19.33	435.61	1,213.39	3,238.93	J1-123	-35.7	118.61	1,998.58	1,213.39
J1-126	2,036.34	J2-228	19.29	435.52	1,214.88	3,306.44	J1-123	-39.4	110.07	2,055.73	1,214.88
J1-160	2,004.43	J1-160	-8.81	194.66	1,215.04	1,210.85	J1-160	20.12	261.44	1,215.04	1,215.04
J1-134	2,004.43	J2-228	19.33	435.62	1,219.87	3,242.13	J1-123	-34.95	120.34	2,015.53	1,219.87
J1-133	2,004.43	J2-228	19.34	435.62	1,220.49	3,245.58	J1-123	-35.19	119.79	2,015.33	1,220.49
J1-137	2,004.43	J2-228	19.34	435.63	1,221.25	3,057.31	J1-123	-22.11	149.97	2,016.83	1,221.25
J1-127	2,036.34	J2-228	19.3	435.55	1,222.65	3,290.70	J1-123	-37.7	114	2,053.03	1,222.65
J1-444	2,036.34	J2-228	19.31	435.57	1,228.16	3,037.82	J1-123	-19.79	155.34	2,053.46	1,228.16
J1-98	2,004.43	J2-228	19.34	435.65	1,233.58	3,259.12	J1-123	-35.56	118.94	2,020.13	1,233.58
J1-143	2,004.43	J2-228	19.34	435.65	1,233.66	3,266.69	J1-123	-36.07	117.76	2,020.45	1,233.66
J1-142	2,004.43	J2-228	19.34	435.65	1,233.74	3,265.87	J1-123	-35.99	117.93	2,020.60	1,233.74
J1-99	2,004.43	J2-228	19.34	435.65	1,234.08	3,197.89	J1-123	-31.18	129.03	2,019.05	1,234.08
J1-140	2,004.43	J2-228	19.35	435.65	1,235.33	3,321.79	J1-123	-39.87	108.98	2,023.84	1,235.33
J1-141	2,004.43	J2-228	19.35	435.65	1,235.34	3,327.48	J1-123	-40.29	108.01	2,023.84	1,235.34
J1-138	2,004.43	J1-138	-0.96	57.79	1,781.98	1,780.01	J2-228	19.52	436.04	1,235.35	1,235.35
J1-139	2,004.43	J2-228	19.35	435.65	1,235.43	3,237.62	J1-123	-33.77	123.06	2,023.82	1,235.43
J1-63	2,004.43	J2-228	19.35	435.65	1,235.55	3,336.41	J1-123	-40.9	106.6	2,024.13	1,235.55
J1-441	2,004.43	J2-228	19.35	435.65	1,235.55	3,336.23	J1-123	-40.89	106.64	2,024.13	1,235.55
J1-847	2,004.43	J2-228	19.35	435.65	1,235.92	3,329.57	J1-123	-40.3	107.98	2,024.65	1,235.92
J1-443	2,004.43	J1-443	-43.11	-79.49	1,584.87	1,583.78	J2-228	19.68	436.42	1,236.02	1,236.02
J1-1013	2,004.43	J1-1013	-18.6	-2.92	1,698.93	1,697.58	J2-228	19.58	436.2	1,236.02	1,236.02
J1-58	2,004.43	J2-228	19.35	435.65	1,236.07	2,493.52	J1-123	10.61	225.48	2,024.95	1,236.07
J1-1015	2,004.43	J2-228	19.35	435.65	1,236.07	2,146.17	J1-123	17.79	242.05	2,024.95	1,236.07
J1-59	2,004.43	J2-228	19.35	435.65	1,236.07	3,207.86	J1-123	-31.5	128.3	2,024.95	1,236.07
J1-41	2,004.43	J2-228	19.35	435.65	1,236.07	2,105.27	J1-123	18.5	243.69	2,024.95	1,236.07
J1-40	2,004.43	J2-228	19.35	435.65	1,236.07	2,259.66	J1-123	16.04	238.02	2,024.95	1,236.07
J1-42	2,004.43	J2-228	19.35	435.65	1,236.07	2,281.16	J1-123	15.76	237.37	2,024.95	1,236.07
J1-44	2,004.43	J2-228	19.35	435.65	1,236.07	2,218.68	J1-123	16.63	239.38	2,024.95	1,236.07
J1-442	2,004.43	J2-228	19.35	435.65	1,236.07	2,285.34	J1-123	15.71	237.25	2,024.95	1,236.07
J1-47	2,004.43	J2-228	19.35	435.65	1,236.07	2,344.81	J1-123	15.04	235.71	2,024.95	1,236.07
J1-48	2,004.43	J2-228	19.35	435.65	1,236.07	2,320.00	J1-123	15.29	236.3	2,024.95	1,236.07
J1-1014	2,004.43	J2-228	19.35	435.65	1,236.07	2,180.16	J1-123	17.23	240.76	2,024.95	1,236.07
J1-1012	2,004.43	J2-228	19.35	435.65	1,236.07	2,150.24	J1-123	17.72	241.89	2,024.95	1,236.07
J1-1011	2,004.43	J2-228	19.35	435.65	1,236.07	2,195.47	J1-123	16.99	240.2	2,024.95	1,236.07
J1-57	2,004.43	J1-57	-37.45	-37.44	1,546.19	1,544.82	J2-228	19.71	436.5	1,236.60	1,236.60
J1-50	2,004.43	J2-228	19.35	435.65	1,236.65	2,394.22	J1-123	14.65	234.82	2,025.55	1,236.65
J1-51	2,004.43	J2-228	19.35	435.65	1,236.65	2,923.94	J1-123	-12.84	171.36	2,025.55	1,236.65
J1-101	2,004.43	J2-228	19.35	435.66	1,236.69	3,026.75	J1-123	-18.55	158.19	2,023.97	1,236.69
J1-54	2,004.43	J2-228	19.35	435.65	1,236.81	3,310.71	J1-123	-38.85	111.34	2,025.59	1,236.81
J1-848	2,004.43	J2-228	19.35	435.65	1,236.81	2,748.73	J1-123	-2.58	195.05	2,025.59	1,236.81
J1-39	2,004.43	J2-228	19.35	435.65	1,237.24	3,295.65	J1-123	-37.59	114.25	2,026.33	1,237.24
J1-100	2,004.43	J2-228	19.35	435.66	1,238.20	3,186.36	J1-123	-29.8	132.23	2,025.59	1,238.20
J1-96	2,004.43	J2-228	19.35	435.66	1,238.59	3,154.76	J1-123	-27.64	137.21	2,026.99	1,238.59
J1-97	2,004.43	J2-228	19.35	435.66	1,238.87	3,174.76	J1-123	-28.98	134.13	2,027.40	1,238.87
J1-93	2,004.43	J2-228	19.35	435.66	1,240.34	3,074.02	J1-123	-22.02	150.19	2,029.78	1,240.34
J1-95	2,004.43	J2-228	19.35	435.67	1,240.87	3,120.21	J1-123	-25	143.3	2,030.40	1,240.87
J1-89	2,004.43	J1-89	-26.71	-5.64	1,595.72	1,594.21	J2-228	19.68	436.41	1,241.12	1,241.12
J1-92	2,004.43	J2-228	19.35	435.67	1,241.16	3,120.25	J1-123	-24.97	143.38	2,030.74	1,241.16
J1-90	2,004.43	J2-228	19.35	435.67	1,241.21	2,929.77	J1-123	-12.74	171.59	2,030.84	1,241.21
J1-7	2,004.43	J2-228	19.35	435.67	1,241.42	3,019.12	J1-123	-18.28	158.81	2,031.83	1,241.42
J1-440	2,004.43	J2-228	19.35	435.67	1,241.47	2,721.71	J1-123	-0.64	199.52	2,031.87	1,241.47
J1-6	2,004.43	J2-228	19.35	435.67	1,241.47	2,939.32	J1-123	-13.27	170.37	2,031.87	1,241.47
J1-12	2,004.43	J2-228	19.35	435.67	1,241.48	2,476.25	J1-123	11.82	228.27	2,031.87	1,241.48
J1-11	2,004.43	J2-228	19.35	435.67	1,241.49	2,390.19	J1-123	14.68	234.88	2,031.88	1,241.49
J1-13	2,004.43	J2-228	19.35	435.67	1,241.49	2,435.63	J1-123	13.69	232.6	2,031.89	1,241.49

J1-5	2,004.43 J2-228	19.35	435.67	1,241.50	2,516.79 J1-123	9.89	223.83	2,031.89	1,241.50
J1-4	2,004.43 J2-228	19.35	435.67	1,241.50	3,111.61 J1-123	-24.32	144.87	2,031.89	1,241.50
J1-9	2,004.43 J2-228	19.35	435.67	1,241.52	2,736.99 J1-123	-1.48	197.59	2,031.91	1,241.52
J1-14	2,004.43 J2-228	19.35	435.67	1,241.53	2,356.50 J1-123	14.96	235.52	2,031.91	1,241.53
J1-94	2,004.43 J2-228	19.35	435.67	1,241.54	3,082.90 J1-123	-22.42	149.25	2,031.19	1,241.54
J1-10	2,004.43 J2-228	19.35	435.67	1,241.59	2,839.75 J1-123	-7.3	184.15	2,031.97	1,241.59
J1-791	2,004.43 J2-228	19.35	435.67	1,241.61	3,066.57 J1-123	-21.33	151.77	2,031.98	1,241.61
J1-3	2,004.43 J2-228	19.35	435.67	1,241.63	3,064.22 J1-123	-21.18	152.13	2,031.99	1,241.63
J1-2	2,004.43 J2-228	19.35	435.67	1,241.64	3,049.54 J1-123	-20.22	154.34	2,032.00	1,241.64
J1-1	2,004.43 J2-228	19.35	435.67	1,241.64	3,023.96 J1-123	-18.57	158.14	2,032.00	1,241.64
J1-20	2,004.43 J2-228	19.35	435.67	1,241.66	3,042.36 J1-123	-19.75	155.42	2,032.02	1,241.66
J1-795	2,004.43 J2-228	19.35	435.67	1,241.67	2,972.76 J1-123	-15.33	165.63	2,032.03	1,241.67
J1-22	2,004.43 J1-22	-45.75	-56.59	1,503.82	1,502.55 J2-228	19.76	436.6	1,241.74	1,241.74
J1-21	2,004.43 J2-228	19.35	435.67	1,241.80	2,571.43 J1-123	7.23	217.69	2,032.10	1,241.80
J1-15	2,004.43 J2-228	19.35	435.67	1,241.83	2,975.01 J1-123	-15.45	165.34	2,032.12	1,241.83
J1-35	2,004.43 J2-228	19.35	435.67	1,241.89	2,615.16 J1-123	5.03	212.6	2,032.15	1,241.89
J1-26	2,004.43 J1-26	-6.25	36.58	1,746.84	1,745.04 J2-228	19.55	436.12	1,241.89	1,241.89
J1-16	2,004.43 J2-228	19.35	435.67	1,241.91	3,032.01 J1-123	-19.06	157.02	2,032.16	1,241.91
J1-23	2,004.43 J1-23	-32.12	-23.14	1,573.43	1,572.02 J2-228	19.7	436.46	1,241.92	1,241.92
J1-34	2,004.43 J2-228	19.35	435.67	1,241.94	2,677.80 J1-123	1.76	205.06	2,032.17	1,241.94
J1-91	2,004.43 J2-228	19.35	435.67	1,241.94	3,060.37 J1-123	-20.9	152.77	2,031.71	1,241.94
J1-31	2,004.43 J2-228	19.35	435.67	1,241.94	2,654.71 J1-123	2.98	207.88	2,032.18	1,241.94
J1-29	2,004.43 J2-228	19.35	435.67	1,241.95	2,679.79 J1-123	1.66	204.82	2,032.18	1,241.95
J1-30	2,004.43 J2-228	19.35	435.67	1,241.95	2,692.32 J1-123	0.99	203.27	2,032.18	1,241.95
J1-28	2,004.43 J2-228	19.35	435.67	1,241.95	2,662.76 J1-123	2.56	206.9	2,032.18	1,241.95
J1-27	2,004.43 J2-228	19.35	435.67	1,241.95	2,210.05 J1-123	16.87	239.93	2,032.18	1,241.95
J1-24	2,004.43 J2-228	19.35	435.67	1,241.98	2,694.71 J1-123	0.86	202.98	2,032.19	1,241.98
J1-25	2,004.43 J2-228	19.35	435.67	1,241.98	2,770.90 J1-123	-3.33	193.32	2,032.20	1,241.98
J1-17	2,004.43 J2-228	19.35	435.67	1,242.09	3,010.03 J1-123	-17.63	160.31	2,032.27	1,242.09
J1-18	2,004.43 J2-228	19.36	435.67	1,242.91	2,881.65 J1-123	-9.64	178.75	2,033.01	1,242.91
J1-19	2,004.43 J2-228	19.36	435.67	1,242.91	2,548.92 J1-123	8.42	220.44	2,033.01	1,242.91
J1-446	2,004.43 J2-228	19.36	435.67	1,243.32	3,152.77 J1-123	-26.87	138.98	2,033.08	1,243.32
J1-80	2,004.43 J2-228	19.36	435.67	1,244.15	2,943.60 J1-123	-13.3	170.31	2,033.86	1,244.15
J1-79	2,004.43 J2-228	19.36	435.67	1,244.38	2,552.98 J1-123	8.33	220.22	2,034.12	1,244.38
J1-77	2,004.43 J2-228	19.36	435.67	1,244.45	2,708.44 J1-123	0.32	201.74	2,034.23	1,244.45
J1-78	2,004.43 J2-228	19.36	435.67	1,244.45	2,175.07 J1-123	17.46	241.29	2,034.23	1,244.45
J1-76	2,004.43 J2-228	19.36	435.67	1,244.58	3,062.34 J1-123	-20.75	153.12	2,034.35	1,244.58
J1-75	2,004.43 J2-228	19.36	435.67	1,244.74	3,126.04 J1-123	-24.93	143.47	2,034.55	1,244.74
J1-81	2,004.43 J1-81	-57.04	-91.63	1,460.83	1,459.66 J2-228	19.8	436.7	1,245.23	1,245.23
J1-70	2,004.43 J2-228	19.36	435.68	1,245.31	3,273.10 J1-400	-43.2	82.3	2,103.17	1,245.31
J1-71	2,004.43 J2-228	19.36	435.68	1,245.31	3,305.75 J1-400	-42	85.06	2,176.06	1,245.31
J1-72	2,004.43 J2-228	19.36	435.68	1,245.31	3,490.92 J1-123	-51.28	82.65	2,035.32	1,245.31
J1-69	2,004.43 J2-228	19.36	435.68	1,245.34	3,323.22 J1-123	-38.6	111.92	2,035.35	1,245.34
J1-88	2,004.43 J2-228	19.36	435.68	1,245.38	3,270.15 J1-123	-34.75	120.8	2,035.42	1,245.38
J1-86	2,004.43 J2-228	19.36	435.68	1,245.38	3,188.40 J1-123	-29.02	134.03	2,035.42	1,245.38
J1-445	2,004.43 J2-228	19.36	435.68	1,245.39	3,253.92 J1-123	-33.59	123.49	2,035.44	1,245.39
J1-113	2,004.43 J2-228	19.36	435.68	1,245.40	3,197.06 J1-123	-29.61	132.66	2,035.44	1,245.40
J1-102	2,004.43 J2-228	19.36	435.68	1,245.67	3,123.62 J1-123	-24.57	144.3	2,035.76	1,245.67
J1-103	2,004.43 J2-228	19.36	435.68	1,245.75	3,080.37 J1-123	-21.69	150.93	2,035.88	1,245.75
J1-112	2,004.43 J2-228	19.36	435.68	1,245.88	2,585.06 J1-123	6.93	217	2,036.10	1,245.88
J1-111	2,004.43 J2-228	19.36	435.68	1,245.93	2,155.17 J1-123	17.83	242.14	2,036.17	1,245.93
J1-110	2,004.43 J2-228	19.36	435.68	1,246.02	2,041.68 J2-228	19.32	435.59	1,245.93	1,245.93
J1-109	2,004.43 J1-109	-18.64	101.98	1,477.11	1,474.86 J2-228	19.79	436.67	1,246.39	1,246.39
J1-104	2,004.43 J2-228	19.36	435.68	1,247.49	2,954.77 J1-123	-13.5	169.85	2,037.71	1,247.49
J1-105	2,004.43 J2-228	19.36	435.69	1,249.30	2,734.85 J1-123	-0.61	199.58	2,039.29	1,249.30
J1-114	2,004.43 J2-228	19.36	435.69	1,250.38	2,982.73 J1-123	-14.96	166.48	2,035.68	1,250.38
J1-447	2,004.43 J2-228	19.36	435.69	1,251.16	2,972.62 J1-123	-14.24	168.14	2,037.61	1,251.16
J1-119	2,004.43 J1-123	-0.6	199.61	1,426.89	2,380.41 J1-123	-15.73	164.7	1,426.89	1,426.89
J1-145	2,004.43 J1-145	1.77	214.08	1,432.19	1,426.98 J2-206	20.02	435.21	1,462.35	1,432.19
J1-157	2,004.43 J2-206	19.55	434.11	1,450.18	2,756.16 J2-206	18.79	432.37	1,450.18	1,450.18
J1-794	2,004.43 J1-794	17.55	255.5	1,876.31	1,866.29 J2-206	19.67	434.4	1,454.82	1,454.82
J1-159	2,004.43 J2-206	19.55	434.12	1,455.50	2,199.43 J2-206	19.37	433.71	1,455.50	1,455.50
J1-151	2,004.43 J2-206	19.55	434.13	1,456.03	2,616.00 J2-206	18.95	432.74	1,456.02	1,456.02
J1-164	2,004.43 J2-206	19.55	434.13	1,457.54	2,650.28 J2-206	18.92	432.66	1,457.54	1,457.54
J1-163	2,004.43 J2-206	19.56	434.13	1,458.02	2,576.74 J2-206	19	432.85	1,458.02	1,458.02
J1-793	2,004.43 J2-206	19.56	434.13	1,458.23	2,230.70 J2-206	19.35	433.65	1,458.23	1,458.23
J1-162	2,004.43 J2-206	19.56	434.13	1,458.50	3,011.57 J1-163	17.98	251.49	2,866.07	1,458.50
J1-148	2,004.43 J2-206	19.56	434.14	1,459.75	3,312.38 J2-206	18.16	430.91	1,459.74	1,459.74
J1-161	2,004.43 J2-206	19.56	434.14	1,460.15	4,902.57 J1-163	6.25	224.43	4,488.42	1,460.15
J1-147	2,004.43 J2-206	19.56	434.14	1,460.58	4,852.46 J1-159	11.92	246.52	4,587.19	1,460.58
J1-150	2,004.43 J2-206	19.56	434.14	1,461.12	4,789.59 J1-159	15.66	255.14	4,644.00	1,461.12
J1-153	2,004.43 J2-206	19.56	434.14	1,462.36	4,721.63 J2-206	16.11	426.18	1,462.35	1,462.35
J1-158	2,012.73 J2-206	19.55	434.12	1,462.39	2,474.36 J2-206	19.11	433.1	1,462.39	1,462.39

J1-152	2,012.73 J2-206	19.55	434.13	1,464.66	2,546.61 J2-206	19.04	432.93	1,464.66	1,464.66
J1-149	2,012.73 J1-149	15.38	233.49	1,844.22	1,837.30 J2-206	19.71	434.49	1,468.04	1,468.04
J1-84	2,004.43 J1-400	-2.17	177	1,534.80	2,404.52 J1-400	-20.93	133.7	1,534.77	1,534.77
J1-120	2,004.43 J1-123	9.47	222.86	1,625.51	2,501.56 J1-123	-9.82	178.35	1,625.50	1,625.50
J1-56	2,004.43 J1-57	-23.67	-5.64	1,627.29	1,641.89 J1-57	18.43	91.53	1,627.29	1,627.29
J1-118	2,004.43 J1-123	11.93	228.53	1,689.80	2,863.89 J1-123	-28.7	134.76	1,689.80	1,689.80
J1-116	2,004.43 J1-123	13.38	231.88	1,734.41	2,924.52 J1-123	-29.77	132.29	1,734.41	1,734.41
J1-121	2,004.43 J1-123	14.4	234.24	1,761.80	2,879.27 J1-123	-27.39	137.79	1,761.80	1,761.80
J1-736	2,004.43 J1-123	15.65	237.11	1,812.56	2,674.87 J1-123	-7.89	182.78	1,812.44	1,812.44
J1-82	2,004.43 J1-400	14.25	214.88	1,835.65	2,525.80 J1-400	-4.77	171	1,835.64	1,835.64
J1-83	2,004.43 J1-83	14.2	144.78	1,910.37	1,907.21 J1-400	17.56	222.52	1,835.64	1,835.64
J1-49	2,004.43 J1-57	10.79	73.9	1,902.65	1,929.62 J1-57	17.59	89.6	1,902.79	1,902.65
J1-117	2,004.43 J1-123	18.36	243.37	1,921.90	3,125.77 J1-123	-32.09	126.94	1,921.88	1,921.88
J1-115	2,004.43 J1-123	18.63	244.01	1,937.78	2,632.58 J1-123	0.84	202.94	1,937.77	1,937.77
J1-60	2,004.43 J2-206	20.6	436.54	4,919.23	9,071.75 J1-123	-37.2	115.15	5,712.99	4,919.23
J1-64	2,004.43 J2-206	20.6	436.55	5,424.57	11,065.98 J1-527	-44.88	116.41	5,652.56	5,424.57
J1-688	2,004.43 J2-206	20.6	436.55	5,445.93	10,011.91 J1-527	-33.54	142.59	5,613.79	5,445.93
J1-686	2,004.43 J2-206	20.6	436.55	5,445.93	10,240.09 J1-527	-36.41	135.96	5,613.79	5,445.93
J1-806	2,004.43 J2-206	20.6	436.55	5,452.11	11,380.06 J1-527	-47.24	110.97	5,602.78	5,452.11
J1-87	2,004.43 J2-206	20.6	436.55	5,471.14	10,881.14 J1-527	-43.81	118.89	5,569.05	5,471.14

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant (gpm)	Critical Node 2 ID	Critical Node 2	Critcal Node 2	Adjusted Available	Design Flow (gpm)
J2-659	2,003.60	J2-659	-78.46	154.92	703.94	702.39	J2-659	20.07	382.32	703.94	703.94
J2-204	2,003.60	J2-206	17.4	429.16	792.64	4,465.03	J2-206	7.13	405.47	792.64	792.64
J2-555	2,003.60	J2-555	-14.13	337.39	866.75	861.9	J2-555	20.09	416.36	866.77	866.75
J2-230	2,003.60	J2-555	-6.28	355.5	974.75	1,963.80	J2-555	-4.95	358.58	974.74	974.74
J2-231	2,003.60	J2-231	-21.74	214.82	1,479.83	1,477.64	J2-555	9.33	391.54	974.74	974.74
J2-838	2,003.60	J2-555	-5.42	357.48	989.56	2,183.96	J2-555	-11.61	343.21	989.55	989.55
J2-670	2,003.60	J2-670	-57.56	173.16	990.11	988.34	J2-670	20.1	352.38	990.11	990.11
J-5095	2,003.60	J-5095	-75.22	116.4	993.8	992.35	J-5095	20.1	336.39	993.8	993.8
J2-839	2,003.60	J2-555	-3.29	362.42	1,026.45	2,423.11	J2-555	-17.49	329.64	1,026.44	1,026.44
J2-840	2,003.60	J2-555	-3.06	362.93	1,031.20	2,595.37	J2-555	-23.66	315.4	1,031.20	1,031.20
J2-669	2,003.60	J2-669	-16.9	298.99	1,037.27	1,033.73	J2-669	20.1	384.4	1,037.27	1,037.27
J2-671	2,003.60	J2-671	-55.87	165.06	1,061.77	1,060.03	J2-671	20.11	340.4	1,061.77	1,061.77
J2-660	2,003.60	J2-660	-48.5	188.07	1,071.10	1,069.19	J2-660	20.11	346.4	1,071.10	1,071.10
J2-662	2,003.60	J2-662	-44.29	197.78	1,096.32	1,094.32	J2-659	19.91	381.95	1,091.23	1,091.23
J2-661	2,003.60	J2-659	-12.95	306.11	1,091.23	1,744.86	J2-659	-2.69	329.78	1,091.23	1,091.23
J2-658	2,003.60	J2-659	-12.95	306.11	1,091.23	2,190.80	J2-659	-21.38	286.66	1,091.23	1,091.23
J2-270	2,003.60	J2-270	-219.92	-397.56	1,110.29	1,109.71	J2-270	20.11	156.41	1,110.28	1,110.28
J2-234	2,003.60	J2-555	1.4	373.22	1,122.81	2,475.68	J2-555	-12.53	341.08	1,122.80	1,122.80
J2-235	2,003.60	J2-555	1.98	374.56	1,136.36	2,424.29	J2-555	-10.07	346.77	1,136.36	1,136.36
J2-233	2,003.60	J2-555	1.98	374.56	1,136.36	2,741.12	J2-555	-20.45	322.79	1,136.36	1,136.36
J2-232	2,003.60	J2-555	2.26	375.22	1,143.22	2,849.12	J2-555	-23.71	315.29	1,143.22	1,143.22
J2-656	2,003.60	J2-671	-31.36	221.63	1,212.02	1,450.07	J2-670	5.72	319.2	1,172.63	1,172.63
J2-702	2,003.60	J2-670	-28.13	241.07	1,172.63	1,504.67	J2-670	1.52	309.5	1,172.63	1,172.63
J2-236	2,003.60	J2-555	3.68	378.48	1,178.88	3,137.15	J2-555	-31.12	298.19	1,178.88	1,178.88
J2-252	2,003.60	J2-252	-75.53	80.7	1,199.19	1,197.87	J2-252	20.12	301.43	1,199.19	1,199.19
J2-237	2,003.60	J2-555	4.49	380.35	1,200.84	2,709.31	J2-555	-15.02	335.34	1,200.83	1,200.83
J2-238	2,003.60	J2-238	-9.21	198.74	1,677.33	1,675.23	J2-555	11.74	397.1	1,200.83	1,200.83
J2-268	2,003.60	J2-268	-109.58	-52.9	1,201.64	1,200.65	J2-268	20.12	246.43	1,201.62	1,201.62
J2-241	2,003.60	J2-555	4.59	380.59	1,203.75	3,295.56	J2-555	-34.77	289.77	1,203.75	1,203.75
J2-239	2,003.60	J2-555	4.64	380.7	1,205.23	3,465.65	J2-555	-41.06	275.25	1,205.22	1,205.22
J2-240	2,003.60	J2-555	4.77	381	1,208.80	3,369.73	J2-555	-37.07	284.44	1,208.79	1,208.79
J2-263	2,003.60	J2-555	4.9	381.3	1,212.52	2,279.13	J2-555	-1.99	365.4	1,212.52	1,212.52
J2-264	2,003.60	J2-264	2.03	195.69	1,810.11	1,808.00	J2-555	9.3	391.45	1,212.52	1,212.52
J2-837	2,003.60	J2-555	4.91	381.33	1,212.63	3,986.10	J2-555	-61.29	228.55	1,212.63	1,212.63
J2-266	2,003.60	J2-266	-2.14	144.07	1,806.66	1,804.91	J2-555	9.4	391.69	1,213.77	1,213.77
J2-262	2,003.60	J2-555	5	381.53	1,215.37	2,517.77	J2-555	-8.45	350.51	1,215.37	1,215.37
J2-257	2,003.60	J2-555	5.21	382.01	1,221.46	2,843.48	J2-555	-17.95	328.58	1,221.46	1,221.46
J2-260	2,003.60	J2-260	-36.81	69.04	1,580.33	1,578.98	J2-555	14.12	402.59	1,222.11	1,222.11
J2-259	2,003.60	J2-555	5.23	382.07	1,222.11	1,954.36	J2-555	6.36	384.68	1,222.11	1,222.11
J2-258	2,003.60	J2-555	5.23	382.07	1,222.11	2,790.84	J2-555	-16.25	332.5	1,222.11	1,222.11
J2-261	2,003.60	J2-555	5.23	382.07	1,222.11	2,034.92	J2-260	4.27	163.85	1,884.69	1,222.11
J2-256	2,003.60	J2-555	5.23	382.08	1,222.26	2,909.66	J2-555	-20.01	323.81	1,222.26	1,222.26
J2-207	2,003.60	J2-206	19.15	433.2	1,222.96	5,215.29	J2-206	12.78	418.49	1,222.96	1,222.96
J2-255	2,003.60	J2-555	5.32	382.27	1,224.71	3,092.80	J2-555	-25.91	310.19	1,224.71	1,224.71
J2-657	2,003.60	J2-670	-20.34	259.07	1,240.28	1,613.91	J2-670	1.09	308.53	1,240.28	1,240.28
J2-554	2,003.60	J2-206	19.24	433.39	1,263.75	9,887.48	J2-206	-1.41	385.74	1,263.75	1,263.75
J2-225	2,003.60	J2-555	7.05	386.28	1,280.02	4,142.64	J2-555	-60.29	230.85	1,280.02	1,280.02
J2-269	2,003.60	J2-270	-135.93	-203.71	1,281.33	1,329.39	J2-270	11.47	136.46	1,281.33	1,281.33
J2-203	2,003.60	J2-206	19.3	433.54	1,281.57	12,582.58	J2-206	-11.48	362.5	1,281.56	1,281.56
J2-226	2,003.60	J2-555	7.36	386.99	1,287.52	3,050.08	J2-555	-20.13	323.55	1,287.52	1,287.52
J2-248	2,003.60	J2-555	7.72	387.82	1,303.21	3,995.05	J2-555	-52.17	249.6	1,303.21	1,303.21
J2-254	2,003.60	J2-555	7.9	388.23	1,306.56	2,043.86	J2-555	7.05	386.27	1,306.56	1,306.56
J2-221	2,003.60	J2-555	8.56	389.75	1,327.93	3,041.66	J2-555	-17.32	330.02	1,327.93	1,327.93
J2-222	2,003.60	J2-555	8.56	389.75	1,327.93	2,147.00	J2-555	5.55	382.82	1,327.93	1,327.93
J2-197	2,003.60	J2-206	19.39	433.75	1,342.35	14,069.85	J2-206	-15.91	352.27	1,342.35	1,342.35
J2-224	2,003.60	J2-555	9.03	390.83	1,347.98	2,479.20	J2-555	-1.45	366.64	1,347.92	1,347.92
J2-223	2,003.60	J2-555	9.03	390.83	1,347.98	4,205.58	J2-555	-55.47	241.99	1,347.92	1,347.92
J2-551	2,003.60	J2-206	19.46	433.92	1,366.59	14,414.98	J2-206	-11.72	361.95	1,366.56	1,366.56
J2-267	2,003.60	J2-268	-62.31	56.21	1,377.67	1,651.35	J2-268	-12.77	170.54	1,377.65	1,377.65
J2-202	2,003.60	J2-206	19.5	433.99	1,384.78	13,962.39	J2-206	-8.35	369.74	1,384.74	1,384.74
J2-198	2,003.60	J2-206	19.47	433.93	1,387.16	10,039.71	J2-206	2.77	395.39	1,387.15	1,387.15
J2-249	2,003.60	J2-555	11.67	396.94	1,455.66	3,222.08	J2-555	-15.49	334.24	1,455.66	1,455.66
J2-220	2,003.60	J2-555	11.64	396.87	1,456.00	4,545.87	J2-555	-57.85	236.49	1,456.00	1,456.00
J2-247	2,003.60	J2-555	11.74	397.08	1,459.23	3,676.31	J2-555	-28.28	304.73	1,459.23	1,459.23
J2-246	2,003.60	J2-555	11.9	397.46	1,466.59	3,617.09	J2-555	-26.04	309.9	1,466.59	1,466.59
J2-199	2,003.60	J2-206	19.58	434.18	1,476.16	5,462.20	J2-206	15.02	423.66	1,476.29	1,476.16
J2-192	2,003.60	J2-206	19.58	434.18	1,483.83	13,973.25	J2-206	-9.22	367.72	1,483.83	1,483.83
J2-219	2,003.60	J2-555	12.91	399.8	1,508.34	3,867.78	J2-555	-30.07	300.61	1,508.40	1,508.34
J2-250	2,003.60	J2-555	12.83	399.61	1,511.87	2,663.71	J2-555	0.22	370.51	1,511.87	1,511.87
J2-245	2,003.60	J2-555	13.08	400.18	1,524.23	3,758.93	J2-555	-26.76	308.23	1,524.23	1,524.23
J2-265	2,003.60	J2-268	-33.22	123.32	1,530.96	1,823.04	J2-268	-11.45	173.57	1,530.95	1,530.95

J2-253	2,003.60	J2-555	13.24	400.56	1,532.67	3,253.39	J2-555	-12.76	340.56	1,532.67	1,532.67
J2-244	2,003.60	J2-555	13.26	400.61	1,533.75	3,830.99	J2-555	-28.3	304.69	1,533.75	1,533.75
J2-552	2,003.60	J2-206	19.65	434.34	1,544.69	5,001.72	J2-206	16.02	425.98	1,544.69	1,544.69
J2-208	2,003.60	J2-206	19.64	434.33	1,547.52	8,808.13	J2-206	7.67	406.7	1,547.52	1,547.52
J2-196	2,003.60	J2-206	19.66	434.37	1,556.35	13,886.67	J2-206	-6.27	374.53	1,556.35	1,556.35
J2-663	2,003.60	J2-669	13.57	369.32	1,567.59	3,510.88	J2-669	-26.45	276.97	1,567.58	1,567.58
J2-653	2,003.60	J2-206	19.73	434.54	1,592.73	13,616.09	J2-654	-19.81	244.29	8,297.67	1,592.73
J2-553	2,003.60	J2-553	16.45	284.96	1,944.23	1,940.81	J2-206	19.76	434.6	1,609.42	1,609.42
J2-195	2,003.60	J2-206	19.71	434.49	1,609.42	3,974.79	J2-553	13.03	277.07	3,751.07	1,609.42
J2-212	2,003.60	J2-212	-14.77	198.92	1,610.72	1,608.66	J2-212	20.16	279.53	1,610.73	1,610.72
J2-251	2,003.60	J2-252	-9.95	232.03	1,612.98	1,817.64	J2-252	5.02	266.57	1,612.99	1,612.98
J3-973	2,003.60	J3-973	-0.71	263.37	1,622.80	1,619.41	J3-973	20.16	311.53	1,622.80	1,622.80
J2-243	2,003.60	J2-555	15.14	404.94	1,641.12	4,537.28	J2-555	-43.14	270.43	1,641.12	1,641.12
J2-194	2,003.60	J2-206	19.76	434.6	1,666.85	3,692.80	J2-206	18.17	430.94	1,666.85	1,666.85
J2-193	2,003.60	J2-206	19.77	434.62	1,675.20	13,697.71	J2-206	-2.44	383.36	1,675.20	1,675.20
J2-218	2,003.60	J2-555	15.96	406.83	1,691.62	5,370.14	J2-555	-65.45	218.95	1,691.62	1,691.62
J2-188	2,003.60	J2-206	19.83	434.76	1,751.12	14,001.33	J2-206	-1.68	385.13	1,751.12	1,751.12
J3-971	2,003.60	J3-973	7.64	282.63	1,752.65	1,885.37	J3-973	13.69	296.59	1,752.65	1,752.65
J2-213	2,003.60	J2-555	16.91	409.02	1,759.57	5,856.53	J2-555	-77.09	192.09	1,759.57	1,759.57
J2-191	2,003.60	J2-206	19.85	434.8	1,780.09	2,720.22	J2-206	19.29	433.53	1,780.09	1,780.09
J2-211	2,003.60	J2-555	18.56	412.84	1,872.20	4,780.27	J2-555	-33.25	293.26	1,872.28	1,872.19
J2-215	2,003.60	J2-555	18.64	413.01	1,888.28	6,032.00	J2-555	-71.3	205.45	1,888.43	1,888.28
J3-970	2,003.60	J3-973	16.32	302.67	1,919.65	2,197.02	J3-973	7.22	281.66	1,919.61	1,919.61
J2-210	2,003.60	J2-555	19.46	414.9	1,951.35	5,221.09	J2-555	-39.81	278.13	1,951.40	1,951.35
J2-187	2,003.60	J2-206	19.98	435.11	1,983.91	6,979.19	J2-206	15.21	424.1	1,983.91	1,983.91
J2-217	2,003.60	J2-555	19.81	415.72	1,986.19	4,756.78	J2-555	-24.83	312.7	1,986.26	1,986.19
J2-216	2,003.60	J2-555	19.93	416.01	1,998.00	4,680.03	J2-555	-22.3	318.54	1,998.06	1,998.00
J2-189	2,003.60	J2-206	20.01	435.19	2,045.08	12,161.06	J2-206	8.16	407.84	2,045.08	2,045.08
J2-664	2,003.60	J2-206	20.62	436.59	19,385.88	3,431.40	J2-669	-3.5	329.93	2,105.60	2,105.60
J2-185	2,003.60	J2-206	20.1	435.4	2,238.38	6,140.20	J2-206	16.97	428.17	2,238.38	2,238.38
J2-833	2,003.60	J2-206	20.62	436.59	19,381.08	2,735.48	J2-669	13.27	368.63	2,256.73	2,256.73
J2-668	2,003.60	J2-206	20.62	436.59	19,400.44	2,614.18	J3-973	5.8	278.39	2,263.77	2,263.77
J5-832	2,003.60	J2-206	20.62	436.59	19,380.85	2,741.33	J2-669	13.3	368.7	2,263.87	2,263.87
J4-424	2,003.60	J2-206	20.62	436.59	19,366.41	2,288.46	J4-424	20.23	390.68	2,313.32	2,313.32
J2-667	2,003.60	J2-206	20.62	436.59	19,400.44	2,764.14	J3-973	2.76	271.37	2,333.58	2,333.58
J2-665	2,003.60	J2-206	20.62	436.59	19,400.43	3,947.21	J2-669	-4.64	327.28	2,448.08	2,448.08
J4-425	2,003.60	J2-206	20.62	436.59	19,422.80	2,810.46	J4-424	16.65	382.43	2,465.05	2,465.05
J2-186	2,003.60	J2-206	20.2	435.62	2,500.21	5,012.80	J2-206	18.42	431.51	2,500.21	2,500.21
J4-844	2,003.60	J2-206	20.62	436.59	19,407.71	3,674.57	J2-669	3.79	346.74	2,540.85	2,540.85
J4-843	2,003.60	J2-206	20.62	436.59	19,408.49	3,312.59	J2-669	9.87	360.78	2,549.29	2,549.29
J2-184	2,003.60	J2-206	20.22	435.66	2,549.49	2,848.94	J2-206	19.84	434.8	2,549.49	2,549.49
J2-172	2,003.60	J2-206	20.22	435.66	2,551.58	4,766.30	J2-206	18.66	432.07	2,551.58	2,551.58
J2-170	2,003.60	J2-206	20.22	435.66	2,554.18	4,441.78	J2-206	18.89	432.6	2,554.18	2,554.18
J2-449	2,003.60	J2-206	20.22	435.66	2,554.34	4,363.97	J2-206	18.95	432.72	2,554.34	2,554.34
J2-169	2,003.60	J2-206	20.22	435.66	2,556.41	3,620.87	J2-206	19.42	433.82	2,556.41	2,556.41
J2-173	2,003.60	J2-206	20.22	435.66	2,556.65	2,936.74	J2-206	19.8	434.7	2,556.65	2,556.65
J2-168	2,003.60	J2-206	20.22	435.66	2,557.34	3,870.30	J2-206	19.27	433.47	2,557.34	2,557.34
J2-166	2,003.60	J2-206	20.22	435.66	2,561.20	4,762.89	J2-206	18.68	432.1	2,561.20	2,561.20
J2-448	2,003.60	J2-206	20.22	435.67	2,562.24	4,749.08	J2-206	18.69	432.13	2,562.24	2,562.24
J2-450	2,003.60	J2-206	20.22	435.67	2,565.45	4,752.94	J2-206	18.69	432.13	2,565.45	2,565.45
J2-165	2,003.60	J2-206	20.22	435.67	2,565.89	4,059.81	J2-206	19.16	433.21	2,565.89	2,565.89
J1-733	2,003.60	J2-206	20.22	435.67	2,567.52	4,065.97	J2-206	19.15	433.21	2,567.52	2,567.52
J2-167	2,003.60	J2-206	20.22	435.67	2,571.71	4,847.92	J2-206	18.63	431.99	2,571.71	2,571.71
J2-175	2,003.60	J2-206	20.23	435.69	2,592.74	4,227.04	J2-206	19.07	433.02	2,592.74	2,592.74
J2-174	2,003.60	J2-206	20.23	435.69	2,595.75	4,793.37	J2-206	18.69	432.14	2,595.75	2,595.75
J2-182	2,003.60	J2-206	20.23	435.7	2,604.76	3,794.77	J2-206	19.35	433.67	2,604.76	2,604.76
J2-179	2,003.60	J2-206	20.24	435.7	2,611.68	4,692.45	J2-181	18.63	358	4,591.20	2,611.68
J2-176	2,003.60	J2-206	20.24	435.71	2,622.65	4,937.18	J2-181	16.64	353.4	4,684.45	2,622.65
J2-181	2,003.60	J2-206	20.24	435.71	2,623.43	3,748.19	J2-206	19.4	433.76	2,623.43	2,623.43
J2-178	2,003.60	J2-206	20.24	435.71	2,629.66	4,146.45	J2-206	19.16	433.21	2,629.66	2,629.66
J2-180	2,003.60	J2-206	20.24	435.71	2,631.01	4,167.14	J2-206	19.15	433.19	2,631.01	2,631.01
J2-177	2,003.60	J2-206	20.25	435.73	2,650.51	5,384.52	J2-181	11.67	341.93	4,762.86	2,650.51
J2-451	2,003.60	J2-206	20.26	435.75	2,680.13	5,576.77	J2-181	12.68	344.26	4,999.51	2,680.13
J2-666	2,003.60	J2-206	20.62	436.59	19,400.43	3,163.89	J3-973	2.98	271.88	2,688.55	2,688.55
J2-183	2,003.60	J2-206	20.26	435.76	2,691.14	4,188.46	J2-206	19.17	433.25	2,691.14	2,691.14
J2-214	2,003.60	J2-206	20.31	435.88	2,928.17	7,690.47	J2-555	-47.91	259.42	2,694.26	2,694.26
J2-209	2,003.60	J2-206	20.31	435.87	2,917.93	8,622.43	J2-555	-62.31	226.19	2,791.52	2,791.52
J2-190	2,003.60	J2-206	20.34	435.94	3,031.84	12,307.93	J2-555	11.36	396.22	8,841.77	3,031.84

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant (gpm)	Critical Node 2 ID	Critical Node 2	Critcal Node 2	Adjusted Available Flow (gpm)	Design Flow (gpm)
J5-638	2,004.38	J5-638	-439.51	-584.33	384.11	383.76	J5-638	20.04	476.24	384.11	384.11
J5-640	2,004.38	J5-640	-311.12	-298.03	493.52	493.04	J5-638	18.91	473.65	480.82	480.82
J5-639	2,004.38	J5-638	-272.52	-198.93	480.82	499.64	J5-638	18.31	472.27	480.82	480.82
J5-841	2,004.38	J5-638	-216.96	-70.72	534.03	565.49	J5-638	17.45	470.27	534.03	534.03
J5-637	2,004.38	J5-638	-169.91	37.88	595.7	703.3	J5-638	11.82	457.29	595.7	595.7
J2-652	2,004.38	J2-652	-356.97	-473.84	676.95	676.55	J2-652	20.07	396.31	676.98	676.95
J5-842	2,004.38	J5-842	-71.76	274.38	764.89	763.16	J5-842	20.08	486.33	764.85	764.85
J2-650	2,004.38	J2-650	-102.55	120.33	1,068.15	1,067.03	J2-650	20.11	403.4	1,068.15	1,068.15
J5-636	2,004.38	J5-842	5.37	452.4	1,478.54	2,510.45	J5-842	-12.27	411.68	1,478.51	1,478.51
J5-644	2,004.38	J5-644	0.46	356.06	1,711.76	1,708.98	J5-644	20.17	401.55	1,711.75	1,711.75
J4-501	2,004.38	J4-501	12.26	278.3	1,927.30	1,925.33	J4-501	20.19	296.6	1,927.30	1,927.30
J3-1001	2,004.38	J3-1001	15.33	353.38	1,937.20	1,934.35	J3-1001	20.19	364.6	1,937.20	1,937.20
J2-648	2,004.38	J2-206	20.59	436.51	6,166.28	2,073.51	J2-648	20.21	328.63	2,076.14	2,076.14
J-5013	2,004.38	J2-206	20.59	436.53	6,483.12	2,093.90	J-5013	20.21	320.64	2,096.54	2,096.54
J-5014	2,004.38	J2-206	20.59	436.53	6,483.12	2,193.30	J-5013	15.89	310.66	2,141.26	2,141.26
J-5016	2,004.38	J2-206	20.59	436.53	6,483.12	2,352.68	J-5013	8.02	292.5	2,199.72	2,199.72
J-5015	2,004.38	J2-206	20.59	436.53	6,483.12	2,297.34	J-5013	12.43	302.69	2,199.72	2,199.72
J-5017	2,004.38	J2-206	20.59	436.53	6,483.12	2,409.05	J-5013	3.42	281.89	2,199.72	2,199.72
J3-999	2,004.38	J2-206	20.59	436.53	6,483.13	2,199.72	J3-1001	20.22	364.66	2,203.39	2,203.39
J3-1000	2,004.38	J2-206	20.59	436.53	6,483.13	2,200.70	J3-1000	20.22	362.66	2,204.34	2,204.34
J-5020	2,004.38	J2-206	20.59	436.53	6,483.12	2,353.06	J3-1000	10.69	340.66	2,204.34	2,204.34
J3-998	2,004.38	J2-206	20.59	436.53	6,483.13	2,203.94	J3-998	20.22	378.67	2,207.96	2,207.96
J-5019	2,004.38	J2-206	20.59	436.53	6,483.12	2,323.86	J-5013	12.43	302.69	2,225.21	2,225.21
J3-997	2,004.38	J2-206	20.59	436.53	6,483.13	2,275.41	J3-997	20.23	383.68	2,279.84	2,279.84
J3-1007	2,004.38	J2-206	20.59	436.53	6,483.13	2,453.66	J3-1007	20.24	424.72	2,460.69	2,460.69
J2-651	2,004.38	J2-206	20.59	436.51	6,166.28	2,457.95	J2-651	20.25	415.72	2,464.31	2,464.31
J-5092	2,004.38	J2-206	20.59	436.51	6,166.28	4,039.05	J2-651	-57.94	235.28	2,464.31	2,464.31
J-527	2,007.20	J2-206	20.59	436.53	6,485.95	2,512.18	J-527	20.25	393.74	2,517.94	2,517.94
J3-1005	2,004.38	J2-206	20.59	436.53	6,483.13	2,595.08	J3-1005	20.26	426.76	2,603.09	2,603.09
J2-647	2,004.38	J2-206	20.59	436.51	6,166.28	3,001.78	J2-650	3.83	365.83	2,622.38	2,622.38
J3-996	2,004.38	J2-206	20.59	436.53	6,483.13	2,665.27	J3-996	20.27	408.77	2,672.52	2,672.52
J3-1010	2,004.38	J2-206	20.59	436.53	6,483.13	2,701.38	J3-1010	20.27	311.78	2,705.54	2,705.54
J5-815	2,004.38	J2-206	20.59	436.53	6,483.14	2,720.84	J5-815	20.27	421.78	2,729.02	2,729.02
J3-1002	2,004.38	J2-206	20.59	436.53	6,483.13	2,949.02	J3-996	14.15	394.66	2,788.08	2,788.08
J3-1003	2,004.38	J2-206	20.59	436.53	6,483.13	3,120.98	J3-1005	12.39	408.59	2,872.79	2,872.79
J3-1009	2,004.38	J2-206	20.59	436.53	6,483.13	2,948.18	J3-1005	17.74	420.95	2,872.79	2,872.79
J3-1006	2,004.38	J2-206	20.59	436.53	6,483.13	3,218.44	J3-1005	10.35	403.88	2,903.69	2,903.69
J3-1008	2,004.38	J2-206	20.59	436.53	6,483.13	3,400.43	J3-1008	20.34	370.94	3,409.28	3,409.28
J2-649	2,004.38	J2-206	20.59	436.51	6,166.28	3,806.36	J2-651	9.55	391.03	3,449.68	3,449.68
J5-799	2,004.38	J2-206	20.59	436.53	6,483.13	4,441.93	J3-1005	16.06	417.06	4,252.35	4,252.35
J2-646	2,004.38	J2-206	20.59	436.51	6,166.28	5,486.41	J2-650	-8.06	338.39	4,428.26	4,428.26
J5-634	2,004.38	J2-206	20.62	436.59	9,501.47	8,303.42	J5-842	3.46	447.98	6,043.58	6,043.58
J2-729	2,004.38	J2-206	20.59	436.51	6,166.28	7,428.30	J2-650	2.53	362.83	6,444.86	6,166.28
J5-643	2,004.38	J2-206	20.59	436.51	6,166.28	7,958.50	J2-651	9.09	389.99	7,197.23	6,166.28
J5-797	2,004.38	J2-206	20.59	436.53	6,483.14	7,589.97	J3-1005	12.88	409.72	7,041.84	6,483.14
J5-633	2,004.38	J2-206	20.62	436.59	10,255.95	6,243.24	J2-206	20.42	436.13	10,255.94	10,255.94

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant (gpm)	Critical Node 2 ID	Critical Node 2	Critcal Node 2	Adjusted Available Flow (gpm)	Design Flow (gpm)
J3-755	2,019.41	J3-853	16.99	781.21	970.49	1,990.51	J3-853	17.12	781.51	970.45	970.45
J3-753	2,019.41	J3-853	16.99	781.21	970.49	2,496.43	J3-853	14.74	776.02	970.45	970.45
J3-748	2,019.41	J3-748	9.07	470.93	1,863.38	1,860.63	J3-853	17.73	782.91	970.45	970.45
J3-758	2,019.41	J3-853	16.99	781.21	970.49	2,521.91	J3-755	12.87	497.7	2,407.74	970.49
J3-754	2,019.41	J3-853	16.99	781.21	970.49	2,489.73	J3-755	2.75	474.34	2,250.52	970.49
J3-559	2,019.41	J3-853	16.99	781.21	970.5	2,479.89	J3-755	3.78	476.72	2,250.52	970.5
J3-751	2,019.41	J3-853	16.99	781.21	970.5	2,444.22	J3-748	2.91	456.71	2,201.38	970.5
J4-414	2,019.41	J4-414	-35.03	320.15	1,004.50	1,001.97	J4-414	20.1	447.38	1,004.53	1,004.50
J4-756	2,019.41	J4-756	1.71	431.95	1,125.56	1,118.42	J4-756	20.11	474.41	1,125.56	1,125.56
J4-690	2,019.41	J3-853	19.5	787	1,201.70	3,608.71	J3-853	17.99	783.51	1,201.72	1,201.70
J4-691	2,019.41	J3-853	19.82	787.74	1,265.39	3,148.68	J3-853	18.28	784.18	1,265.40	1,265.39
J4-530	2,007.20	J3-853	19.92	787.96	1,275.42	3,090.84	J3-853	18.32	784.28	1,275.42	1,275.42
J4-528	2,007.20	J3-853	19.92	787.96	1,275.42	3,892.96	J4-691	13.71	465.65	3,343.09	1,275.42
J4-692	2,019.41	J3-853	19.94	788.01	1,292.32	3,983.12	J4-691	13.01	464.03	3,387.23	1,292.32
J4-693	2,019.41	J3-853	20	788.15	1,306.52	4,186.49	J4-691	11.25	459.95	3,481.47	1,306.52
J4-694	2,019.41	J3-853	20.05	788.27	1,318.43	4,113.60	J4-691	13.27	464.64	3,559.90	1,318.43
J4-696	2,019.41	J3-853	20.52	789.36	1,411.05	5,701.31	J4-690	-2.26	435.78	4,126.21	1,411.05
J4-695	2,019.41	J3-853	20.51	789.33	1,420.48	5,468.49	J4-690	1.05	443.43	4,076.40	1,420.48
J3-759	2,019.41	J3-759	0.85	396.97	1,465.04	1,460.20	J3-759	20.14	441.49	1,465.04	1,465.04
J4-747	2,019.41	J3-956	-16.27	572.46	1,544.05	1,892.17	J3-716	-5.23	612.92	1,512.80	1,512.80
J4-746	2,019.41	J4-746	-50.41	333.66	1,589.85	1,609.44	J3-716	16.39	662.83	1,512.80	1,512.80
J4-697	2,019.41	J3-853	20.96	790.36	1,547.72	5,743.41	J4-690	-1.16	438.32	4,257.55	1,547.72
J4-698	4,019.41	J3-853	18.13	783.85	1,615.55	6,515.67	J4-690	-12.8	411.46	4,377.08	1,615.55
J4-412	2,019.41	J4-414	11.72	428.05	1,685.38	2,026.66	J4-414	11.53	427.6	1,685.37	1,685.37
J4-413	2,019.41	J4-414	11.72	428.05	1,685.38	1,938.80	J4-414	13.83	432.93	1,685.37	1,685.37
J-5064	2,019.41	J-5064	-3.57	239.75	1,765.90	1,763.92	J-5064	20.17	294.56	1,765.91	1,765.90
J4-742	2,019.41	J3-853	21.53	791.7	1,901.71	6,679.49	J4-690	-12.84	411.37	4,535.66	1,901.71
J3-865	2,019.41	J3-865	17.07	429.4	1,904.19	1,896.61	J3-865	20.19	436.59	1,904.19	1,904.19
J4-699	2,028.23	J3-853	21.53	791.7	1,910.53	5,015.83	J4-690	14.04	473.41	4,544.48	1,910.53
J4-622	2,019.41	J4-622	20.5	447.31	2,045.73	2,035.16	J4-622	20.2	446.62	2,045.73	2,045.73
J4-411	2,019.41	J4-414	21.94	451.65	2,128.26	2,692.93	J4-414	8.55	420.72	2,128.26	2,128.26
J4-741	4,019.41	J3-853	18.48	784.66	2,150.95	6,633.40	J4-690	-7.84	422.91	4,753.18	2,150.95
J4-764	2,019.41	J3-853	24.48	798.51	6,591.96	2,214.87	J4-764	20.22	398.66	2,221.15	2,221.15
J-5065	2,019.41	J3-853	24.16	797.76	5,959.05	2,357.89	J-5065	20.23	293.7	2,361.46	2,361.46
J-5061	2,019.41	J3-853	24.16	797.76	5,959.55	2,544.08	J-5061	20.25	276.74	2,547.93	2,547.93
J3-101	2,019.41	J3-853	24.17	797.77	5,973.74	2,872.64	J3-101	20.29	281.82	2,877.63	2,877.63
J4-625	2,019.41	J3-853	24.17	797.78	6,016.09	2,865.99	J4-625	20.28	406.81	2,878.23	2,878.23
J3-972	2,019.41	J3-853	24.17	797.77	5,973.74	2,880.84	J3-972	20.29	306.82	2,886.56	2,886.56
J4-410	2,019.41	J3-570	25	505.7		3,506.46	J4-414	11.21	426.87	2,908.07	2,908.07
J3-963	2,019.41	J3-853	24	797.39	5,375.80	2,939.80	J3-963	20.29	366.83	2,948.06	2,948.06
J4-750	2,019.41	J3-853	24.16	797.76	5,954.43	3,273.17	J3-759	16.42	432.89	3,030.31	3,030.31
J-5071	2,019.41	J3-853	24.17	797.77	5,973.74	3,046.37	J-5071	20.3	294.86	3,052.37	3,052.37
J-5070	2,019.41	J3-853	24.17	797.77	5,973.74	3,114.76	J-5070	20.31	304.87	3,121.39	3,121.39
J-5063	2,019.41	J3-853	24.16	797.76	5,959.05	3,229.00	J-5064	16.84	286.87	3,163.67	3,163.67
J3-100	2,019.41	J3-853	24.17	797.77	5,973.74	3,190.39	J3-100	20.32	318.89	3,197.95	3,197.95
J-5069	2,019.41	J3-853	24.17	797.77	5,973.74	3,314.19	J-5069	20.33	318.92	3,322.36	3,322.36
J3-964	2,019.41	J3-853	24.04	797.47	5,507.46	3,394.83	J3-964	20.34	370.94	3,406.24	3,406.24
J4-739	2,019.41	J3-853	23.26	795.68	3,560.45	8,197.87	J3-853	11.94	769.55	3,560.45	3,560.45
J4-428	2,019.41	J3-853	24.17	797.78	6,016.08	3,600.91	J4-625	19.49	404.98	3,573.48	3,573.48
J4-767	2,019.41	J3-853	24.49	798.52	6,635.75	3,566.11	J4-767	20.35	378.98	3,579.91	3,579.91
J4-2009	2,019.41	J3-853	24.47	798.46	6,613.94	3,588.04	J4-2009	20.36	366.98	3,601.09	3,601.09
J3-966	2,019.41	J3-853	23.52	796.27	4,672.37	3,600.08	J3-966	20.36	396.98	3,609.75	3,609.75
J4-2017	2,019.41	J3-853	24.35	798.19	6,392.83	3,611.32	J4-2017	20.36	366.99	3,624.19	3,624.19
J4-2007	2,019.41	J3-853	24.47	798.46	6,613.94	3,613.15	J4-2007	20.36	366.99	3,626.39	3,626.39
J4-2005	2,019.41	J3-853	24.47	798.46	6,613.94	3,637.19	J4-2005	20.36	366.99	3,650.60	3,650.60
J4-766	2,019.41	J3-853	24.49	798.51	6,631.02	3,640.71	J4-766	20.36	381.99	3,655.50	3,655.50
J-5072	2,019.41	J3-853	24.47	798.46	6,613.94	3,647.55	J-5072	20.36	366.99	3,661.05	3,661.05
J4-620	2,019.41	J3-853	23.94	797.25	5,020.64	3,992.58	J4-622	16.93	439.07	3,705.50	3,705.50
J4-2008	2,019.41	J3-853	24.47	798.46	6,613.94	3,699.17	J4-2008	20.37	367.01	3,713.07	3,713.07
J4-2018	2,019.41	J3-853	24.43	798.39	6,553.84	3,738.21	J4-2018	20.37	367.02	3,752.07	3,752.07
J-5068	2,019.41	J3-853	24.17	797.77	5,973.74	3,745.52	J-5068	20.37	347.02	3,758.11	3,758.11
J4-2002	2,019.41	J3-853	24.47	798.46	6,613.94	3,766.88	J4-2002	20.37	359.02	3,780.27	3,780.27
J3-967	2,019.41	J3-853	23.15	795.42	4,317.30	3,795.26	J3-967	20.38	397.03	3,802.82	3,802.82
J4-2006	2,019.41	J3-853	24.47	798.46	6,613.94	3,823.66	J4-2006	20.38	367.04	3,838.54	3,838.54
J3-364	2,019.41	J3-853	23.02	795.13	3,852.72	4,192.01	J3-364	20.42	407.12	4,196.72	3,852.72
J4-2004	2,019.41	J3-853	24.47	798.46	6,613.94	3,847.58	J4-2004	20.38	367.04	3,862.62	3,862.62
J3-965	2,019.41	J3-853	23.96	797.31	5,262.77	3,981.80	J3-965	20.4	352.07	3,995.39	3,995.39
J4-738	2,019.41	J3-853	23.59	796.45	4,163.31	6,499.56	J3-853	17.12	781.5	4,163.33	4,163.31
J4-432	2,019.41	J3-853	24.16	797.76	5,959.55	4,196.63	J-5061	19.21	274.33	4,176.44	4,176.44
J-5060	2,019.41	J3-853	24.16	797.76	5,959.55	4,275.68	J-5061	16.09	267.12	4,176.44	4,176.44

J4-2003	2,019.41	J3-853	24.47	798.46	6,613.94	4,239.33	J4-2009	20.41	367.1	4,257.04	4,257.04
J3-969	2,019.41	J3-853	23.15	795.42	4,317.30	5,154.19	J3-967	16.18	387.34	4,970.69	4,317.30
J-5062	2,019.41	J3-853	24.16	797.76	5,959.05	4,347.03	J-5064	19.11	292.1	4,321.35	4,321.35
J-5009	2,019.41	J3-853	24.16	797.76	5,959.55	4,442.61	J-5061	20.43	277.16	4,454.47	4,454.47
J4-796	2,019.41	J3-853	23.94	797.26	5,029.49	4,722.46	J4-622	18.41	442.48	4,535.15	4,535.15
J4-740	2,179.02	J3-853	23.69	796.67	4,554.67	6,928.40	J3-853	16.51	780.09	4,554.67	4,554.67
J4-772	2,019.41	J3-853	24.49	798.51	6,631.02	4,584.78	J4-772	20.46	387.21	4,609.61	4,609.61
J4-752	2,019.41	J3-853	24.16	797.76	5,954.43	11,775.04	J4-756	-5.26	415.86	4,621.48	4,621.48
J4-439	2,019.41	J3-853	24.6	798.78	6,925.65	4,590.93	J4-439	20.46	408.21	4,621.74	4,621.74
J3-968	2,019.41	J3-853	23.52	796.27	4,672.37	6,265.90	J3-966	12.82	379.59	5,798.26	4,672.37
J4-2016	2,019.41	J3-853	24.28	798.04	6,274.21	4,710.90	J4-2016	20.47	367.24	4,732.97	4,732.97
J4-619	2,019.41	J3-853	23.65	796.59	4,801.79	10,916.31	J3-853	3.97	751.16	4,801.78	4,801.78
J-5055	2,019.41	J3-853	24.16	797.76	5,960.00	4,974.90	J-5055	20.5	247.3	4,988.27	4,988.27
J4-763	2,019.41	J3-853	24.38	798.27	6,405.85	4,974.92	J4-763	20.5	377.3	5,001.33	5,001.33
J4-618	2,019.41	J3-853	23.94	797.25	5,006.89	8,898.86	J3-853	12.8	771.55	5,006.47	5,006.47
J4-2015	2,019.41	J3-853	24.35	798.19	6,392.83	5,010.99	J4-2017	20.5	367.31	5,036.09	5,036.09
J4-621	2,019.41	J3-853	23.95	797.26	5,055.59	9,946.50	J3-853	10.04	765.17	5,055.58	5,055.58
J4-749	2,019.41	J3-853	24.09	797.6	5,711.72	7,383.20	J4-756	15.09	462.83	5,059.80	5,059.80
J4-2001	2,019.41	J3-853	24.47	798.46	6,613.94	5,055.37	J4-2009	20.46	367.22	5,079.18	5,079.18
J4-617	2,019.41	J3-853	23.95	797.28	5,093.19	5,769.89	J3-853	20.13	788.46	5,093.08	5,093.08
J4-616	2,019.41	J3-853	23.95	797.28	5,106.44	6,502.70	J3-853	18.51	784.71	5,106.17	5,106.17
J4-615	2,019.41	J3-853	23.96	797.29	5,120.40	6,269.22	J3-853	19.06	785.99	5,119.99	5,119.99
J4-607	2,019.41	J3-853	23.96	797.3	5,122.07	11,218.14	J3-853	4.7	752.86	5,122.00	5,122.00
J4-614	2,019.41	J3-853	23.96	797.29	5,131.94	11,354.79	J3-853	4.37	752.1	5,131.85	5,131.85
J4-610	2,019.41	J3-853	23.96	797.29	5,146.98	7,201.35	J3-853	17.03	781.29	5,146.97	5,146.97
J-5059	2,019.41	J3-853	24.16	797.76	5,959.99	5,133.81	J-5059	20.51	247.34	5,148.09	5,148.09
J4-609	2,019.41	J3-853	23.96	797.29	5,149.27	8,024.72	J3-853	15.16	776.98	5,148.77	5,148.77
J4-606	2,019.41	J3-853	23.98	797.34	5,151.42	17,096.14	J3-784	-19	501.16	10,563.82	5,151.42
J4-608	2,019.41	J3-853	23.97	797.31	5,182.16	9,292.45	J3-853	12.44	770.71	5,181.98	5,181.98
J4-611	2,019.41	J3-853	23.97	797.31	5,183.55	12,159.44	J3-853	-0.03	741.94	5,183.13	5,183.13
J-5057	2,019.41	J3-853	24.16	797.76	5,960.00	5,170.80	J-5057	20.52	247.35	5,185.29	5,185.29
J4-421	2,019.41	J3-570	25	505.7		5,158.73	J4-421	20.51	408.34	5,196.69	5,196.69
J4-612	2,019.41	J3-853	23.97	797.33	5,207.85	12,755.89	J3-853	-3.89	733.03	5,207.86	5,207.85
J4-613	2,019.41	J3-853	23.96	797.31	5,262.77	12,494.44	J3-853	-1.98	737.44	5,262.78	5,262.77
J-5050	2,019.41	J3-853	24.16	797.76	5,959.98	5,253.35	J-5050	20.52	247.37	5,268.33	5,268.33
J-5052	2,019.41	J3-853	24.16	797.76	5,959.99	5,274.76	J-5052	20.53	247.37	5,289.87	5,289.87
J-5058	2,019.41	J3-853	24.16	797.76	5,959.99	5,306.76	J-5058	20.53	247.38	5,322.06	5,322.06
J3-962	2,019.41	J3-853	24.04	797.47	5,507.46	9,238.23	J4-756	13.01	458.03	5,331.43	5,331.43
J-5049	2,019.41	J3-853	24.16	797.76	5,959.91	5,323.17	J-5049	20.53	247.38	5,338.55	5,338.55
J-5051	2,019.41	J3-853	24.16	797.76	5,959.97	5,338.89	J-5051	20.53	247.39	5,354.39	5,354.39
J-5053	2,019.41	J3-853	24.16	797.76	5,959.98	6,256.53	J-5059	-11.33	173.86	5,372.95	5,372.95
J3-961	2,019.41	J3-853	24	797.39	5,375.80	11,223.76	J3-853	6.64	757.31	5,375.81	5,375.80
J4-433	2,019.41	J3-853	24.02	797.44	5,385.04	18,499.17	J3-784	-19.3	500.45	11,062.64	5,385.04
J-5056	2,019.41	J3-853	24.16	797.76	5,960.00	5,371.47	J-5056	20.54	247.39	5,387.15	5,387.15
J4-757	2,019.41	J3-853	24.21	797.88	6,121.59	15,896.39	J4-756	-8.44	408.53	5,416.01	5,416.01
J-5048	2,019.41	J3-853	24.16	797.76	5,959.81	5,422.54	J-5048	20.54	247.4	5,438.49	5,438.49
J-5054	2,019.41	J3-853	24.16	797.76	5,960.01	5,443.62	J-5054	20.54	247.41	5,459.73	5,459.73
J4-858	2,019.41	J3-853	24.05	797.5	5,484.60	18,220.96	J3-784	-18.06	503.31	11,251.68	5,484.60
J-5047	2,019.41	J3-853	24.16	797.76	5,959.55	5,981.28	J-5061	7.57	247.47	5,554.96	5,554.96
J-5073	2,019.41	J3-853	24.12	797.68	5,793.30	7,161.63	J4-756	17.89	469.29	5,588.94	5,588.94
J-5074	2,019.41	J3-853	24.12	797.68	5,793.30	19,014.52	J4-756	-24.82	370.71	5,588.94	5,588.94
JF-101	2,019.41	J3-853	24.16	797.76	5,959.90	5,602.46	JF-101	20.56	277.45	5,621.80	5,621.80
J4-830	2,019.41	J3-853	24.1	797.62	5,684.85	18,371.35	J4-756	-19.54	382.9	5,745.21	5,684.85
J4-773	2,019.41	J3-853	24.48	798.51	6,591.96	5,646.08	J4-773	20.56	408.46	5,692.61	5,692.61
J5-856	2,006.41	J3-853	24.12	797.67	5,791.33	11,136.12	J4-430	1.15	360.65	8,484.37	5,791.33
J4-436	2,019.41	J3-853	24.69	798.98	7,125.96	5,745.21	J4-436	20.57	409.48	5,794.22	5,794.21
J4-435	2,019.41	J3-853	24.43	798.39	6,502.02	9,485.42	J4-756	13.97	460.24	5,830.30	5,830.30
J-5067	2,019.41	J3-853	24.17	797.77	5,973.74	5,837.74	J-5067	20.58	389.5	5,884.59	5,884.59
J4-2014	2,019.41	J3-853	24.41	798.34	6,516.62	5,868.80	J4-756	20.08	474.34	5,897.63	5,897.63
J4-2013	2,019.41	J3-853	24.43	798.39	6,553.84	6,298.98	J4-756	18.94	471.72	5,919.72	5,919.72
J4-2012	2,019.41	J3-853	24.45	798.42	6,583.32	6,759.66	J4-756	18.13	469.84	5,938.34	5,938.34
J4-2010	2,019.41	J3-853	24.46	798.45	6,600.61	7,103.33	J4-756	17.78	469.04	5,949.80	5,949.80
J4-765	2,019.41	J3-853	24.49	798.51	6,628.51	8,154.47	J4-756	16.44	465.93	5,958.34	5,958.34
JF-102	2,019.41	J3-853	24.16	797.76	5,958.44	6,330.25	JF-102	20.63	285.61	6,358.14	5,958.44
J4-2000	2,019.41	J3-853	24.47	798.46	6,613.94	7,404.03	J4-756	17.45	468.27	5,958.94	5,958.94
J4-847	2,019.41	J3-853	24.16	797.76	5,959.05	5,953.82	J-5064	20.12	294.43	5,958.99	5,958.99
J4-440	2,019.41	J3-853	24.16	797.76	5,959.31	6,214.06	J-5064	19.34	292.62	6,183.61	5,959.31
J-5066	2,019.41	J3-853	24.16	797.76	5,960.26	6,636.47	J3-853	20.41	789.11	5,960.31	5,960.26
J4-441	2,019.41	J3-853	24.16	797.77	5,961.84	6,888.68	J3-853	19.94	788.02	5,961.89	5,961.84
J4-2011	2,019.41	J3-853	24.48	798.49	6,631.45	7,465.06	J4-756	17.39	468.14	5,971.47	5,971.47
J-5091	2,019.41	J3-853	24.17	797.77	5,982.28	7,480.06	J4-625	16.96	399.13	7,078.61	5,982.28
J4-527	2,007.20	J3-570	25	505.7		5,966.89	J4-527	20.6	398.53	6,012.26	6,012.26

J4-427	2,019.41	J3-853	24.17	797.78	6,016.09	7,675.46	J4-625	13.39	390.91	6,852.65	6,016.09
J4-770	2,019.41	J3-853	24.51	798.56	6,696.57	6,271.18	J4-756	19.34	472.64	6,028.44	6,028.44
J4-419	2,019.41	J3-570	25	505.7		5,979.24	J4-419	20.6	419.53	6,037.67	6,037.67
J4-430	2,144.80	J3-853	24.16	797.75	6,062.44	7,429.45	J3-853	19.1	786.09	6,062.46	6,062.44
J4-420	2,019.41	J3-853	24.97	799.62	7,158.87	6,013.22	J4-420	20.6	414.54	6,069.33	6,069.33
J4-431	2,144.80	J3-853	24.16	797.76	6,079.46	10,464.87	J4-441	-9.34	332.45	7,265.93	6,079.46
J4-429	2,144.80	J3-853	24.17	797.77	6,096.51	7,331.02	J3-853	19.37	786.7	6,096.53	6,096.51
J4-437	2,019.41	J3-853	24.55	798.67	6,810.83	6,190.53	J4-756	19.86	473.84	6,137.89	6,137.89
J4-438	2,019.41	J3-853	24.59	798.74	6,865.43	5,988.63	J4-756	20.52	475.36	6,190.43	6,190.43
J4-426	2,019.41	J3-853	24.19	797.82	6,245.87	6,319.10	J4-426	20.63	402.61	6,401.23	6,245.87
J4-762	2,019.41	J3-853	24.37	798.25	6,371.99	10,941.54	J3-853	8.02	760.51	6,371.73	6,371.73
J4-418	2,019.41	J3-570	25	505.7		6,485.65	J4-418	20.65	417.65	6,552.74	6,552.74
J4-768	2,019.41	J3-853	24.49	798.52	6,648.45	8,448.85	J4-770	16	393.94	7,923.70	6,648.45
J4-769	2,019.41	J3-853	24.49	798.52	6,652.55	7,734.24	J4-770	14.88	391.33	7,135.09	6,652.55
J4-434	2,019.41	J3-853	24.53	798.61	6,661.82	13,317.13	J3-853	-0.02	741.94	6,662.00	6,661.82
J4-771	2,019.41	J3-853	24.66	798.91	7,199.25	6,828.15	J4-756	20.45	475.2	7,024.54	7,024.54
J4-408	2,019.41	J3-570	25	505.7		17,346.19	J3-853	-0.61	740.6	7,043.20	7,043.20
J4-409	2,019.41	J3-570	25	505.7		13,306.20	J3-853	6.68	757.41	7,141.02	7,141.02
J4-416	2,019.41	J3-570	25	505.7		7,887.24	J3-853	19.11	786.11	7,154.39	7,154.39
J4-422	2,019.41	J3-570	25	505.7		10,139.10	J3-853	11.03	767.46	7,181.85	7,181.85
J4-415	2,019.41	J3-570	25	505.7		13,153.71	J3-853	7.35	758.96	7,209.72	7,209.72
J4-624	2,019.41	J3-570	25	505.7		13,644.37	J3-853	6.67	757.4	7,245.35	7,245.35
J4-417	2,019.41	J3-570	25	505.7		7,125.64	J4-756	20.7	475.77	7,598.49	7,598.49

ID	Total Demand	Critical Node 1 ID	Critical Node 1	Critical Node 1	Adjusted Fire-Flow (gpm)	Available Flow at Hydrant (gpm)	Critical Node 2 ID	Critical Node 2	Critcal Node 2	Adjusted Available Flow (gpm)	Design Flow (gpm)
J3-992	1,006.67	J-5116	31.33	517.31		4,649.04	J-5089	12.41	580	0	3100.00
J3-274	1,006.67	J3-274	-6.52	425.95	888.77	888.31	J3-274	20.09	487.36	888.77	888.77
J3-281	1,006.67	J3-281	9.43	528.75	939.87	939.23	J3-281	20.09	553.37	939.83	939.83
J3-283	1,006.67	J3-281	11.25	532.97	950.48	1,085.92	J3-281	-1.83	502.78	950.49	950.48
J3-282	1,006.67	J3-281	11.25	532.97	950.48	969.87	J3-281	17.03	546.31	950.49	950.48
J3-276	1,006.67	J3-276	12.24	529.24	957.83	957.22	J3-276	20.1	547.38	957.83	957.83
J3-275	1,006.67	J3-276	12.24	529.24	957.83	1,029.79	J3-276	8.44	520.49	957.83	957.83
J3-557	1,006.67	J3-557	21.1	617.69	1,018.50	1,017.41	J3-557	20.1	615.39	1,018.50	1,018.50
J-515	1,006.67	J3-557	21.1	617.69	1,018.50	1,818.73	J3-557	-99.09	340.31	1,018.50	1,018.50
J-513	1,006.67	J-513	27.76	667.07	1,108.53	1,107.10	J-513	20.11	649.41	1,108.48	1,108.48
J3-289	1,006.67	J3-289	28.37	640.47	1,114.82	1,113.46	J3-289	20.11	621.41	1,114.84	1,114.82
J3-279	1,006.67	J-5116	31.33	517.31		1,140.22	J3-279	20.11	581.42	1,141.30	1,141.30
J3-280	1,006.67	J-5116	31.33	517.31		1,145.66	J3-280	20.11	603.42	1,146.92	1,146.92
J3-929	1,006.67	J3-929	23.69	806.66	1,166.37	1,246.39	J3-929	20.12	798.44	1,166.37	1,166.37
J3-506	1,007.20	J3-506	28.19	606.05	1,208.60	1,205.86	J3-506	20.12	587.43	1,208.60	1,208.60
J3-930	1,006.67	J3-929	24.21	807.87	1,213.40	1,410.78	J3-929	18.42	794.52	1,213.40	1,213.40
J3-909	1,006.67	J3-929	29.19	819.36	2,744.33	1,221.03	J3-909	20.12	566.44	1,222.73	1,222.73
J3-928	1,006.67	J3-929	24.63	808.83	1,258.73	1,485.19	J3-929	18.18	793.96	1,258.74	1,258.73
J3-927	1,006.67	J3-929	24.83	809.3	1,276.86	1,946.21	J3-929	11.29	778.06	1,276.86	1,276.86
J3-776	1,006.67	J3-776	24.78	667.19	1,286.84	1,276.68	J3-776	20.13	656.45	1,286.84	1,286.84
J3-932	1,006.67	J3-929	24.91	809.49	1,287.93	1,507.05	J3-929	18.38	794.42	1,287.94	1,287.93
J3-912	1,006.67	J3-929	24.95	809.59	1,289.73	2,064.03	J3-915	-1.17	671.3	1,620.67	1,289.73
J3-914	1,006.67	J3-929	24.95	809.59	1,289.73	1,743.82	J3-929	14.86	786.29	1,289.74	1,289.73
J3-915	1,006.67	J3-929	24.95	809.59	1,289.73	1,534.91	J3-929	17.98	793.51	1,289.74	1,289.73
J3-916	1,006.67	J3-929	24.95	809.59	1,289.73	2,100.14	J3-929	9.06	772.9	1,289.74	1,289.73
J3-913	1,006.67	J3-929	24.95	809.59	1,289.73	1,966.34	J3-915	4.16	683.61	1,620.67	1,289.73
J3-931	1,006.67	J3-929	24.96	809.61	1,294.20	2,043.61	J3-929	10.2	775.55	1,294.21	1,294.20
J3-956	1,006.67	J-5116	31.33	517.31		1,331.28	J3-956	20.13	656.46	1,307.31	1,307.31
J3-600	1,006.67	J3-929	25.17	810.09	1,314.80	2,910.03	J3-929	-3.43	744.08	1,314.80	1,314.80
J3-596	1,006.67	J3-929	25.22	810.2	1,319.93	2,175.79	J3-929	8.7	772.08	1,319.94	1,319.93
J3-597	1,006.67	J3-929	25.22	810.2	1,319.93	2,660.68	J3-929	1.72	755.96	1,319.94	1,319.93
J3-595	1,006.67	J3-929	25.26	810.3	1,324.42	3,533.64	J3-929	-7.34	735.07	1,324.42	1,324.42
J-5116	2,003.60	J-5116	2.86	451.61	1,872.96	1,882.66	J3-929	13.56	783.3	1,325.83	1,325.83
J-5110	2,003.60	J3-929	11.68	778.96	1,325.84	2,055.55	J-5116	7.84	463.1	1,954.68	1,325.84
J-5109	2,003.60	J3-929	11.68	778.96	1,325.84	2,038.49	J-5116	10.2	468.55	1,954.68	1,325.84
J3-593	1,006.67	J3-929	25.3	810.39	1,328.89	2,451.78	J3-929	4.23	761.76	1,328.90	1,328.89
J3-592	1,006.67	J3-929	25.3	810.39	1,328.89	2,251.61	J3-929	7.68	769.73	1,328.90	1,328.89
J3-594	1,006.67	J3-929	25.3	810.39	1,328.89	3,450.71	J3-929	-7.44	734.82	1,328.90	1,328.89
J3-598	1,006.67	J3-929	25.32	810.43	1,330.95	1,694.71	J3-929	16.44	789.94	1,330.95	1,330.95
J3-601	1,006.67	J3-929	25.32	810.43	1,330.95	3,167.70	J3-929	-5.54	739.22	1,330.95	1,330.95
J3-599	1,006.67	J3-929	25.33	810.47	1,332.36	3,094.19	J3-929	-7.09	735.64	1,332.36	1,332.36
J3-743	1,006.67	J-5116	31.33	517.31		1,354.50	J3-743	20.13	623.47	1,333.99	1,333.99
J3-933	1,006.67	J3-929	25.84	811.64	1,391.66	1,986.09	J3-929	13.48	783.11	1,391.67	1,391.66
J3-392	1,006.67	J-5116	31.33	517.31		1,429.93	J3-392	20.14	715.49	1,391.68	1,391.68
J3-994	1,006.67	J3-929	29.05	819.05	2,617.02	1,421.66	J3-994	20.14	429.48	1,425.00	1,425.00
J3-744	1,006.67	J-5116	31.33	517.31		1,455.13	J3-744	20.14	608.49	1,434.07	1,434.07
J3-960	1,006.67	J-5116	31.33	517.31		1,504.49	J3-960	20.15	661.5	1,475.21	1,475.21
J3-315	1,006.67	J-5116	31.33	517.31		1,554.04	J3-315	20.15	726.51	1,505.94	1,505.94
J3-294	1,006.67	J-5116	31.33	517.31		1,620.59	J3-280	9.76	579.53	1,506.41	1,506.41
J-5082	1,006.67	J-5116	31.33	517.31		1,520.40	J-5082	20.15	501.51	1,524.54	1,524.54
J3-995	1,006.67	J3-929	29.05	819.05	2,617.02	1,530.15	J3-994	20.15	429.51	1,534.03	1,534.03
J3-401	1,006.67	J-5116	31.33	517.31		1,701.39	J3-506	14.1	573.54	1,547.65	1,547.65
J-5080	1,006.67	J-5116	31.33	517.31		1,548.21	J-5080	20.15	529.51	1,549.85	1,549.85
J3-723	1,006.67	J-5116	31.33	517.31		1,720.50	J3-743	6.3	591.55	1,558.12	1,558.12
J3-724	1,006.67	J-5116	31.33	517.31		1,667.45	J3-743	11.79	604.2	1,558.12	1,558.12
J3-725	1,006.67	J-5116	31.33	517.31		1,792.89	J3-743	-1.4	573.78	1,558.12	1,558.12
J3-745	1,006.67	J-5116	31.33	517.31		1,657.42	J3-743	12.81	606.56	1,558.12	1,558.12
J3-879	1,006.67	J3-929	29.21	819.42	2,776.01	1,564.07	J3-879	20.16	518.52	1,566.01	1,566.01
J3-716	1,006.67	J-5116	31.33	517.31		1,625.47	J3-716	20.16	671.53	1,590.59	1,590.59
J3-297	1,006.67	J-5116	31.33	517.31		1,628.56	J3-297	20.16	679.53	1,591.73	1,591.73
J3-288	1,006.67	J-5116	31.33	517.31		1,654.36	J3-280	16.51	595.1	1,595.08	1,595.08
J3-955	1,006.67	J-5116	31.33	517.31		1,744.89	J3-956	11.51	636.56	1,605.75	1,605.75
J3-717	1,006.67	J-5116	31.33	517.31		1,747.91	J3-716	12.38	653.58	1,606.65	1,606.65
J3-957	1,006.67	J-5116	31.33	517.31		1,749.90	J3-716	12.53	653.91	1,610.25	1,610.25
J3-958	1,006.67	J-5116	31.33	517.31		1,735.28	J3-716	13.76	656.75	1,611.95	1,611.95
J3-959	1,006.67	J-5116	31.33	517.31		1,657.55	J3-716	19.55	670.11	1,613.36	1,613.36
J3-718	1,006.67	J-5116	31.33	517.31		1,641.59	J3-718	20.16	601.53	1,617.65	1,617.65
J3-715	1,006.67	J-5116	31.33	517.31		1,700.57	J3-716	16.77	663.69	1,617.66	1,617.66
J3-299	1,006.67	J-5116	31.33	517.31		1,729.66	J3-297	15.27	668.23	1,621.70	1,621.70
J3-719	1,006.67	J-5116	31.33	517.31		1,951.68	J3-956	-4.02	600.72	1,627.81	1,627.81
J3-722	1,006.67	J-5116	31.33	517.31		2,000.19	J3-956	-8.35	590.72	1,627.81	1,627.81

J3-714	1,006.67	J-5116	31.33	517.31		1,674.16	J3-714	20.17	674.54	1,637.22	1,637.22
J3-875	1,006.67	J3-929	29.22	819.43	2,774.93	1,639.61	J3-875	20.16	516.53	1,641.71	1,641.71
J-5079	1,006.67	J-5116	31.33	517.31		1,688.83	J-5080	18.87	526.55	1,645.48	1,645.48
J3-309	1,006.67	J-5116	31.33	517.31		1,681.61	J3-309	20.17	649.54	1,650.76	1,650.76
J3-713	1,006.67	J-5116	31.33	517.31		1,695.53	J3-713	20.17	685.55	1,655.19	1,655.19
J3-296	1,006.67	J-5116	31.33	517.31		2,010.41	J3-297	-1.48	629.59	1,670.04	1,670.04
J3-558	1,006.67	J-5116	31.33	517.31		1,818.75	J3-289	8.88	595.5	1,671.15	1,671.15
J3-581	1,006.67	J3-929	26.97	814.24	1,672.44	2,792.43	J3-929	15.63	788.08	1,672.45	1,672.44
J3-585	1,006.67	J3-929	27.06	814.44	1,683.64	2,606.34	J3-929	16.75	790.67	1,683.64	1,683.64
J3-583	1,006.67	J3-929	27.07	814.47	1,684.07	2,440.31	J3-929	17.61	792.64	1,684.07	1,684.07
J3-584	1,006.67	J3-929	27.07	814.48	1,685.34	2,630.46	J3-929	16.64	790.4	1,685.35	1,685.34
J3-582	1,006.67	J3-929	27.14	814.63	1,691.72	2,691.30	J3-929	16.34	789.7	1,691.73	1,691.72
J3-589	1,006.67	J3-929	26.95	814.19	1,700.17	3,877.62	J3-929	8.62	771.9	1,700.17	1,700.17
J-5084	1,006.67	J-5116	31.33	517.31		1,735.56	J-5084	20.17	531.56	1,716.11	1,716.11
J-5076	1,006.67	J-5116	31.33	517.31		1,797.91	J-5080	14.56	516.6	1,721.94	1,721.94
J3-978	1,006.67	J-5116	31.33	517.31		1,744.89	J3-978	20.17	561.56	1,722.75	1,722.75
J3-325	1,006.67	J-5116	31.33	517.31		1,793.62	J3-325	20.18	741.57	1,725.00	1,725.00
J3-405	1,006.67	J-5116	31.33	517.31		1,746.45	J3-405	20.17	545.56	1,725.81	1,725.81
J-5075	1,006.67	J-5116	31.33	517.31		1,872.02	J-5080	4.63	493.69	1,726.23	1,726.23
J-5083	1,006.67	J-5116	31.33	517.31		1,747.38	J-5083	20.17	536.56	1,727.40	1,727.40
J-5077	1,006.67	J-5116	31.33	517.31		1,782.39	J-5080	17.21	522.71	1,730.62	1,730.62
J-5078	1,006.67	J-5116	31.33	517.31		1,881.86	J-5080	3.9	492	1,736.16	1,736.16
J3-586	1,006.67	J3-929	27.57	815.64	1,744.36	2,703.48	J3-929	16.7	790.55	1,744.36	1,744.36
J3-588	1,006.67	J3-929	27.57	815.64	1,744.36	1,854.91	J3-588	20.18	519.58	1,855.35	1,744.36
J-5081	1,006.67	J-5116	31.33	517.31		1,952.41	J-5080	-2.13	478.08	1,768.49	1,768.49
J3-290	1,006.67	J-5116	31.33	517.31		2,166.06	J3-297	-3.81	624.2	1,770.96	1,770.96
J3-397	1,006.67	J-5116	31.33	517.31		1,852.56	J3-397	20.18	708.58	1,802.07	1,802.07
J3-587	1,006.67	J3-929	27.87	816.33	1,830.03	2,494.58	J3-929	18.3	794.23	1,829.92	1,829.92
J3-376	1,006.67	J3-929	28.56	817.9	1,835.21	2,521.01	J3-929	14.19	784.75	1,835.23	1,835.21
J3-591	1,006.67	J3-929	27.94	816.49	1,853.83	2,783.78	J3-929	16.89	790.98	1,853.71	1,853.71
J3-291	1,006.67	J-5116	31.33	517.31		2,246.82	J3-297	-2.37	627.52	1,854.29	1,854.29
J3-979	1,006.67	J-5116	31.33	517.31		2,163.06	J3-297	3.61	641.33	1,857.63	1,857.63
J3-974	1,006.67	J-5116	31.33	517.31		2,159.19	J3-297	3.87	641.93	1,857.63	1,857.63
J3-975	1,006.67	J-5116	31.33	517.31		2,103.37	J3-297	7.57	650.48	1,857.63	1,857.63
J3-976	1,006.67	J-5116	31.33	517.31		2,129.09	J3-297	5.88	646.56	1,857.63	1,857.63
J3-977	1,006.67	J-5116	31.33	517.31		2,060.79	J3-297	10.34	656.87	1,857.63	1,857.63
J3-300	1,006.67	J-5116	31.33	517.31		1,912.90	J3-297	19.87	678.86	1,862.00	1,862.00
J3-396	1,006.67	J-5116	31.33	517.31		2,091.19	J3-389	14.59	710.67	1,895.87	1,895.87
J3-389	1,006.67	J-5116	31.33	517.31		1,961.18	J3-389	20.2	723.61	1,895.87	1,895.87
J3-394	1,006.67	J-5116	31.33	517.31		2,066.27	J3-389	15.69	713.2	1,895.87	1,895.87
J3-395	1,006.67	J-5116	31.33	517.31		2,191.29	J3-389	10.09	700.28	1,895.87	1,895.87
J3-393	1,006.67	J-5116	31.33	517.31		2,044.88	J3-389	16.62	715.36	1,895.87	1,895.87
J-5089	1,006.67	J-5116	31.33	517.31		1,952.33	J-5089	20.19	626.61	1,918.39	1,918.39
J-5087	1,006.67	J-5116	31.33	517.31		1,963.99	J-5087	20.2	610.61	1,932.20	1,932.20
J3-590	1,006.67	J3-929	28.07	816.78	1,935.38	4,731.08	J3-929	4.09	761.43	1,935.38	1,935.38
J-5035	1,006.67	J-5116	31.33	517.31		1,964.02	J-5035	20.2	530.61	1,953.72	1,953.72
J3-377	1,006.67	J3-929	28.93	818.77	1,959.49	2,199.98	J3-929	19.35	796.65	1,959.53	1,959.49
J-5086	1,006.67	J-5116	31.33	517.31		2,024.43	J-5087	19.34	608.62	1,981.16	1,981.16
J-5088	1,006.67	J-5116	31.33	517.31		2,116.92	J-5089	15.01	614.64	2,013.49	2,013.49
J3-327	1,006.67	J-5116	31.33	517.31		2,097.29	J3-327	20.21	727.64	2,022.83	2,022.83
J3-305	1,006.67	J-5116	31.33	517.31		2,079.55	J3-305	20.21	646.64	2,038.53	2,038.53
J3-576	1,006.67	J3-929	29.22	819.43	2,770.43	2,054.63	J3-576	20.2	503.63	2,057.73	2,057.73
J3-893	1,006.67	J3-929	29.05	819.05	2,617.02	2,393.11	J3-994	10.49	407.21	2,083.65	2,083.65
J3-892	1,006.67	J3-929	29.05	819.05	2,617.02	3,087.55	J3-994	-14.79	348.86	2,083.65	2,083.65
J3-894	1,006.67	J3-929	29.05	819.05	2,617.02	2,121.81	J3-994	18.89	426.59	2,083.65	2,083.65
J3-578	1,006.67	J3-929	29.22	819.43	2,770.43	2,081.32	J3-578	20.21	530.64	2,085.09	2,085.09
J3-786	1,006.67	J3-929	29.22	819.43	2,770.43	2,119.44	J3-786	20.21	578.65	2,125.39	2,125.39
J-5124	1,006.67	J-5116	31.33	517.31		2,190.59	J-5124	20.22	526.66	2,164.77	2,164.77
J3-781	1,006.67	J3-929	28.61	818.03	2,172.78	2,901.36	J3-929	17.41	792.18	2,172.78	2,172.78
J3-783	1,006.67	J3-929	28.61	818.03	2,172.78	3,306.93	J3-929	15.27	787.23	2,172.78	2,172.78
J3-911	1,006.67	J3-929	28.61	818.03	2,172.78	2,768.19	J3-929	18.04	793.63	2,172.79	2,172.78
J3-782	1,006.67	J3-929	28.61	818.03	2,172.78	3,439.20	J3-929	14.51	785.48	2,172.79	2,172.78
J3-780	1,006.67	J3-929	28.61	818.03	2,172.78	4,451.45	J3-929	8.02	770.51	2,172.78	2,172.78
J3-404	1,006.67	J-5116	31.33	517.31		2,341.12	J3-405	7.67	516.69	2,187.39	2,187.39
J3-815	1,006.67	J3-929	28.62	818.04	2,195.12	3,438.09	J3-929	14.85	786.27	2,195.12	2,195.12
J3-882	1,006.67	J3-929	28.62	818.04	2,195.12	3,925.28	J3-929	12.11	779.95	2,195.12	2,195.12
J-5125	1,006.67	J-5116	31.33	517.31		2,211.75	J-5125	20.22	596.67	2,219.08	2,219.08
J3-577	1,006.67	J3-929	29.22	819.43	2,770.43	2,241.05	J3-577	20.22	498.67	2,244.63	2,244.63
J3-883	1,006.67	J3-929	28.7	818.24	2,256.41	3,870.41	J3-929	12.61	781.11	2,256.41	2,256.41
J3-884	1,006.67	J3-929	28.7	818.24	2,256.41	2,400.87	J3-884	20.24	486.71	2,404.61	2,256.41
J3-903	1,006.67	J3-929	29.22	819.43	2,770.43	2,269.43	J3-903	20.23	548.68	2,274.63	2,274.63
J3-346	1,006.67	J-5116	31.33	517.31		2,394.33	J3-346	20.24	753.71	2,283.14	2,283.14
J3-886	1,006.67	J3-929	29.22	819.43	2,770.43	2,338.27	J3-886	20.23	524.7	2,342.90	2,342.90

J3-775	1,006.67	J3-776	28.61	676.03	2,350.35	2,318.94	J3-776	20.23	656.69	2,350.45	2,350.35
J-5128	1,006.67	J-5116	31.33	517.31		2,399.90	J-5128	20.24	541.71	2,369.02	2,369.02
J-5127	1,006.67	J-5116	31.33	517.31		2,423.35	J-5127	20.24	526.72	2,393.55	2,393.55
J3-779	1,006.67	J3-929	28.9	818.71	2,402.95	4,662.40	J3-776	8.03	628.53	3,170.01	2,402.95
J3-860	1,006.67	J3-929	29.47	820.01	2,784.58	2,400.12	J3-860	20.24	472.71	2,403.58	2,403.58
J3-989	1,006.67	J-5116	31.33	517.31		2,482.29	J3-989	20.25	656.73	2,424.85	2,424.85
J-5117	1,006.67	J3-929	28.93	818.76	2,450.33	3,533.73	J3-929	14.89	786.37	2,450.33	2,450.33
J3-987	1,006.67	J-5116	31.33	517.31		2,509.37	J3-987	20.25	654.73	2,451.79	2,451.79
J3-887	1,006.67	J3-929	29.22	819.43	2,770.43	2,447.47	J3-887	20.24	530.72	2,452.76	2,452.76
J-5118	1,006.67	J3-929	28.93	818.77	2,453.18	3,517.71	J3-929	14.99	786.59	2,453.18	2,453.18
J-5126	1,006.67	J-5116	31.33	517.31		2,507.83	J-5126	20.25	601.73	2,466.44	2,466.44
J3-917	1,006.67	J3-929	28.96	818.84	2,469.33	4,265.86	J3-929	10.81	776.95	2,469.33	2,469.33
J3-898	1,006.67	J3-929	29.22	819.43	2,770.43	2,473.88	J3-898	20.25	496.73	2,478.23	2,478.23
J3-885	1,006.67	J3-929	28.94	818.79	2,483.55	5,261.97	J3-929	4.98	763.5	2,483.55	2,483.55
J3-918	1,006.67	J3-929	28.98	818.89	2,496.02	4,144.35	J3-929	11.63	778.84	2,496.02	2,496.02
J3-777	1,006.67	J3-929	28.98	818.87	2,498.39	3,162.09	J3-776	17.12	649.51	2,741.26	2,498.39
J3-778	1,006.67	J3-929	28.98	818.89	2,501.16	3,681.88	J3-929	14.28	784.97	2,501.16	2,501.16
J3-919	1,006.67	J3-929	28.98	818.89	2,503.12	4,264.28	J3-929	10.96	777.3	2,503.12	2,503.12
J3-920	1,006.67	J3-929	28.98	818.89	2,503.12	3,240.15	J3-929	17.13	791.54	2,503.12	2,503.12
J3-944	1,006.67	J3-929	28.96	818.83	2,509.87	5,613.77	J3-929	2.84	758.54	2,509.87	2,509.87
J3-922	1,006.67	J3-929	28.98	818.88	2,512.64	4,563.18	J3-929	9.23	773.31	2,512.64	2,512.64
J3-946	1,006.67	J3-929	28.97	818.85	2,519.00	5,198.15	J3-929	5.59	764.89	2,519.00	2,519.00
J3-947	1,006.67	J3-929	28.97	818.85	2,519.00	4,627.76	J3-929	9.11	773.02	2,519.00	2,519.00
J3-921	1,006.67	J3-929	28.98	818.87	2,519.92	4,745.04	J3-929	8.2	770.92	2,519.92	2,519.92
J3-926	1,006.67	J3-929	28.97	818.87	2,523.17	4,389.97	J3-929	10.41	776.02	2,523.17	2,523.17
J3-925	1,006.67	J3-929	28.97	818.87	2,523.42	4,454.83	J3-929	10.02	775.14	2,523.42	2,523.42
J3-924	1,006.67	J3-929	28.97	818.87	2,524.05	4,685.63	J3-929	8.64	771.93	2,524.05	2,524.05
J3-923	1,006.67	J3-929	28.97	818.87	2,525.96	5,315.92	J3-929	4.69	762.82	2,525.96	2,525.96
J3-948	1,006.67	J3-929	28.97	818.87	2,528.95	5,842.07	J3-929	1.31	755.02	2,528.95	2,528.95
J3-950	1,006.67	J3-929	28.98	818.87	2,533.10	5,380.53	J3-929	4.51	762.4	2,533.10	2,533.10
J3-373	1,006.67	J-5116	31.33	517.31		2,743.59	J3-373	20.27	796.79	2,541.48	2,541.48
J3-943	1,006.67	J3-929	28.98	818.89	2,542.75	6,083.28	J3-929	-0.31	751.29	2,542.75	2,542.75
J3-774	1,006.67	J3-929	29.01	818.96	2,552.63	3,385.37	J3-929	16.66	790.44	2,552.63	2,552.63
J3-988	1,006.67	J-5116	31.33	517.31		2,625.19	J3-988	20.26	656.76	2,562.75	2,562.75
J3-985	1,006.67	J-5116	31.33	517.31		2,631.10	J3-985	20.26	660.76	2,566.80	2,566.80
J3-936	1,006.67	J-5116	31.33	517.31		2,762.40	J3-936	20.28	777.79	2,609.71	2,609.71
J4-700	1,006.67	J3-929	29.05	819.05	2,617.02	4,107.21	J3-929	12.97	781.92	2,617.03	2,617.02
J3-572	1,006.67	J3-929	29.05	819.05	2,617.02	4,712.78	J3-994	-28.51	317.2	3,671.12	2,617.02
J3-571	1,006.67	J3-929	29.05	819.05	2,617.02	4,119.11	J3-929	12.89	781.74	2,617.03	2,617.02
J3-390	1,006.67	J-5116	31.33	517.31		2,737.59	J3-390	20.27	705.79	2,647.47	2,647.47
J3-308	1,006.67	J-5116	31.33	517.31		3,135.71	J3-309	-2.65	596.88	2,650.02	2,650.02
J3-372	1,006.67	J-5116	31.33	517.31		2,873.61	J3-372	20.29	796.82	2,656.94	2,656.94
J3-568	1,006.67	J3-929	29.22	819.43	2,770.43	2,658.61	J3-568	20.27	576.77	2,667.87	2,667.87
J3-785	1,006.67	J3-929	29.22	819.43	2,770.43	2,684.97	J3-785	20.27	583.78	2,695.13	2,695.13
J3-910	1,006.67	J3-929	29.14	819.26	2,695.90	6,584.80	J3-929	-2.8	745.55	2,695.91	2,695.90
J-5129	1,006.67	J-5116	31.33	517.31		2,754.81	J-5129	20.27	606.79	2,706.42	2,706.42
J3-986	1,006.67	J-5116	31.33	517.31		2,970.43	J3-987	11.63	634.84	2,721.83	2,721.83
J3-908	1,006.67	J3-929	29.18	819.33	2,729.35	5,359.73	J3-929	6.8	767.7	2,729.36	2,729.35
J3-983	1,006.67	J-5116	31.33	517.31		2,895.25	J3-985	15.98	650.89	2,729.50	2,729.50
J3-784	1,006.67	J3-929	29.22	819.43	2,770.43	2,730.63	J3-784	20.27	591.79	2,742.14	2,742.14
J3-907	1,006.67	J3-929	29.19	819.36	2,744.33	5,064.89	J3-929	8.88	772.5	2,744.34	2,744.33
J3-941	1,006.67	J-5116	31.33	517.31		2,837.32	J3-941	20.28	762.81	2,748.76	2,748.76
J3-388	1,006.67	J-5116	31.33	517.31		2,876.61	J3-388	20.29	730.82	2,753.05	2,753.05
J3-906	1,006.67	J3-929	29.19	819.37	2,758.30	5,286.94	J3-929	7.64	769.63	2,758.31	2,758.30
J3-331	1,006.67	J-5116	31.33	517.31		2,898.00	J3-331	20.29	738.82	2,760.87	2,760.87
J3-905	1,006.67	J3-929	29.19	819.37	2,762.57	3,718.19	J3-929	16.8	790.77	2,762.58	2,762.57
J3-904	1,006.67	J3-929	29.19	819.37	2,764.06	5,477.76	J3-929	6.47	766.94	2,764.07	2,764.06
J3-566	1,006.67	J3-929	29.22	819.43	2,770.43	6,751.96	J3-929	-3.62	743.64	2,770.44	2,770.43
J3-890	1,006.67	J3-929	29.22	819.43	2,770.43	3,077.78	J3-568	11.79	557.22	2,789.97	2,770.43
J3-900	1,006.67	J3-929	29.22	819.43	2,770.43	3,074.05	J3-902	19.68	557.41	3,063.04	2,770.43
J3-899	1,006.67	J3-929	29.22	819.43	2,770.43	3,233.22	J3-902	15.05	546.73	3,068.18	2,770.43
J3-603	1,006.67	J3-929	29.22	819.43	2,770.43	4,079.61	J3-784	12.65	574.19	3,679.29	2,770.43
J3-889	1,006.67	J3-929	29.22	819.43	2,770.43	2,935.76	J3-568	15.93	566.75	2,789.97	2,770.43
J3-575	1,006.67	J3-929	29.22	819.43	2,770.43	2,809.10	J3-575	20.28	567.8	2,818.45	2,770.43
J3-902	1,006.67	J3-929	29.22	819.43	2,770.43	2,814.21	J3-902	20.28	558.81	2,822.99	2,770.43
J3-891	1,006.67	J3-929	29.22	819.43	2,770.43	2,982.55	J3-568	16.11	567.18	2,840.64	2,770.43
J3-573	1,006.67	J3-929	29.22	819.43	2,770.43	3,950.30	J3-784	13.7	576.62	3,611.55	2,770.43
J3-574	1,006.67	J3-929	29.22	819.43	2,770.43	4,045.17	J3-784	14.58	578.66	3,742.64	2,770.43
J3-567	1,006.67	J3-929	29.22	819.43	2,770.43	4,221.39	J3-784	12.58	574.04	3,806.08	2,770.43
J3-602	1,006.67	J3-929	29.22	819.43	2,770.43	3,308.29	J3-929	19	795.86	2,770.44	2,770.43
J3-604	1,006.67	J3-929	29.22	819.43	2,770.43	3,357.71	J3-929	18.75	795.27	2,770.45	2,770.43
J3-897	1,006.67	J3-929	29.22	819.43	2,770.43	3,111.42	J3-902	18.74	555.26	3,068.88	2,770.43
J3-895	1,006.67	J3-929	29.22	819.43	2,770.43	3,373.51	J3-902	10.88	537.1	3,074.08	2,770.43

J3-901	1,006.67	J3-929	29.22	819.43	2,770.43	3,250.73	J3-902	13.6	543.38	3,040.66	2,770.43
J3-896	1,006.67	J3-929	29.22	819.43	2,770.43	3,388.92	J3-902	10.8	536.93	3,085.93	2,770.43
J3-579	1,006.67	J3-929	29.22	819.43	2,770.43	4,254.77	J3-784	10.41	569.03	3,732.34	2,770.43
J3-888	1,006.67	J3-929	29.22	819.43	2,770.43	3,029.71	J3-568	13.21	560.49	2,789.97	2,770.43
J3-565	1,006.67	J3-929	29.22	819.43	2,770.86	6,767.79	J3-929	-3.76	743.33	2,770.87	2,770.86
J3-880	1,006.67	J3-929	29.23	819.46	2,771.97	8,130.07	J3-905	-24.6	509.22	6,334.25	2,771.97
J3-881	1,006.67	J3-929	29.22	819.43	2,772.70	6,763.48	J3-929	-3.73	743.39	2,772.71	2,772.70
J3-863	1,006.67	J3-929	29.25	819.5	2,773.07	8,379.05	J3-905	-30.63	495.32	6,362.58	2,773.07
J3-874	1,006.67	J3-929	29.22	819.43	2,774.30	6,130.78	J3-929	1.55	755.58	2,774.31	2,774.30
J3-873	1,006.67	J3-929	29.22	819.43	2,774.93	5,936.69	J3-929	3.11	759.18	2,774.94	2,774.93
J3-877	1,006.67	J3-929	29.21	819.42	2,776.01	3,499.96	J3-878	12.12	517.96	3,274.27	2,776.01
J3-878	1,006.67	J3-929	29.21	819.42	2,776.01	2,894.92	J3-878	20.29	536.82	2,902.46	2,776.01
J3-872	1,006.67	J3-929	29.21	819.42	2,776.01	4,610.00	J3-929	11.89	779.45	2,776.02	2,776.01
J3-870	1,006.67	J3-929	29.21	819.42	2,776.01	5,769.84	J3-929	4.66	762.76	2,776.02	2,776.01
J3-876	1,006.67	J3-929	29.19	819.38	2,778.60	6,754.96	J3-929	-3.72	743.4	2,778.62	2,778.60
J3-328	1,006.67	J-5116	31.33	517.31		3,188.64	J3-325	14.25	727.89	2,782.06	2,782.06
J3-858	1,006.67	J3-929	29.47	820.01	2,784.55	7,011.55	J3-929	-5.19	740.03	2,784.56	2,784.55
J3-859	1,006.67	J3-929	29.47	820.01	2,784.55	4,327.22	J3-929	13.62	783.44	2,784.56	2,784.55
J3-864	1,006.67	J3-929	29.47	820.01	2,784.55	5,410.01	J3-929	7.08	768.33	2,784.57	2,784.55
J3-861	1,006.67	J3-929	29.69	820.52	2,793.15	6,316.91	J3-929	0.96	754.21	2,793.16	2,793.15
J3-869	1,006.67	J3-929	29.77	820.7	2,795.79	4,878.56	J3-929	10.46	776.13	2,795.80	2,795.79
J3-866	1,006.67	J3-929	29.77	820.7	2,795.79	3,177.91	J3-929	19.83	797.75	2,795.80	2,795.79
J3-867	1,006.67	J3-929	29.77	820.7	2,795.79	4,930.86	J3-929	10.14	775.4	2,795.80	2,795.79
J3-868	1,006.67	J3-929	29.77	820.7	2,795.79	4,353.56	J3-866	11.77	437.16	4,178.61	2,795.79
J3-862	1,006.67	J3-929	29.77	820.7	2,795.79	6,099.82	J3-929	2.67	758.16	2,795.80	2,795.79
J-5043	1,006.67	J3-929	30.04	821.32	2,803.92	5,028.35	J3-929	9.61	774.17	2,803.93	2,803.92
J-5040	1,006.67	J3-929	30.04	821.32	2,803.92	4,217.05	J3-929	14.36	785.15	2,803.93	2,803.92
J-5039	1,006.67	J3-929	30.04	821.32	2,803.92	5,838.76	J3-929	4.47	762.32	2,803.93	2,803.92
J-5044	1,006.67	J3-929	30.32	821.98	2,811.59	5,403.12	J3-929	7.33	768.92	2,811.60	2,811.59
J-5037	1,006.67	J3-929	30.78	823.04	2,817.62	4,746.71	J3-929	11.4	778.32	2,817.64	2,817.62
J-5046	1,006.67	J-5116	31.33	517.31		4,320.86	J3-929	13.93	784.14	2,824.37	2,824.37
J3-314	1,006.67	J-5116	31.33	517.31		3,164.62	J3-315	14.68	713.88	2,830.79	2,830.79
J3-304	1,006.67	J-5116	31.33	517.31		2,986.27	J3-305	16.4	637.84	2,839.47	2,839.47
J3-383	1,006.67	J-5116	31.33	517.31		2,968.37	J3-383	20.3	756.84	2,842.25	2,842.25
J-5042	1,006.67	J-5116	31.33	517.31		2,872.13	J-5042	20.29	541.82	2,865.13	2,865.13
J3-352	1,006.67	J-5116	31.33	517.31		3,056.28	J3-352	20.3	775.86	2,868.02	2,868.02
J3-937	1,006.67	J-5116	31.33	517.31		2,994.61	J3-937	20.3	751.85	2,878.25	2,878.25
J3-380	1,006.67	J-5116	31.33	517.31		3,006.87	J3-380	20.3	743.85	2,906.04	2,906.04
J3-984	1,006.67	J-5116	31.33	517.31		3,127.98	J3-985	14.23	646.85	2,907.37	2,907.37
J3-391	1,006.67	J-5116	31.33	517.31		3,039.43	J3-391	20.3	728.86	2,908.40	2,908.40
J3-952	1,006.67	J-5116	31.33	517.31		3,017.59	J3-952	20.3	674.85	2,959.71	2,959.71
J3-991	1,006.67	J-5116	31.33	517.31		3,029.28	J3-991	20.3	633.85	2,961.91	2,961.91
J3-345	1,006.67	J-5116	31.33	517.31		3,182.53	J3-345	20.32	767.89	2,969.87	2,969.87
J3-378	1,006.67	J3-929	31.22	824.05	2,987.59	4,683.08	J3-929	10.91	777.18	2,987.59	2,987.59
J3-351	1,006.67	J-5116	31.33	517.31		3,153.64	J3-351	20.31	759.88	2,993.35	2,993.35
J3-354	1,006.67	J-5116	31.33	517.31		3,489.60	J3-373	18.72	793.2	3,013.57	3,013.57
J-5028	1,006.67	J-5116	31.33	517.31		3,058.04	J-5028	20.31	586.86	3,036.55	3,036.55
J-5041	1,006.67	J-5116	31.33	517.31		3,055.46	J-5041	20.3	586.86	3,047.09	3,047.09
J-5033	1,006.67	J-5116	31.33	517.31		3,120.25	J-5041	17.66	580.76	3,047.09	3,047.09
J-5031	1,006.67	J-5116	31.33	517.31		3,068.81	J-5031	20.31	606.86	3,059.20	3,059.20
J3-360	1,006.67	J-5116	31.33	517.31		3,213.41	J3-360	20.32	783.9	3,067.37	3,067.37
J3-358	1,006.67	J-5116	31.33	517.31		3,218.42	J3-358	20.32	778.9	3,080.78	3,080.78
J3-338	1,006.67	J-5116	31.33	517.31		3,251.66	J3-338	20.32	721.91	3,112.82	3,112.82
J3-332	1,006.67	J-5116	31.33	517.31		3,315.86	J3-332	20.33	747.92	3,127.56	3,127.56
J3-326	1,006.67	J-5116	31.33	517.31		3,289.20	J3-326	20.33	734.91	3,129.10	3,129.10
J3-940	1,006.67	J-5116	31.33	517.31		4,180.31	J3-929	15.97	788.85	3,147.77	3,147.77
J-5024	1,006.67	J-5116	31.33	517.31		3,868.22	J3-929	18.38	794.43	3,176.13	3,176.13
J-5030	1,006.67	J-5116	31.33	517.31		3,289.13	J-5031	20.33	606.91	3,263.32	3,263.32
J3-790	1,006.67	J-5116	31.33	517.31		3,852.17	J3-360	16.44	774.95	3,286.59	3,286.59
J3-353	1,006.67	J-5116	31.33	517.31		3,813.00	J3-373	19.15	794.19	3,323.39	3,323.39
J3-359	1,006.67	J-5116	31.33	517.31		4,277.61	J3-358	11.6	758.76	3,324.00	3,324.00
J3-990	1,006.67	J-5116	31.33	517.31		3,645.28	J3-985	12.09	641.91	3,326.38	3,326.38
J3-363	1,006.67	J-5116	31.33	517.31		4,547.51	J3-360	10.01	760.1	3,344.76	3,344.76
J3-333	1,006.67	J-5116	31.33	517.31		3,560.20	J3-333	20.36	748.98	3,346.20	3,346.20
J3-357	1,006.67	J-5116	31.33	517.31		3,488.54	J3-357	20.35	770.96	3,346.91	3,346.91
J-5090	1,006.67	J-5116	31.33	517.31		3,481.00	J-5090	20.35	689.96	3,364.82	3,364.82
J3-562	1,006.67	J-5116	31.33	517.31		3,622.77	J3-562	20.36	776.99	3,372.35	3,372.35
J-5023	1,006.67	J-5116	31.33	517.31		4,270.28	J3-929	16.27	789.55	3,374.90	3,374.90
J3-942	1,006.67	J-5116	31.33	517.31		4,883.95	J3-929	13.92	784.13	3,392.79	3,392.79
J-5021	1,006.67	J-5116	31.33	517.31		7,409.07	J3-929	-3.58	743.74	3,421.74	3,421.74
J3-324	1,006.67	J-5116	31.33	517.31		3,650.18	J3-324	20.36	748	3,429.58	3,429.58
J3-375	1,006.67	J-5116	31.33	517.31		3,681.48	J3-375	20.37	771.01	3,437.69	3,437.69
J-5026	1,006.67	J-5116	31.33	517.31		3,472.19	J-5026	20.35	606.96	3,444.59	3,444.59

J3-361	1,006.67	J-5116	31.33	517.31	4,731.51	J3-360	9.99	760.07	3,465.44	3,465.44
J3-951	1,006.67	J-5116	31.33	517.31	4,472.95	J3-929	17.18	791.65	3,512.78	3,512.78
J3-938	1,006.67	J-5116	31.33	517.31	3,825.47	J3-936	19.95	777.04	3,535.22	3,535.22
J3-343	1,006.67	J-5116	31.33	517.31	3,784.82	J3-343	20.38	753.03	3,540.39	3,540.39
J3-334	1,006.67	J-5116	31.33	517.31	3,796.57	J3-334	20.38	752.03	3,552.30	3,552.30
J3-330	1,006.67	J-5116	31.33	517.31	3,773.65	J3-330	20.38	741.03	3,560.46	3,560.46
J3-344	1,006.67	J-5116	31.33	517.31	3,803.22	J3-344	20.38	752.03	3,570.92	3,570.92
J3-348	1,006.67	J-5116	31.33	517.31	3,842.68	J3-348	20.38	768.04	3,580.33	3,580.33
J3-934	1,006.67	J-5116	31.33	517.31	5,223.08	J3-929	13.72	783.66	3,581.58	3,581.58
J3-350	1,006.67	J-5116	31.33	517.31	3,660.14	J3-350	20.37	632	3,582.44	3,582.44
J3-339	1,006.67	J-5116	31.33	517.31	3,743.17	J3-339	20.37	708.02	3,590.53	3,590.53
J3-374	1,006.67	J-5116	31.33	517.31	3,873.62	J3-374	20.39	780.05	3,591.67	3,591.67
J3-939	1,006.67	J-5116	31.33	517.31	4,436.80	J3-929	18.07	793.7	3,613.05	3,613.05
J3-382	1,006.67	J-5116	31.33	517.31	4,461.18	J3-929	18.03	793.61	3,627.55	3,627.55
J3-371	1,006.67	J-5116	31.33	517.31	4,699.45	J3-372	16.04	787.02	3,628.91	3,628.91
J3-386	1,006.67	J-5116	31.33	517.31	3,850.08	J3-386	20.38	737.04	3,642.76	3,642.76
J3-313	1,006.67	J-5116	31.33	517.31	3,923.41	J3-315	18.9	723.62	3,658.51	3,658.51
J3-953	1,006.67	J-5116	31.33	517.31	4,489.50	J3-929	18.17	793.94	3,669.27	3,669.27
J3-323	1,006.67	J-5116	31.33	517.31	3,936.75	J3-324	20.32	747.9	3,682.67	3,682.67
J3-336	1,006.67	J-5116	31.33	517.31	4,067.25	J3-331	17.71	732.87	3,683.34	3,683.34
J3-335	1,006.67	J-5116	31.33	517.31	3,899.49	J3-335	20.39	737.06	3,686.46	3,686.46
J3-355	1,006.67	J-5116	31.33	517.31	4,186.62	J3-373	19.66	795.37	3,687.65	3,687.65
J3-935	1,006.67	J-5116	31.33	517.31	4,486.77	J3-373	17.9	791.3	3,694.61	3,694.61
J3-726	1,006.67	J-5116	31.33	517.31	4,365.34	J3-333	14.43	735.3	3,701.96	3,701.96
J3-337	1,006.67	J-5116	31.33	517.31	4,408.08	J3-333	13.97	734.23	3,712.12	3,712.12
J3-347	1,006.67	J-5116	31.33	517.31	4,143.89	J3-929	20.12	798.44	3,728.43	3,728.43
J3-356	1,006.67	J-5116	31.33	517.31	4,390.03	J3-373	18.74	793.24	3,731.67	3,731.67
J3-341	1,006.67	J-5116	31.33	517.31	4,526.48	J3-333	12.56	731	3,732.60	3,732.60
J3-370	1,006.67	J-5116	31.33	517.31	4,502.34	J3-929	18.47	794.62	3,732.77	3,732.77
J3-342	1,006.67	J-5116	31.33	517.31	4,207.08	J3-333	17.39	742.14	3,737.70	3,737.70
J3-560	1,006.67	J-5116	31.33	517.31	4,027.78	J3-333	20.03	748.23	3,742.73	3,742.73
J3-329	1,006.67	J-5116	31.33	517.31	4,201.47	J3-929	19.96	798.07	3,745.02	3,745.02
J3-387	1,006.67	J-5116	31.33	517.31	4,176.41	J3-929	20.09	798.35	3,745.91	3,745.91
J3-789	1,006.67	J-5116	31.33	517.31	4,750.53	J3-360	13.64	768.48	3,752.20	3,752.20
J3-322	1,006.67	J-5116	31.33	517.31	4,024.63	J3-333	20.23	748.68	3,752.55	3,752.55
J3-561	1,006.67	J-5116	31.33	517.31	4,145.59	J3-333	18.6	744.93	3,757.32	3,757.32
J3-385	1,006.67	J-5116	31.33	517.31	4,357.40	J3-373	19.2	794.31	3,771.07	3,771.07
J3-321	1,006.67	J-5116	31.33	517.31	4,341.13	J3-333	16.06	739.06	3,772.59	3,772.59
J3-318	1,006.67	J-5116	31.33	517.31	4,051.13	J3-333	20.26	748.75	3,777.85	3,777.85
J3-349	1,006.67	J-5116	31.33	517.31	3,991.68	J3-349	20.4	727.08	3,816.90	3,816.90
J3-303	1,006.67	J-5116	31.33	517.31	3,951.86	J3-303	20.39	681.07	3,818.85	3,818.85
J3-320	1,006.67	J-5116	31.33	517.31	4,280.91	J3-333	17.73	742.93	3,820.30	3,820.30
J3-398	1,006.67	J-5116	31.33	517.31	3,955.77	J3-398	20.39	667.07	3,832.26	3,832.26
J-5025	1,006.67	J-5116	31.33	517.31	6,288.22	J-5024	-102.2	344.14	3,833.24	3,833.24
J3-310	1,006.67	J-5116	31.33	517.31	3,955.79	J3-309	20.31	649.88	3,844.02	3,844.02
J3-319	1,006.67	J-5116	31.33	517.31	4,401.38	J3-333	16.62	740.36	3,854.64	3,854.64
J3-317	1,006.67	J-5116	31.33	517.31	4,030.21	J3-317	20.4	685.09	3,888.89	3,888.89
J3-312	1,006.67	J-5116	31.33	517.31	4,070.70	J3-312	20.41	677.1	3,935.86	3,935.86
J3-307	1,006.67	J-5116	31.33	517.31	4,066.89	J3-307	20.41	665.09	3,942.35	3,942.35
J3-379	1,006.67	J-5116	31.33	517.31	4,638.67	J3-380	11.8	724.23	3,958.47	3,958.47
J3-369	1,006.67	J-5116	31.33	517.31	5,596.37	J3-929	14.48	785.42	3,992.31	3,992.31
J3-316	1,006.67	J-5116	31.33	517.31	4,567.07	J3-387	16.74	739.63	3,997.76	3,997.76
J3-368	1,006.67	J-5116	31.33	517.31	5,593.81	J3-929	14.56	785.6	4,000.10	4,000.10
J3-362	1,006.67	J-5116	31.33	517.31	4,872.01	J3-929	18.12	793.82	4,006.06	4,006.06
J3-381	1,006.67	J-5116	31.33	517.31	4,706.25	J3-383	15.7	746.24	4,114.64	4,114.64
J3-302	1,006.67	J-5116	31.33	517.31	5,600.39	J3-387	4.11	710.5	4,126.41	4,126.40
J3-954	1,006.67	J-5116	31.33	517.31	5,871.02	J3-356	9.02	751.81	4,183.47	4,183.47
J3-384	1,006.67	J-5116	31.33	517.31	5,876.90	J3-347	8.6	741.85	4,285.68	4,285.68
J3-857	1,006.67	J-5116	31.33	517.31	7,641.51	J3-345	-11.71	693.97	4,311.70	4,311.70
J3-856	1,006.67	J-5116	31.33	517.31	7,654.71	J3-345	-11.89	693.57	4,311.92	4,311.92
J4-2022	1,006.67	J-5116	31.33	517.31	8,700.44	J3-345	-24.79	663.79	4,320.20	4,320.20
J3-292	1,006.67	J-5116	31.33	517.31	6,968.77	J3-387	-11.52	674.42	4,327.37	4,327.37
J3-293	1,006.67	J-5116	31.33	517.31	7,378.00	J3-387	-16.09	663.86	4,390.99	4,390.99
J3-295	1,006.67	J-5116	31.33	517.31	7,393.35	J3-387	-16	664.07	4,402.65	4,402.65
J3-367	1,006.67	J-5116	31.33	517.31	5,881.38	J3-929	16.67	790.47	4,574.30	4,574.30
J3-366	1,006.67	J-5116	31.33	517.31	6,002.34	J3-929	16.54	790.17	4,647.95	4,647.95
J-5045	1,006.67	J-5116	31.33	517.31	15,398.25	J-5023	-190.8	159.65	7,202.26	7,202.26

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J2-736	6.87	335	381.18	20.01
J3-271	7.08	405	452.01	20.37
J5-645	47.13	329	381	22.53
J2-229	7.44	395	449.67	23.69
J5-641	47.13	325	381.18	24.34
J-5115	17.8	617	674.7	25
J3-570	17.8	448	505.7	25
J3-704	7.08	600	657.7	25
J3-929	17.8	752	810.04	25.15
J2-228	7.44	391	449.66	25.42
J2-206	7.44	389	449.24	26.1
J5-632	47.13	470	530.29	26.13
J5-631	47.13	470	530.47	26.2
J3-930	17.8	746	809.93	27.7
J3-775	17.8	610	674.21	27.82
J3-776	17.8	610	674.2	27.82
J3-928	17.8	746	810.27	27.85
J3-932	17.8	746	811.3	28.3
J2-205	7.44	385	451.46	28.8
J3-564	17.8	605	674.24	30
J3-373	17.8	750	820.33	30.47
J3-533	0	744	814.84	30.7
J3-372	17.8	750	821.6	31.02
J-5116	7.44	445	517.31	31.33
J-517	10.48	350	422.63	31.47
J3-784	17.8	545	617.75	31.52
J4-756	58.48	428	500.73	31.52
J3-854	0	750	823.59	31.89
J3-774	17.8	600	674.2	32.15
J3-853	0	742	816.56	32.3
J3-777	17.8	598	674.24	33.03
J3-1020	0	745	821.32	33.07
J3-370	17.8	751	829.05	33.82
J4-424	7.44	344	422.64	34.07
J3-606	0	740	818.84	34.16
J3-855	0	742	820.94	34.2
J3-377	17.8	740	819.2	34.32
J3-785	17.8	537	616.38	34.39
J2-555	7.44	370	449.67	34.52
J3-355	17.8	738	818.18	34.74
J3-354	17.8	738	818.68	34.96
J3-707	7.08	573	653.78	35
J3-376	17.8	736	817.35	35.25
J3-365	7.08	753	835.15	35.6
J3-778	17.8	592	674.17	35.61
J3-933	17.8	732	814.44	35.72
J2-207	7.44	369	451.63	35.8
J3-367	17.8	749	832.03	35.98
J4-805	0	752	835.25	36.07
J3-935	17.8	736	820.04	36.42

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J3-872	17.8	471	662.67	83.05
J3-875	17.8	470	661.8	83.11
J3-873	17.8	470	661.83	83.12
J3-974	17.8	546	737.85	83.13
J3-976	17.8	546	737.85	83.13
J3-754	58.48	406	597.99	83.19
J2-649	9.07	344	536.41	83.37
J2-663	7.44	230	422.54	83.43
J3-947	17.8	475	667.57	83.44
J2-738	7.44	207	399.76	83.52
J3-276	17.8	501	693.8	83.54
J3-788	17.8	419	611.93	83.6
J4-613	58.48	308	501.42	83.81
J3-279	17.8	535	728.48	83.83
J6-404	451	340	533.78	83.97
J4-607	58.48	307	500.99	84.06
J6-550	0	340	534.59	84.31
J1-161	9.47	170	364.76	84.39
J3-701	17.8	590	784.96	84.48
J2-252	7.44	255	450.27	84.61
J4-606	58.48	305	500.99	84.92
J5-643	9.07	342	538.22	85.02
J3-1002	9.07	340	536.36	85.08
J1-83	9.47	112	308.37	85.09
J3-965	58.48	305	501.37	85.09
J2-185	7.44	252	448.44	85.12
J-5023	17.8	600	796.53	85.16
J3-705	7.08	600	796.59	85.18
J3-294	17.8	533	729.62	85.2
J1-146	9.47	181	378.21	85.45
J3-950	17.8	470	667.22	85.46
J1-5107	9.47	110	307.51	85.58
J1-5108	9.47	110	307.5	85.58
J1-5106	9.47	110	307.53	85.59
J1-5105	9.47	110	307.55	85.6
J3-944	17.8	470	667.55	85.6
J3-595	17.8	594	791.57	85.61
J2-666	7.44	225	422.64	85.64
J3-983	17.8	600	797.79	85.7
J3-984	17.8	600	797.91	85.75
J1-5104	9.47	110	307.97	85.78
J-5068	58.48	300	498.05	85.81
J3-914	17.8	610	808.47	86
J2-667	7.44	224	422.63	86.07
J3-309	17.8	603	801.97	86.21
J3-997	9.07	337	536.08	86.26
J3-893	17.8	306	505.3	86.36
J-531	0	223	422.47	86.43
J-5127	17.8	480	679.77	86.56
J1-115	9.47	109	308.82	86.58

J3-366	17.8	749	833.08	36.43	J3-282	17.8	494	693.81	86.58
J4-407	45.56	419	503.17	36.47	J3-856	17.8	615	815.12	86.71
J3-360	17.8	737	821.23	36.5	J3-857	17.8	615	815.14	86.72
J3-374	17.8	733	817.23	36.5	J3-363	17.8	610	810.7	86.96
J3-786	17.8	532	616.37	36.56	J3-305	17.8	600	802.58	87.78
J3-371	17.8	739	823.4	36.57	J3-885	17.8	465	667.78	87.87
J2-669	7.44	338	422.53	36.63	J4-747	58.48	426	629.05	87.98
J3-568	17.8	530	614.93	36.8	J3-563	7.08	605	808.06	87.99
J3-931	17.8	724	809.8	37.18	J2-186	7.44	240	443.13	88.01
J3-356	17.8	731	816.89	37.22	J3-990	17.8	595	798.19	88.04
J3-562	17.8	730	815.9	37.22	J3-892	17.8	302	505.32	88.1
J3-787	17.8	419	505.25	37.37	J1-831	0	300	503.6	88.22
J2-659	7.44	336	422.37	37.42	J3-998	9.07	332	536.03	88.41
J3-352	17.8	729	815.9	37.65	J1-112	9.47	103	307.06	88.42
J3-358	17.8	732	819.71	38	J-5021	17.8	605	809.25	88.5
J3-936	17.8	731	819.52	38.36	J2-450	7.44	237	441.52	88.62
J3-938	17.8	730	819.53	38.79	J3-586	17.8	482	687.16	88.9
J1-802	10.21	227	316.77	38.9	J2-553	7.44	247	452.33	88.97
J1-804	10.21	227	316.77	38.9	J2-653	7.44	195	400.42	89.01
J1-805	10.21	227	316.81	38.91	J3-948	17.8	462	667.71	89.13
J3-368	17.8	740	830.11	39.04	J1-103	9.47	103	308.75	89.15
J3-369	17.8	740	830.12	39.05	J4-830	58.48	295	500.83	89.19
J3-375	17.8	724	814.32	39.13	J2-173	7.44	216	421.9	89.21
J3-604	17.8	522	612.32	39.14	J3-744	17.8	562	768.04	89.28
J3-345	17.8	721	811.48	39.2	J6-444	451	327	533.34	89.41
J3-347	17.8	722	812.61	39.26	J3-278	17.8	522	728.5	89.48
J3-927	17.8	718	808.78	39.33	J3-874	17.8	454	661.53	89.92
J3-575	17.8	521	612.32	39.57	J4-698	58.48	333	541.23	90.22
J3-348	17.8	721	813.04	39.88	J4-741	58.48	328	536.3	90.25
J-5111	7.44	425	517.31	40	J3-912	17.8	600	808.48	90.33
J3-721	7.08	537	629.31	40	J5-642	47.13	330	538.49	90.34
J2-654	7.44	290	382.42	40.04	J1-172	0	110	318.71	90.43
J2-227	7.44	357	449.68	40.16	J2-234	7.44	240	449.53	90.79
J3-353	17.8	725	817.78	40.2	J3-986	17.8	588	797.84	90.92
J4-425	7.44	330	422.79	40.21	J3-943	17.8	457	666.9	90.95
J3-574	17.8	520	613.54	40.53	J4-697	58.48	332	541.92	90.96
J3-567	17.8	527	620.67	40.59	J-5024	17.8	580	790.05	91.01
J3-357	17.8	724	818.35	40.88	J1-729	7.44	185	395.44	91.18
J5-842	9.07	440	534.45	40.93	J2-672	6.87	185	395.6	91.25
J3-402	17.8	559	653.67	41.02	J2-730	7.44	185	395.69	91.29
J3-362	17.8	732	827.98	41.59	J4-692	58.48	337	547.78	91.33
J3-397	17.8	662	758.84	41.96	J4-858	58.48	290	500.83	91.35
J3-905	17.8	566	663.72	42.34	J4-528	12.96	337	548.02	91.44
J-529	0	723	820.92	42.43	J3-991	17.8	587	798.19	91.51
J4-701	45.56	403	501.33	42.6	J3-304	17.8	591	802.59	91.68
J3-917	17.8	575	674.09	42.93	J-5077	17.8	455	667.56	92.1
J1-527	12.96	220	319.25	43.01	J-5082	17.8	455	667.55	92.1
J-5118	17.8	575	674.66	43.18	J-5076	17.8	455	667.61	92.12
J-5117	17.8	575	674.69	43.2	J1-102	9.47	96	308.74	92.18
J1-801	10.21	218	317.7	43.2	J3-1008	9.07	324	536.87	92.24
J3-343	17.8	706	805.81	43.25	J1-5103	9.47	110	323.22	92.39
J4-414	58.48	401	501.38	43.5	J3-581	17.8	480	693.34	92.44

J3-334	17.8	705	805.77	43.66	J2-170	7.44	225	438.6	92.55
J4-622	58.48	400	500.88	43.71	J1-5102	9.47	110	323.71	92.6
J3-902	17.8	512	612.96	43.74	J-5074	58.48	287	500.82	92.65
J-532	0	705	806.19	43.84	J1-101	9.47	95	308.85	92.66
J3-351	17.8	713	814.32	43.9	J2-172	7.44	226	439.85	92.66
J3-940	17.8	722	823.51	43.98	J1-5101	9.47	110	323.87	92.67
J3-329	17.8	705	806.62	44.03	J4-742	58.48	325	539.04	92.75
J3-333	17.8	702	803.87	44.14	J3-718	17.8	555	769.12	92.78
J2-833	7.44	320	422.61	44.46	J3-588	17.8	473	687.15	92.79
J5-832	7.44	320	422.61	44.46	J1-5100	9.47	110	324.34	92.88
J3-332	17.8	701	803.86	44.57	J1-120	9.47	94	308.49	92.94
J3-324	17.8	701	804.33	44.77	J2-169	7.44	218	432.51	92.95
J4-619	58.48	398	501.33	44.77	J2-668	7.44	208	422.63	93
J-5123	17.8	554	657.85	45	J1-5099	9.47	110	324.66	93.01
J-5131	17.8	576	679.85	45	J1-5098	9.47	110	324.85	93.09
J3-709	17.8	655	758.85	45	J1-5097	9.47	110	324.9	93.12
J3-344	17.8	705	808.9	45.02	J3-1009	9.07	321	536.47	93.36
J5-638	9.07	430	534.11	45.11	J4-433	58.48	285	500.83	93.52
J3-346	17.8	707	811.47	45.27	J2-198	7.44	236	451.89	93.55
J1-156	10.21	213	317.66	45.35	J3-569	17.8	448	664.27	93.71
J4-689	45.56	448	552.84	45.43	J1-736	9.47	92	308.82	93.95
J3-387	17.8	701	806.13	45.55	J2-647	9.07	319	536.55	94.27
J-5109	7.44	412	517.31	45.63	J2-212	7.44	233	450.74	94.35
J3-571	17.8	400	505.59	45.75	J3-1001	9.07	318	536	94.46
J4-700	17.8	400	505.59	45.75	J3-999	9.07	318	536.01	94.46
J3-759	58.48	395	500.61	45.76	J2-226	7.44	232	450.03	94.47
J3-385	17.8	702	808.15	46	J2-202	7.44	232	450.35	94.61
J3-297	17.8	633	739.27	46.05	J1-82	9.47	90	308.38	94.62
J3-378	17.8	715	821.48	46.14	J3-719	17.8	550	768.38	94.62
J3-941	17.8	716	823.5	46.58	J2-551	7.44	231	450.66	95.18
J3-383	17.8	710	817.8	46.71	J3-1000	9.07	316	535.99	95.32
J5-639	9.07	426	534.03	46.81	J2-222	7.44	230	450.08	95.36
J3-939	17.8	710	818.28	46.92	J1-84	9.47	87	308.35	95.91
J4-740	322.24	395	503.71	47.1	J2-195	7.44	230	452.33	96.34
J2-208	7.44	343	451.9	47.19	J2-729	9.07	315	537.46	96.39
J4-620	58.48	392	500.92	47.2	J5-845	9.07	315	537.51	96.41
J3-325	17.8	695	804.32	47.37	J-5026	17.8	560	782.67	96.48
J3-330	17.8	694	803.32	47.37	J2-194	7.44	229	451.81	96.54
J3-579	17.8	500	609.36	47.38	J3-978	17.8	515	737.82	96.55
J5-841	9.07	424	534.01	47.67	J2-552	7.44	230	452.92	96.59
J4-690	58.48	441	551.52	47.89	J3-723	17.8	545	768.07	96.65
J3-331	17.8	692	802.71	47.97	J3-724	17.8	545	768.05	96.65
J3-865	58.48	390	500.85	48.03	J1-856	0	227	450.72	96.94
J3-903	17.8	502	612.95	48.07	J1-118	9.47	85	308.84	96.99
J3-323	17.8	692	803.12	48.15	J3-881	17.8	436	660.94	97.47
J2-190	7.44	340	451.56	48.34	J1-100	9.47	84	309.05	97.51
J3-506	0	541	653.68	48.82	J2-221	7.44	225	450.09	97.53
J4-618	58.48	388	501.08	49	J3-100	58.48	272	497.76	97.82
J3-937	17.8	705	818.27	49.08	J-5069	58.48	272	497.81	97.84
J3-891	17.8	500	613.28	49.09	J3-350	17.8	585	811.18	98
J3-904	17.8	550	663.79	49.3	J2-250	7.44	224	450.29	98.05
J3-335	17.8	690	803.84	49.33	J-519	58.48	273	499.31	98.06

J3-934	17.8	704	817.97	49.38	J3-720	7.08	542	768.36	98.08
J5-640	9.07	420	534.03	49.41	J3-400	7.08	571	797.54	98.16
J2-204	7.44	337	451.36	49.55	J1-116	9.47	81	308.83	98.72
J4-750	58.48	386	500.71	49.7	J-5119	17.8	570	797.99	98.79
J3-326	17.8	688	803.11	49.88	J1-99	9.47	81	309.17	98.86
J6-557	451	418	533.29	49.96	J1-86	9.47	80	308.54	99.03
J4-738	58.48	390	505.37	49.99	J1-113	9.47	80	308.57	99.04
J3-580	17.8	588	703.39	50	J2-238	7.44	220	449.55	99.46
J3-708	17.8	634	749.39	50	J2-254	7.44	220	449.69	99.53
J6-405	451	418	533.68	50.12	J-5030	17.8	560	789.92	99.63
J4-691	58.48	434	549.75	50.15	J-5031	17.8	560	789.92	99.63
J3-386	17.8	690	806.14	50.32	J2-251	7.44	220	450.28	99.78
J2-670	7.44	306	422.29	50.39	J-5130	17.8	576	806.45	99.85
J4-408	58.48	386	502.67	50.55	J3-880	17.8	430	660.54	99.89
J3-602	17.8	494	611.61	50.96	J4-530	12.96	317	548.02	100.1
J2-183	7.44	331	448.91	51.09	J3-869	17.8	440	671.21	100.18
J4-617	58.48	383	501	51.13	J3-884	17.8	440	671.68	100.39
J3-779	17.8	557	675.06	51.15	J-5028	17.8	540	771.94	100.5
J4-434	58.48	383	501.26	51.24	J-5044	17.8	450	682.06	100.55
J3-381	17.8	699	817.8	51.48	J2-176	7.44	211	444.14	101.02
J3-781	17.8	560	678.92	51.53	J1-737	65.41	72	305.68	101.25
J3-890	17.8	494	613.64	51.84	J-5121	17.8	433	667.5	101.61
J-5129	17.8	560	679.82	51.92	J1-94	9.47	75	309.49	101.61
J3-918	17.8	552	672.16	52.07	J1-445	9.47	74	308.72	101.7
J3-573	17.8	491	611.41	52.17	J2-199	7.44	221	456.17	101.9
J3-316	17.8	685	805.52	52.22	J2-177	7.44	210	445.31	101.96
J4-412	58.48	381	501.53	52.23	J3-572	17.8	270	505.51	102.05
J4-749	58.48	380	500.94	52.4	J-5122	17.8	433	668.85	102.19
J3-790	17.8	700	821.2	52.51	J2-451	7.44	210	445.96	102.24
J3-380	17.8	697	818.41	52.61	J1-803	10.21	227	463.17	102.33
J3-388	17.8	684	805.52	52.65	J1-446	9.47	73	309.21	102.35
J3-906	17.8	542	663.66	52.71	J3-992	17.8	562	798.48	102.47
J3-327	17.8	681	803.11	52.91	J4-431	260.64	263	500	102.69
J4-410	58.48	380	502.12	52.92	J2-200	6.87	219	456.19	102.78
J3-994	17.8	383	505.25	52.97	J2-201	6.87	219	456.31	102.83
J3-995	17.8	383	505.25	52.97	J1-97	9.47	72	309.5	102.91
J2-660	7.44	300	422.3	52.99	J3-761	7.08	540	777.66	102.98
J2-662	7.44	300	422.32	53	J3-972	58.48	260	497.73	103.01
J3-591	17.8	562	684.32	53	J3-310	17.8	564	801.93	103.09
J3-712	17.8	650	772.32	53	J2-168	7.44	195	433.21	103.22
J3-322	17.8	678	800.66	53.15	J3-583	17.8	454	692.41	103.3
J3-300	17.8	621	743.7	53.16	J2-174	7.44	204	442.5	103.34
J3-942	17.8	696	818.74	53.19	J3-860	17.8	426	665.09	103.6
J5-637	9.07	411	534.15	53.36	J1-122	9.47	135	374.37	103.72
J3-328	17.8	681	804.33	53.44	J2-235	7.44	210	449.51	103.78
J3-315	17.8	680	803.66	53.58	J1-98	9.47	70	309.53	103.79
J3-391	17.8	682	806.11	53.78	J1-91	9.47	70	309.7	103.86
J3-876	17.8	540	664.12	53.78	J1-92	9.47	70	309.74	103.88
J3-587	17.8	560	684.7	54.03	J-5070	58.48	258	497.79	103.9
J4-843	7.44	298	422.72	54.04	J1-95	9.47	70	309.83	103.92
J-5126	17.8	555	679.78	54.07	J1-129	9.47	69	309.02	104
J3-603	17.8	485	610.15	54.23	J1-130	9.47	69	309.02	104

J3-338	17.8	675	800.49	54.37	J2-167	7.44	200	440.39	104.16
J4-409	58.48	377	502.73	54.48	J3-592	17.8	558	798.81	104.34
J3-578	17.8	484	610.14	54.66	J1-121	9.47	67	308.06	104.45
J2-554	7.44	325	451.52	54.82	J3-862	17.8	430	671.21	104.52
J3-401	17.8	527	653.69	54.9	J1-982	9.47	66	307.5	104.64
J-853	0	685	811.97	55.02	J3-883	17.8	430	671.69	104.72
J3-527	12.96	679	806.08	55.06	J1-117	9.47	67	308.82	104.78
J3-336	17.8	675	802.24	55.13	J1-143	9.47	68	309.92	104.82
J-5110	7.44	390	517.31	55.16	J1-142	9.47	68	310.01	104.86
J3-359	17.8	690	817.61	55.29	J3-292	17.8	566	808.03	104.87
J4-411	58.48	374	501.78	55.37	J2-448	7.44	197	439.09	104.9
J2-671	7.44	294	422.28	55.58	J-5078	17.8	425	667.56	105.1
J3-389	17.8	677	805.34	55.61	J-5075	17.8	425	667.59	105.11
J4-419	58.48	372	500.73	55.78	J2-166	7.44	196	438.57	105.11
J4-796	58.48	372	500.95	55.87	J1-96	9.47	66	309.8	105.64
J4-615	58.48	372	500.99	55.89	J1-133	9.47	65	309.41	105.9
J3-954	17.8	686	815.22	55.99	J1-134	9.47	65	309.41	105.9
J3-887	17.8	484	613.61	56.16	J1-124	9.47	62	306.56	105.97
J-5125	17.8	550	679.78	56.23	J2-237	7.44	205	449.55	105.97
J3-384	17.8	685	814.81	56.25	J1-844	9.47	120	364.76	106.05
J3-755	58.48	468	597.97	56.32	J1-137	9.47	64	309.42	106.34
J4-418	58.48	370	500.93	56.73	J2-646	9.07	291	537.24	106.7
J2-181	7.44	315	446.11	56.81	J2-233	7.44	203	449.51	106.81
J3-349	17.8	680	811.18	56.84	J3-861	17.8	423	669.68	106.89
J4-417	58.48	370	501.31	56.89	J1-135	9.47	62	308.91	106.99
J3-919	17.8	540	671.42	56.94	J1-136	9.47	62	308.91	106.99
J3-920	17.8	540	671.41	56.94	J1-132	9.47	62	309.24	107.13
J5-633	9.07	402	533.42	56.95	J3-306	17.8	554	802.11	107.5
J3-888	17.8	482	613.62	57.03	J1-90	9.47	62	310.12	107.51
J3-713	17.8	639	770.75	57.09	J1-93	9.47	62	310.68	107.76
J3-901	17.8	480	612.06	57.22	J2-268	7.44	200	449.1	107.93
J-5095	7.44	290	422.28	57.32	J1-139	9.47	67	316.13	107.95
J3-871	17.8	530	662.6	57.45	J-5112	17.8	425	674.64	108.17
J2-673	6.87	185	317.64	57.47	J-5071	58.48	248	497.78	108.23
J4-420	58.48	367	500.01	57.63	J-5041	17.8	540	789.89	108.28
J3-907	17.8	530	663.39	57.8	J3-722	17.8	518	768.26	108.44
J5-634	9.07	400	533.62	57.9	J3-760	7.08	540	790.61	108.59
J4-752	58.48	367	500.82	57.98	J1-125	65.41	57	307.79	108.67
J-5085	17.8	535	668.86	58	J2-232	7.44	198	449.51	108.98
J4-616	58.48	367	501	58.06	J-5039	17.8	425	676.76	109.09
J1-400	9.47	182	316.26	58.18	J-5040	17.8	425	676.76	109.09
J-5089	17.8	580	714.3	58.19	J-5043	17.8	425	676.76	109.09
J2-191	7.44	317	451.42	58.25	J3-274	17.8	441	692.9	109.15
J3-915	17.8	674	808.74	58.38	J3-308	17.8	550	801.99	109.19
J3-566	17.8	525	659.79	58.41	J1-88	9.47	56	308.54	109.43
J3-561	17.8	665	799.98	58.49	J1-27	9.47	54	307.09	109.66
J3-565	17.8	525	660.09	58.53	J2-224	7.44	197	450.18	109.7
J3-886	17.8	478	613.6	58.76	J4-2022	17.8	562	815.54	109.86
J3-299	17.8	603	738.91	58.89	J1-128	9.47	55	308.74	109.94
J4-436	58.48	362	497.96	58.91	J1-131	9.47	55	308.81	109.98
J4-439	58.48	361	497.36	59.08	J1-89	9.47	56	310.08	110.09
J3-314	17.8	667	803.68	59.22	J1-28	9.47	53	307.1	110.1

J1-109	9.47	145	281.73	59.24	J1-29	9.47	53	307.1	110.1
J3-392	17.8	669	806.06	59.39	J1-30	9.47	53	307.1	110.1
J4-621	58.48	364	501.06	59.39	J2-648	9.07	282	536.21	110.15
J3-826	0	670	808.07	59.83	J1-126	65.41	54	308.64	110.34
J4-773	58.48	361	499.2	59.88	J1-127	65.41	54	308.8	110.41
J-516	17.8	527	665.47	60	J-5064	58.48	248	502.98	110.48
J3-703	58.48	460	598.47	60	J3-745	17.8	513	768.06	110.52
J3-339	17.8	661	799.81	60.14	J1-31	9.47	52	307.1	110.53
J3-780	17.8	540	678.93	60.2	J3-864	17.8	410	665.11	110.54
J4-421	58.48	361	500.56	60.47	J1-69	9.47	53	308.49	110.7
J2-664	7.44	283	422.6	60.49	J1-26	9.47	51	307.08	110.96
J4-416	58.48	362	501.76	60.56	J1-23	9.47	51	307.11	110.97
J4-625	58.48	360	499.76	60.56	J1-34	9.47	51	307.1	110.97
J4-770	58.48	357	496.78	60.57	J1-138	9.47	60	316.13	110.98
J3-953	17.8	676	815.86	60.6	J1-24	9.47	51	307.12	110.98
J4-610	58.48	361	500.99	60.66	J-5065	58.48	247	503.26	111.04
J3-318	17.8	660	800.37	60.82	J4-847	58.48	247	503.76	111.25
J3-589	17.8	553	693.72	60.97	J1-35	9.47	50	307.1	111.4
J3-379	17.8	677	818.42	61.28	J1-25	9.47	50	307.12	111.41
J4-415	58.48	362	503.45	61.29	J3-858	17.8	408	665.12	111.41
J3-714	17.8	628	769.62	61.37	J3-605	7.08	403	660.86	111.73
J4-428	58.48	358	499.78	61.43	J1-22	9.47	49	307.12	111.84
J4-435	58.48	357	498.87	61.47	J1-21	9.47	49	307.13	111.85
J3-896	17.8	470	611.94	61.5	J2-264	7.44	191	449.23	111.89
J4-430	260.64	358	499.96	61.51	J-5062	58.48	245	503.4	111.96
J3-900	17.8	470	611.99	61.52	J1-444	65.41	50	309.03	112.24
J3-599	17.8	664	806.04	61.55	J4-832	0	300	559.24	112.33
J3-598	17.8	660	802.43	61.72	J1-20	9.47	48	307.27	112.34
J4-413	58.48	359	501.49	61.74	J1-1	9.47	48	307.28	112.35
J4-438	58.48	355	497.61	61.79	J1-2	9.47	48	307.28	112.35
J4-765	58.48	355	497.65	61.81	J1-3	9.47	48	307.28	112.35
J2-184	7.44	306	448.73	61.85	J1-791	9.47	48	307.29	112.35
J3-951	17.8	675	818.13	62.02	J1-981	9.47	48	307.5	112.44
J3-909	17.8	520	663.34	62.11	J1-10	9.47	47	307.27	112.77
J4-844	7.44	279	422.72	62.27	J1-795	9.47	47	307.27	112.77
J3-321	17.8	656	799.77	62.29	J3-863	17.8	400	660.86	113.03
J4-757	58.48	357	500.82	62.32	J3-866	17.8	410	671.17	113.17
J4-429	260.64	356	499.9	62.35	J1-9	9.47	46	307.28	113.21
J3-716	17.8	625	769.02	62.4	J-5066	58.48	240	501.34	113.24
J4-771	58.48	357	501.14	62.46	J2-253	7.44	189	450.39	113.26
J1-159	9.47	219	363.44	62.59	J3-882	17.8	412	673.68	113.39
J1-157	9.47	220	364.51	62.62	J-5013	9.07	274	535.91	113.49
J3-670	7.08	448	592.89	62.78	J1-11	9.47	45	307.26	113.64
J4-426	58.48	355	499.88	62.78	J3-293	17.8	547	809.28	113.65
J1-158	22.91	219	363.94	62.8	J2-219	7.44	188	450.41	113.7
J3-993	17.8	570	715.4	63	J3-295	7.08	547	809.51	113.75
J3-889	17.8	468	613.62	63.1	J3-101	58.48	235	497.71	113.83
J4-422	58.48	356	501.93	63.23	J-5063	58.48	240	503.21	114.05
J4-441	58.48	354	499.99	63.26	J1-16	9.47	44	307.24	114.06
J-5088	17.8	568	714.3	63.39	J1-17	9.47	44	307.23	114.06
J3-382	17.8	670	816.86	63.63	J1-14	9.47	43	307.25	114.5
J3-897	17.8	465	611.94	63.67	J1-15	9.47	43	307.24	114.5

J3-390	17.8	659	806.1	63.74	J1-140	9.47	52	316.34	114.54
J4-437	58.48	350	497.11	63.74	J1-4	9.47	43	307.34	114.54
J4-764	58.48	352	499.1	63.74	J6-450	0	270	534.59	114.64
J3-758	58.48	451	598.23	63.8	JF-102	58.48	238	502.67	114.68
J3-393	17.8	658	805.33	63.84	J1-733	7.44	175	439.77	114.73
J3-706	7.08	506	653.69	63.99	J2-165	7.44	174	439.1	114.87
J3-748	58.48	450	597.89	64.08	J3-859	17.8	400	665.11	114.87
J3-597	17.8	651	799.15	64.19	J1-19	9.47	42	307.29	114.95
J3-908	17.8	515	663.18	64.21	J1-5	9.47	42	307.34	114.97
J1-160	9.47	215	363.44	64.32	J1-6	9.47	42	307.33	114.97
J4-624	58.48	355	503.59	64.38	J1-141	9.47	51	316.35	114.98
J3-600	17.8	655	803.74	64.45	J1-8	10.21	42	307.41	115
J3-727	17.8	649	797.73	64.45	J3-867	17.8	405	671.19	115.34
J3-361	17.8	672	821.18	64.64	J3-275	17.8	427	693.32	115.4
J1-794	9.47	215	364.21	64.65	J1-7	9.47	41	307.35	115.41
J3-394	17.8	656	805.33	64.7	J1-76	9.47	41	307.84	115.62
J-5087	17.8	564	713.76	64.89	J1-12	9.47	40	307.26	115.8
J-5091	58.48	350	499.88	64.94	J-5081	17.8	400	667.51	115.91
J-518	7.44	273	423.01	65	J1-980	9.47	40	307.5	115.91
J3-726	17.8	650	800.16	65.06	J1-812	9.47	54	321.55	115.93
J3-311	17.8	655	805.31	65.13	J1-75	9.47	40	307.98	116.11
J2-189	7.44	301	451.46	65.19	J1-18	9.47	39	307.3	116.25
J4-527	12.96	351	501.49	65.21	J1-81	9.47	40	308.42	116.31
J4-762	58.48	349	499.59	65.25	J2-236	7.44	180	449.5	116.77
J3-962	58.48	350	501.1	65.47	J1-813	10.21	52	321.77	116.89
J4-423	58.48	350	501.34	65.57	J1-814	10.21	52	321.79	116.9
J-5086	17.8	562	713.76	65.76	J2-248	7.44	180	450.03	117
J3-337	17.8	648	800.06	65.89	J2-223	7.44	180	450.18	117.07
J1-811	9.47	213	365.14	65.92	J2-225	7.44	179	450.02	117.43
J3-596	17.8	647	799.15	65.92	J3-1010	9.07	265	536.36	117.58
J1-155	10.09	213	365.17	65.93	J1-80	9.47	36	307.52	117.65
J1-154	10.09	213	365.2	65.95	J-5014	9.07	264	535.92	117.82
J1-153	9.47	213	365.29	65.99	J-523	7.44	110	382.08	117.89
J3-922	17.8	518	670.3	65.99	J1-13	9.47	35	307.25	117.97
J3-870	17.8	510	662.71	66.17	J1-440	9.47	35	307.27	117.98
J1-163	9.47	210	363.13	66.35	J4-440	58.48	232	504.89	118.24
J3-715	17.8	616	769.14	66.36	JF-101	58.48	230	502.93	118.26
J3-789	17.8	670	823.66	66.58	J1-63	9.47	46	319.67	118.58
J3-959	17.8	615	768.9	66.68	J3-815	17.8	400	673.68	118.58
J3-960	17.8	615	768.89	66.68	J1-441	9.47	46	319.7	118.6
J3-916	17.8	654	808.28	66.85	J-526	7.44	110	383.74	118.61
J2-182	7.44	290	444.3	66.86	J2-837	7.44	175	449.89	119.11
J4-694	58.48	393	547.44	66.92	JF-100	0	228	502.93	119.13
J1-152	22.91	210	364.5	66.95	J2-249	7.44	175	450.17	119.23
J3-576	17.8	457	611.6	66.99	J1-808	9.47	50	326.83	119.95
J2-838	7.44	295	449.72	67.04	J3-725	17.8	491	768.04	120.04
J3-782	17.8	524	678.9	67.12	J1-87	9.47	45	322.08	120.06
J-513	17.8	603	758.79	67.5	J1-686	9.47	50	328.05	120.48
J1-106	9.47	153	308.81	67.51	FCV-7-OUT	0	50	328.1	120.5
J1-85	9.47	152	308.34	67.74	J2-220	7.44	172	450.41	120.64
J3-1005	9.07	380	536.43	67.78	J1-1019	9.47	46	324.96	120.87
J1-151	9.47	208	364.56	67.84	J1-1020	9.47	46	325.42	121.07

J1-105	9.47	152	308.81	67.95	J1-810	9.47	48	327.54	121.12
J4-427	58.48	343	499.87	67.97	J3-1018	0	46	325.63	121.17
J-5046	17.8	540	696.94	68	J3-1023	0	46	325.65	121.17
J3-895	17.8	455	611.93	68	J3-1024	0	46	325.67	121.18
J4-614	58.48	344	501.06	68.05	J-5015	9.07	256	535.92	121.29
J3-560	17.8	642	799.13	68.09	J-5019	9.07	256	535.92	121.29
J3-966	58.48	350	507.15	68.09	J-5020	9.07	256	535.93	121.29
J4-772	58.48	340	497.37	68.19	J1-64	9.47	46	326.71	121.63
J3-313	17.8	645	802.41	68.21	J2-211	7.44	170	450.75	121.65
J-5067	58.48	342	499.57	68.27	J2-210	7.44	170	450.79	121.67
J1-793	9.47	207	364.63	68.3	J1-1022	9.47	46	326.83	121.68
J3-973	7.44	265	422.62	68.3	J1-851	9.47	46	326.83	121.68
J3-590	17.8	526	683.85	68.4	J1-806	9.47	44	324.85	121.69
J1-144	10.21	119	276.92	68.43	J2-209	7.44	170	450.89	121.71
J4-609	58.48	343	500.99	68.46	J2-214	7.44	170	450.94	121.73
J3-289	17.8	575	733.39	68.63	J3-868	17.8	390	671.18	121.84
J3-956	17.8	610	768.42	68.64	J1-57	9.47	49	331.69	122.49
J3-1007	9.07	378	536.43	68.65	J1-77	9.47	25	307.72	122.5
J3-342	17.8	641	799.44	68.65	J1-1021	9.47	44	326.9	122.58
J4-769	58.48	338	496.7	68.76	J1-855	0	42	324.94	122.6
J3-753	58.48	439	598.11	68.94	J1-847	9.47	42	325.07	122.65
J2-702	7.44	263	422.29	69.02	J2-246	7.44	167	450.19	122.71
J3-577	17.8	452	611.39	69.07	J6-446	451	250	533.32	122.76
J1-164	9.47	203	362.66	69.18	J1-688	9.47	45	328.5	122.84
J2-230	7.44	290	449.66	69.18	FCV-8-OUT	0	45	328.59	122.88
J1-858	9.47	153	313	69.33	J2-239	7.44	166	449.59	122.88
JU-404	0	375	535.19	69.41	J1-1016	9.47	44	328.71	123.36
J2-656	7.44	262	422.28	69.45	J3-1017	0	44	328.9	123.45
J2-657	7.44	262	422.3	69.46	J1-852	9.47	48	333.36	123.65
J-514	17.8	573	733.37	69.49	J4-501	9.07	250	535.45	123.69
J3-272	17.8	505	665.45	69.52	J6-455	0	255	540.76	123.82
J4-768	58.48	336	497.24	69.87	J3-283	17.8	408	693.79	123.83
J2-661	7.44	261	422.32	69.9	J1-850	9.47	46	332.1	123.97
J3-601	17.8	641	802.45	69.95	J1-854	9.47	46	332.24	124.03
J3-898	17.8	450	611.93	70.16	J1-56	9.47	45	331.69	124.22
J3-899	17.8	450	611.95	70.17	J1-848	9.47	45	332.18	124.43
J5-815	9.07	375	537.14	70.26	J1-54	9.47	45	332.18	124.44
J-5090	17.8	643	805.3	70.33	J2-247	7.44	163	450.19	124.44
J4-766	58.48	335	497.35	70.35	J1-79	9.47	20	307.59	124.61
J1-162	9.47	201	363.57	70.44	J1-71	9.47	20	308.44	124.98
J3-317	17.8	638	800.76	70.52	J1-72	9.47	20	308.46	124.99
J1-111	9.47	144	306.9	70.59	J1-49	9.47	43	331.7	125.09
J3-921	17.8	506	669.27	70.74	J1-78	9.47	19	307.72	125.1
J6-447	451	370	533.29	70.75	J1-51	9.47	43	331.77	125.12
J3-967	58.48	350	513.39	70.8	J4-699	50.81	250	539.01	125.23
J1-150	9.47	201	365.06	71.09	J2-263	7.44	160	449.23	125.33
J3-557	17.8	569	733.34	71.21	J2-241	7.44	160	449.47	125.43
J1-107	9.47	170	334.63	71.33	J1-50	9.47	42	331.73	125.54
J1-108	9.47	170	334.63	71.33	J-5033	17.8	500	789.87	125.6
J2-180	7.44	281	445.68	71.36	J1-70	9.47	20	310.07	125.69
J3-341	17.8	635	799.7	71.37	J1-39	9.47	49	339.39	125.83
JU-402	0	370	535.01	71.5	J2-255	7.44	159	449.43	125.84

J4-767	58.48	332	497.24	71.6	J2-258	7.44	158	449.35	126.24
J3-302	17.8	640	805.31	71.63	FCV-4-OUT	0	30	322.1	126.57
J3-273	17.8	527	692.72	71.8	J1-59	9.47	39	331.51	126.74
J1-148	9.47	199	364.83	71.85	J3-403	7.08	504	797.48	127.16
J2-651	9.07	369	535.1	71.97	J3-711	7.08	363	656.72	127.27
J3-717	17.8	603	769.13	71.99	J2-240	7.44	155	449.47	127.59
J4-2011	58.48	330	496.32	72.07	J-5042	17.8	495	789.86	127.76
J3-364	58.48	360	526.6	72.19	J2-260	7.44	154	449.31	127.96
J1-149	22.91	198	364.81	72.28	J1-60	9.47	35	330.34	127.97
J5-799	9.07	370	536.88	72.31	J2-256	7.44	154	449.36	127.98
J3-296	17.8	571	738.19	72.44	J2-245	7.44	155	450.39	127.99
J2-178	7.44	278	445.26	72.47	J2-257	7.44	153	449.34	128.41
J1-110	9.47	138	305.75	72.69	J-5011	17.8	512	809.44	128.88
J1-715	0	110	277.79	72.7	J-5016	9.07	238	535.91	129.09
J3-559	58.48	430	598.01	72.8	J2-244	7.44	152	450.41	129.3
J1-145	9.47	210	378.22	72.89	J3-405	17.8	499	797.44	129.31
J4-763	58.48	330	499.31	73.36	J-5009	58.48	230	528.91	129.52
J-5010	17.8	640	809.44	73.42	J2-266	7.44	149	449.16	130.06
J3-303	17.8	634	803.66	73.51	J2-218	7.44	150	450.92	130.39
J5-636	9.07	365	534.74	73.55	J-5054	58.48	200	501.49	130.63
J3-979	17.8	568	737.91	73.62	J-5055	58.48	200	501.49	130.64
J3-291	17.8	567	737.78	74	J1-700	0	20	321.51	130.64
J4-611	58.48	330	501.08	74.13	J-5056	58.48	200	501.53	130.65
J3-320	17.8	628	799.13	74.15	J-5057	58.48	200	501.53	130.65
J3-396	17.8	634	805.33	74.24	J-5058	58.48	200	501.63	130.7
J3-301	17.8	634	805.35	74.25	J-5059	58.48	200	501.64	130.7
J3-913	17.8	637	808.49	74.31	J-5052	58.48	200	501.75	130.75
J2-197	7.44	279	451.41	74.71	J-5050	58.48	200	501.82	130.78
J3-280	17.8	557	729.6	74.79	J-5051	58.48	200	502.09	130.89
J3-971	7.44	250	422.62	74.79	J-5049	58.48	200	503.93	131.69
J3-878	17.8	490	662.64	74.81	J2-243	7.44	146	450.9	132.11
J2-665	7.44	250	422.67	74.82	J-5035	17.8	484	789.83	132.52
J3-277	17.8	521	694.09	75	J-5061	58.48	230	535.85	132.53
J3-312	17.8	630	803.23	75.06	J-5048	58.48	200	506.48	132.8
J3-969	58.48	340	513.42	75.14	J6-410	0	225	533.34	133.6
J3-958	17.8	595	768.68	75.26	J2-836	7.44	140	449.37	134.05
J3-926	17.8	495	668.79	75.3	J4-432	58.48	227	536.52	134.12
J-5072	58.48	320	494.18	75.47	J-5047	58.48	200	511.32	134.89
J4-2008	58.48	320	494.18	75.47	J2-259	7.44	137	449.31	135.32
J4-2009	58.48	320	494.18	75.47	J6-409	451	225	540.76	136.82
J2-203	7.44	277	451.19	75.48	J-5060	58.48	220	535.97	136.91
J4-2007	58.48	320	494.19	75.48	J2-215	7.44	135	451.86	137.3
J4-2005	58.48	320	494.21	75.49	J-530	0	52	369.83	137.72
J4-2006	58.48	320	494.23	75.49	J1-38	9.47	50	369.42	138.4
J4-2004	58.48	320	494.31	75.53	J3-1025	0	50	369.43	138.41
J3-996	9.07	362	536.33	75.54	FCV-6-OUT	0	50	369.54	138.45
J4-2003	58.48	320	494.44	75.58	FCV-6-IN	0	50	369.69	138.52
J3-584	17.8	518	692.56	75.64	FCV-14-IN	0	50	369.93	138.63
J4-696	58.48	370	544.74	75.71	FCV-14-OU	0	50	369.93	138.63
J1-147	9.47	190	364.93	75.8	J2-262	7.44	128	449.24	139.19
J4-2001	58.48	320	494.98	75.82	J2-213	7.44	130	451.26	139.2
J5-797	9.07	362	537.14	75.89	J1-815	9.47	0	321.56	139.33

J3-968	58.48	332	507.18	75.91	J1-816	9.47	0	321.64	139.37
J4-2018	58.48	320	495.98	76.25	J2-265	7.44	127	449.13	139.58
J4-2000	58.48	320	496.03	76.27	J1-58	9.47	38	360.19	139.6
J4-2010	58.48	320	496.02	76.27	J1-900	9.47	0	322.33	139.66
J4-2012	58.48	320	496.02	76.27	J1-401	9.47	0	323.25	140.06
J4-2013	58.48	320	496.02	76.27	J6-448	0	210	533.82	140.31
J4-2014	58.48	320	496.05	76.28	J6-449	0	210	534.59	140.64
J4-2017	58.48	320	496.28	76.38	J2-267	7.44	124	449.1	140.87
J4-2015	58.48	320	496.31	76.4	JU-401	0	215	540.55	141.06
J1-123	9.47	201	377.49	76.47	J-5017	9.07	209	535.91	141.65
J3-964	58.48	324	501.04	76.71	J3-404	17.8	470	797.46	141.89
J4-2016	58.48	320	497.05	76.72	J1-849	0	42	369.77	142.02
J3-290	17.8	560	737.24	76.8	J1-47	9.47	37	365.59	142.38
J2-556	7.44	340	517.31	76.83	J1-44	9.47	40	369.59	142.81
J-5124	17.8	480	657.84	77.06	J1-1011	9.47	40	369.69	142.86
J3-910	17.8	485	662.87	77.07	J1-1013	9.47	40	369.75	142.88
J-5120	17.8	535	712.94	77.1	J1-1012	9.47	40	369.76	142.89
J3-955	17.8	590	768.44	77.32	J1-1014	9.47	40	369.8	142.9
J-5083	17.8	490	668.48	77.34	J1-48	9.47	37	367.13	143.04
J3-398	17.8	620	798.54	77.36	J1-1015	9.47	40	370.42	143.17
J3-957	17.8	590	768.56	77.37	J1-442	9.47	39	369.41	143.17
J3-925	17.8	490	668.67	77.42	J1-40	9.47	39	369.48	143.2
J-5113	17.8	620	798.8	77.47	J1-42	9.47	39	369.48	143.2
J3-593	17.8	620	798.87	77.51	J6-445	0	202	533.34	143.57
J4-746	58.48	450	628.92	77.53	J1-41	9.47	40	373.04	144.31
J3-961	58.48	322	501.25	77.67	FCV-5-OUT	0	40	373.22	144.38
J2-650	9.07	357	536.5	77.78	J2-217	7.44	122	457.84	145.52
J3-1006	9.07	357	536.5	77.78	J2-216	7.44	121	458.54	146.26
J2-839	7.44	270	449.66	77.85	J2-270	7.44	110	449.06	146.92
J4-712	45.56	363	543.01	78	J-525	7.44	110	449.22	146.99
J-5073	58.48	320	500.81	78.34	J2-150	3.36	110	449.25	147
J3-963	58.48	320	501.17	78.5	FCV-5-IN	0	40	379.76	147.22
J2-192	7.44	270	451.41	78.61	FCV-7-IN	0	50	395.9	149.88
J-5114	17.8	617	798.78	78.76	J2-271	0	110	457.16	150.42
J2-658	7.44	240	422.37	79.02	J-521	5.2	46	396	151.65
J3-689	7.08	547	729.53	79.09	J-522	12.96	46	395.99	151.65
J3-585	17.8	510	692.66	79.15	FCV-8-IN	0	45	395.78	151.99
J4-695	58.48	362	544.72	79.17	J-5018	9.07	185	535.9	152.05
J3-783	17.8	496	678.89	79.25	J-520	12.96	44	395.99	152.52
J4-2002	58.48	312	494.95	79.27	J2-269	7.44	90	449.07	155.58
J4-612	58.48	318	501.14	79.35	J1-176	0	110	470.15	156.05
J5-644	9.07	355	538.21	79.38	J-528	12.96	454	815.71	156.73
J2-193	7.44	268	451.4	79.47	J1-165	0	25	389.81	158.07
J2-196	7.44	268	451.41	79.47	J1-166	0	25	389.95	158.13
J6-456	451	350	533.4	79.47	J1-167	0	25	389.95	158.13
J3-924	17.8	485	668.46	79.49	J3-406	7.08	430	797.46	159.22
J-5084	17.8	485	668.48	79.5	J1-443	9.47	20	389.81	160.24
J3-985	17.8	614	797.78	79.63	J-5053	58.48	110	501.83	169.78
J3-702	7.08	470	653.89	79.68	J2-261	7.44	50	449.31	173.02
J6-406	451	350	533.89	79.68	J4-2021	0	405	816	178.08
J4-608	58.48	317	501.03	79.74	J-5096	9.07	110	533.62	183.55
J3-594	17.8	615	799.09	79.77	J-5092	9.07	110	534.4	183.89

J2-179	7.44	260	444.18	79.8
J3-1003	9.07	352	536.47	79.93
J2-231	7.44	265	449.66	80.01
J2-840	7.44	265	449.72	80.04
J-5128	17.8	495	679.8	80.08
J3-558	17.8	549	733.84	80.09
J-5080	17.8	483	667.9	80.12
J6-407	451	350	535.12	80.21
J3-307	17.8	618	803.15	80.23
J3-319	17.8	614	799.21	80.25
J3-894	17.8	320	505.29	80.29
J2-188	7.44	266	451.39	80.33
J3-288	17.8	546	731.52	80.39
J2-652	9.07	350	536.47	80.8
J4-739	58.48	325	511.65	80.87
J1-104	9.47	122	308.75	80.92
J3-281	17.8	507	693.9	80.98
J3-582	17.8	505	691.94	81
J3-946	17.8	480	667.58	81.28
J3-970	7.44	235	422.62	81.3
J3-989	17.8	610	797.78	81.37
J3-988	17.8	610	797.8	81.38
J-5079	17.8	480	667.9	81.42
J3-751	58.48	410	597.96	81.44
J3-923	17.8	480	668.29	81.58
J-5037	17.8	500	688.69	81.76
J1-447	9.47	120	308.81	81.81
J3-911	17.8	490	678.89	81.84
J-527	12.96	347	536.21	81.99
J4-693	58.48	358	547.49	82.11
J2-175	7.44	253	442.61	82.16
J3-975	17.8	548	737.84	82.26
J3-977	17.8	548	737.84	82.26
J3-987	17.8	608	797.84	82.26
J3-952	17.8	628	818.12	82.38
J2-187	7.44	260	450.21	82.42
J5-856	19.3	310	500.23	82.43
J3-879	17.8	472	662.61	82.59
J1-114	9.47	118	308.81	82.68
J2-449	7.44	252	442.94	82.73
J3-743	17.8	577	768.05	82.78
J3-395	17.8	614	805.32	82.9
J1-119	9.47	118	309.55	83
J3-877	17.8	471	662.64	83.04

J-5093	9.07	110	536.55	184.82
J3-731	7.08	434	885.4	195.59
J-5004	0	434	885.63	195.69
J-5007	0	434	885.63	195.69
J-5006	0	434	889.1	197.19
J-5003	0	434	889.11	197.2
J-5005	0	434	890.29	197.71
J-5002	0	434	890.3	197.72
FCV-4-IN	0	30	494.97	201.47
J-524	17.8	110	729.53	268.44
J-515	17.8	110	733.31	270.08
J-5025	17.8	110	790.04	294.66
J-5045	17.8	110	808.83	302.8
J-854	407.2	110	819.67	307.5

Appendix M

Preventative Maintenance Schedule

SURFACE WATER FILTRATION PLANT

Standard Operating Procedures

The City of Camas Water Filter Plant is a group III facility. In accordance with WAC 246-292-040 a Water Treatment Plant Operator shall be certified at a level equal to or higher than the water system's classification rating by the department.

Any decisions concerning process control, or any adjustments that could impact water quality must be made by a WTPO 2 or greater.

After hours On-call personnel responding to an alarm at the filter plant may initiate shutdown procedures in accordance with the O&M plan when the plant is in automated by-pass mode. Notify supervisor of action

Weekend duty personnel shall maintain record requirements while doing rounds. If the filter plant alarms and goes into by-pass, follow the afterhours procedure above.

If there is an emergency or you need clarification, call Mike Stevens, Mike Nelson, or Monte Brachmann at the following phone numbers:

Mike Stevens	360-921-2872, or 360-835-9093
Mike Nelson	360-921-2751, or 360-687-5014
Monte Brachmann	360-921-3799, or 360-834-2749

It is the intent of this directive to have a WTPO 2 or greater make all operational decisions at the plant. Emergency actions may be taken by field personnel to protect the public health and safety. Before any action is taken by a field staff they must try to contact a person on the list above. The action taken must follow O&M procedures at the minimum level required to protect the public.

Surface Water Filtration Plant daily Operations

1. Record influent turbidity
2. Record influent pH, filter pH, and effluent pH.
3. Record influent water temperature.
4. Record the air temperature.
5. Record flow, headloss, influent pressure, and effluent turbidity.

6. Record alum pump stroke percent, and dose.

7. Record secondary floc pump stroke percent, and dose.

8. Record alum tank level from sight gauge and calculate pervious day's alum useage.

9. Record effluent chlorine residual with on-line analyzer.

10. Record effluent turbidity with on line analyzer.

11. Check the level of caustic tank.

12. Check the level of the secondary flocculent and fill if necessary.

13. Record fluoride meter reading and check fluoride level in saturator. Fill saturator if necessary.

14. Record fluoride concentration in the plant effluent.

15. Visually check all pumps, mechanical devices, and equipment for abnormalities.

16. Record weather conditions.

17. Record time of last backwash.

Surface Water Filtration Plant Shutdown Procedures – Routine Maintenance

1. At the blue S&B control panel by the entrance door, disable alarms by holding the red button down for 5 seconds. When the red light starts flashing, the alarms are disabled.

2. Shut off the following chemical feed pumps: alum, caustic, secondary floc, and fluoride.

3. Turn the Backwash on Headloss switch to **OFF.**

4. Turn the pressure gauge on at the southeast corner of the filter building to **ON.**

5. Turn the Influent Valve switch to **CLOSE.**

6. As the influent valve closes, the influent pressure will rise. Open the gate valve (described in the pressure regulation section above) to keep the pressure from going above 130. It will take approximately 3 minutes for the influent valve to fully close.

7. Turn the Effluent Waste (Filter to Waste) switch to **CLOSE.**

8. Open the 12 – inch bypass valve with the orange marker on the east side of the building to allow influent water to discharge to Lacamas Lake.

9. Push blue button to left of Sodium Thiosulfate Feed switch to initiate timed feed of sodium thiosulfate.

10. Turn sodium hypochlorite feed pump at Surface Water Chlorination Plant **OFF.**

11. If the effluent line is to be shut off, turn the chlorine analyzer on the south wall of the filter building to **OFF.**

12. If the 10- inch transmission main from the headworks is to be drained, unplug the streaming current monitor at the southeast corner of the filter plant building.

APPENDIX M

City of Camas Water System
Preventative Maintenance Schedule

Daily Maintenance Activities

Surface Water Chlorination Plant (in operation)

- Note liquid level in the sodium hypochlorite tank.
- Record the chlorine dosage.
- Record the weather conditions.
- Record the time.
- Record the chlorine residual results.
- If chlorine residual level is below 2.3 mg/L at the sample tap in the chlorination building, make appropriate adjustments at feed pump to bring the chlorine residual up to target level. Target level 1.8 – 2.3 mg/L (Depending on Weather)
- Check propane tank fuel level for generator
- Check pump performance with calibration cylinder

Surface Water Filtration Plant (in operation)

- Run sample and record influent turbidity.
- Run sample and record influent pH, filter pH, and effluent pH.
- Test and record influent water temperature.
- Record the air temperature.
- Record flow, headloss across filters, influent pressure, and effluent turbidity.
- Record alum pump stroke percentage, dosage, and whether in auto or manual position.
- Record effluent caustic pump stroke percentage, dosage, and whether in auto or manual position.
- Record secondary flocculent pump stroke percentage, dosage, and whether in auto or manual position.
- Record the alum tank level from the sight gauge and calculate the previous day's usage.
- Run sample and compare the effluent chlorine residual with the auto analyzer's results.
- Run sample and compare the effluent turbidity with the continuous analyzer's results.
- Check the level of the secondary flocculent and fill if necessary.
- Record the totalized fluoride meter reading and check the level of the fluoride in the saturator, filling if necessary.
- Test and record the fluoride concentration in the plant effluent. Fluoride concentration shall be between 0.8 and 1.2 mg/L at plant sample point and in the distribution system.

Daily Maintenance Activities
(continued)

Surface Water Filtration Plant (in operation)

- Visually check all pumps, mechanical devices, and equipment for abnormalities.
- Record weather conditions.
- Record time of last backwash.
- Record the chlorine residuals required on the Washington State DOH Disinfection Monthly Form.
- Record all required parameters on the Washington State DOH Water Treatment Plant Monthly Report.

Surface Water Filtration Plant (during extended shutdown)

- Check influent pressure gauge (this checks pressure in transmission pipeline).

Well No. 5, 6, 9, Washougal Wellfield (Wells 7, 8, 10, 11, 12), & Well No. 13

- Check motor oil level at each well
- Verify proper pumping operations.
  - Read upstream and down stream pressure gauges to see if pressures are in normal operating range.
  - Read flow meters for instantaneous and totalized flow to verify flow.
  - Observe well pump and motor while operating for abnormal vibrations.
  - Check for signs of loose fittings (water on floor).
- Record sodium hypochlorite level in drum (Well 5, and 9 only).
- Test chlorine residual and record. Chlorine residual should be between 0.7 and 1.0 mg/L at the sample point.
- Check fluoride level in the saturator and fill as necessary.
- Test fluoride concentration and record. Fluoride concentration shall be between 0.8 and 1.2 mg/L at well sample point and in the distribution system.
- Record totalized flow meter reading from fluoride saturator.
- Check for proper operation of surge valves at each well. Inspect blow off discharge points to check if standing water is accumulating anywhere in the surge discharge system.
- Check for proper operation of chlorinator for each well.
- Check for proper operation of the fluoride system for each well.

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Perform general inspection.
- Perform Coolant heater inspection.
- Check oil level.
- Check coolant level.
- Check fuel level.
- Record hour meter

Weekly Maintenance Activities

Jones and Boulder Creek Surface Water Sources

Twice per week (when in operation)

- Check impoundment structure for stability at both surface water intakes.
- Check for debris accumulation at intake screens at both sources.
- Read and record totalized flow on flowmeter.

Weekly

- Perform security check of facilities.

Surface Water Filtration Plant (during extended shut down)

Every TWO weeks:

- Backwash both filters.
- Check sodium hydroxide storage tank for signs of leakage.
- Check Alum storage tank for mixer operation and signs of leakage.

Reservoirs: Butler, Gregg, Upper & Lower Prune Hill, & Lacamas

- Perform full security check.
- Perform full structural check.

Booster Pump Stations: Butler, Old & New Gregg, Upper & Lower Prune Hill, Angelo Forest Home, Lacamas, & Francis Rd

- Perform full security check.
- Verify proper pumping operations.
    - Read upstream and down stream pressure gauges to see if pressures are in normal operating range.
    - Read flow meters for instantaneous and totalized flow to verify flow.
    - Observe well pump and motor while operating for abnormal vibrations.
    - Check for signs of loose fittings (water on floor).

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Air cleaner inspection.
- Air pipe inspection.
- Battery charger inspection.
- Drain fuel filters.
- Check block heater connections

Monthly Maintenance Activities

Surface Water Filtration Plant

- Enter all Plant reports for the month into the City's database.
- The reports are to be reviewed by the Operations Manager and/or Operations Supervisor and submitted to the Department of Health.
- Check oil in all pumps and compressors.

Well No. 5, 6, 9, Washougal Wellfield (7, 8, 10, 11, 12) and Well 13

- Inspect property for security purposes.
- Check fluoride pump gear oil.
- Inspect pump packing lubrication for proper operation.
- Inspect cooling screens on Vertical Turbine pumps for blockage.

On-Site Sodium Hypochlorite Generation System (Washougal Wellfield and Well 13)

- Clean blower inlet screen
- Check hardness of water from water softener – should be less than 10 mg/L.

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Drain exhaust condensate trap
- Check starting batteries
- Check antifreeze and DCA concentration
- Drive belt inspection
- Check block heater connections

Semi-Annual Maintenance Activities

On-Site Sodium Hypochlorite Generation System (Washougal Wellfield and Well 13)

- Level switch – remove and clean calcification
- Clean cells if needed

Annual Maintenance Activities

Jones and Boulder Creek Surface Water Sources

- Jones Creek - close inlet valve to screenhouse so that no water is diverted to surface water filtration plant from May 15th to November 1.

- Boulder Creek - close outlet valve from screenhouse so no water is diverted to surface water filtration plant from May 15th to November 1.

Surface Water Chlorination Plant

- Drain and clean hypochlorite tank when tank is taken off line from May 15th to November 1st.

Surface Water Filtration Plant

- Change motor oil in all pumps and compressors.
- Inspect roof and building for maintenance items.
- Clean fluoride vent fan filter bags.
- Check vent where exhaust from fluoride vent exists the building

Well No. 5, 6, 9, Washougal Wellfield (Wells 7, 8, 10, 11, 12) and Well 13

- Change oil on all oil lubricated equipment.
- Clean out fluoride saturator.
- Clean filter bags on ventilation fan.
- Infrared scan electrical panels.
- Exercise pump.
- Sample water.
- Inspect roof and building for maintenance requirements.
- Check control valves and piping for proper operation

Annual Maintenance Activities
(continued)

On-Site Sodium Hypochlorite Generation System (Washougal Wellfield and Well 13)

- Temperature switch – confirmation that the bi metal opens at 60º C when immersed in hot water
- Replace bellows and poppets on water pump.
- Inspect water heater and perform the following as needed:
  - Descale the heating element
  - Change anode rod
  - Change heating element
  - Change thermostat
  - Reset high limit switch

Reservoirs: Butler, Gregg, Upper & Lower Prune Hill, & Lacamas

- Visually inspect inside of reservoir using Liquivision and/or Tank Divers.
- Inspect and remove sediment.

Booster Pump Stations: Butler, Old & New Gregg, Upper & Lower Prune Hill, Angelo Forest Home, Lacamas, & Francis Rd

- Pump and motor maintained per manufacturer's instructions.
- Check control valves for proper operation
- Check Operations Center files for each of the booster stations for instructions concerning equipment at pump station.

Diesel Powered Auxiliary Generators (Washougal Wellfield Facility, Well No. 13, New Gregg Booster Station, Angelo Booster Station, Lower Prune Hill Pump Station)

- Inspect radiator hoses
- Change air cleaner element
- Change crankcase oil and filter
- Change coolant filter
- Change fuel filters
- Clean cooling system
- Check block heater connections

Distribution System

- Leak detection survey (as determined by maintenance staff)

Five Year Maintenance Activities

Pressure Reducing Valves

- Perform a comprehensive evaluation of the PRVs in the system. This is contracted through GC Systems.
- Quarterly inspect each station

Appendix N

Emergency Response Program

APPENDIX N

WATER SYSTEM EMERGENCY RESPONSE PLAN

FEDERAL AND STATE REQUIREMENTS

FEDERAL REQUIREMENTS

Under the Public Health Security and Bioterrorism Preparedness and Response Act (Bioterrorism Act), Public Law 107-122 of June 12, 2002, drinking water systems serving more than 3,300 but less than 50,000 customers must complete a vulnerability assessment by June 30, 2004 and an emergency response plan (ERP) by December 30, 2004.

The U.S. Environmental Protection Agency (EPA) considers completion to mean the date on which the vulnerability assessment and certification were sent to EPA. The City submitted its vulnerability assessment on June 30, 2004, and the City completed its ERP certification by December 30, 2004.

The Bioterrorism Act requires the ERP to incorporate the results of the vulnerability assessment and include the following:

- Plans, procedures and equipment that can be implemented or utilized in the event of a terrorist or other intentional attack on the public water system.

- Actions, procedures and identification of equipment that can obviate or significantly lessen the impact of terrorist attacks or other intentional actions on the public health and the safety and supply of drinking water provided to communities and individuals.

STATE REQUIREMENTS

The operations and maintenance section of Chapter 246-290-415 (2)(b) WAC requires public water systems in Washington to have an emergency response plan as part of a water system plan. It also requires that systems employ reasonable security measures to protect the raw water intake facilities, water treatment processes, storage facilities, pump houses, and distribution systems from possible damage or intruders. The State requirements for emergency response must address all applicable hazards that could lead to abnormal operating conditions, such as flood, fire, unscheduled power outages, facility failure and system maintenance.

WATER SYSTEM EMERGENCY RESPONSE PLAN OUTLINE

Both the EPA and Washington State Department of Health (DOH) have prepared guides to develop emergency response plans that will comply with the Bioterrorism Act.

- *Emergency Response Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002*, EPA 816-R-04-002, April 2004.

- *Emergency Response Planning Guide for Public Drinking Water Systems*, DOH Publication 331-211, May 2003.

The City's water system emergency response plan is based primarily upon the EPA guidance document, which establishes eight basic elements for an ERP:

1. System Specific Information
2. Community Water System Roles and Responsibilities
3. Water System Communication Procedures
4. Personal Safety
5. Identification of Alternative Water Sources
6. Replacement of Equipment and Chemicals
7. Property Protection
8. Water Sampling and Monitoring

The DOH planning guidance has been utilized to develop the eight elements of this ERP. Whenever possible, terminology used by the Department of Homeland Security and its sub-agency, the Federal Emergency Management Agency (FEMA) as well as the Occupational Safety and Health Administration (OSHA) and the National Fire Protection Association (NFPA) has been used relative to emergency management principles, hazardous materials response, mass casualty response and emergency medical response.

The following documents from EPA Water Security website were a technical resource for this ERP as well:

(Reference: http://cfpub.epa.gov/safewater/watersecurity/index.cfm)

Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox (December 2003)

- Overview and Application
- Module 1: Water Utility Planning Guide
- Module 2: Contamination Threat Management Guide
- Module 3: Site Characterization and Sampling Guide
- Module 4: Analytical Guide

- Module 5: Public Health Response Guide
- Module 6: Remediation and Recovery Guide

EMERGENCY PLANNING AND OPERATION PRECEPTS

To be effective in a resource-constrained environment where multiple response agencies are involved, emergency planning for a water system must be considered in the context of the community's overall planning for emergency operations. The following sections identify and discuss the various plans that the City utilizes in its "all hazards" emergency management program.

CITY OF CAMAS DISASTER MANUAL

The City's Disaster Manual identifies the Emergency Response functions within the City based on a modified Incident Command System. The City Fire Chief is designated as the Incident Commander. The five functions coordinated by the incident commander are as follows:

- Police
- Public Information Officer
- Resource Officer (includes Public Works)
- Communications
- Disaster Control Officer

Emergency Operations Center (EOC)

The EOC is located at the City Police Department Headquarters building and provides overall direction, control and coordination of an incident. The EOC is primarily concerned with resource management and coordination between City Departments and other County/Regional, State and Federal emergency response and management agencies.

On-Scene Emergency Management

On scene management of emergencies is the responsibility of the Disaster Control Officer, who has a number of functions to coordinate, including:

- Suppression (includes rescue and control)
- Safety
- Triage

The City does not have its own hazardous materials response capability. This response capability is available from the City of Vancouver and the Georgia Pacific paper mill through a coordinated response plan that is under development by the County Regional Emergency Services Agency.

CLARK COUNTY REGIONAL EMERGENCY SERVICES AGENCY (CRESA)

The City utilizes the Clark County Regional Emergency Services Agency (CRESA) as its emergency management agency. CRESA also serves as the Local Emergency Planning Authority under the Superfund Amendments and Reauthorization Act (SARA) Title III (also known as the Emergency Planning and Community Right to Know Act – EPCRA) for communities in Clark County, including the City of Camas, the City of Washougal and the City of Vancouver. The CRESA website is:

http://www.cresa911.org/

RELATED COUNTY AND REGIONAL PLANS

In the event local capabilities to manage an incident are exceeded, the City will utilize mutual aid partners through the following plans and guidance documents:

- Clark County Regional Hazardous Materials Response Plan
- Washington State Department of Transportation Public Works Emergency Response Mutual Aid Agreement
- Interlocal Agreement between the City of Camas and the City of Washougal for Equipment Acquisition
- Reimbursable Services Agreement between Clark County Department of Public Works and the City of Camas

HAZARD IDENTIFICATION AND VULNERABILITY ANALYSIS

The City of Camas utilizes the Clark County Hazard Identification and Vulnerability Analysis as the primary means for identifying hazards and vulnerabilities. The Clark County HIVA was last updated in 2003.

To comply with the Bioterrorism Act, the City completed a water system vulnerability assessment (WSVA) in June 2004. The results of the WSVA are considered confidential and will not be addressed as to their specific finding and recommendations in the ERP. However, the ERP must incorporate the WSVA results in terms of providing response plans that address the general categories of vulnerabilities identified in the WSVA.

Table N-1 summarizes all hazards identified in the County HIVA and the City's WSVA that have been considered in the development of the City's ERP; the final column identifies those hazards considered significant enough to address in the City's water

system ERP. Clark County has assigned probability, vulnerability and risk levels to each hazard. Each of these parameters is discussed in greater detail below.

Probability

An adjective description (High, Moderate, or Low) of the probability of a hazard impacting Clark County within the next 25 years is assigned to each hazard. Probability is based on an assessment of a hazard's frequency using information provided by relevant sources, observations and trends.

- HIGH: There is great likelihood that a hazardous event will occur within the next 25 years.

- MODERATE: There is moderate likelihood that a hazardous event will occur within the next 25 years.

- LOW: There is little likelihood that a hazardous event will occur within the next 25 years.

Vulnerability

An adjective description (High, Moderate, or Low) of the potential impact a hazard could have on Clark County is assigned to each hazard. It is the ratio of population, property, commerce, infrastructure and services at risk relative to the entire County.

- HIGH: The total population, property, commerce, infrastructure and services of the county are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worse case scenario there could be a disaster of major to catastrophic proportions.

- MODERATE**:** The total population, property, commerce, infrastructure and services of the county are exposed to the effects of a hazard of moderate influence;

  or

  The total population, property, commerce, infrastructure, and services of the county are exposed to the effects of a hazard, but not all to the same degree;

  or

  An important segment of population, property, commerce, infrastructure, or service is exposed to the effects of a hazard. In a worse case scenario

there could be a disaster of moderate to major, though not catastrophic proportions.

- LOW: A limited area or segment of population, property, commerce, infrastructure, or service is exposed to the effects of a hazard. In a worse case scenario there could be a disaster of minor or moderate proportions.

Risk Rating

An adjective description (High, Moderate, or Low) of the overall threat posed by a hazard over the next 25 years. It is a subjective estimate of the combination of probability of occurrence and vulnerability.

- HIGH: There is strong potential for a disaster of major proportions during the next 25 years;

  or

  History suggests the occurrence of multiple disasters of moderate proportions during the next 25 years. The threat is significant enough to warrant major program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a major focus of the emergency management training and exercise program.

- MODERATE: There is moderate potential for a disaster of less than major proportions during the next 25 years. The threat is great enough to warrant modest effort to prepare for, respond to, recover from, and mitigate against hazard. This hazard should be included in an emergency management training and exercise program.

- LOW: There is little potential for a disaster during the next 25 years. The threat is such as to warrant no special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the county's emergency management training and exercise program except as generally dealt with during hazard awareness training.

TABLE N-1

Hazard Identification and Vulnerability Assessment Summary City of Camas

Hazard Classification	Hazard	Probability	Vulnerability	Risk	Applies to City of Camas Water System
Drinking Water Unique	Bacteriological Contamination	MODERATE	MODERATE	MODERATE	X
Natural Disaster	Drought	HIGH	MODERATE	MODERATE	X
	Earthquake	HIGH	HIGH	HIGH	X
	Flood	HIGH	MODERATE	HIGH	X
	Forest/Wildland Fire	MODERATE	MODERATE	MODERATE	X
	Landslide	HIGH	LOW	MODERATE	X
	Severe Local Storm	HIGH	HIGH	HIGH	X
	Tornado	HIGH	LOW	LOW	X
	Volcano	LOW	MODERATE	LOW	X
Technological Hazards	Airplane Crash	MODERATE	LOW	MODERATE	X
	Dam Failure	LOW	LOW	LOW	X
	Hazardous Materials	HIGH	MODERATE	HIGH	X
	Energy Emergency	MODERATE	MODERATE	MODERATE	X
	Transportation Accident	MODERATE	LOW	MODERATE	X
	Urban Fire	MODERATE	MODERATE	MODERATE	X
Criminal Activity	Terrorist Use of Chemical, Biological, Radiological, Nuclear Agents and Explosives	LOW	MODERATE	MODERATE	X
	Cyber Attack	LOW	MODERATE	MODERATE	X
	Vandalism	LOW	MODERATE	MODERATE	X

SYSTEM SPECIFIC INFORMATION

Chapter 3 of this manual provides a complete description of the City's water system facilities.

Interties

The City currently has an emergency intertie agreement with the City of Washougal to the east. The City has two one-way PRV interties with Washougal, located on SE Shepherd Street and at the intersection of SE 3rd Street and Whitney Street. These interties provide water from the City of Camas to the City of Washougal under low pressure conditions. The City does not have any other intertie agreements at the present time.

Telemetry and Control System

The City's telemetry system monitors levels in the storage facilities and the status of the booster pump stations and groundwater wells. Installed in 1988 and upgraded in 2000, the system allows the City to record pump run times, filter plant metering information, and relays filter plant alarms to the office. The system also has the capability of reading instantaneous flow from individual pumps; however, the City does not have the source and pump meters in place that will allow this operation. The system allows the City to monitor and control the operation of these facilities from the office and over the Internet from home. The chemical feed system for the Washougal wellfield and can be remotely monitored in its operations in the same manner as the wells and reservoirs.

Supervisory Control and Data Acquisition (SCADA) System

The City has a SCADA system with master control located at the City Operations Center. The system uses programmable control software, which can be controlled by a personal computer at the operations center or remotely by a modem connected to a remote computer. The system monitors reservoir levels, well status, well flow rate, booster pump flow rate when metered, pump status, run time and alarm conditions. Reservoir levels are recorded on circular charts on a continual basis. The City also has the ability to monitor the drawdown level in the aquifer of Well No. 9.

WATER SYSTEM ROLES AND RESPONSIBILITIES

PUBLIC WORKS DIRECTOR

The City water system is operated by the Public Works Department. In the event of an emergency sufficient to activate the EOC, the City's Public Works Director or designated representative will locate to the EOC at the Police Department. The Public Works EOC representative is responsible for coordinating all public works functions with other

members of the EOC Operations Group. The Public Works Director also serves as the Public Information Officer for all Public Works matters.

OPERATIONS MANAGER

The water system is one of several utilities within the Public Works Department that is managed by the Operations Manager, who reports directly to the Public Works Director. In the event of an emergency involving the water system, the Operations Manager will serve as the on-scene Incident Commander until properly relieved by an appropriate Police or Fire Department representative The Operations Manager is responsible for all aspects of the water system during an emergency, including damage assessments, assessing customer impacts, coordinating with jurisdictional public health agencies and adjacent water utilities, keeping the public and media informed through the City's Public Information Officer, and working with the Public Works Engineering Manager for design and construction services required for repair and recovery operations.

OPERATIONS SUPERVISOR

The water utility has a supervisory operator reporting to the Operations Manager, who is responsible for operating the water system during an emergency. The Operations Supervisor assists the Operations Manager in damage assessments and coordinating repair and recovery operations.

WATER QUALITY MONITOR

Within the water division a water system operator is assigned responsibility for water quality monitoring. The responsibilities for water quality monitoring for routine compliance sampling and testing are outlined in the Operations and Maintenance manual. Positive coliform events of the water system require the water quality monitoring operator to follow procedures as outlined in the water sampling and monitoring section within this plan. Intentional contamination of the water system is covered in a separate incident specific plan at the end of this plan.

WATER SYSTEM COMMUNICATION PROCEDURES

The City Disaster Manual establishes communications procedures during an emergency. The City utilizes a 911 call service operated by CRESA, which provides dispatch services for fire police and emergency medical services.

The City maintains emergency phone number lists for use by City personnel. The list contains City staff home phone numbers, addresses and cell phone numbers. The second list includes the numbers for emergency services, generator rentals, adjacent utilities, fuel suppliers, parts supplies, safety equipment, pumper trucks, and contractors. The emergency phone numbers are updated frequently as phone numbers change.

The employee on-call will be the first person notified in the event of an emergency, disaster, or incident. The responding party shall report to the command center for a briefing and further instructions. The on-call employee shall be in charge of all Public Works functions until relieved by a higher ranking Public Works employee.

At the command center, the on-call employee will receive a "Public Works Department Duty Checklist." A copy of this form is provided in the Appendix H. The employee is to fill out the checklist. The employee is to determine if it is within the employee's capabilities to handle the incident requirements of the Public Works Department. If the employee is unable to fill the needs of the incident, the employee shall notify the Water/Sewer Supervisor. The Water/Sewer Supervisor shall notify the Public Works Operations Manager of the incident.

The City of Camas Disaster Manual provides additional procedures for Public Works response. A copy of this document can be found in the offices of the Public Works Director and the Public Works Operations Manager. It is an orange manual and all Public Works employees should be familiar with the contents and procedures.

In the event that public notification is required during a water system emergency, the Public Works Director provides information to the media for this purpose.

Liaison with the Washington State Department of Health (DOH) is normally the responsibility of the Public Works Director. An emergency contact list for DOH is presented in Table N-2.

TABLE N-2

Emergency Contact List for DOH

Agency/Contact	Contact Telephone Number	Purpose
DOH Hot Line DOH SWRO After Hours	(877) 481-4901 (360) 236-3030	After Hours Emergencies.
DOH/Regional Engineer	(360) 236-3033	Regulatory Assistance
DOH/Coliform Program Manager - SWRO	(360) 236-3044	Coliform Monitoring
DOH Public Information Coordinator	(360) 236-3162	Media Affairs and Public Notification Assistance
Security Manager (SWRO)	(360) 236-3159	Questions Regarding Water System Security

The City has entered into a mutual aid agreement with the City of Vancouver and several other public works organizations. The contact names and phone numbers for the responsible individuals for those purveyors are presented in Table N-3.

TABLE N-3

Mutual Aid Water Utility and Public Works Contacts

Utility	Contact Person	Contact Number	
		Phone	FAX
City of Vancouver	Terry McClure	(360) 735-8845	(360) 696-8002
City of Washougal	Trevor Evans	(360) 835-2662 (360) 835-8501	(360) 835-8808
Clark County	Peter Capel	(360) 397-2446 (360) 397-6118 (360) 901-7469(1)	(360) 397-6051
Clark Public Utilities	Doug Quinn	(360) 992-8022 (360) 992-3000(1)	(360) 992-8027
Washington State Department of Transportation	Bob Kofstad	(360) 905-2130 (360) 921-9119(1)	(360) 905-2075

(1) After hours

PERSONAL SAFETY

EVACUATION PLANS

The City's Disaster Manual provides limited guidance for evacuation operations. The Police Department has overall responsibility for evacuation operations. Each City Department and Division is responsible for developing emergency evacuation plans for its department/division.

The on-scene incident commander will normally direct evacuation operations. The Incident Commander at the scene will initially be the senior City employee at the scene; the on-scene incident commander duties will eventually be assumed by a Police or Fire Department representative depending upon the nature of the emergency.

The Occupational Safety and Health Administration (OSHA) provides guidance on developing evacuation plans for terrorist incidents:

http://www.osha.gov/dep/evacmatrix/index.html

Per the City's Disaster Manual, the Fire Department will be responsible for incident command during a hazardous materials (HAZMAT) release as this duty requires specific

training and certification under federal regulations. City and Regional Emergency Plans for terrorist incident response also require that HAZMAT protocols and procedures be followed for incidents involving the intentional release of chemical and biological agents.

EVACUATION ROUTES AND EXITS

Evacuation routes and exits for City facilities are to be posted at each facility. In the event of an evacuation from an area that encompasses more than one facility, the City Police or Fire Department will identify additional evacuation routes as needed. During an incident involving the release of hazardous materials, the Fire Department is responsible for identifying evacuation routes that mitigate hazards to evacuees. In the absence of direction from the Fire Department, the general rule for evacuation during a hazardous materials release is to travel uphill and upwind of the release.

ASSEMBLY AREAS AND ACCOUNTABILITY

Assembly areas for evacuation from City facilities are posted along with evacuation routes and exits at City facilities. In the event of an evacuation from an area that encompasses more than one facility, the City Police or Fire Department will identify additional assembly areas as needed. The senior water division employee is responsible for ensuring that all personnel are accounted for at the assembly area after an evacuation has been conducted.

SHELTER

Sheltering is not addressed in the City's Disaster Manual. The City defers to CRESA for emergency sheltering operations. The City is responsible for sheltering of City employees; this responsibility includes identifying City facilities that may be used for sheltering during a emergency.

TRAINING AND INFORMATION

All water utility employees are provided with the following training:

- Blood borne pathogens
- Cardiopulmonary resuscitation (CPR)
- Defensive driving
- Emergency first aid
- Emergency response awareness (including FEMA ICS - IS195)
- Equipment lock-out/tag-out procedures
- Fall protection
- Fire extinguishers/evacuation
- Hazard communication
- Hearing conservation and testing

- Protection from water borne pathogens

When appropriate for their duties, water utility employees are provided training in:

- Bucket truck
- Confined space (aerial platform)
- Forklift operation
- Respiratory protection and fit testing
- Trenching and shoring

Water utility employees are issued protective equipment appropriate to their job responsibilities including hard hats, safety goggles, work gloves and safety boots.

Recommended training: The water quality monitor should be trained in hazardous materials awareness (reference: 29 CFR 1910.120). This training is available from the City Fire Department.

Emergency Equipment

The water utility has a hoist, harness and gas detection equipment for confined space entry. All employees are issued hard hats and reflective safety vests. All trucks are equipped with emergency first aid kits.

FIRST AID

Water utility employees are trained in emergency first aid that includes the following:

- How to determine the safe response to an emergency situation.
- Recognizing and caring for life-threatening emergencies in adults, such as respiratory, choking, and cardiac problems.
- Caring for injuries including severe cuts and burns, sprains and strains.
- Caring for sudden illnesses such as poisonings, bites, and stings.
- Recognizing and caring for heat- and cold-related emergencies.
- Workplace emergency procedures, including notifications for medical emergencies.

The Fire Department provides emergency medical services for trauma victims whose injuries exceed emergency first aid treatment.

IDENTIFICATION OF ALTERNATIVE WATER SOURCES

INTERTIES

The City has interties with the City of Washougal that would normally be used to supply water to the City of Washougal. The City has no other interties and; therefore, must be self-sufficient in the event of a water shortage or water system failure.

REDUNDANCY IN CITY WATER SYSTEM

The City has several wells and a surface water source that provide some redundancy in the event certain elements of the water system fail. For example, if the Washougal Wellfield is flooded, the surface water source may serve as a backup, with water conservation measures in place to offset the loss of the wellfield.

Emergency Water Supplies

Under the County's CEMP, citizens are urged to keep a 72-hour supply of food and water in the event of an emergency. The City will endeavor to supply potable water to support emergency operations within its capabilities.

TRANSPORT OF POTABLE WATER DURING EMERGENCIES

If the City obtains potable water by transporting from another source, DOH has issued guidelines for water system utilities that deliver potable water to the public during emergencies. This guidance is found at the following website and are summarized below:

http://www.doh.wa.gov/ehp/dw/Publications/Truck_Transport.htm

General

- DOH recommends that someone with water treatment expertise be responsible for the operation and management of trucked potable water.

- The City should contact the regional office of the DOH Division of Drinking Water (DOH-DDW) or local health department to discuss current requirements and approve the proposed operation. [see WAC 246-290-415(2)(d) and 246-290-451(4)]. Southwest Regional Office – (360) 236-3030.

Truck Container

- The truck container must be contaminant-free and capable of being maintained so that water contamination is prevented.

- If a truck container has been previously used only for potable water and has been protected from possible contamination, it may be used without disinfection and testing for bacteria.

- Truck containers that cannot pass the initial testing criteria after disinfection (i.e. absence of coliforms) shall not be used.

- Trucks previously used for substances other than potable water will be evaluated on an individual basis. Consult with DOH before using trucks that may have previously carried toxic or other non-potable liquids.

- All truck containers must be filled or emptied through an air gap or approved double-check valve assembly, in accordance with WAC 246-290-490.

Initial Truck Disinfection

- The tank and all hoses, pumps, and other equipment used in handling water should disinfected by filling with water containing at least 50 to 60 parts per million (ppm) of chlorine and then held in the tank for at least 24 hours.

- One gallon of liquid bleach is required in every 1,000 gallons of water to produce 50 to 60 ppm. Bleach should be 5.25 to 6 percent hypochorite with no additives. Bleach should be added in proportion to the water as the tank is being filled, e.g., add approximately one-half gallon of bleach with each 500 gallons of water.

- The chlorine solution must be flushed from the tank after 24 hours.

- Once the tank is emptied, refill it with the water to be transported, and test for coliform bacteria. If coliforms are present, repeat the process. If the tank cannot be disinfected to eliminate coliforms, it must not be used.

- Water to be transported by tank trucks should contain a free chlorine residual of about one part per million (1 ppm or 1 mg/L) at the beginning of the haul.

Source of Water

- The source for emergency trucked water must come from an approved public water supply, unless otherwise approved by DOH.

- Every precaution should be taken to ensure that the water remains potable once it is collected and transported.

Receiving Tank

- The water system's receiving tanks must be inspected to assure that water quality issues will not occur during filling and later distribution to consumers.

- Receiving tanks must be cleaned and disinfected using the procedures for truck containers (see "Initial Truck Disinfection" guidelines).

- The receiving tanks must be kept secure and protected from contamination throughout the emergency response.

- The customer's receiving tank must be filled through an air gap or an approved double-check valve assembly in accordance with WAC 246-290-490.

Documentation and Record Keeping

- The receiving water system is responsible for documenting and keeping proper records of the emergency trucked water operation.

- Records should be retained for at least 6 months for review upon request by health agencies, haulers, or the supplying water system.

REPLACEMENT OF EQUIPMENT AND CHEMICALS

EQUIPMENT AND SUPPLIES

A list of equipment suppliers that the City has access to for emergencies is provided in Appendix I.

CHEMICALS

Table N-4 lists chemicals used by the City in its water treatment processes. Appendix J provides a list of chemical suppliers.

To assist the City in identifying chemicals with emergency planning implications, threshold quantities under EPCRA, the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and the Clean Air Act (CAA) are also shown in Table N-4, where applicable.

The applicability of each regulation is briefly discussed below.

Use and Storage – EPCRA governs reporting requirements for chemicals, either in use or in storage, that pose a significant environmental or health hazard.

Liquid Spill – In the event of a spill where the quantity exceeds the CERCLA threshold, certain reporting requirements will be in effect.

Risk of Air Release – Gaseous chemicals will require a risk management plan if they exceed threshold quantities.

Explanatory notes following Table N-4 provide greater detail regarding reporting requirements.

The City should coordinate all EPCRA, CERCLA and CAA planning and reporting requirements with CRESA.

Hazardous substance releases should be reported to the Washington State Department of Ecology (Ecology) and responses coordinated with CRESA through the City Fire Department.

CRESA Phone: (360) 737-1911

Ecology 24-Hour Spill Response Phone: (360) 753-2353.

TABLE N-4

Water Treatment Chemicals used by the City of Camas

Name[1]	Use[2]	CAS/EPCRA Section 313 Category Codes[3]	EPCRA Section 302 EHS TPQ[4] (pounds)	EPCRA Section 304 EHS RQ[5] (pounds)	CERCLA RQ[6] (pounds)	EPCRA Section 313[7]	CAA 112(r) TQ[8] (pounds)
Aluminum sulfate (alum)	CG	10043-01-3	N/A	N/A	**5,000**	N/A	N/A
Calcium hypochlorite	DI	7778-54-3	N/A	N/A	**10**	N/A	N/A
Hydrofluorosilicic acid	F	7732-18-5	N/A	N/A	N/A	N/A	N/A
Polymer	CG	12125-02-9	N/A	N/A	**5,000**	N/A	N/A
Sodium fluoride (> 99%)	F	7681-49-4	N/A	N/A	**1,000**	N/A	N/A
Sodium hydroxide (20 – 30%)	CO/pH	1310-73-2	N/A	N/A	**1,000**	N/A	N/A
Sodium hypochlorite (5-12.5%)	DI	7681-52-9	N/A	N/A	**100**	N/A	N/A

All reporting quantities noted in **bold** font n/a = not applicable.

(1) The chemicals listed above were taken from an extensive inventory of chemicals provided in a document titled *List of Lists, Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act (consolidated list), EPA,550-B-01-003, October 2001*. EPA put the list together to help chemical handling firms determine what reporting requirements apply under sections 302, 304, or 313 of EPCRA and if they are subject to the accident prevention regulations under CAA section 112(r). The chemical names are those that are generally used in the regulatory programs developed under EPCRA, CERCLA, and CAA section 112(r)

(2) Use Definitions: Coagulant (CG); Corrosion Control (CO); Disinfection (DI); Fluoridation (F); pH Adjustment (pH).

(3) The chemicals above are organized under the Chemical Abstracts Service (CAS) registry number and the EPCRA Section 313 category codes.

(4) EPCRA Section 302 includes a list of *Extremely Hazardous Substances* (EHSs). The presence of EHSs in quantities at or above the Threshold Planning Quantity (TPQ) require local emergency planning committees to develop emergency response plans and notify State emergency response committees. Facilities with a listed EHS are subject to the reporting requirements of EPCRA section 311. The facility must provide a material safety data sheet or a list of covered chemicals to State and local emergency response committees and the local fire department. The minimum TPQ for section 311 reporting is 500 pounds or the TPQ, whichever is less. EHS TPQ and RQ are represented in pounds.

(5) Under EPCRA Section 304, releases of reportable quantities (RQ) of EHSs are subject to State and local reporting.

(6) Under Section 304 of EPCRA, releases of hazardous substances listed in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) are to be reported to the National Response Center, as well as to the State and local emergency response committees. The CERCLA RQ column shows the reportable quantities (in pounds) for chemicals that are CERCLA hazardous substances as listed in 40 CFR Part 302, Table 302.4. Solid metals listed under CERCLA, with mean diameters greater than 100 micrometers, are not reported. The CERCLA RQs listed above apply to smaller particles.

(7) Under the column titled Section 313, the notation "313" means that the chemical is required to report under section 313 and 6607 of the Pollution Prevention Act. An "X" indicates that this chemical may have a second name or that the same chemical may have the same CAS number listed under a different name. The lower case "c" indicates that a chemical must report under one or more of the EPCRA section 313 chemical categories even though it has no CAS number.

(8) Under CAA section 112(r) EPA identified 77 toxic substances and 63 flammable substances, including their threshold quantities (TQs), which are subject to accident prevention provisions. The requirements for risk management programs for accidental release prevention are found in 40 CFR Part 68. CAA section 112(r) lists several substances in solution that are covered only in concentrations above a specific level. Most of these chemicals are listed above and include ammonia CAS #7664-41-7 (concentrations 20 percent or greater); hydrochloric acid CAS #7647-01-0 (concentrations 37 percent or greater); hydrogen fluoride/hydrofluoric acid CAS #7664-39-3 (concentrations 50 percent or greater); and nitric acid CAS #76997-37-2 (concentrations 80 percent or greater). CAA section 112(r) TQs are in pounds and apply to those quantities within a process and not at the facility as a whole.

PROPERTY PROTECTION

The City controls access to its water facilities using barriers and locks. Reservoirs are fenced, with access controlled by locked gates. Utility vaults are covered and locked. The City maintains strict control over its keys. The Operations Manager has the master key to all locks. Employees are issued keys only to those facilities they are required to access to perform their duties. The City has also partnered with residential customers to be vigilant of the areas around its chlorination plant, filter plant, well and reservoir sites to alert the City if they notice any suspicious activity.

WATER SAMPLING AND MONITORING

Water sampling for routine compliance is described in Chapter 2 of this manual.

Water sampling and monitoring for a coliform incident is described below under incident specific plans (bacteriological contamination).

Water sampling and testing for a suspected intentional contamination incident is described below under incident specific plans.

MAJOR WATER SUPPLY INTERRUPTIONS

WATER MAIN BREAKS

Depending on the location where the main break occurs, if susceptible populations are impacted, use contact list in Appendix B (Coliform Monitoring Plan) for notification. City will provide bottled water for lengthy outages. Depending on circumstances, portable toilets may be supplied as well. Trucked potable water may be provided. If the City uses trucked potable water, the guidelines in DOH Publication #331-063 will be followed.

The City maintains an inventory of piping and fittings to address most emergency repair requirements and has a list of vendor telephone numbers to obtain supplies when existing material stocks are inadequate for emergencies. When repairs are too large for City crews to manage, the City will contact contractors from its small works roster.

When water supply interruptions for a pressure zone are expected to be lengthy, the City will consider instituting measures to allow customers to come to a reservoir and obtain water directly from a reservoir. Any water dispensed in this manner will be done under the supervision of a City employee.

BOOSTER STATIONS

The City has developed detailed written procedures for operating the water system when booster stations are not in service and has figures showing locations of pumps, piping, meters, shut off valves and other key features of each facility, such as valve size/type, motor manufacturer/type/hp and pump capacity/type. Copies of these procedures, technical details and figures are kept at each facility.

A brief summary of the booster station emergency procedures follows.

Butler Booster Station

Auxiliary Power

The Butler Booster Station does not have an auxiliary power system.

HOA Setting

Emergency operation of the booster station may require the pump to be operated in the HAND mode to compensate for distribution system problems in other areas of the system during a power outage.

Backup Operations

Angelo Booster Station serves as a backup for feeding the Lower Prune Hill (455) Zone if the Butler Booster Station is out of service. The City has a standby pump for the 455 Zone at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Gregg Booster Station

Auxiliary Power

The New Gregg Booster Station has a diesel powered 300-kW generator with automatic transfer switch capable of operating the New Gregg Booster Station pumps during a power outage.

HOA Setting

Emergency operation of the booster station may require the pump to be operated in HAND mode to compensate for distribution system problems in other areas.

Backup Operations

There is no back up in the event Gregg Booster Stations are out of service; however, there is sufficient pumping capacity at the Gregg Booster Stations to operate with the largest pump out of service under normal system demands, including fire flow.

Angelo Booster Station

Auxiliary Power

The Angelo Booster Station is equipped with a 200-kW diesel generator with an automatic transfer switch. This generator is capable of providing power to three of the pumps, the lighting, and the HVAC system.

Backup Operations

If Angelo Booster Station is out of service, Butler Booster Station and Forest Home Booster Station serve as back up to feed the upper zones (Lower Prune Hill, Lacamas, Upper Prune Hill) from the lower zone (Butler). The City has a standby pump at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Lower Prune Hill Reservoir Out of Service

If the Lower Prune Hill Reservoir is out of service, one pump at the station will be placed into hand mode and operated with the reservoir isolated. The pressure relief valve at the station will bleed excess pressure to the inlet piping. This will allow the system to maintain a constant pressure in the zone. During this operation, the pump and pressure need to be monitored every two hours.

Forest Home Booster Station

Auxiliary Power

Auxiliary power is not available for the Forest Home Booster Station.

HOA Settings

During emergencies the booster station may need to be operated in the HAND mode to compensate for distribution system problems in other areas of the system.

Backup Operations

If the Forest Home Booster Station is out of service, Butler Booster Station and Angelo Booster Station serve as back up to feed the upper zones (Lower Prune Hill, Lacamas, Upper Prune Hill) from the lower zone (Butler). The City has a standby pump at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Lacamas Booster Station

Auxiliary Power

The Lacamas Booster Station has an auxiliary generator with automatic transfer switch available to provide power. This generator is a 60 kW natural gas generator and is capable of running the two 500-gpm pumps, the building lights and ventilation system. This generator is able to provide the Lacamas Booster Station with power as long as natural gas service is not interrupted. If the generator fails during a power outage, water service can be maintained through the pressure reducing valve (PRV) stations that that connected to the system that feeds down from the Upper PruneHill Reservoir. Well No. 9 also serves the area supplied by Lacamas Booster Station, but since it does not have auxiliary power, it is more than likely unavailable during a power outage.

Lacamas Reservoir Out of Service

When the Lacamas Reservoir is out of service, pressure to the Lacamas (544) Zone can be maintained by operating one of the pumps in the Lacamas Booster Station. The pressure relief valve will return excess pressure to the inlet piping while maintaining the downstream pressure. Under this operating condition, the pump operation and pressure need to be checked every 2 hours. The 544 Zone can also be served from Upper Prune Hill through PRV stations.

Backup Operations

When the Lacamas Booster Station is out of service Well No. 9 and the Lower Prune Hill Booster Station can be used to feed the Lacamas (544) Zone.

Lower Prune Hill Booster Station

Auxiliary Power

This facility is equipped with a 300-kW diesel powered generator with an automatic transfer switch to operate the three pumps in the event of a power failure.

Temporary Pump

During high seasonal demands a mobile skid mounted pump is rented by the City to supplement the LPH Booster Station. This pump is installed via connections constructed for this purpose near the entrance to the pump station. It is operated in a manual mode and has a capacity between 600 and 700 gpm. This pump is not powered by the auxiliary power generator. The City also has pumping capacity available at the Upper Prune Hill Booster Station to serve the Upper Prune Hill area for temporary losses of service at the Lower Prune Hill Booster Station, but this is limited and cannot provide supply for extended interruptions in service or extended periods of high demands.

Upper Prune Hill Booster Station

Auxiliary Power

The Upper Prune Hill Booster Station is equipped with a manual transfer switch to allow the City to bring in a portable generator to supply power to the booster station. The portable generator used by the City can operate two of the 20-hp pumps.

RESERVOIR EMERGENCY PROCEDURES

General

The City has developed detailed written procedures for operating the water system when reservoirs are not in service. These procedures are kept at each facility. If a reservoir must be taken off line isolation valves are used to prevent water from being pumped into the reservoirs and the reservoirs are allowed to empty into the distribution system.

A brief summary of the reservoir emergency procedures follows.

Butler Reservoir

Water service is maintained to the system during cleaning / draining / disinfection of the reservoir with the following procedures.

- Connect 6-inch overflow piping to the 12-inch main in the Butler Yard.
- Open the 6-inch overflow valve.
- Open the 4-inch main connecting line valve between the 12-inch and 14-inch mains until water comes out of the 6-inch overflow.
- Close the two 12-inch valves in the reservoir valve pit to take the Butler Reservoir offline.

- Adjust the 4-inch connecting valve to maintain a small amount of water flow from the 6-inch overflow. As long as water flows from the overflow, water service will be maintained to the 343 Zone.

- Depending on the season and the demand, a well may need to be in operation to maintain system pressure in the 343 Zone.

- The pressure reducers on NE 22nd Avenue and NE Everett Street regulate pressure and keep the 343 Zone served.

Reverse the order to place the reservoir back online.

Gregg Reservoir

Water service can be maintained to the Gregg area by running a pump in the HAND position in the Gregg Booster Station. The pressure relief/bypass valve at the Gregg Booster Station will maintain pressure in the service area and also keep it from over pressurizing the zone. The Gregg Reservoir can be isolated after the pump in the Booster Station is placed into operation. Close attention will be paid to the system pressure and the pump to provide uninterrupted service.

Lacamas Reservoir

The Lacamas Reservoir is supplied from the Upper Prune Hill Zone via PRVs, from the Lower Prune Hill Zone via the Lacamas Booster Station, or from Well No. 9. As long as one of these facilities is in operation, the reservoir can be filled.

Water service can be maintained to the Lacamas area (544 Zone) by running a pump in the HAND position in the Lacamas Booster Station or Well No. 9. The pressure relief/bypass valve at the Lacamas Booster Station will maintain pressure in the service area and also keep it from over pressurizing the zone. The Lacamas Reservoir can be isolated after the pump in the Booster Station is placed into operation. Close attention must be paid to the system pressure and the pump to provide uninterrupted service.

Lower Prune Hill (LPH) Reservoirs

Emergency operation of the reservoir would be required if a problem were to occur with one of the reservoirs. If a reservoir were to experience a physical or water quality problem, one reservoir could be taken out of service and the remaining one could be used to supply water until the problem is solved. If the smaller of the two tanks was used alone, the start levels for the Butler, Forest Home, and the Angelo Booster will be raised to keep the reservoir full at all times.

Upper Prune Hill (UPH) Reservoirs

UPH 2.4-MG Reservoir

The 2.4-MG reservoir inlet has an altitude valve that closes to allow the UPH standpipe to fill when the reservoir is full (63-foot level). The UPH 2.4-MG reservoir outlet valve is normally opened, but is seismically controlled and will close in a seismic event. The UPH booster pumps will also be turned off in a seismic event.

If both the Lower Prune Hill and Upper Prune Hill Booster Stations are out of service and the Upper Prune Hill Standpipe level drops low enough, site valves can be opened to allow both the standpipe and the 2.4-MG Reservoir to float on the system.

Two of the booster pumps (No. 2 and No. 3) are equipped with modified pump control valves that employ two valves that are adjusted to drain the UPH 2.4-MG reservoir. Detailed procedures for using these pump control valves are provided at the UPH booster station.

UPH Standpipe

The UPH standpipe inlet valve is a spring-activated altitude valve that is designed to shut off when the standpipe is full. This valve is not controlled by the telemetry system. When the UPH standpipe altitude valve is closed, the UPH booster pumps operate based on the pump discharge pressure.

If the Upper Prune Hill Standpipe is out of service, the UPH area can be supplied by the UPH Booster Station and the LPH Booster Station. The LPH Booster Station operates based on reservoir level in the 2.4 MG UPH Reservoir. If the LPH Booster Station flows exceed system demands, the 2.4 MG UPH Reservoir will fill. If the 2.4 MG UPH Reservoir is full, the LPH Booster Station will shut off and the UPH Booster Station will be called in pressure mode and will supply the system. If system demands exceed the supply of the LPH Booster Station while it is in operation, the UPH Booster Station will be called in pressure mode to provide additional supply. Pressure mode for the UPH Booster Station is discussed below.

At the Upper Prune Hill Pump Control Panel Screen, the operator selects this setting at the pump control panel, which is a six step operating sequence (numbered 0 to 5) that is based satisfying a minimum pressure of the pump discharge. The operator sets the pressure at 40 psi, which simulates a full standpipe.

- Step 0 – no pumps on (40 psi is satisfied)
- Step 1 – pump 1 on and runs till 40 psi is satisfied
- Step 2 – pump 1 and 2 on if 40 psi is not satisfied after Step 1
- Step 3 – pump 1 and 3 on if 40 psi is not satisfied after Step 2

- Step 4 – pump 1, 2 and 3 on if 40 psi is not satisfied after Step 3
- Step 5 – all pumps on if 40 psi not satisfied after step 4

There is a 15 second delay built in between each step. Pumps turn off sequentially in 15 second intervals once 40 psi is satisfied.

WELLS

Detailed written operating instructions are maintained at each well. These instructions cover normal operations as well as response to pump and power failure. For wells with treatment facilities, written descriptions of shutdown and start up of treatment equipment is included with the written procedures. A brief summary of emergency operations at each well is provided below.

Well No. 5

There is neither a generator nor an angle drive to operate Well No. 5 during a power outage. Well No. 5 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Under these conditions, Well No. 5 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit.

Well No. 6

There is neither a generator nor an angle drive to operate Well No. 6 during a power outage. Well No. 6 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 6 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit.

Well No. 7

There is not a generator or an angle drive to operate Well No. 7 during a power outage. Well No. 7 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 7 has to be run from the HAND position from the well facility or the Operations Center master telemetry unit.

Well No. 8

During a power outage, Well No. 8 has an auxiliary engine and angle drive. Well No. 8 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 8 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit during a power outage. The backup chlorination system is also run by the generator.

Well No. 9

There is neither a generator nor angle drive to operate Well No. 9 during a power outage.

Well No. 10

There is neither a generator nor angle drive to operate Well No. 10 during a power outage.

Well Nos. 11 and 12

The Washougal Wellfield Facility has its own diesel powered auxiliary generator with an automatic transfer switch. This generator is 350 kW and is designed to serve the Washougal Wellfield Treatment Facility during a power outage, to include the two well pumps, chemical feed pumps, controls for the well pumps and chemical feed system, HVAC system and lighting.

Well No. 13

The Well No. 13 Facility has its own diesel powered auxiliary generator with an automatic transfer switch and acoustical enclosure. This generator is 250 kW and is designed to serve the Well 13 Facility during a power outage, to include the well pump, chemical feed pumps, controls for the well pump and chemical feed system, HVAC system and lighting.

SURFACE WATER FILTRATION PLANT

Detailed written operating instructions are maintained at the Surface Water Filtration Plant. These instructions cover normal operations as well as start up and shut down procedures. The plant is equipped with a 45 kW propane powered auxiliary generator in event of a power outage.

INCIDENT SPECIFIC RESPONSE PLANS

Per the hazard assessment summarized in Table N-1, the following incident specific response plans are outlined below:

- Drinking Water Unique: bacteriological contamination
- Natural Disasters: drought, earthquake, flood, landslide/mudflow/debris flow, severe snow storm, tsunami, volcano
- Technological Hazards: power failure, dam failure, hazardous materials, urban fire, transportation accident

- Criminal Acts: Terrorism, cyber attack, vandalism

BACTERIOLOGICAL CONTAMINATION

WAC 246-290-320 establishes specific procedures for water utilities to follow should bacteriological contamination be detected in the water system. These procedures are outlined in Figure N-1. If the chlorine disinfection residual in the distribution system is lost, it may be necessary to batch chlorinate the reservoirs and flush distribution piping.

For every 1.0 million gallons of storage, approximately 17 lbs. of 70 percent calcium hypochlorite (HTH) is necessary to provide a 1.0 mg/L chlorine residual. As an alternative, 18 gallons of 5.25 percent sodium hypochlorite, available as household bleach in the supermarket, can be added to 1.0 million gallons to provide a dose of 1.0 mg/L.

In the event of a suspected intentional contamination with a microbial agent, the protocols for intentional contamination shall be followed in addition to the procedures outlined here. Law enforcement authorities will need to be consulted prior to making public notifications as discussed further in the intentional contamination incident plan.

Boil Water Notification

Emergencies such as floods, earthquakes, and other disasters can result in damage to water system infrastructure, thereby warranting a boil water notice as a cautionary measure. A suggested boil water notification form is presented at the end of this Appendix. The City would issue the order through radio, television and newspapers serving the local area. Prior to the issuance of a boil water notice, the City should consider the experience gained by other communities in the past. A summary of pertinent information follows:

- An initial press conference should be held following issuance of the boil water notice to advise the public of the situation. All press releases will go the City's Public Information Officer.

- Consolidated press releases, announced on morning and evening television and radio news broadcasts, can also be used to keep the public informed.

- A 24-hour telephone hotline will be established to respond to public and media inquiries regarding the notice. The hotline should be staffed with knowledgeable representatives from the City and other governmental agencies. In order to maintain the consistency of information released, hotline operators should be provided with standard question and answer

sheets and briefed as new information becomes available. The hotline should remain available for 24 hours after the boil water notice has been rescinded to provide relevant information and reassurance for concerned customers. All media inquiries shall be directed to the Public Information Officer.

- Other State, County, and City agencies will be consulted prior to release of information to the public, including DOH and the Clark County Health Agency. A consensus will be reached among the jurisdictional agencies regarding information to be released and actions to be taken. It is important not to release conflicting information so as not to confuse the public.

- Agencies and hot line phone operators should be aware of difficult questions that could be asked by the public or the press. A few examples follow:

  1. What other utilities are affected?

  2. What should be done about coffee and ice machines that use water directly from the system?

  3. How did the system get contaminated and what is being done about it?

- Protocol should be developed for rescinding the boil water notice. One example includes two consecutive days of no detection of Cryptosporidium, Giardia, or coliform bacteria in the system.

- Once the boil water notice is rescinded, a notice should be developed to inform the public regarding appropriate measures for use of the water supply including flushing of pipes and fixtures as required.

A thorough investigation of the contamination source should be conducted and strategies developed to avoid similar future occurrences. The public should be informed and given updates regarding investigation findings in order to restore confidence in the quality of water provided by the water system.

DROUGHT

The Clark County Hazard Identification and Vulnerability Analysis states that nearly all areas of the county are vulnerable to drought.

History suggests a high probability of occurrence in Clark County. Although the entire population of the county is considered vulnerable to the effects of drought, severity has historically been low. Actual drought conditions have been limited to a few days, even during extended dry periods.

The hazard of a short-term drought will be addressed through water conservation measures outlined in the Water Conservation Chapter of the Water System Plan. The City will need to coordinate with adjacent water users in developing an effective drought response. This type of coordination will become essential with longer drought periods when more stringent water conservation measures may become necessary. Additionally, extended droughts may also increase fire hazards, particularly in the heavily wooded areas of the City.

EARTHQUAKE

The County's assessment indicates that of all potential disasters, the City is most vulnerable to a severe earthquake. However, the ability of the City's water system facilities to withstand a major earthquake has not been fully characterized.

The Northridge earthquake, which struck on January 17, 1994, left the Metropolitan Water District of Southern California (MWDSC) facing a major disaster. Fortunately, the MWDSC had established emergency planning procedures that proved to be essential to restoring water service to its customers. Two essential components were an Emergency Response Center and pre-established reconnaissance patrols that were able to quickly conduct damage inspections. The MWDSC had also stockpiled considerable repair parts and materials in order to be virtually self-sufficient in an emergency. Following the Northridge earthquake, however, the MWDSC found that most parts and equipment were readily available via overnight shipping from around the nation, indicating that stockpiling does not need to be wholly relied on for effecting repairs.

The Pacific Northwest is a very seismically active area. The Clark County HIVA states that potential earthquake sources in Clark County are not well characterized because of their infrequent occurrence compared to California. Estimations of possible earthquake sources are limited to studies of many small earthquakes, investigations of known faults, and other geological surveys.

CRESA indicates that earthquakes in Clark County are most likely to originate from three sources: (1) the Mt. St. Helens seismic Zone; (2) the Portland/Vancouver Seismic Zone; and (3) the Cascadia Subduction Zone. Descriptions of each of these seismic zones are summarized from the Clark County HIVA below.

1. Mt. St. Helens Seismic Zone – This seismic zone is most commonly a source of several small earthquakes (<4 M). The strongest earthquake associated with this zone was the Elk Lake earthquake of February 13, 1981. This was approximately 5.5 M magnitude earthquake. While this

was just a moderate earthquake it was felt over an area of about 104,000 km^2 that ran as far north as Ferndale, Washington and as far South as Salem, Oregon. Geologists suggest that the possibility exist for an earthquake as great as 6.5 M originating from this zone.

2. Portland/Vancouver – The Portland metropolitan area is the most seismically active region in Oregon in historic times. In the past 150 years there have been six earthquakes of magnitude 5 or greater. The Washington side of the seismic area is the second most seismically active area in Washington (the Puget Sound area is the most seismically active area in the state). The area between the Lacamas Creek Fault and the Portland Hills Fault borders this seismic region. The existence of the Portland Hills fault was only recently confirmed by the digging of the light rail tunnel through the West Hills of Portland. This discovery, matched with other geophysical studies suggest that earthquakes as large as 6 M or larger should occur in the Portland region every 300 to 350 years and an event of M 6.5 or larger about every 800 to 900 years. Earthquakes in this area present what may be the worst-case scenario for Clark County because the epicenters may be quite close. Geologists theorize there may be faults directly underneath the cities of Portland and Vancouver. Recent studies suggest that the epicenter for the 5.5 M earthquake in November 5, 1962, was located underneath the City of Vancouver.

3. Cascadia Subduction Zone – The Cascadia Subduction Zone lies about 50 miles offshore, extending from near Vancouver Island to northern California. The zone is where the oceanic Juan de Fuca plate dives beneath the continental North American plate. These plates are converging at a rate of 1 to 1.5 inches per year.

CRESA considers the entire county population, property, commerce, infrastructure and services as vulnerable to an earthquake. The scope of damage will be a function of earthquake magnitude and level of preparedness. Damage could range from minimal to extreme loss of life and destruction of property.

Most injury, death, and property damage in an earthquake result from seismic impacts on structural and non-structural materials. The vulnerability of certain areas partially depends on the types of structures in that area. A wood frame residential structure that is adequately secured to the foundation is relatively safe. An un-reinforced masonry building is at greatest risk from seismic impacts. Most injuries in earthquakes result from non-structural materials such as light fixtures, equipment, and furniture, falling on people and causing injury.

Another factor in earthquake vulnerability is soil type. Water-saturated loose sand and silt lose their ability to support structures in an earthquake. Areas in Clark County that

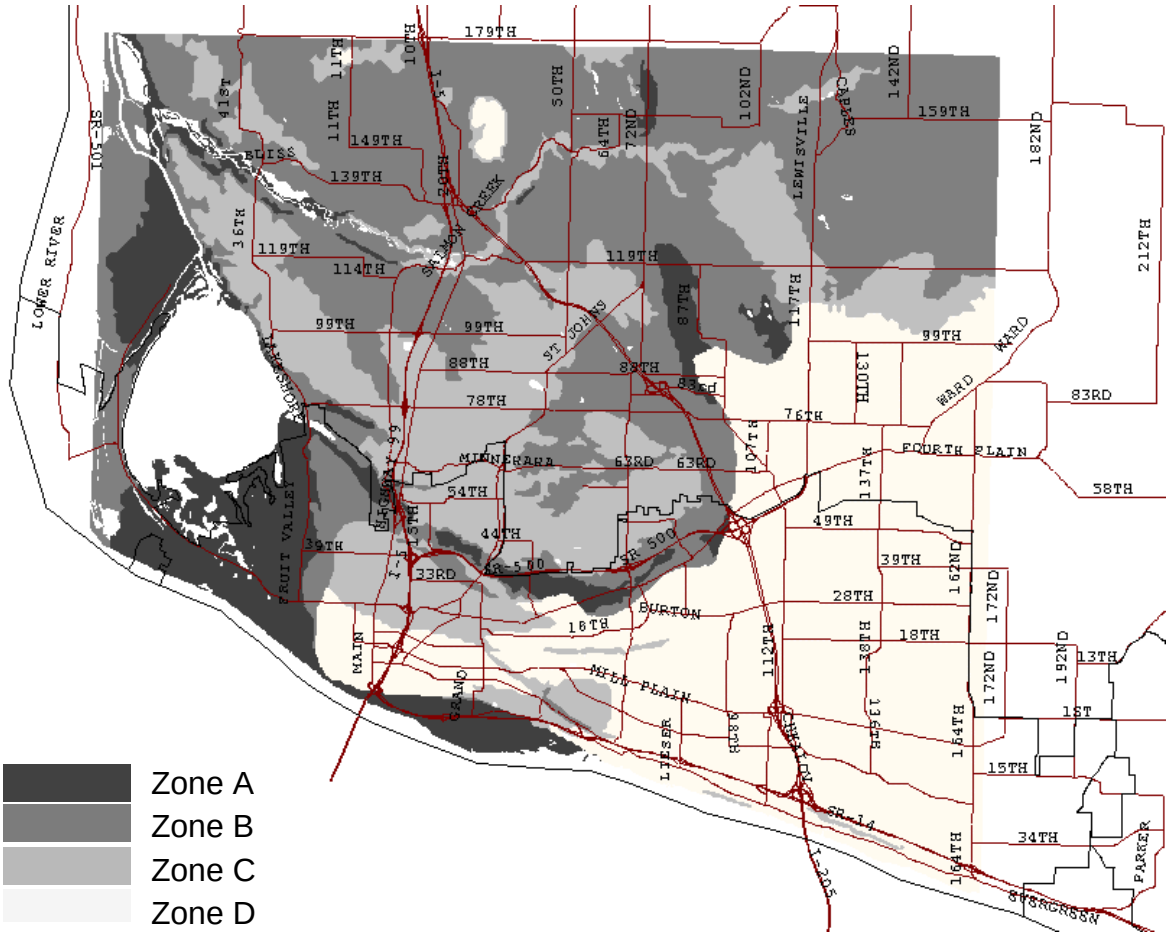
are near flood plains or areas with silt deposits are at the greatest risk during an earthquake.

Within the limits of predictability, CRESA assigns a high probability of occurrence for a damaging earthquake during the next 25 years. A large earthquake could have a catastrophic impact on Clark County suggesting high vulnerability. Accordingly, a high-risk rating is assigned.

Figure N-2 shows a map of Clark County with zones of relative hazards for earthquakes. Based on evaluation of soil liquifaction, ground amplification, and earthquake induced landsliding hazards. Zone A is area of greatest relative hazard. Zone D is area of least relative hazard. The City of Camas is primarily in Zone D.

FIGURE N-2

Relative Earthquake Hazard Map, Clark County, Washington



Earthquake response measures for the City's water system are shown in Table N-5.

TABLE N-5

Earthquake Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Transmission and distribution system mains may be broken and the City's ability to monitor and respond to these incidents may be limited.	Isolate the major broken sections of piping throughout the system as they are located and repair as necessary and possible. Contact DOH.
Storage Facilities	Reservoirs may be leaking or structurally damaged	Inspect each reservoir for structural damage or cracks and leaks. Seal or drain these reservoirs as required. Contact DOH.
Booster Stations	Booster stations may be structurally damaged or mechanical damage to pumps and piping may have occurred.	Check booster stations and shut down pumps as required. If zones can be fed by alternate methods, implement those procedures. Contact DOH.
Wells	Unable to supply additional water to system. Well casings may be broken. Pumping capacity may be lost.	Investigate situation. Determine which wells can be utilized. Determine if surface water source still available. Contact DOH.
Treatment Facilities	Damage may have occurred to the treatment building, piping, or filters at the filter plant. May be unable to supply water from surface water source.	Shut down the equipment at the treatment facility. Attempt to repair. Check possibility of supplying City with groundwater sources. Contact DOH.

FLOOD

The Clark County HIVA states that floods are the most common disaster in Washington State and Clark County. The County's climate, topography, and geology are conducive to flooding. Normal annual precipitation ranges from 38 inches on the western floodplains to over 114 inches in the mountainous northeastern part of the county.

History of Flooding in Clark County and Adjacent Areas

- **December 1933 –** The largest flood of record on the Lewis River.

- **May 30, 1948 –** Columbia River crested at 34.4 ft. Flood stage at that time was 15 ft. This is the flood that destroyed the City of Vanport. Vanport, with a population at the time of the disaster of 18,500, was the second largest City in Oregon. The destruction of the town occurred when a 600-foot section of dike protecting the settlement from the rising Columbia River broke. Unfortunately, few people evacuated Vanport prior to the dam rupture. Evacuation was hampered by the fact that there were very few good evacuation routes. Fifteen people died in the flood.

- **June 1956 –** Columbia River flooded due to snowmelt runoff.

- **January 1972 –** A combination of intense rainfall and snowmelt caused major East Fork of the Lewis River floods.

- **December 1977 –** Heavy rainfall and snowmelt caused flooding on the East Fork of the Lewis River. Salmon Creek had largest flood since gages were placed on Salmon Creek. The Washougal River also received its largest flood since gages were placed in 1944. This flood was an extremely rare event, greater than a 500-year flood.

- **February 8, 1996 –** The Columbia River crested at 27.1 feet on February 9. This flood produced some of the worst flooding seen in the County since 1948. Approximately 1,500 people were evacuated, and 177 homes were destroyed. This flood occurred because of the confluence of several factors. The winter of 1995/96 was extremely rainy. Prior to the flooding period, the region experienced a cold snap with low elevation freezing, ice, and snow. This was followed by a strong warming trend with heavy precipitation.

In Clark County, the weather that produces the most serious flooding events are extensive wet conditions that follow a period of mid and high elevation ice and snow pack development. Many rivers in Clark County historically flood every few years. These include the East Fork of the Lewis River, Washougal River, Salmon Creek, and the Columbia River. Flooding on these rivers usually occurs between October and February. Long periods of heavy rainfall and mild temperatures coupled with snowmelt contribute to flooding.

There are three types of flood threats:

- Riverine

- Tidal
- Flash and Surface

The greatest threat of flooding in the City will be flash and surface flooding due to inundation of stormwater collection and conveyance systems. This may impact the water system operation through a number of mechanisms, including:

- Restricting access to water system facilities due to flooded streets
- Flooded valve and meter vaults
- Flooded City facilities
- Increasing groundwater levels that threaten contamination of leaking underground water lines

Actions the City will consider depending on the extent of flooding and the risks that might be mitigated include:

Pre-Flood

- Sandbagging around City facilities, such as the Public Works Operations Center
- Securing large pieces of equipment and materials that could be carried off by floodwaters
- Raising electronic equipment and computers off the floor
- Moving valuable records to locations expected to remain dry

Post-Flood

- Checking coliform levels in the water system for contamination (see incident specific plan for bacteriological contamination)
- Inspecting meters and PRV stations to ensure proper operation
- Cleaning debris from around reservoirs

Figure N-3 includes a flood map of the City of Camas. As the flood map indicates areas susceptible to flooding include the Washougal Wellfield (Well Nos. 5, 6, 7, 8, 10 and 12 as well as the new chemical feed building).

Historically, flooding occurs along one or more of the County's waterways every few years, suggesting a high probability of occurrence. Because of the relative land area and population affected, the County is exposed to moderate vulnerability. Although the vulnerability is moderate, the frequency of flooding, the potential for simultaneous flooding events, plus the historical record of recurrent flooding and cumulative costs, all suggest the assignment of a high risk rating.

Table N-6 lists flood response measures specific to the City's water system.

TABLE N-6

Flood Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Transmission and distribution mains could be affected by landslides or high water levels. City staff transportation for monitoring the system and making repairs may be limited.	Monitor possible areas of concern for waterline conditions. Monitor waterline bridge crossings for possible damage. Prepare to valve off any washed out or damaged waterlines. Contact DOH.
Storage Facilities	Minimum physical/structural impact due to locations. Flooding could cause elevated coliform levels in water system.	Monitor coliform levels. Contact DOH to advise of acute of non-acute coliform violations.
Booster Stations	Minimal operational impact.	None.
Wells	Facilities could be overwhelmed by flood waters.	Prepare to disconnect any well affected by flood waters. Contact DOH.
Treatment Facilities	Heavy rainfall or snow melt may overwhelm the capacity of the water treatment facility. Flooding in the vicinity of the plant is a risk.	Allow the water to bypass the filtration plant by closing intake facilities. Use wells as source of water for City. Contact DOH.

LANDSLIDE/MUDFLOW/DEBRIS FLOW

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Landslides commonly occur on water-saturated slopes when the base of the slope can no longer support the weight of the soil above it, thus their frequency increases during or after periods of heavy rain and flooding. Though commonly associated with heavy rain and flooding conditions, landslides may also be associated with earthquakes (the 1994 Northridge Earthquake caused an estimated 11,000 landslides) and volcanic activity.

CRESA indicates that Clark County experienced the greatest number of landslides from 1996 to 1997. One of the largest landslides in the area occurred just outside of Clark County, two miles north of Woodland on February 8 and 9 when 32,000 yd^3 of earth fell across all lanes of I-5 and the adjacent railroad tracks, disrupting traffic until February 19. In the same flooding period there were also several landslides that disrupted railroad operations in the area adjacent to Vancouver Lake. The following year, which was marked by heavy rains but no significant flooding, there were several landslides. Clark County has several areas where landslides have taken place and several areas that are susceptible to landslides. The hills north of La Center and the slopes north of Camas and Washougal are particularly susceptible.

Slides in Clark County generally range in size from thin masses of soil of a few yards wide to deep-seated bedrock slides more than six miles across. Travel rate may range in velocity from a few inches per month to many feet per second, depending largely on slope, material, and water content. The recognition of ancient dormant slide masses is important as they can be reactivated by earthquakes or unusually wet winters. Also, because they consist of broken materials and disrupted ground water, they are more susceptible to construction-triggered sliding than adjacent undisturbed material.

CRESA states that typical effects of landslides include damage or destruction of portions of roads and railroads, sewer lines, pipelines, and water lines, electrical and communications distribution lines, and destroyed homes and public buildings, but the most significant effect of landslides is the disruption of transportation and the destruction of private and public property.

The Clark County HIVA indicates the County has a history of landslides and their numbers are increasing, suggesting a high probability of occurrence. Landslides tend to occur in isolated, sparsely developed areas threatening individual structures and remote sections of the transportation, energy and communications infrastructure suggesting low vulnerability. Because of the high probability of occurrence and the trend to more frequent landslides, a moderate risk rating is assigned.

The risk to the water system is considered low because of the lack of steep slopes in the Camas area. Flooding and Earthquakes will increase the risk of landslides. Refer to Tables 5-5 and 5-6 for response measures that may be appropriate for landslides induced by those event categories.

SEVERE SNOWSTORM

The most significant anticipated impact of a severe snowstorm is limiting access to the City's facilities. City personnel may not be able to access water mains, reservoirs or valves for maintenance and/or manual operation of system components. During a severe snowstorm the City will rely on the telemetry system for information on the major system components. Additional hazards to be considered with severe winter storms include:

- Freezing in City Reservoirs – Mitigated by ensuring continuous turnover.
- Water service line breaks – Mitigated by asking customers to be vigilant for flooding around homes and businesses.
- Roof Collapse on City buildings and reservoirs – Mitigated by observing snow levels and having City crews remove when snow load may be exceeded.

Table N-7 lists water system response measures associated with winter storms.

TABLE N-7

Severe Snowstorm Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	City staff transportation for monitoring system and making repairs will be limited.	Contact City street department to expedite plowing of critical water system component access. Maintain chains and other snow gear for maintenance equipment on hand. Be able to provide accurate locations of valving for maintenance purposes.
Storage Facilities	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.
Booster Stations	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.
Wells	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.
Treatment Facilities	Snow may prevent access.	Clear snow from access roads. Three 4 x 4 vehicles are available for water department use to access critical sites.

TORNADO

Tornadoes are characterized by funnel clouds of varying sizes that generate winds as fast as 500 miles per hour. They can affect an area of 1/4 to 3/4 of a mile and seldom more than 16 miles long. Tornadoes normally descend from the large cumulonimbus clouds

that characterize severe thunderstorms. They form when a strong crosswind (sheer) intersects with strong warm updrafts in these clouds causing a slowly spinning vortex to form within a cloud. Eventually, this vortex may develop intensity and then descend to form a funnel cloud. When this funnel cloud touches the ground or gets close enough to the ground to affect the surface it becomes a tornado. Tornadoes can come from lines of cumulonimbus clouds or from a single storm cloud. Tornado hazards are measured using the Fujita Scale ranging from F0 to F6.

A history of tornadoes in Clark County follows:

- October 1951 – Battle Ground (F0 on the Fujita Scale). 8-miles long and 25-yards wide, which uprooted trees and destroyed a two-story barn.

- August 26, 1953 – Ridgefield (F0 on the Fujita Scale). Lasted 3 minutes and severely damaged a farm.

- April 5, 1972 – Vancouver (F3 on the Fujita Scale). This was the most disaster to occur in Clark County and the most serious tornado in Washington State. Six people died and 300 were injured when a tornado cut a swath of destruction through East Vancouver. The tornado's path was 9-miles long, from the Columbia River, just east of Andresen Road up to Fourth Plain Blvd. Peter S. Ogden Elementary, a shopping center, and a bowling alley were severely damaged.

- December 1974 – Camas (F0 on the Fujita Scale). Windows were broken and walls collapsed but there was no serious damage.

- October 1984 – Woodland (F1 on the Fujita Scale). A funnel cloud touched down several times, snapping and overturning trees, and ripping up fence lines. A barn roof was torn off, corrals flattened and a pump house lifted and exploded.

- June 29, 1989 – La Center (F1 on the Fujita Scale). Uprooted several trees and tossed one car off the road causing minor injuries to the driver.

- May 31, 1997 – Vancouver (F0 on the Fujita Scale). Caused $10,000 in property damage.

- September 15, 1997 – Yacolt (F0 on the Fujita Scale). No reported damage.

- May 11, 2000 – Battleground (F0 on the Fujita Scale). Caused $10,000 in property damage.

- May 27, 2004 – La Center (F0 on the Fujita Scale). No reported damage.

- September 2004 – Ridgefield (F0 on the Fujita Scale). No reported damage.

- January 10, 2008 – Vancouver, (F1 on the Fujita Scale). Damage reports showed widespread downed power lines, malfunctioning traffic lights, and roofing that had been ripped off. Although the majority of damage was light in nature, in at least one case a home was completely demolished. At least 2,500 homes and businesses had lost power because of the storm. Property damage estimated to total $525,000.

Table N-8 provides definitions of tornado hazards.

TABLE N-8

Tornado Hazard Scale

F-Scale Number	Intensity Phase	Wind Speed	Type of Damage Done
F0	Gale Tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate Tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant Tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe Tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted.

Tornadoes are not normal occurrence in the Northwest as they require a confluence of warm surface temperatures and warm fronts coming from the south with cold fronts coming from the north. Northwest climates do not normally generate the temperature variations conducive to tornado formation. Washington is ranked 43 in the US for total number of tornadoes. Nonetheless, CRESA states that the tornado threat should be taken very seriously. The conditions conducive to tornado formation may develop in Southwest Washington and it is common for funnel clouds to be reported in this region. During severe thunderstorms it is possible for tornadoes to occur.

With the exception of the April 1972 disaster, tornadoes in Washington and Oregon tend to be light or moderate, with winds ranging from 40 to 112 mph. There are a notable minority of tornadoes that cause significant to severe damage with winds going as high as 200 mph. The peak season for tornadoes is April through July. However, in Washington tornadoes may occur in the late summer months and, in a few rare cases, may occur in the

winter months. While tornadoes are sometimes formed in association with large Pacific storms, most of them are caused by intense local thunderstorms. Tornadoes almost exclusively occur in the late afternoon and early evening.

It is possible for a tornado to occur anywhere in the lower elevations of Clark County. Normally, Pacific Northwest tornadoes are moderate but it is possible for serious tornadoes to develop, causing death and serious injury as well as property damage.

Water systems most vulnerable to tornadoes will be reservoirs, booster stations and treatment facilities. Reservoirs are not designed to withstand the high winds possible with tornadoes and buildings that house well pumps, booster pumps and treatment facilities may be damaged or destroyed by a severe tornado.

VOLCANO

According to the Clark County HIVA, the most likely scenarios for volcanic eruptions that will impact the County are as follows:

- Ashfall and *tephra* (the ash, rock and boulder-sized debris from an exploding volcano) from Mt. St. Helens.

- Ashfall and the generation of *lahars* (volcanic mud/debris flows) from the Sandy River in Oregon due to volcanic activity at Mt. Hood.

The most severe impacts in Southwest Washington from another major eruption from Mt. St. Helens eruption would be in Cowlitz County. In this event, Clark County emergency managers and responders may support Cowlitz County agencies and the Forest Service in assisting in evacuation, perimeter control, search and rescue and other operations. Drawing from these resources may leave the City of Camas potentially vulnerable to an inability to respond should emergencies arise that require local response assets.

The vulnerability to damage from lahars is greatest in southern Clark County, due to potential impacts from lahars in the Sandy River. Since the Sandy River empties into the Columbia across from Camas, lahar deposits could influence the flow of the Columbia River and possibly affect low lying areas of Camas near the Columbia. However, the potential exists for ashfall from volcanic activity to impact the entire county by creating a respiratory hazard and potentially adding weight to the roofs of City facilities (including the water reservoirs) that will increase significantly if it becomes wet. Wet ash also creates a slipping hazard and will create traffic problems and make water system maintenance hazardous.

URBAN FIRE

In the 2001 Water System Plan, a hydraulic analysis was conducted in several areas throughout the system to determine if the water system had adequate capacity to provide fire flow. Deficiencies were noted in the following areas:

- PRV Systems – Lacking pressure-sustaining features to prevent fire flows in lower pressure zones from causing unacceptable service pressures in upper pressure zones.
- NW 3rd Avenue – Fire flow limitations.
- Sierra Lane – Fire flow limitations.
- NW Ostenson Canyon Road – Fire flow limitations.

The modeling of the water system is generally based on single event structural fires. In addition to the areas with fire flow deficiencies noted above, multiple structural fires occurring simultaneously in the same pressure zone could conceivably overwhelm the water system's capacity. If mutual aid agreements are invoked, the City would need to consider the potential for a water shortage in a coordinated fire response.

However, in the event of a fire City personnel monitor reservoir levels and system performance with the telemetry system, which allows the Fire Department to understand the limitations of water supplies available for fire suppression and to operate accordingly.

Other issues to consider with fires include:

- Creating a vacuum on waterlines due to high fire demand; this may create a cross-contamination hazard.
- Water quality complaints from customers due to high pipe velocities scouring inner pipe surfaces.

Table N-9 lists water system response measures for urban fires.

TABLE N-9

Urban Fire Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	Low pressure may result in the extremities of the system depending on the extent of the fire incident.	Monitor system and adjust pumps if applicable.
Storage Facilities	Draw down will occur in the reservoirs with increased demand.	Monitor reservoir levels.
Booster Stations	Additional pumps called on.	Monitor pump station to ensure proper operation.
Treatment Facilities	Fire in watershed could cause increased sediment in the surface water source. Turbidity levels may exceed acceptable levels.	Use groundwater sources until surface water sources available. Provide silt fences along areas that have lost vegetation due to fire. Contact DOH.

POWER FAILURE

Various types of severe weather can cause loss of electrical power. In order to alleviate the effects of a power outage, the City has installed auxiliary generators at the Chlorination Plant, the Filter Plant, Butler/Gregg Booster Stations, Angelo Booster Station, Lacamas Booster Station and the Lower Prune Hill Pump Station. Well Nos. 8, 11 and 12 also have an auxiliary power source to allow the wells to operate during an electrical outage. The Washougal Wellfield Treatment Facility obtains auxiliary power from the generator for Wells 11 and 12.

Table N-10 presents the potential effects of a lengthy power failure on the water system components.

TABLE N-10

Power Failure Response City of Camas Water System

Water System Component	Potential Effects	Recommended Actions
Transmission and Distribution System	No effect	None.
Storage Facilities	Telemetry system may be inoperable.	Manually check reservoir levels. Some reservoirs can provide water to lower areas.
Booster Stations	Booster stations inoperable without auxiliary power.	Operate booster station with auxiliary power.
Wells	Unable to supply additional water to system.	Well Nos. 8, 11 and 12 Auxiliary Power
Treatment Facilities		Auxiliary generator.

DAM FAILURE

Dam failures are the release of impounded water due to structural deficiencies, which can affect lives and property downstream. Dam failures are caused by flooding, earthquakes, lack of maintenance and repair, misoperation, poor construction, vandalism, or terrorism.

According to the Clark County HIVA, several dam failures have occurred in Washington State over the last 40 years, some of which been catastrophic, but none have occurred in or has impacted Clark County.

There are 36 dams in Clark County. These dams are used for hydroelectric power generation, irrigation, and recreation. Table N-11 shows dams that could potentially impact the City of Camas.

TABLE N-11

Clark County Dams Upstream of the City of Camas

Name of Dam	Year Built	Type	Nearest City Downstream	Distance in Miles	River	Downstream Hazard Category
Clark Reservoir Dam	1948	RE	Camas	4	Robinson Creek	3
Lacamas and Round Lakes, Lower Dam	1936	BU	Camas	1	Lacamas Creek	2
Lacamas and Round Lakes, Upper Dam	1936	BU	Camas	1	Lacamas Creek	2
Price Reservoir Dam	1950	RE	Camas	3	Tributary - Lacamas Creek	3

Dam Type: BU – Buttressed Dam, RE – Reinforced Earth Dam.
Hazard Category:
1 = High; 2 = Significant; 3 = Low
(reference: Washington State Department of Ecology Dam Safety Guidelines, July 1992, revised Sept 2004)
2 = 1 to 6 lives at risk, appreciable economic loss, limited or short term water quality degradation
3 = No lives at risk, minimal economic losses, no significant water quality impacts

Washington State uses a Downstream Hazard Classification system for dams, which assigns a Low, Significant or High rating for populations at risk of economic loss and environmental damage should the dam fail. In Clark County, most dams are rated low, three are significant and three high. (The three potential high hazard dams are the Merwin Dam on the Lewis River, Erickson on Rock Creek and Tsugawa Brothers Reservoir Dam on Mason Creek.) The three potential significant hazard dams are the Elmer Dam on Mason Creek and the Lacamas and Round Lakes, upper and lower dams on Lacamas Creek; these latter two dams pose a downstream hazard to the City of Camas.

In addition to the dams located in Clark County, the county can also be affected by dam failures of dams on the Columbia River upstream from Clark County. CRESA considers these dams to be well maintained, operated with 24-hour staffing and inspected on a regular basis.

CRESA states that Washington experiences a dam failure on a frequency of approximately once every two years. The majorities of failures were in whole or part the result of a failure to perform adequate maintenance and monitoring of the facilities. Dam failure can have many effects such as loss of life, damage to structures, roads, utilities, and crops. Economic losses can also result from a lowered tax base and lack of power profits.

History suggests a low probability of occurrence. The failure of a high hazard dam would threaten a small segment of the County suggesting low vulnerability. Because there has not been a major dam failure in Clark County, and the three high hazard dams are well maintained and operated providing no reason to suspect a compromise in

structural integrity baring a natural disaster or terrorist action, a low risk rating is assigned.

For response measures in the event of a dam failure, refer to Table N-7 (flood response).

TRANSPORTATION ACCIDENT (AIRPLANE CRASH)

Although there have been no major airplane crashes in Clark County, the scope of the impact of such an event and the potential complexities of the response require the City to consider how such an incident could impact the water system operation.

The City of Vancouver is across the river from Portland International Airport. The airspace over the Columbia River and Vancouver is heavily used by all types of aircraft flying into Pearson Airpark, Portland Air National Guard Base and Portland International Airport. Most airplane accidents occur during arrival and departure so the City of Vancouver is at a greater risk than any other area in the County. Considering the flight paths of aircraft into and out of Portland International Airport, Vancouver has the potential for a major airplane crash with mass casualties, hazardous materials incidents, and fires. Accordingly, response assets from the City of Camas may be drawn to a crash site and leave the City potentially vulnerable if another emergency arises that requires those assets. Additionally, an airplane crash could cause major transportation routes to be closed for significant periods of time, resulting in significant delays for contractors, equipment and chemical suppliers to access the City of Camas.

TRANSPORTATION ACCIDENT (HIGHWAY OR RAIL)

City water lines cross a number of well-trafficked thoroughfares through the City, including SR 14 and the railroad that runs parallel to SR14. It is conceivable that a major accident on one of these thoroughfares would damage a water line. The Public Works component of the response to a transportation incident includes the following:

- Coordinate damage assessments, emergency road clearing and road repair activities
- Provide contracts for repair and recover work, including damaged utilities
- Provide maps for transportation route planning

The water utility will need to be assessed rapidly in the event of a major transportation incident to determine if water lines have either been damaged or are at risk of being damaged due to the incident. It may become necessary to isolate damaged or at-risk water lines until the incident has been cleared and emergency repairs have been made to allow recovery efforts to proceed.

HAZARDOUS MATERIALS (HAZMAT) INCIDENT

According to the Clark County HIVA, as of 1998, Clark County had approximately 77 entities, at 117 facility locations, which filed an Emergency and Hazardous Chemical Inventory Form (known as a Tier Two Form) with Washington State Department of Ecology. Of these 117 facilities about 58 of them use chemicals on the Environmental Protection Agencies list of Extremely Hazardous Substances.

The City may obtain Clark County Tier Two Hazardous Chemical Inventories from CRESA:

Phone: (360) 737-1911 Email: cresa@clark.wa.gov

Statistics show that nearly half of all hazardous materials incidents occur during transit. Large quantities of HAZMAT are transported through and in the close vicinity of the City via the interstate highway and by rail. In the event of a HAZMAT spill, the Fire Department will be the City's lead department for incident response within the City limits. A large spill will trigger the need for mutual response under the Regional HAZMAT response agreement.

The City of Camas Fire Department has no HAZMAT response capability. A HAZMAT response capability permits offensive operations necessary to perform the following operations:

- Preliminary hazard characterization
- Safely enter the hazardous area
- Mitigate the effects of the release prior to recovery operations
- Exit the hazard area employing a deliberate and thorough decontamination process

The above capabilities can only be provided by HAZMAT teams that are equipped and trained to Occupational Safety and Health Agency regulations (29 CFR 1910.120) and National Fire Protection Association competency levels (NFPA 471 and 472). The City of Vancouver and the Georgia Pacific Mill have such response capabilities. The City Fire Department will coordinate all HAZMAT support with this units working with CRESA under the regional HAZMAT response plan. Telephone numbers for the City of Vancouver and Georgia Pacific HAZMAT teams leaders are as follows:

City of Vancouver (360) 619-4165
Georgia Pacific (360) 834-8465

The Public Works and Fire Departments will communicate during a HAZMAT spill to determine if the incident poses a hazard to water system personnel and facilities. It may become necessary to isolate water lines that are at risk of contamination due to a HAZMAT spill in order to prevent contamination of the water system.

INTENTIONAL CONTAMINATION

This type of incident could accompany a terrorist incident involving chemical, biological or radiological agents as well as vandalism. It is treated as a unique class of incident due to the complexities of the response from an operational, public health, law enforcement and physical recovery standpoint.

The EPA recommended protocols for managing a suspected intentional contamination incident are summarized in Figure N-4. The EPA protocol has seven phases with three response decision points:

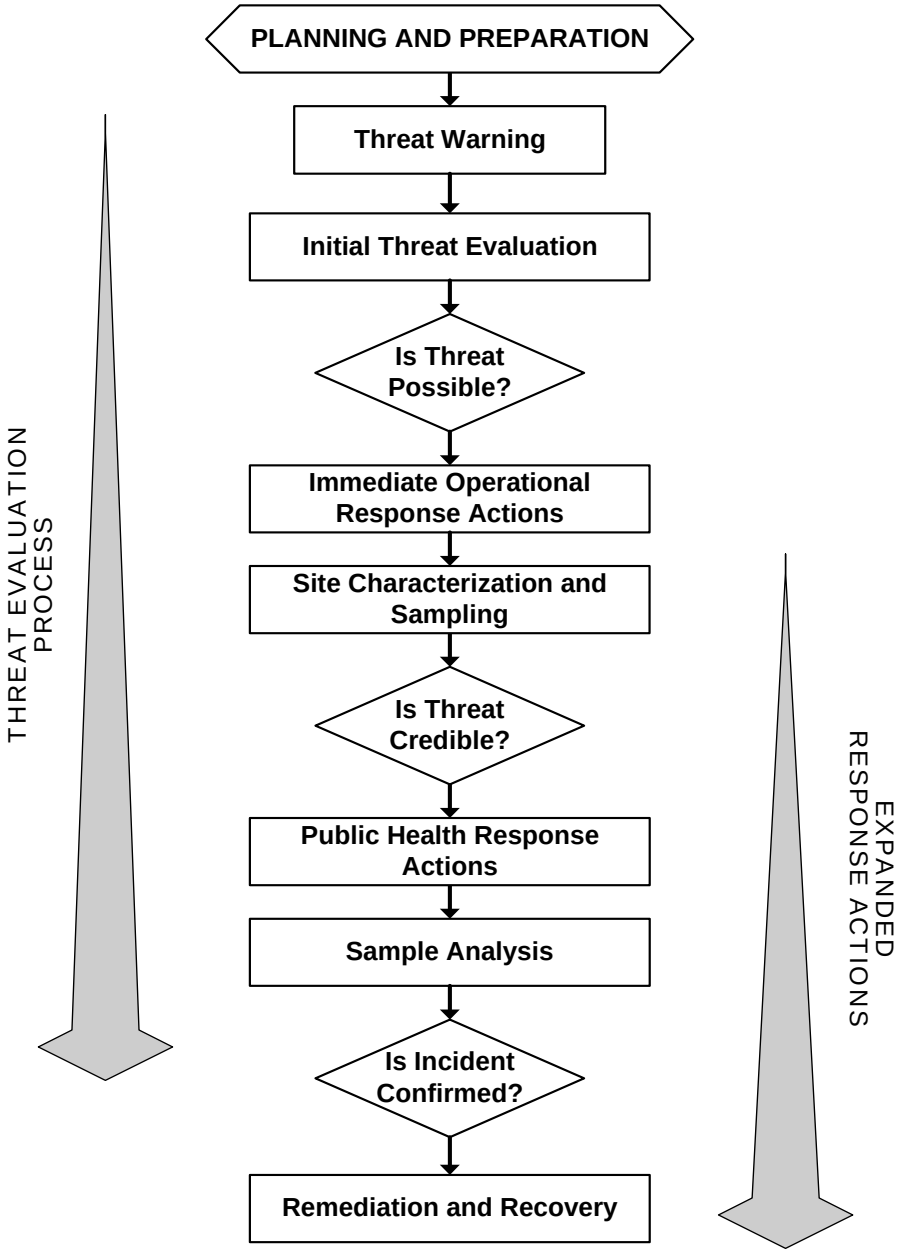
Phase	**Response Decision**
1. Threat Warning	
2. Initial Threat Evaluation	Decide if threat is possible
	yes
3. Immediate Response Actions	
4. Site Characterization/Sampling	Decide if threat is credible
	yes
5. Public Health Response	
6. Sample Analysis	Decide if incident is confirmed
	yes
7. Remediation and Recovery	

In no case should the utility pursue these actions unilaterally. Jurisdictional law enforcement agencies and public health agencies must be involved in each phase of the process. There are legal and practical requirements for this involvement, including rules of evidence for criminal investigations, balancing the need to protect law-enforcement sensitive information with public-right-to-know provisions in the Safe Drinking Water Act, obtaining specialized technical advice for sampling procedures and protecting the safety and health of water system personnel when taking water samples to test for suspected contamination.

Terrorism is a Federal crime and will require the involvement of federal law enforcement (Federal Bureau of Investigation).

FIGURE N-4

Protocol for Managing an Intentional Contamination Incident



Reference: Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox, USEPA, December 12, 2003.

Additionally, it is always recommended that the water utility consult with the HAZMAT team leader during the characterization and sampling process since, depending on the exposure hazard, it may become necessary for HAZMAT technician trained personnel to perform the site assessment and collect samples wearing OSHA compliant personal protective equipment.

Threat Warning

This is any unusual occurrence, observation, or discovery that indicates a potential contamination incident and initiates actions to address this concern. Such a warning would typically come in the form of an apparent security breach in the water system. Evidence of a security breach could come in the form of a telephone call threatening contamination or stating that intentional contamination has occurred; statements by witnesses who have seen water facilities being tampered with or broken into; physical evidence at a water facility indicating water facilities have been intentionally damaged or tampered with; and reports of increased illnesses from local hospitals or the Clark County Health Department.

Initial Threat Evaluation

This is the part of the threat management process in which all available and relevant information about the threat is evaluated to determine if the threat is possible. This is an iterative process in which the threat evaluation is revised as additional information becomes available. The conclusions from the threat evaluation are considered when making *response decisions*.

Immediate Response Actions

These are actions taken in response to a possible contamination threat in an attempt to minimize the potential for exposure to the potentially contaminated water. Immediate operational response actions will generally have a negligible impact on consumers. These actions will include estimating the potential area(s) within the water system that may have been subject to contamination and isolating these areas from the system to contain the contamination. This process must be performed quickly and generally will not allow modeling tools to be used unless the scenarios have been developed and modeled prior to the suspected contamination event.

Immediate Characterization and Sampling

This is the process of collecting information from an *investigation site* in order to support the evaluation of a drinking water contamination threat. Site characterization activities include the site investigation, *field safety screening*, *rapid field testing* of the water, and sample collection.

Field Safety Screening

Screening performed to detect any environmental hazards (i.e., in the air and on surfaces) that might pose a threat to the *site characterization* team. Monitoring for radioactivity as the team approaches the site is an example of field safety screening.

Rapid Field Testing

Analysis of water during *site characterization* using rapid field water testing technology in an attempt to tentatively identify contaminants or unusual water quality.

Public Health Response

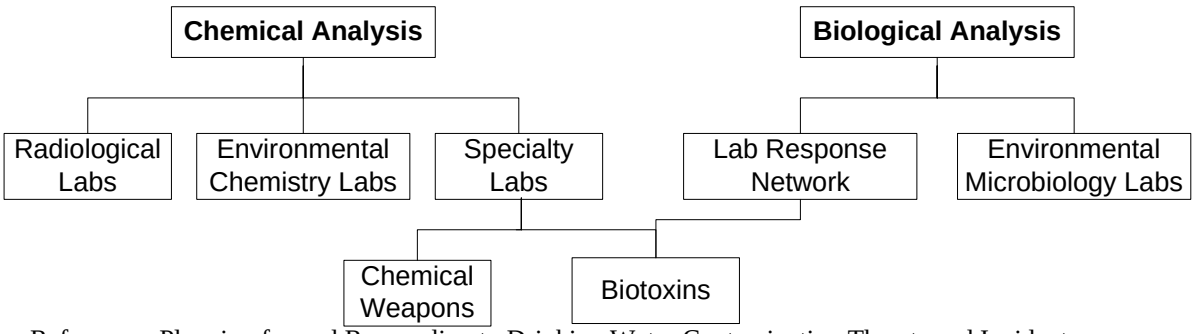
This encompasses all actions taken to mitigate consequences resulting from threats or incidents involving biological, chemical, or radiological contaminants. These actions include public notification, using an alternative water supply, boil water notices and chemical sterilization.

Sample Analysis

This step involves laboratory analysis that is undertaken to confirm the presence/absence of contamination such that specific decisions can be made by law enforcement and public health officials and allow the water utility to proceed with definitive response and recovery actions. It is important to keep in mind that not all labs can definitively confirm a potential contamination agent. Figure N-5 shows the types of laboratories and their general capabilities.

FIGURE N-5

Types of Laboratories by Contaminant Class



Reference: Planning for and Responding to Drinking Water Contamination Threats and Incidents Response Protocol Toolbox, Module 4: Analytical Guide, USEPA, December 12, 2003

Definitions for terms used in Figure N-5 are provided below. The EPA Environmental Laboratory Compendium provides a national listing of laboratories and their capabilities. The City may sign up for this list by going to the EPA's water security website:

http://cfpub.epa.gov/safewater/watersecurity/index.cfm

Environmental Chemistry Laboratory

This is any laboratory, either commercial or government-operated that is able to perform analysis of water samples for compliance with the Safe Drinking Water, Clean Water Acts, or other applicable environmental regulation, as well as other chemical parameters that are important to system operation and overall water quality. These laboratories have the instrumentation necessary to implement methods for chemical analysis of a water sample.

Environmental chemistry laboratories perform water analyses to support regulatory compliance and they are familiar with the need to treat samples with precautions necessary for legal defensibility. Analysis for regulatory compliance purposes, however, may proceed differently than analysis of emergency samples in response to a contamination threat, which has the dual role of both providing an emergency response to protect public health and also providing legally defensible evidence to support a criminal investigation. Additionally, no commercial environmental chemistry laboratories can analyze chemical warfare agents (e.g., nerve, mustard and blood/choking agents); this latter type of analysis can only be performed by a small number of government-operated laboratories in the United States whose access is restricted to law enforcement and military agencies.

Environmental Microbiological Labs

These labs include those of EPA, state environmental agencies, and the commercial sector, that typically perform analyses for waterborne pathogens. Most of these laboratories have the equipment and staff necessary to analyze for indicators of fecal contamination such as fecal and total coliforms and *E. coli*. Culture techniques are available for many of the more common waterborne pathogens such as *Vibrio cholerae*, *Salmonella enteriditis*, Typhi, and *Shigella* spp.; however, analyses for these pathogens are not routinely performed in most environmental microbiological laboratories. While some environmental microbiological laboratories have expanded capabilities to analyze for parasites such as *Cryptosporidium* and *Giardia* or to perform molecular assays for some organisms, these capabilities are not widespread.

Only laboratories registered for the analysis of select agents are legally permitted to analyze for those agents, and currently most registered labs reside in the LRN. Thus, even if environmental microbiological laboratories develop additional capabilities for pathogen analysis, they could not perform such analyses without registering for select agents.

Laboratory Response Network (LRN)

This is a network of laboratories developed by the Centers for Disease Control (CDC), Association of Public Health Laboratories (APHL), and the Federal Bureau of Investigation (FBI) for the express purpose of dealing with bioterrorism threats, including pathogens and some biotoxins.

Radiological Labs

These laboratories specialize in the analysis and handling of radiological materials. For radionuclides, analytical confirmation may be viewed differently than most chemicals because radionuclide analysis can take the form of screens for gross alpha, beta, or gamma radiation, and/or it can take the form of analysis for the specific radionuclides themselves, such as strontium-90. Thus, analytical confirmation may involve the process of confirming quantity of gross radiation or identifying the radionuclide. The type of analysis that is performed will be based on the analytical goals. For example, radionuclides in drinking water regulation are often characterized by their gross alpha and gross beta emissions.

For the purpose of emergency analysis of water contaminants, a tiered approach is suggested, with screening for gross radiation in the field or upon receipt by the laboratory followed by identification of the radionuclide, which may be important for a more complete understanding of risks to public health as well as potential criminal actions against perpetrators.

Specialty Labs

These are laboratories that are capable of analyzing samples for chemical, biological and radiological agents that cannot be analyzed by commercial laboratories. These labs require special safety certifications for operation and their access is controlled by law enforcement agencies and the military.

Remediation and Recovery

The remediation process involves: system characterization; selection of remedy options; provision of an alternate drinking water supply during remediation; and monitoring to demonstrate that the system has been remediated. This process will follow a process similar to the US EPA's Superfund program's approach to hazardous waste site cleanup to include *risk assessment*, *system characterization*, *feasibility study*, analysis of alternatives, *remedy* selection, *remedial design*, *remedial action*, and post-remedial monitoring and operations.

EXPLOSIVES INCIDENT

A bomb threat will be handled by the City Police Department. If the call is received at the CRESA 911 call center, the call center staff is trained regarding information to be obtained and questioning techniques. If the call is received by a City employee they will follow procedures as shown in Appendix L.

In the event of an attack on the water system with explosive devices, the response will, like a contamination incident, be complex and multidisciplinary (police, fire, public works, emergency medical services (EMS), public information, etc.). Important issues to be considered in the response include:

- Assignment of the Incident Commander (will depend on the situation/risks) – the incident commander is responsible for overall command and control at the incident scene and the health and safety of all response personnel.

- Presence of casualties and proper procedures for casualty extraction and emergency medical treatment at the incident site.

- The risk of fire/explosion presented by flammable materials in the vicinity of the explosion.

- Threat of a secondary device (a device that is placed at the scene to kill or injure emergency responders after their arrival).

- Physical hazards associated with collapsed structures.

- Evidence preservation requirements.

- Respiratory, ocular and skin hazards associated with vapors and fine particulate matter generated by the explosion and subsequent fires and what personal protective equipment (PPE) levels are appropriate for the hazards – note that "escape" respirators (e.g., Quickmask 2000), are <u>not</u> designed for prolonged exposures necessary for intentional entry into a hazardous area, they are designed solely to allow movement away from the incident site to a safer location. Additionally, as of late 2004, no escape masks have received federal certification (the approval agency is NIOSH – National Institute of Occupational Safety and Health) for an independently recognized and tested level of performance.

- The need to maintain communication between all response units (especially police, fire, public works and EMS) to ensure different response units all have the same hazard assessment and understand which

response units are being allowed at the incident site, their locations and basic tasks; this becomes even more critical as mutual aid from other agencies and jurisdictions arrive at the site.

- The need to isolate damaged elements of the water system to make emergency repairs and minimize impact to undamaged elements of the water system.

- The need to maintain a single spokesperson for the City to release information to the public and the news media.

CYBER ATTACK

The City maintains an IT network separate from the water system SCADA network. The network is used for intracity business and is password protected. Firewall protection is used and no outside access for third parties is allowed.

If a cyber attack is successful, the response will require the IT-System Administrator to assess the extent of impact and develop a plan to restore damaged or compromised files and attempt to recover lost files.

If the SCADA system is compromised it will become necessary to monitor the water facilities by periodic and direct visual contact until the system is restored to normal operations.

DOCUMENTATION PROCEDURES

During an emergency, precise documentation of actions taken and materials used will greatly increase the efficiency with which the City handles the situation. Detailed recording and reporting of events, such as shut downs, valve isolations, sampling events and reservoir operations, enables repairs to be made quickly keeping down time to a minimum. The detailed reports are invaluable in making certain that the system is quickly and efficiently returned to pre-emergency operating status. To aid employees, an Operating and Damage Report form is included in Appendix M.

The Federal Emergency Management Agency (FEMA) requires proper documentation of damage for the City to file claims in the event the City is covered by a Presidential Disaster Declaration. Photographic evidence of “before” and “after” an event as well as equipment purchase records will strengthen any justification for compensation from the Federal government.

The FEMA disaster assistance website for public agencies can be consulted for further information:

http://www.disasterassistance.gov/daip_en.portal

MAJOR WATER SUPPLY INTERRUPTIONS

WATER MAIN BREAKS

Depending on the location where the main break occurs, if susceptible populations are impacted, use contact list in Appendix B (Coliform Monitoring Plan) for notification. City will provide bottled water for lengthy outages. Depending on circumstances, portable toilets may be supplied as well. Trucked potable water may be provided. If the City uses trucked potable water, the guidelines in DOH Publication #331-063 will be followed.

The City maintains an inventory of piping and fittings to address most emergency repair requirements and has a list of vendor telephone numbers to obtain supplies when existing material stocks are inadequate for emergencies. When repairs are too large for City crews to manage, the City will contact contractors from its small works roster.

When water supply interruptions for a pressure zone are expected to be lengthy, the City will consider instituting measures to allow customers to come to a reservoir and obtain water directly from a reservoir. Any water dispensed in this manner will be done under the supervision of a City employee.

BOOSTER STATIONS

The City has developed detailed written procedures for operating the water system when booster stations are not in service and has figures showing locations of pumps, piping, meters, shut off valves and other key features of each facility, such as valve size/type, motor manufacturer/type/hp and pump capacity/type. Copies of these procedures, technical details and figures are kept at each facility.

A brief summary of the booster station emergency procedures follows.

Butler Booster Station

<u>Auxiliary Power</u>
The Butler Booster Station does not have an auxiliary power system.

<u>HOA Setting</u>
Emergency operation of the booster station may require the pump to be operated in the HAND mode to compensate for distribution system problems in other areas of the system during a power outage.

<u>Backup Operations</u>
Angelo Booster Station serves as a back up for feeding the Lower Prune Hill (455) Zone if the Butler Booster Station is out of service. The City has a standby pump for the 455 Zone at the Angelo Booster Station in the event that a pump is out of service. There is

sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Gregg Booster Station

Auxiliary Power
The New Gregg Booster Station has a diesel powered 300-kW generator with automatic transfer switch capable of operating the New Gregg Booster Station pumps during a power outage.

HOA Setting
Emergency operation of the booster station may require the pump to be operated in HAND mode to compensate for distribution system problems in other areas.

Backup Operations
There is no back up in the event Gregg Booster Stations are out of service, however, there is sufficient pumping capacity at the Gregg Booster Stations to operate with the largest pump out of service under normal system demands, including fire flow.

Angelo Booster Station

Auxiliary Power
The Angelo Booster Station is equipped with a 200-kW diesel generator with an automatic transfer switch. This generator is capable of providing power to three of the pumps, the lighting, and the HVAC system.

Backup Operations
If Angelo Booster Station is out of service, Butler Booster Station and Forest Home Booster Station serve as back up to feed the upper zones (Lower Prune Hill, Lacamas, Upper Prune Hill) from the lower zone (Butler). The City has a standby pump at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Lower Prune Hill Reservoir Out of Service
If the Lower Prune Hill Reservoir is out of service, one pump at the station will be placed into hand mode and operated with the reservoir isolated. The pressure relief valve at the station will bleed excess pressure to the inlet piping. This will allow the system to maintain a constant pressure in the zone. During this operation, the pump and pressure need to be monitored every two hours.

Forest Home Booster Station

Auxiliary Power
Auxiliary power is not available for the Forest Home Booster Station.

HOA Settings
During emergencies the booster station may need to be operated in the HAND mode to compensate for distribution system problems in other areas of the system.

Backup Operations
If the Forest Home Booster Station is out of service, Butler Booster Station and Angelo Booster Station serve as back up to feed the upper zones (Lower Prune Hill, Lacamas, Upper Prune Hill) from the lower zone (Butler). The City has a standby pump at the Angelo Booster Station in the event that a pump is out of service. There is sufficient pumping capacity to the 455 Zone to operate with the largest pump out of service under normal system demands, including fire flow.

Lacamas Booster Station

Auxiliary Power
The Lacamas Booster Station has an auxiliary generator with automatic transfer switch available to provide power. This generator is a 60 kW natural gas generator and is capable of running the two 500-gpm pumps, the building lights and ventilation system. This generator is able to provide the Lacamas Booster Station with power as long as natural gas service is not interrupted. If the generator fails during a power outage, water service can be maintained through the pressure reducing valve (PRV) stations that that connected to the system that feeds down from the Upper PruneHill Reservoir. Well No. 9 also serves the area supplied by Lacamas Booster Station, but since it does not have auxiliary power, it is more than likely unavailable during a power outage.

Lacamas Reservoir Out of Service
When the Lacamas Reservoir is out of service, pressure to the Lacamas (544) Zone can be maintained by operating one of the pumps in the Lacamas Booster Station. The pressure relief valve will return excess pressure to the inlet piping while maintaining the downstream pressure. Under this operating condition, the pump operation and pressure need to be checked every 2 hours. The 544 Zone can also be served from Upper Prune Hill through PRV stations.

Backup Operations
When the Lacamas Booster Station is out of service Well No. 9 and the Lower Prune Hill Booster Station can be used to feed the Lacamas (544) Zone.

Lower Prune Hill Booster Station

Auxiliary Power
This facility is equipped with a 300-kW diesel powered generator with an automatic transfer switch to operate the three pumps in the event of a power failure.

Temporary Pump
During high seasonal demands a mobile skid mounted pump is rented by the City to supplement the LPH Booster Station. This pump is installed via connections constructed

for this purpose near the entrance to the pump station. It is operated in a manual mode and has a capacity between 600 and 700 gpm. This pump is not powered by the auxiliary power generator. The City also has pumping capacity available at the Upper Prune Hill Booster Station to serve the Upper Prune Hill area for temporary losses of service at the Lower Prune Hill Booster Station, but this is limited and cannot provide supply for extended interruptions in service or extended periods of high demands.

Upper Prune Hill Booster Station

Auxiliary Power
The Upper Prune Hill Booster Station is equipped with a manual transfer switch to allow the City to bring in a portable generator to supply power to the booster station. The portable generator used by the City can operate two of the 20-hp pumps.

RESERVOIR EMERGENCY PROCEDURES

General

The City has developed detailed written procedures for operating the water system when reservoirs are not in service. These procedures are kept at each facility. If a reservoir must be taken off line isolation valves are used to prevent water from being pumped into the reservoirs and the reservoirs are allowed to empty into the distribution system.

A brief summary of the reservoir emergency procedures follows.

Butler Reservoir

Water service is maintained to the system during cleaning / draining / disinfection of the reservoir with the following procedures.

- Connect 6-inch overflow piping to the 12-inch main in the Butler Yard.
- Open the 6-inch overflow valve.
- Open the 4-inch main connecting line valve between the 12-inch and 14-inch mains until water comes out of the 6-inch overflow.
- Close the two 12-inch valves in the reservoir valve pit to take the Butler Reservoir offline.
- Adjust the 4-inch connecting valve to maintain a small amount of water flow from the 6-inch overflow. As long as water flows from the overflow, water service will be maintained to the 343 Zone.
- Depending on the season and the demand, a well may need to be in operation to maintain system pressure in the 343 Zone.
- The pressure reducers on NE 22nd Avenue and NE Everett Street regulate pressure and keep the 343 Zone served.

Reverse the order to place the reservoir back online.

Gregg Reservoir

Water service can be maintained to the Gregg area by running a pump in the HAND position in the Gregg Booster Station. The pressure relief/bypass valve at the Gregg Booster Station will maintain pressure in the service area and also keep it from over pressurizing the zone. The Gregg Reservoir can be isolated after the pump in the Booster Station is placed into operation. Close attention will be paid to the system pressure and the pump to provide uninterrupted service.

Lacamas Reservoir

The Lacamas Reservoir is supplied from the Upper Prune Hill Zone via PRVs, from the Lower Prune Hill Zone via the Lacamas Booster Station, or from Well No. 9. As long as one of these facilities is in operation, the reservoir can be filled.

Water service can be maintained to the Lacamas area (544 Zone) by running a pump in the HAND position in the Lacamas Booster Station or Well No. 9. The pressure relief/by-pass valve at the Lacamas Booster Station will maintain pressure in the service area and also keep it from over pressurizing the zone. The Lacamas Reservoir can be isolated after the pump in the Booster Station is placed into operation. Close attention must be paid to the system pressure and the pump to provide uninterrupted service.

Lower Prune Hill (LPH) Reservoirs

Emergency operation of the reservoir would be required if a problem were to occur with one of the reservoirs. If a reservoir were to experience a physical or water quality problem, one reservoir could be taken out of service and the remaining one could be used to supply water until the problem is solved. If the smaller of the two tanks was used alone, the start levels for the Butler, Forest Home, and the Angelo Booster will be raised to keep the reservoir full at all times.

Upper Prune Hill (UPH) Reservoirs

<u>UPH 2.4-MG Reservoir</u>
The 2.4-MG reservoir inlet has an altitude valve that closes to allow the UPH standpipe to fill when the reservoir is full (63 foot level). The UPH 2.4-MG reservoir outlet valve is normally opened, but is seismically controlled and will close in a seismic event. The UPH booster pumps will also be turned off in a seismic event.

If both the Lower Prune Hill and Upper Prune Hill Booster Stations are out of service and the Upper Prune Hill Standpipe level drops low enough, site valves can be opened to allow both the standpipe and the 2.4-MG Reservoir to float on the system.

Two of the booster pumps (No. 2 and No. 3) are equipped with modified pump control valves that employ two valves that are adjusted to drain the UPH 2.4-MG reservoir.

Detailed procedures for using these pump control valves are provided at the UPH booster station.

UPH Standpipe

The UPH standpipe inlet valve is a spring-activated altitude valve that is designed to shut off when the standpipe is full. This valve is not controlled by the telemetry system. When the UPH standpipe altitude valve is closed, the UPH booster pumps operate based on the pump discharge pressure.

If the Upper Prune Hill Standpipe is out of service, the UPH area can be supplied by the UPH Booster Station and the LPH Booster Station. The LPH Booster Station operates based on reservoir level in the 2.4 MG UPH Reservoir. If the LPH Booster Station flows exceed system demands, the 2.4 MG UPH Reservoir will fill. If the 2.4 MG UPH Reservoir is full, the LPH Booster Station will shut off and the UPH Booster Station will be called in pressure mode and will supply the system. If system demands exceed the supply of the LPH Booster Station while it is in operation, the UPH Booster Station will be called in pressure mode to provide additional supply. Pressure mode for the UPH Booster Station is discussed below.

At the Upper Prune Hill Pump Control Panel Screen, the operator selects this setting at the pump control panel, which is a six step operating sequence (numbered 0 to 5) that is based satisfying a minimum pressure of the pump discharge. The operator sets the pressure at 40 psi, which simulates a full standpipe.

- Step 0 – no pumps on (40 psi is satisfied)
- Step 1 – pump 1 on and runs till 40 psi is satisfied
- Step 2 – pump 1 and 2 on if 40 psi is not satisfied after Step 1
- Step 3 – pump 1 and 3 on if 40 psi is not satisfied after Step 2
- Step 4 – pump 1, 2 and 3 on if 40 psi is not satisfied after Step 3
- Step 5 – all pumps on if 40 psi not satisfied after step 4

There is a 15 second delay built in between each step. Pumps turn off sequentially in 15 second intervals once 40 psi is satisfied.

WELLS

Detailed written operating instructions are maintained at each well. These instructions cover normal operations as well as response to pump and power failure. For wells with treatment facilities, written descriptions of shutdown and start up of treatment equipment is included with the written procedures. A brief summary of emergency operations at each well is provided below.

Well No. 5

There is neither a generator nor an angle drive to operate Well No. 5 during a power outage. Well No. 5 can be used to maintain pressure in the lower grid when the Butler

Reservoir is out of service. Under these conditions, Well No. 5 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit.

Well No. 6

There is neither a generator nor an angle drive to operate Well No. 6 during a power outage. Well No. 6 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 6 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit.

Well No. 7

There is not a generator or an angle drive to operate Well No. 7 during a power outage. Well No. 7 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 7 has to be run from the HAND position from the well facility or the Operations Center master telemetry unit.

Well No. 8

During a power outage, Well No. 8 has an auxiliary engine and angle drive. Well No. 8 can be used to maintain pressure in the lower grid when the Butler Reservoir is out of service. Well No. 8 has to be run from the HAND position from the pump house or the Operation Center master telemetry unit during a power outage. The backup chlorination system is also run by the generator.

Well No. 9

There is neither a generator nor angle drive to operate Well No. 9 during a power outage.

Well No 10

There is neither a generator nor angle drive to operate Well No. 10 during a power outage.

Well No. 11 & 12

The Washougal Wellfield Facility has its own diesel powered auxiliary generator with an automatic transfer switch. This generator is 350 kW and is designed to serve the Washougal Wellfield Treatment Facility during a power outage, to include the two well pumps, chemical feed pumps, controls for the well pumps and chemical feed system, HVAC system and lighting.

Well No. 13

The Well No. 13 Facility has its own diesel powered auxiliary generator with an automatic transfer switch and acoustical enclosure. This generator is 250 kW and is designed to serve the Well 13 Facility during a power outage, to include the well pump, chemical feed pumps, controls for the well pump and chemical feed system, HVAC system and lighting.

SURFACE WATER FILTRATION PLANT

Detailed written operating instructions are maintained at the Surface Water Filtration Plant. These instructions cover normal operations as well as start up and shut down procedures. The plant is equipped with a 45 kW propane powered auxiliary generator in event of a power outage.

DRINKING WATER WARNING

The _____ Water System, ID_____, located in _____County is contaminated with fecal coliform/ *E. coli* bacteria.

Fecal coliform/ *E. coli* bacteria were detected/confirmed in the water supply on _____. These bacteria can make you sick and are a particular concern for people with weakened immune systems.

DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST. Bring all water to a rolling boil for one minute. Let it cool before using. Boiled or purchased bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until *further notice*. Boiling kills bacteria and other organisms in the water.

Fecal coliforms and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems. The symptoms above are not caused only by organisms in drinking water. If you experience any of these symptoms and they persist, you may want to seek medical advice. People at increased risk should seek advice about drinking water from their health care provider.

What happened? What is the suspected or known source of contamination?

The following is being done to correct the problem:

We have consulted with the Washington State Department of Health about this incident. We will notify you when you no longer need to boil the water. We anticipate resolving the problem by _____.

For more information, please contact _____ at ( )___-_____ or at _____.
(owner or operator) (phone number) (address)

Please share this notice with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distribution copies by hand or mail.

This notice is sent to you by _____ Water System on ___/___/____

10/17/08

City of Camas Water System
Public Works Department Emergency Phone Numbers

Employee	Pager	Home	Cell
A. Blanchard	418-5474	835-5645	606-4275
J. Gant	418-5517	834-2410	518-4646
G. Emmert	418-5509	835-3758	606-1137
R. Crum	418-5490	335-8023	
P. Hargrave	418-5521	693-1005	901-4238
B. Walton	418-5621	699-4926	
E. Nickelsen	418-5585	834-6732	
L. Grimani	418-5519	835-9451	
J. Martell	418-5150	835-9476	772-3522
C. Hittle	418-5525	254-0124	772-0236
G. Reed	418-5588	834-3604	772-0232
K. Kunkel	418-5559	834-2896	772-0230
J. Carothers		891-4542	936-0292
J. Hodges		885-0953	909-8031
W. Heigh		254-1238	921-8209
K. Kakuk		834-6809	
A. Ashton		834-7104	904-7619
H. Hoyer		256-1962	
J. Englund		834-6546	
911 from Cell Phone			696-4461
M. Stevens	418-5616	835-9093	921-2872
M. Nelson	418-5578	687-5014	921-2751
M. Clapp	690-1446	834-1667	609-0889
K. Murray	418-5574	835-8919	921-5020
T. Reed	418-5590	834-1089	931-0327
B. Prather	418-5737	326-3718	
K. Lougheed	418-5733	901-1886	931-0326
J. Dickinson	418-5497	254-3431	606-4604
R. Shirley	418-5602	687-4750	
T. Holtcamp	418-5550	986-2138	
O. Helland	418-5524	837-8637	
S. Skinner	418-5603	834-6715	
S. Adlard	418-5446	687-5913	
C. Reed		834-7941	609-0885
E. Levison	418-5952	210-4302	609-0887
M. Brachmann	690-0584	834-2749	921-3799
Filter Plant		834-6190	
Sonitrol	696-0777	After Hours	737-0592
STP 834-3263	STP Cells	901-1579	606-7090

City of Camas Water System
Other Departments 24-Hour Emergency Phone Numbers

Department	Pager	Home	Cell
Larry Larimer, Fire Department	418-5474	835-5645	606-4275
Allen Wolk, Fire Marshal	418-5517	834-2410	518-4646
Police Chief	418-5509	835-3758	606-1137
Police Captain	418-5490	335-8023	
Patrol Sargeant	418-5521	693-1005	901-4238
Detective Sargeant	418-5621	699-4926	
Patrol Car 31	418-5585	834-6732	
Patrol Car 273	418-5519	835-9451	
Patrol Car 302	418-5150	835-9476	772-3522
Patrol Car 307	418-5525	254-0124	772-0236
Patrol Car 320	418-5588	834-3604	772-0232
Patrol Car 321	418-5559	834-2896	772-0230
Kit Kanekoa		891-4542	936-0292
Crime Prevention		885-0953	909-8031

City of Camas Water System
Other Agencies 24-Hour Emergency Phone Numbers

Agency	Pager	Home	Cell
AT&T/Comcast		834-7104	904-7619
Burlington Northern Railroad		256-1962	
City of Vancouver		834-6546	
City of Washougal			696-4461
Clark Public Utilities	418-5616	835-9093	921-2872
DOE Hazardous Spills	418-5578	687-5014	921-2751
Evergreen Adjustment	690-1446	834-1667	609-0889
Georgia-Pacific MERT	418-5574	835-8919	921-5020
NW Natural	418-5590	834-1089	931-0327
One Call Locates	418-5737	326-3718	
Verizon	418-5733	901-1886	931-0326
Wafertech	418-5497	254-3431	606-4604
Wast Connections - Bob Byrd	418-5602	687-4750	
WSDOT	418-5550	986-2138	

Appendix O

Cross Connection Control Ordinance

ORDINANCE NO. 1504

AN ORDINANCE amending Sub-section (2) of Section VIII of Ordinance No. 601, as last amended by Ordinance No. 1265 and Section 13.08.190 of the Camas City Code by revising regulations for connections to the City Water System.

THE COUNCIL OF THE CITY OF CAMAS DO ORDAIN AS FOLLOWS:

Section I

That Sub-section (2) of Section VIII of Ordinance No. 601 as last amended by Ordinance No. 1265 and Section 13.08.190 of the Camas City Code be and the same are hereby amended to read as follows:

Section 13.08.190 Unlawful connections - Cross Connections - Private water systems.

(1) It shall be unlawful for any person, except duly authorized city employees, to make connections with any water main or water pipe belonging to the municipal water supply system, without first obtaining written permission to do so from the Public Works Director or his designated representative.

(2) As used herein, the terms "cross connection" shall be construed to mean any physical arrangement whereby the public water supply is connected, directly or indirectly, with any other water supply system, sewer, drain, conduit, pool, storage reservoir, plumbing fixture or other device which contains or may contain contaminated water, sewage, or other wastes or liquids of unknown or unsafe quality or which may be capable of imparting contamination to the public water supply as a result of back-flow.

(3) The installation or maintaining of a cross connection with the public water supply system of the City is prohibited, except as provided in sub-section 5 hereof.

(4) The control or elimination of cross connections shall be in accordance with the rules and regulations of the Washington State Board of Health regarding public water supplies, Washington Administrative Code 248-54-285 as it now exists or as it may hereinafter be amended, and with any requirements set forth by the "U.S. Environmental Protection Agency" as authorized by the "Safe Drinking Water Act", PL 93-523, as it presently exists or as it may hereinafter be amended, and with any manual of standard practice pertaining to cross connection control approved by the Public Works Director or his designated representative.

(5) The owner or operator of any water system having a separate source of water supply may cross connect such water supply to the city water system only after first having installed, at the point of such cross connection, a back-flow preventative device approved in writing by the Public Works Director or his designated representative. Such approval shall not be given unless the back-flow device meets the existing requirements of the Washington State Board of Health.

(6) All automatic fire sprinkler systems connected to the City water supply system shall be required to have Washington State Board of Health approved type back-flow preventative devices installed at or near the service connection and ahead of any type of outlet or pumper connection.

(7) The Director of Public Works, or his designated representative, upon showing proper identification shall be allowed access to all portions of the premises, including buildings and structures, to which City water is supplied, at reasonable hours of the day and for the sole purpose of inspecting and determining compliance with all provisions of this section. Water service may be refused or discontinued to any premises for failure to allow such necessary access and inspection.

(8) Where a back-flow preventative device is in service, the device shall be inspected and tested at least annually by the Public Works Director or an authorized representative, and must be in a satisfactory operating condition. If the device is not found to be in a satisfactory operating condition, the connection between the City water supply and the system isolated by the device shall be severed immediately or City water service may be discontinued without notice.

Section II

This Ordinance shall be in full force and effect from and after five (5) days from the date of its passage and publication according to law.

PASSED by the Council and APPROVED by the Mayor this 13 day of February, 1984.

SIGNED: Nan A. Henriksen
MAYOR

ATTEST: Ruth E. Vaughn
CLERK

APPROVED as to form:

CITY ATTORNEY

Cross Connection Control

Actions taken to improve CCC program:

2003 Irrigation Permits from the Building Department
Compared previous three year's worth of irrigation permits to BPMS database. Addresses that were not in the database were placed on a non-compliance spreadsheet. Notices were sent to addresses that had not submitted a test report.

This exercise is performed annually using the previous year's data. And notices are sent out.

2004 Letters were sent to all local businesses informing them of the Cross Connection Control program and testing requirements. We asked that they contact us regarding any assemblies that they had on-site – irrigation, soda machines, medical equipment. Letters were sent to 15 businesses and 29 restaurants and gas stations.

2005 We created an informational brochure regarding backflow prevention. This brochure was mailed with notices to residential customers listed in the BPMS database. We also placed brochures in kiosks at multiple city facilities.

We had summer help note addresses with possible irrigation systems. We compared that list to addresses in our BPMS database. Addresses not in BPMS were compared to the non-compliance spreadsheet. Addresses not in the spreadsheet were added to the spreadsheet. Those addresses received notices regarding testing requirements. From that list we developed an AVB listing and were able to bring more citizens into compliance. An additional 1,080 letters were sent.

This is an on-going process. We continue to add to this list every year. We gather information from homeowners, meter readers, City of Camas Finance Department, BF testers, etc.

2007 Medical facilities and veterinaries were contacted asking what CCC they had on site and questioning if they use stand-alone bottled water at their patient stations.

Fall 2007, City of Camas meter readers were asked to identify all addresses with possible irrigation systems. This information was downloaded to an Excel spreadsheet and compared to the BPMS database. All addresses not in the database were then compared to the non-compliance spreadsheet. Any addresses not in either the database or spreadsheet were added to the spreadsheet. Non-compliance notices will be sent in spring 2008.

2008 We were able to increase the Water/Sewer staff to include a Cross Connection Control certified employee. This person has been performing surveys of our industrial customers and of sites shown to have an AVB on site. He has also offered assistance to support staff in managing calls from City of Camas water customers.

We were able to increase our support staff to assist in managing the CCC program with data management and answering questions from BF testers and citizens.

We created two informational brochures (line card format), which replaces the brochure created in 2005. They are titled: Backflow Prevention Requirements / Irrigation and LEAKS. These cards will be mailed to water customers with possible irrigation systems that are not listed in BPMS. Cards have also been placed in kiosks at multiple city facilities.

IMPORTANT INFORMATION FROM
THE CITY OF CAMAS – WATER DEPARTMENT
ANNUAL BACKFLOW DEVICE TESTING NOTICE

May 1, 2007

Dear Current Water Customer,

Our records indicate that you have one or more backflow prevention assemblies installed in your water supply plumbing that are due for testing (i.e., lawn irrigation system, soda machine, sterilization equipment, etc.).

It is imperative that each assembly is working properly to safeguard your health and the health of others. Washington State Law (WAC 246-290-490 Cross Connection Control) requires annual testing of backflow prevention assemblies. The testing is to be performed by a Washington State Certified Tester. Please have your assembly tested within 30 (thirty) days. A list of State Certified Backflow Testers has been copied on the reverse side of this letter. Backflow Testers are private contractors and their fees are not regulated by the City of Camas. The tester will notify the City that the test has been completed. To obtain additional information on the importance of backflow device testing, please review the backflow information on the City's website at:

http://www.ci.camas.wa.us/services/utilities/irrigation.htm

Thank you for helping us to preserve our water quality. If you have questions or need information on your location, please call the Backflow Hotline at (360) 817-1569 and leave a message or e-mail rsyverson@ci.camas.wa.us. You will receive a return call as soon as possible. If you have a test report and would like to fax it to the City of Camas, please send it to (360) 834-1535.

Sincerely,

Ronda L. Syverson
Sr. Administrative Support Assistant

Appendix P

Wellhead Protection Program

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
PH: 360-834-6864 • F: 360-834-1535
http://www.ci.camas.wa.us

May 28, 2010

Department of Ecology
Southwest Regional Office
PO Box 47775
Olympia, WA 98504-7775

Re: City of Camas Wellhead Protection Plan

Dear Department of Ecology:

The City of Camas has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

The enclosed map depicts the WHPA boundary, source wells, and identified potential contaminant sources. Please review the map and use it as a reference when inspecting and permitting the storage, use, and disposal of hazardous material within our WHPA.

Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 834-2457 ext 4251.

Sincerely,

Eric Levison
Director of Operations
City of Camas

James E. Carothers, P.E.
Engineering Manager
City of Camas

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
PH: 360-834-6864 • F: 360-834-1535
http://www.ci.camas.wa.us

May 28, 2010

Ron Mitchell, Police Chief
Washougal Police Department
1320 "A" Street
Washougal, WA 98671

Re: City of Camas Wellhead Protection Plan

Dear Chief Mitchell:

The City of Camas has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

As part of this Plan, the city must provide wellhead protection information to agencies responsible for incident/spill response procedures. Since a portion of our WHPA extends into the City of Washougal's jurisdiction, it is important that you are aware of where potential contaminant releases could adversely impact the quality of our communities drinking water supply.

A map of the wellhead protection areas and adjacent transportation routes is enclosed for your review. An acknowledgement of receipt of this information or a response from your office as part of our wellhead protection plan documentation would be appreciated.

In the event of a spill or contaminant release, we would ask that you notify immediately us and the Department of Ecology, so that we can take appropriate measures to deal with the problem.

Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 834-2457 ext 4251.

Sincerely,

Eric Levison
Director of Operations
City of Camas

James E. Carothers, P.E.
Engineering Manager
City of Camas

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
PH: 360-834-6864 • F: 360-834-1535
http://www.ci.camas.wa.us

May 28, 2010

Ron Schumacher, Fire Chief
Washougal Fire Department
1400 A street
Washougal, WA 98671

Re: City of Camas Wellhead Protection Plan

Dear Chief Schumacher:

The City of Camas has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

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Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 834-2457 ext 4251.

Sincerely,

Eric Levison
Director of Operations
City of Camas

James E. Carothers, P.E.
Engineering Manager
City of Camas

CITY OF CAMAS

616 Northeast Fourth Avenue
P.O. Box 1055
Camas, Washington 98607
PH: 360-834-6864 • F: 360-834-1535
http://www.ci.camas.wa.us

May 28, 2010

Mitch Lackey, Police Chief
City of Camas Police Department
2100 NE 3rd Avenue
Camas, WA 98607

Re: City of Camas Wellhead Protection Plan

Dear Chief Lackey:

The City of Camas has developed a Wellhead Protection Plan to help maintain the drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA).

As part of this Plan, the city must provide wellhead protection information to agencies responsible for incident/spill response procedures. It is important that you are aware of where potential contaminant releases could adversely impact the quality of our communities drinking water supply.

A map of the wellhead protection areas and adjacent transportation routes is enclosed for your review. An acknowledgement of receipt of this information or a response from your office as part of our wellhead protection plan documentation would be appreciated.

In the event of a spill or contaminant release, we would ask that you notify immediately us and the Department of Ecology, so that we can take appropriate measures to deal with the problem.

Thank you for your attention in this matter. If you have any questions or would like a copy of the wellhead protection plan, please contact me at (360) 834-2457 ext 4251.

Sincerely,

Eric Levison
Director of Operations
City of Camas

James E. Carothers, P.E.
Engineering Manager
City of Camas

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P.O. Box 1055
Camas, Washington 98607
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May 28, 2010

Leo Leon, Fire Chief
City of Camas Fire Department
616 NE 4th Avenue
Camas, Washington 98607

Re: City of Camas Wellhead Protection Plan

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Sincerely,

Eric Levison
Director of Operations
City of Camas

James B. Carothers, P.E.
Engineering Manager
City of Camas

Date

Address of local business (see Table 1)

Re: City of Camas Wellhead Protection Plan

To Whom It May Concern:

The City of Camas has developed a Wellhead Protection Plan to help maintain drinking water quality for our city residents. The Plan is based on Washington Department of Health WAC 246-290-135(3) regulations. As part of the Plan, maps were prepared that show the areas around each city drinking water well where a chemical spill on the ground may cause contamination of the well/aquifer. These areas are Wellhead Protection Areas (WHPA). The Plan also requires an inventory of potential sources of groundwater contamination within these wellhead protection areas.

The primary purpose of this letter is to notify you that your facility is located within our WHPA. Since your business or the activities conducted at your facility may involve the use of chemicals (e.g., gasoline, underground storage tanks, hazardous waste, etc.), and the potential exists that a chemical spill from your facility may adversely impact the city drinking water supply, please notify the City of Camas immediately if a chemical spill occurs at your facility. All spills should be reported by dialing 911 and requesting that the City of Camas Fire Department and Southwest Washington Health Department be contacted.

Please note that the groundwater aquifer that supplies City Camas' wells also supply the City of Washougal's wells. Therefore, immediate notification of City of Camas in the event of a spill also assists the City of Washougal by protecting the water supply for the entire community.

Thank you for assisting us in protecting our water supply and groundwater resources. If you have any questions, please contact me at (360) 834-2457 ext 4251.

Sincerely,

Eric Levison
Director of Operations
City of Camas

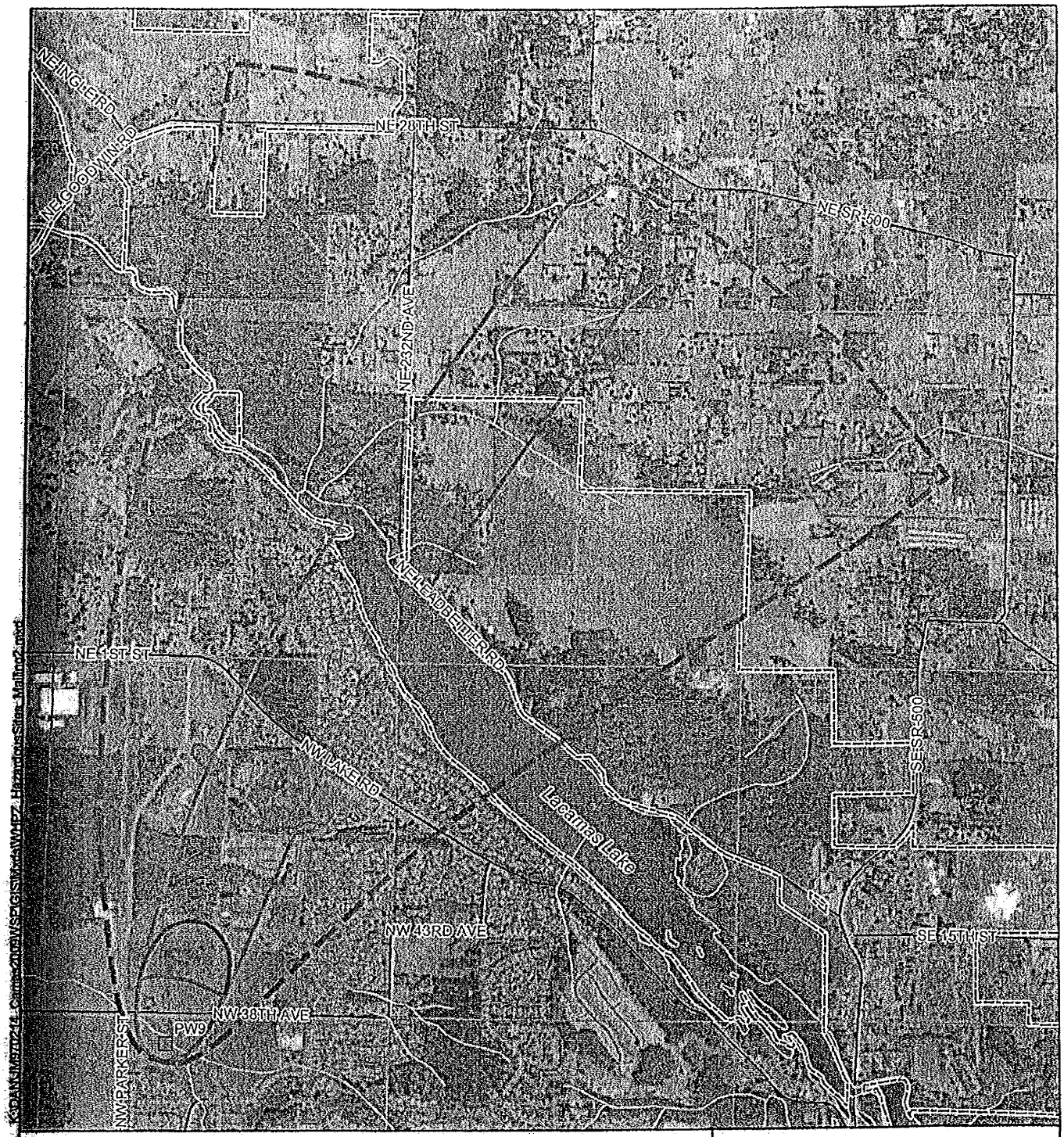
Table 1 - Mailing List for Wellhead Protection Area Notification

Facility/Site ID	Facility/Site Name	Address	City	State	Zip Code
18768638	All Seasons Auto Centers Inc Camas	3440 NE 3RD AVE	CAMAS	WA	98607
94778244	Asher Engine Service	1405 E ST	WASHOUGAL	WA	98671
64124152	Brass Lamp Motor Inn	544 6TH ST	WASHOUGAL	WA	98671
74959167	CAMAS STP	1129 SE POLK ST	CAMAS	WA	98607
92847997	CAMAS WASHOUGAL PORT	24 A ST	WASHOUGAL	WA	98671-2163
1043	CHEVRON BULK PLANT CAMAS	SE 6TH AVE & SE UNION AVE	CAMAS	WA	98607
95756539	CLARK COUNTY PUB WKS WASHOUGAL SITE	4624 SE WASHOUGAL	WASHOUGAL	WA	98671-9262
5352681	CLARK PUBLIC UTILITY DIST C ST	89 C ST	WASHOUGAL	WA	98671-2142
5016308	COLUMBIA ROCK CONCRETE PRODUCTS INC	1615 SE 6TH AVE	CAMAS	WA	98607
11338232	COLUMBIA STORAGE INC 2ND ST	365 2ND ST	WASHOUGAL	WA	98671-2111
37125488	COLUMBIA WAREHOUSE	361 C ST	WASHOUGAL	WA	98671
70983458	CONCRETE PRODUCTS OF OREGON LLC	1635 SE 6TH AVE	CAMAS	WA	98607-2260
4168647	GK Construction & Equipment Rentals	1840 SE 8TH AVE	CAMAS	WA	98607
85837922	GOODYEAR TIRE CAMAS	3440 3RD AVE	CAMAS	WA	98607
4399598	HAMBLETON BROS LOG YARD	335 S A ST	WASHOUGAL	WA	98671-2138
69936158	Helland Brothers SS	135 6TH ST	CAMAS	WA	98607
22538744	HI WAY FUEL	1250 E ST	WASHOUGAL	WA	98671
86429735	JIMBOS DELI MART 2	165 C ST	WASHOUGAL	WA	98671
79581825	Napa Washougal	1414 E ST	WASHOUGAL	WA	98671
14447751	Northwest Pipeline GP Washougal M/S	30 C ST	WASHOUGAL	WA	98671-2143
49392144	Overton Mfg Inc	1325 E ST	WASHOUGAL	WA	98671-1410
64113396	S & S FOOD MART	1641 E ST	WASHOUGAL	WA	98671-1430
52218486	Schucks Auto Supply Camus	3440 NE 3RD ST	CAMAS	WA	98607
3264254	TARR INC WASHOUGAL	361B C ST	WASHOUGAL	WA	98671
7282918	TIDLAND CORPORATION	2363 8TH AVE SE	CAMAS	WA	98607-2261
3153967	TRIANGLE RESOURCES	612 SE UNION ST	CAMAS	WA	98607
3811629	US DOE BPA Camas Substation	1ST ST 1 BLK N OF 8TH AVE	WASHOUGAL	WA	98671
16327542	WASHOUGAL ELECTRIC & SHEET METAL INC	594 C ST	WASHOUGAL	WA	98671-0005
48371594	WASHOUGAL SCHOOL DIST BUS GARAGE	995 E ST	WASHOUGAL	WA	98671-1317
57872946	WASHOUGAL SHELL	730 E ST	WASHOUGAL	WA	98671

Figure 1
City of Camas
Wellhead Protection Capture Zones
and Contaminant Threats
- Lower Washougal River Vicinity

Camas Wellhead Protection Plan

PGG



Camas Well 9

City Limits

6 Month Capture Zone

1 Year Capture Zone

5 Year Capture Zone

10 Year Capture Zone

Critical Aquifer Recharge Area (CARA)

From PGG, 2002

0 Feet 2,000

N

2007 Aerial Photo from Clark County

Figure 2

City of Camas Wellhead Protection Capture Zones and Contaminant Threats - Well 9 Vicinity

Camas Wellhead Protection Plan

PGG

City of Camas
Hydrogeologic Summary and
Wellhead Protection Assessment Report

September 16, 2009

Pacific Groundwater Group
Seattle, Washington

JM9702.14

City of Camas
Hydrogeologic Summary and
Wellhead Protection Assessment Report

Prepared for:

City of Camas
616 NE Fourth Avenue
Camas, WA 98607
(360) 834-3451

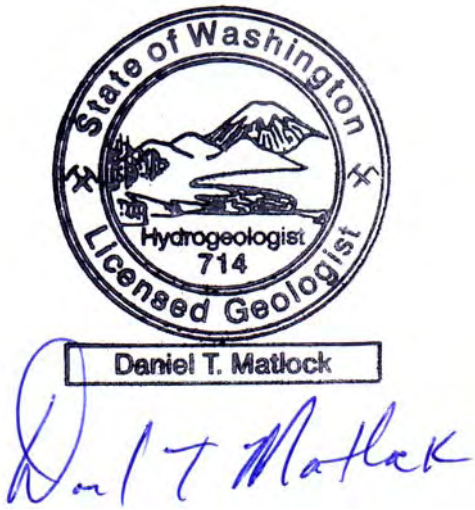
Prepared by:

Pacific Groundwater Group
2377 Eastlake Avenue East, #200
Seattle, WA 98102
(206) 329-0141
www.pgwg.com

September 16, 2009
JM9702.14

SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.



Dan Matlock
Principal Hydrogeologist
Washington State Hydrogeologist No. 714

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Appendix A Environmental Sites Information

List of Acronyms

BNSF	Burlington Northern Santa Fe
CARA	Critical Aquifer Recharge Area
EPA	Environmental Protection Agency
FSID	Facility Site Identification
GIS	Geographic Information System
GP	Georgia Pacific
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
ModFlow	Modular Three-Dimensional Finite-Difference Ground-Water Flow Model
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
PAA	Pleistocene Alluvial Aquifer
RA	Remedial Assessment
SGA	Sand and Gravel Aquifer
SHA	Site Hazardous Assessment
SSL	Site Screening Level
SWMP	Stormwater Management Plan
UST	Underground Storage Tank
VCP	Voluntary Cleanup Program
WAC	Washington Administrative Codes
WDOT	Washington Department of Transportation
WHPA	Wellhead Protection Area

1 Introduction

This report summarizes the hydrogeology, municipal wellhead protection area ("WHPA") delineations, and contaminant risks to groundwater supplies for the City of Camas ("the City"). Information presented in this report supports an update of the City's Water System Plan ("WSP") currently being prepared for the City by Gray & Osborne, Inc (Gray & Osborne, 2009). The purpose of this report is to help the City better manage its groundwater supply wells and to better understand the contaminant risks posed to these sources.

The study area for this investigation focuses on the City's eight shallow supply wells that lie in close proximity to low Washougal River (**Figure 1**). The City also operates one deeper supply well in the Lacamas Lake area (Well 9). This well is used primarily as a peaking supply. Well construction and land use conditions limit the susceptibility and vulnerability of this source; therefore, it was not reviewed as part of this investigation.

This report is organized in four sections:

- **Section 1: Introduction.** This section contains background information on the report.

- **Section 2: Hydrogeologic Framework.** This section presents the regional and local hydrogeologic features that are pertinent to the City's groundwater supplies. It describes the deposits that form aquifers and aquitards, and describes the movement of groundwater through these deposits.

- **Section 3: Wellhead Protection Area Delineations.** This section discusses the methods used to delineate the WHPAs and presents the results of the analysis. Time-related capture zones are presented for the Lower Washougal Wellfield area.

- **Section 4: Risk Assessment.** This section presents an inventory of confirmed and potential sources of contamination, particularly those that lie within the wellhead capture zones. An evaluation of risks associated with these sources is also presented.

This work was performed, and this report prepared, in accordance with generally accepted hydrogeologic practices at this time and in this area for the exclusive use of the City of Camas for specific application to the study area. No other warranty, expressed or implied, is made.

2 Hydrogeologic Framework

2.1 Geology and Hydrogeology

The geology of the greater Clark County region and the study area is commonly divided into older rocks and younger sediments, which are semi-consolidated or unconsolidated. The older rocks crop out in the foothills and mountains in the north and east portions of Clark County, and occur at depth in the central and western portions of the County.

Within the Camas study area, the older rocks crop out north and east of the Washougal River. The younger sediments crop out in all other areas, and contain all of the principal aquifers noted in the County. The sedimentary units, from youngest to oldest, consist of:

- Recent alluvial deposits
- Pleistocene alluvial deposits
- Troutdale formation

These units are described below and shown on hydrogeologic cross section A-A′ (**Figure 2)**. Surface outcrop patterns for these units are shown on **Figure 1**, along with the cross section location. The main focus of attention for the existing Camas groundwater sources is the Pleistocene alluvial deposits that occur in the Lower Washougal River lowland. All but one of the City's active supply wells (Wells 5 - 8 and Wells 10 - 13) are completed in these materials.

The Troutdale formation does not occur in the immediate vicinity of the City's wellfield but underlies the Pleistocene alluvial deposits further east of the wellfield and is an important source of water in other parts of the Clark County. Throughout most of the county, the Troutdale formation contains three coarse-grained units that are separated by finer-grained confining units. The coarse units are:

- The Upper Troutdale unit – variably cemented gravel in a matrix of sand and silt;
- The Lower Troutdale unit – relatively discontinuous occurrence of fine sand; and,
- The "SGA" - a deeper sand and gravel unit.

2.2 Recent and Pleistocene Alluvial Deposits

2.2.1 Deposits Origin, Texture, Distribution

Recent floodplain alluvium consisting of silt, sand, and gravel occurs along many of the rivers and streams in the study area, including Lacamas Creek and the Columbia, Washougal, and Little Washougal rivers. The recent floodplain alluvium generally occurs in narrow bands (less than 1,000 feet wide) along these rivers and streams, with thicknesses ranging from several feet to ten or twenty feet.

During the late Pleistocene time, the ancestral Columbia River deposited a great deltaic fan emanating to the west from the mouth of the Gorge during a series catastrophic flood events known as the "Missoula floods." Textures are similar to those of the recent alluvium, which overlies the Pleistocene alluvium along streams and rivers. Due to textural similarities between Recent and Pleistocene alluvium, hydrogeologic distinction is not necessary between the two units.

The combined Recent and Pleistocene alluvial deposits are approximately 100 feet thick in vicinity of the City's Lower Washougal Wellfield, and are underlain by clay and locally by bedrock. The City of Camas occurs near the eastern limit of the area scoured by catastrophic Columbia River flooding during late Pleistocene times. Therefore, the

sedimentary basin at Camas is small compared to portions of Clark County farther to the west. The older bedrock exposed to the north is relatively impermeable and functions as an adjacent no-flow boundary.

2.2.2 Aquifer Definition, Recharge, Production, Capture

The Pleistocene Alluvial Aquifer (PAA), defined as the combination of the Recent and Pleistocene alluvial deposits found along the Columbia and lower Washougal rivers, is the principal aquifer in the Lower Washougal lowland. The aquifer is recharged by incident precipitation, and induced recharge from the incised Columbia and Washougal rivers.

The productive zone of the aquifer is described on drillers' logs as a loose mixture of gravel, cobbles, boulders and little sand. Depending on the thickness of saturation, this aquifer can be very productive with well yields in excess of 1,000 gpm. Immediately north and east of the Washougal River, where this aquifer pinches out on top of bedrock or Troutdale deposits, wells yields are likely to be significantly lower. Eight of nine City production wells are completed in the PAA including Well 5 - 8, and Wells 10 – 13. The water supply sources are collectively referred to as the Lower Washougal wellfield as shown on **Figure 1**. Groundwater in the PAA in the vicinity of the Lower Washougal wellfield area occurs under unconfined conditions.

Three new supply wells are being installed in the Lower Washougal wellfield. These sources are intended to meet future city growth and will also serve as a replacement supply for Boulder and Jones Creeks during low-flow months when these sources will be shutdown to improve fish habitat. The new sources include Well 14 which was recently installed on the east side of the wellfield and the Parkers Landing and Treatment Plant wells which will be installed in the near future on the south side of SR 14. The three new wells are being installed under new water right permits that were issued by the Department of Ecology in 2008 after seven years of extensive study and negotiations.

Groundwater flow directions in the PAA are relatively dynamic because the hydraulic connection to the Washougal and Columbia rivers causes groundwater levels to move up and down with the tides and with seasonal changes in runoff. Pumping at industrial supply wells operated by Georgia Pacific also influences water levels in the PAA. Georgia Pacific owns and operates as many as 17 industrial supply wells that are completed at depths of approximately 50 to 120 feet in the PAA. Total production from the Georgia Pacific wellfield may exceed 25 mgd at times. This large scale pumping has a significant affect on water levels within City production wells with large declines occurring during peak industrial supply periods.

2.2.3 Aquifer Susceptibility

The sensitivity of the City's groundwater sources to potential contamination was evaluated by assessing the relative susceptibility and vulnerability of the City's primary production aquifer. Aquifer susceptibility refers to the estimated ease of contaminant transport from the land surface to the aquifer. Some of the primary factors influencing aquifer susceptibility are the thickness and permeability of the sediments overlying the aquifer. Shallow aquifers are typically more susceptible to surficial contaminants than deeper aquifers. Aquifers overlain by highly permeable sediments such as sand and gravel are also at higher risk than aquifers overlain by lower permeability sediments such as silt or clay. In the vicinity of the Lower Washougal wellfield, coarse grained soils typically extend from ground surface to the water table which lies at depths of 30 to 50 feet. Drillers' logs from wells in the area indicate no laterally extensive low permeability layers exist between land surface and the underlying PAA. The combination of a shallow depth to water and relatively high permeability of the overlying sediments indicate the PAA has relatively high susceptibility to contamination.

Aquifer vulnerability combines the aquifer susceptibility discussed above, with an evaluation of the availability of contaminants at land surface, and the likelihood of a contaminant release. In general, aquifer susceptibility is a function of stratigraphy and hydrogeology, and cannot be substantially modified. The potential for contaminant release on the other hand is controllable, and can be reduced in areas where susceptible aquifers are utilized as a major source of potable water. One of the primary purposes of a water system's wellhead protection plan is to evaluate the susceptibility of the systems aquifer(s), and the potential sources of contamination within the systems capture zones. Additional attention to potential contamination sources is recommended within the capture zones in high susceptibility aquifers areas, to reduce the likelihood of a contaminant release. This is especially true for potential contaminant sources within the shorter duration capture zones, such as the 1 year capture zone shown in **Figure 3**.

3 WHPA Delineations

3.1 WHPA Model

This section documents methods used to delineate the wellhead protection areas (WHPAs) and presents the results of the analysis. The "capture zone" for the Lower Washougal wellfield was estimated using a computer groundwater flow model (ModFlow) that was developed by the US Geologic Survey (McDonald and Harbaugh, 1988). A capture zone is the area that supplies groundwater recharge to a pumping well, or wellfield—in other words, its "zone of contribution." In natural systems, capture zones are not circular but elongated, with most of the capture occurring from areas that lie hydraulically up-gradient of the wellhead. Each capture zone has a stagnation point—the furthermost "point of capture" down-gradient of the wellhead. A time-related capture zone is the area that supplies groundwater recharge to a pumping well within a specified time period. The capture zone encompasses portions of the aquifer that surround the well. Time-related capture zones provide a basis for developing monitoring plans, land-use

inventories, and data collection plans. They are used in conjunction with the results of the aquifer vulnerability assessment.

The groundwater flow model developed for the Lower Washougal and Columbia River lowlands depicts the major aquifers in the study area (PAA and SGA), the occurrence of bedrock, the Columbia and Washougal rivers, recharge from precipitation, and groundwater inflow from areas outside the model domain (PGG, 2004 and 2007). The model simulates three-dimensional flow in its two layers (one for each aquifer), and includes cell sizes ranging from 100 feet square to 600 feet square. Model boundary conditions include cells that represent the rivers, pumping wells, specified inflows from outside the model domain, and incident recharge applied to the top of the uppermost aquifer. The model was calibrated to observed summer drawdowns in the City's Washougal Wellfield vicinity, summer seepage losses from the Washougal River, and groundwater level responses to tidal fluctuations and runoff events in the Columbia River.

The calibrated model was used to perform predictive simulations which included evaluation of capture zones for the Lower Washougal wellfield. The simulations assumed that the City would fully exercise all of their water rights which provides for a fairly conservative assessment of the capture zone extent. In addition, a high-end pumping was assumed for the Georgia Pacific wellfield (37.5 mgd).

3.2 Capture Zone Analysis

Estimated capture zones for 6-month, 1-year, and 5-year times-of-travel for the Lower Washougal wellfield area are shown on **Figure 3**. All groundwater in the recharge area is younger than 10 years, therefore there is no need for a 10-year time-of-travel delineation. The shape and extent of these capture zones are influenced by pumping at the Georgia Pacific wellfield, and aquifer boundaries including the Washougal and Columbia Rivers and older bedrock exposures to the north. Capture for Well 13 is primarily to the northeast, extending to the approximate boundary where the PAA is pinched out by older bedrock. Capture for the proposed Treatment Plant Well extends southeast toward the Columbia River. Capture for the remaining Lower Washougal wells extends to the east, between the Columbia and Washougal rivers. Evaluation of mass-balance calculations for the groundwater flow model indicate that the majority of water captured by the Lower Washougal welllfield originates as flow within the PAA, that otherwise would have discharged to the Columbia and Washougal rivers.

The estimated capture zones were generated using a steady state groundwater flow model, meaning that only the long term average rates of withdrawal were simulated. Variations in pumping, recharge and boundary conditions such as river stage are not simulated in a steady state model. As a result, **Figure 3** shows the average positions of the capture zones, not the temporal variations in the capture areas. Increased pumping during peak use months will result in variations of the predicted capture zones beyond the long term average estimates shown in **Figure 3**. In order to account for the uncertainties associated with temporal variations in capture zone, an additional capture zone labeled

Critical Aquifer Recharge Area (CARA) is shown. This zone includes areas that were not included in the steady state capture zone analysis, but likely will contribute recharge during certain times of the year given variations in pumping, river elevation, and natural recharge.

4 Risk Assessment

4.1 Data Sources

Contaminant sources that lie within the vicinity of Camas' Lower Washougal Wellfield were investigated and mapped using data from two sources. The first, a parcel database that contains information on land use and zoning, was provided by Clark County. The second contains data from the Washington State Department of Ecology's Facility / Site database[1], including state cleanup sites, federal superfund sites, hazardous waste generators, solid waste facilities and underground storage tanks. The information from these sources were classified and plotted on GIS coverages to assess whether existing and potential contaminant sources were located within the vicinity of Camas' production wells and WHPA delineations.

4.1.1 Land Use Database

Clark County's database contains a description of the land use within each parcel in the study area. A GIS analysis was used to identify land uses that could pose a risk to groundwater within the vicinity of the City's wellfield. Parcels where such land uses were identified were designated "parcels of concern." This approach provides a way to assess potential sources of contamination. The "parcels of concern" include those where potential activities could result in a release of contaminants to groundwater. **Table 1** summarizes the land use categories that are considered to be of concern.

Figure 4 shows the distribution of zoning throughout the study area. It also shows the parcels of concern that occur within the City's capture zone areas. Parcels of concern are shown as green cross-hatched areas. For the Lower Washougal wellfield, 31 parcels of concern occur in the 6-month capture zone, 11 parcels fall within the one-year capture zone, and 24 parcels fall within the 5 year capture zone. Two additional parcels fall outside of the capture zones, but within the defined CARA. Parcels of concern that fall within the various capture zones should be considered as potential contaminant sources, with the shorter time of travel zones being more critical for risk management.

4.2 Current Land Use and Zoning

Zoning information from the County's GIS was used to evaluate current and future land-use in the study area. The following zoning categories were mapped (**Figure 4**):

[1] http://www.ecy.wa.gov/fs/

- Agriculture
- Commercial
- Industrial
- Parks
- Residential

The most common allowed land use within the Lower Washougal wellhead protection capture zone is residential followed by industrial and commercial. Areas zoned as commercial and industrial are most likely to comprise threats to groundwater quality. Most of the allowed commercial and industrial use is concentrated along SR-14, the southern terminus of SR-500, the railroad corridors, SE 3rd and 6th Avenues, and E. Street.

4.3 Contaminant Sources

Table 3 summarizes the known contaminant sources that fall within the Lower Washougal Wellfield wellhead protection capture zones. Thirty-five confirmed or potential contaminant sources occur within the Lower Washougal wellfield capture zone. **Figure 5** displays the location of each of these sites, and indicates through the location symbols which types of activities or risk are associated with each site. Each site marker has three pie slices which indicate the type of activities associated with the site as follows:

Underground Storage Tanks (UST/LUST)

Cleanup Site (State Cleanup or Voluntary Cleanup)

Hazardous Material Generator or Handler

Any combination of the three indicators is possible. In addition to the pie slices, a red circle around the outside of the pie indicates that a release to either groundwater or soils has occurred at the site. Site markers without any pie slices filled in indicate the facility is tracked in Ecology's facilities database, and the facility type is considered to have risk to groundwater, but the facility is not a cleanup site, a hazardous materials handler, nor does it have registered underground storage tanks.

4.3.1 Known/Confirmed Sources

Table 3 indicates seven confirmed contaminant sources occur in the Lower Washougal wellfield capture area. Confirmed contaminated sites are shown on **Figure 5** by one of the following types of sites:

- State Cleanup Sites
- Leaking Underground Storage Tanks (LUST)

4.3.1.1 State Cleanup Sites

Of the seven contaminant release sites in the Lower Washougal wellfield capture area, three are included on the State Cleanup List. A brief discussion of each of these sites follows, with additional information provided in **Appendix A**.

State Cleanup Sites		
FS ID	**Facility Name**	**WHPZ**
1043	CHEVRON BULK PLANT CAMAS	6-Month
4399598	HAMBLETON BROS LOG YARD	6-Month
5016308	COLUMBIA ROCK CONCRETE PRODUCTS INC	CARA

The Chevron Bulk Plant site (FSID 1043) has contaminated soil and groundwater and is located at SE 6th Avenue and SE Union Avenue. A Site Hazardous Assessment (SHA) was completed for the site in 1994, and Ecology has assigned a ranking of "2" to this site, indicating that it poses a serious threat to human health and the environment. The site is on active status, indicating that the site is still managed by Ecology. The site is undergoing "monitored natural attenuation" with quarterly monitoring of groundwater quality. Affected media at the site include both soil and groundwater, with petroleum products (diesel, gasoline, and heavy range organics) being the most common contaminants. Other contaminants detected at the site include benzene, toluene, ethylbenzene, xylenes, dissolved and total lead. Two new monitoring wells (MW-15 and MW-16) have been installed between the contamination 'hot spot' and Camas Well #6 for the purpose of monitoring contaminant migration. No contaminants have been detected at MW-15, while MW-16 has had several diesel range organic detections, although the contamination levels have been well below the cleanup standards. There have been no contaminants detected in Well 6.

The Hambleton Bros. Log Yard (FSID 4399598) is located at 335 South A Street. The site has contaminated soil, sediment, surface water, and groundwater. The site has undergone Phase I and II Environmental Site Assessments (ESA) during which numerous borings and monitoring wells were installed. Analysis of reconnaissance groundwater samples indicate metals (arsenic, cadmium and lead) concentrations exceed the EPA Region VI Site Screening Levels (SSLs) and the MTCA Method A cleanup levels. Quarterly groundwater monitoring has been conducted for six onsite monitoring wells since January 2008. Barium, chromium, arsenic and lead were detected in the quarterly groundwater sampling, of these, only arsenic exceeded the EPA SSL. Arsenic did not exceed the MTCA Method A cleanup level.

The Columbia Rock Concrete Products site is located at 1615 SE 6th Avenue, and has both soil and groundwater contamination. A SHA has been completed by Clark County Public Health (2007), with the site receiving a ranking of "2" indicating that it poses a serious threat to human health and the environment. Affected media at the site include soil and groundwater. Contaminants of concern (above MTCA Level A Cleanup Levels) in soils include petroleum products (diesel, gasoline, and heavy range organics), while groundwater contaminants include arsenic, chromium, lead and barium. The site is awaiting a remedial assessment (RA).

4.3.1.2 LUST Sites

Figure 5 and **Table 3** show that three leaking underground storage (LUST) sites occur within the Lower Washougal Wellfield wellhead protection capture. A brief discussion of each of these sites follows, with some additional information provided in **Appendix A**.

The Camas Washougal Port site (FSID 92847997) is located at 24 South A Street, Washougal. Cleanup at the site began in 1990 and was completed (reported clean) in 1995.

The Goodyear Tire site (FSID 85837922) at 3440 3rd Avenue has been classified as no further action (NFA) after undergoing voluntary cleanup (VCP). This classification indicates that the site is considered clean, and no further action is required. Contaminants of concern for soils included petroleum hydrocarbons and halogenated organics.

The Hiway Fuel site (FSID 22538744) is located at 1250 E Street in Washougal. Cleanup at the site began in 1996, with cleanup still ongoing. Affected media are both soil and groundwater.

4.3.1.3 VCP Sites

Of the seven contaminant release sites in the Lower Washougal wellfield capture area, two are participating in the Voluntary Cleanup Program (VCP). A brief discussion of each of these sites follows, with additional information provided in **Appendix A**.

Voluntary Cleanup Program (VCP) Sites		
FS ID	**Facility Name**	**WHPZ**
14447751	Northwest Pipeline GP Washougal M/S	6-Month
85837922	GOODYEAR TIRE CAMAS	1 Year

The Northwest Pipeline GP Washougal M/S (FSID 14447751) is located at 30 C Street, Washougal. This site is participating in the VCP program, and the site is currently undergoing cleanup. Impacted media is soil, with contaminants of concern including arsenic, and metals / priority pollutants.

Leaking Underground Storage (LUST) Sites		
FS ID	**Facility Name**	**WHPZ**
92847997	CAMAS WASHOUGAL PORT	6-Month
85837922	GOODYEAR TIRE CAMAS	1 Year
22538744	HI WAY FUEL	5 Year

As discussed previously, the Goodyear Tire site has been classified as no further action (NFA) after undergoing voluntary cleanup (VCP).

4.3.2 Potential Sources

This section discusses potential sources of contamination within the wellhead protection capture zones based on Ecology's Facility database, and Clark County's parcel,

stormwater, and septic system databases. The following potential contamination sources have been identified within or near the capture zones for the Camas wells:

- Hazardous materials
- On-site septic systems
- Underground storage tanks
- Stormwater
- Unused and improperly constructed wells
- Agriculture, golf courses, and parks
- Transportation corridors

4.3.2.1 Hazardous Materials

The commercial use of chemicals poses a major threat to groundwater quality, since the chemicals can be accidentally spilled or disposed of improperly. The likelihood of such releases from spills can be reduced by proper methods of handling, spill prevention measures, and emergency response strategies. Risk reduction strategies should target on-site waste management practices. Improper disposal is likely the most common pathway for chemicals to be released into the environment. The following facility activity classifications were included as hazardous materials sites:

Activity Code	Definition
HWG	Facilities that generate any quantity of a dangerous waste. They may be classified as small, medium or large quantity generators (SQG, MQG, or LQG) depending on hazardous waste generated for a given month.
HWOTHER	Facilities that are required to have a RCRA Site ID# but who do not generate and/or manage hazardous waste (XQG generator status). This includes transporters, used oil recycler's, and dangerous waste fuel marketers and burners.
HWTRNSFR	Transfer facility is a site, owned, leased or operated by a transporter of regulated hazardous waste shipments where any of the following occurs: 1) receives wastes from another transporter, 2) transfers wastes from one transport vehicle to another, 3) transfers waste from one container to another, and 4) stores waste within a vehicle or on property for 10 days or less. Examples of transfer facilities include a parking lot, warehouse, truck terminal, barge or steamship loading and unloading facility, or railroad spur loading or unloading facility.
HWTSDF	Facilities that treat store or dispose hazardous waste.
TIER2	Businesses that store 10,000 pounds or more of a hazardous chemical or 500 pounds or less, depending on the chemical, of an extremely hazardous chemical on site at any one time must report annually. Reports are sent to the State Emergency Response Commission [represented by Ecology], Local Emergency Planning Committees, and local fire departments for emergency planning. [product, not waste]
TRI	Facilities in specific industries that manufacture, process or use more than the threshold amount of one or more of 600 listed toxic chemicals. Most threshold amounts are 10,000 or 25,000 pounds per year. Some chemicals have much lower thresholds.

The most significant threats to groundwater are related to the use and storage of solvents. Solvents are persistent, both soluble and insoluble in water, and highly mobile. A large plume of contamination can be created with a small quantity of solvent.

The Washington State Facility Site database indicates that there are twenty-one sites within the Lower Washougal wellfield that fall into one of the above hazardous waste classifications. Of these twenty-one sites, eight have active status, the rest are inactive. Inactive status indicates that the sites do not have current permitting, and therefore, are not actively overseen by Ecology.

Active Hazardous Materials Sites			
FS ID	**Facility Name**	**WHPZ**	**Activity Code**
11338232	COLUMBIA STORAGE INC 2ND ST	6-Month	TIER2
37125488	COLUMBIA WAREHOUSE	6-Month	TIER2
3264254	TARR INC WASHOUGAL	6-Month	TIER2
88277363	Tidland Corp	6-Month	HWG
39956434	West Coast Marine Cleaning Inc	1 Year	HWOTHER
38772238	Camas City Operations Center	CARA	TIER2, HWOTHER
994431	CAMAS CITY WELL 11 & 12	CARA	TIER2
83917959	HERAEUS SHIN ETSU AMERICA	CARA	TIER2

The facility site index database does not indicate whether sites listed are large or small hazardous waste generators.

4.3.2.2 On-Site Septic Systems

4.3.2.2.1 Potential Risks

On-site septic systems pose a risk to groundwater where they are relatively high in density and/or where hazardous wastes are discharged to them. Potential contaminants from septic systems include pathogenic organisms (bacteria and parasites), toxic substances, and nitrogen compounds.

The extent to which pathogens are transported in the subsurface away from a septic drain field depends on the type of pathogen and the chemical and physical conditions in the subsurface. In general, if a septic system is properly sited, constructed, and maintained, the transport of microorganisms will be limited. Household hazardous chemicals such as cleaners, polishes, waxes, and paints can be transported to groundwater can via a septic system. Some products contain toxic and persistent chemicals that can cause low-level contamination when coupled with a high density of septic systems. Homeowners can improperly apply or dispose of chemicals because they do not understand the threat they pose to groundwater quality. In some areas, business and commercial facilities still use on-site septic systems for sewage disposal. Business, commercial, and industrial operations that utilize on-site systems need to take special precautions to avoid contamination of their wastewater.

Ammonia and nitrate are highly soluble in water and can be expected in detectable quantities wherever portions of an aquifer are affected by septic system discharges. Septic systems are a source of nitrates in groundwater throughout Clark County. Nitrate is regulated, since ingestion can result in methemoglobinemia, or "blue baby" syndrome. Other sources of nitrate include fertilizers, feedlots, and natural mineral deposits. Background concentrations of nitrates in groundwater are typically less than 1 milligram of nitrogen per liter (mg-N/L). The maximum contaminant level (MCL) for nitrate is 10 mg-N/L.

Although significant portions of the urban areas are served by sewer systems, many residents still rely on septic systems. Clark County maintains a GIS coverage of on-site septic system locations, locations that are based on information provided by the South-west Washington Health Department. The locations of the septic systems are plotted on **Figure 5**. This figure indicates that the Lower Washougal wellfield capture zone has only one identified septic system within the six-month capture zone, 4 systems within the one-year capture zone, and 19 systems within the 5 year capture zone. Overall, 24 septic system fall within the Lower Washougal Critical Aquifer Recharge Area.

4.3.2.3 Underground Storage Tanks

Contamination in soil and groundwater caused by leaking USTs ("LUSTs") is a major environmental, legal, and regulatory issue. The most common causes of leaks are structural failure, corrosion, improper fittings, improper installation, and natural phenomena. Although USTs usually contain flammable motor fuels or heating oils, they may contain other compounds used by industry, government, or business.

Leakage from USTs and associated piping often occurs without detection. Even relatively small amounts of certain compounds can adversely impact groundwater quality. Once released from an UST, some VOCs and petroleum products can rapidly migrate to groundwater, a problem that is especially serious in areas with permeable soils such as the sand and gravel comprising the PAA.

Of the many materials stored in USTs, solvents are considered the most toxic. However, petroleum products may pose a greater total risk because of the prevalence of tanks containing petroleum products. In addition, petroleum products contain many potential contaminants, including three EPA priority pollutants: benzene, toluene, and ethylbenzene. Benzene is a known human carcinogen.

Figure 5 shows the locations of USTs in the WHPA. These sites were identified from the WDOE UST site data. Most of them lie along the railroad corridor and within areas zoned industrial and commercial.

A total of twelve USTs occur within the Lower Washougal wellfield capture zone. Based on status information from Ecology, four are active and eight are inactive. Inactive USTs do not currently store materials.

4.3.2.4 Storm Water

Storm water (i.e., urban runoff) is produced when rainfall or other precipitation accumulates faster than it can evaporate, be used by plants, or infiltrate to the subsurface. Urban areas produce more runoff than rural areas because they have more impermeable surfaces, such as rooftops, driveways, streets, and highways. These surfaces not only promote runoff but they also reduce the infiltration that recharges groundwater supplies. Even grass lawns can produce more runoff than forests and pasture.

Storm water typically contains pollutants, such as sediment, nutrients, bacteria, oils and grease, metals, and other toxicants. Many of these contaminants come from air pollution, motor vehicles, application of pesticides and fertilizers, soil erosion, and pet feces. Roofing materials have also been identified as a diffuse source of metals in runoff, particularly zinc (Good, 1993). In general, contaminant concentrations in storm water are similar for all land uses with slightly higher nitrate concentrations in residential areas, and higher zinc concentrations in commercial areas. Concentrated sources of storm water contamination may also occur if undiluted pollutants (e.g., fertilizer, gasoline) are accidentally spilled or intentionally released and enter storm drains.

Storm water contamination has primarily been a concern for surface water pollution because most urban runoff is directed to streams, lakes, and other water bodies with fish and other aquatic life that are highly sensitive to common storm water contaminants. However, where storm water is discharged to infiltration areas, there is also potential for groundwater contamination.

4.3.2.4.1 Potential Risks

Concern over potential groundwater contamination from storm water has been recognized by several governmental agencies in western Washington. Storm water-related impacts to water quality are of particular concern in industrial, commercial, and high-density residential development areas, where runoff volumes can be large. Consequently, storm water runoff from highways and roads can introduce contaminants such as heavy metals and organic priority pollutants, pesticides, and coliform bacteria into the groundwater system. Impervious surfaces in the commercial and industrial areas along SR-14, the southern terminus of SR-500, the railroad, and 3rd Avenue contribute substantial amounts of runoff in the Camas study area. Storm water runoff from lawns and agricultural areas can introduce nitrate, herbicides, pesticides, and bacterial contaminants.

4.3.2.4.2 Occurrence in the Camas Area

Jim Hodges of Camas Public Works provided information about Camas' storm water facilities for this section (e-mail comm, August 17, 2009). In addition, Clark County's GIS data was reviewed to assess the distribution of dry wells in the area.

All of the stormwater runoff in Camas flows to catchment basins, drainage ditches, biofiltration swales, exfiltration ponds or sedimentation ponds. Catchment basins and other surface storm water facilities filter out some pollutants before the water enters the subsurface or surface water environment. Near the Lower Washougal Wellfield area,

most storm water is captured via catchment basins and then routed to the Washougal River via outfall pipes. Commercial construction projects in the vicinity of Well 5 and SE 6th Avenue have required the construction of collection ponds that provide some filtration and allow infiltration of stormwater. The City's stormwater discharges are regulated under the Federal National Pollutant Discharge Elimination System (NPDES) Phase II permitting process. The permitting process requires that the City provided annual reports and develop a stormwater management plan (SWMP). The City has prepared a draft SWMP (2008) and is in compliance with the other NPDES permitting requirements.

There are no known drywells in the City of Camas stormwater system. Drywells previously used in the area of Oak Park and Goot Park in southeast Camas were abandoned and replaced with new storm water collection systems in the mid 1990's

By contrast to the City of Camas, Washougal has more than 100 dry wells. Most of the dry wells are in the older part of Washougal which includes the area bounded by 6th Street on the west, 32nd Street on the east, SR-14 on the south, and where Washougal River road crosses the Washougal River on the north. This area includes a portion of the 5-year capture zone for the City of Camas' Lower Washougal wellfield. Dry wells are the most common storm water facility in the older parts of Washougal, whereas surface storm water facilities are the most common in newer developments of Washougal. Similar to current engineering practices implemented by the City of Camas, all new construction of storm water facilities in Washougal include only surface storm water facilities such as biofiltration swales and retention ponds.

4.3.2.5 Unused, and Improperly Constructed Wells

Well casings can provide a conduit between the ground surface and underlying aquifers. Improperly constructed or abandoned wells pose several potential problems. In wells with no surface seal, contaminants introduced near the wellhead can move downward outside the casing to underlying aquifers. Many older wells that were constructed before the implementation of WAC 173-160 have no surface seal. Unused wells that have not been properly abandoned are left uncapped in many cases, posing a special risk because contaminants can be introduced directly into the aquifer. Unused wells also pose a risk when they are damaged during site redevelopment. Any of these situations can provide a conduit for contaminant movement.

Among the private wells in the Camas vicinity, a portion were constructed prior to adoption of Ecology's drilling standards and therefore have a higher likelihood of improper construction. In addition, since there has been no inventory of the number or location of these wells, some of these wells may have been abandoned properly. Public water supplies have served most of the Lower Washougal area since the 1930s and therefore few private wells occur in this area.

4.3.2.6 Agriculture, Golf Courses, Parks, and Lawns

Fertilizers, pesticides, and herbicides are applied to residential lawns, commercial landscaping, agricultural lands, and landscaped areas adjacent to roads. If optimally applied, these chemicals pose little threat to groundwater, however, applications are commonly not made correctly and groundwater contamination can result if fertilizers are applied in exceedance of the agronomic uptake rate. Excess nitrate from fertilizer will be recharged to the underlying groundwater system. Frimpter and others (1990) estimated that an average of 9 pounds of nitrate-N leached annually to groundwater from each 5,000-square-foot lawn. Landscaping activities can also be the source of pesticides and herbicides such as EDB, DBCP, and dicamba.

Agriculture and park turf is not a significant concern in the Lower Washougal Wellfield capture area (**Figure 4**). Most of the parks with managed turf in the study area are outside the wellfield capture zone, except for several parks in the eastern half of the 5 year capture zone.

Residential lawns and landscaping occur throughout the Lower Washougal wellfield. These are potential sources of nitrogen, pesticides and herbicides to the groundwater. The risk of groundwater contamination by these contaminants is high in the PAA because the aquifer is unconfined and groundwater is relatively shallow.

4.3.2.7 Transportation Spills

Vehicles transporting hazardous material can be a source of groundwater contamination through accidents and resultant chemical spills. Hazardous materials are transported through Camas on a daily basis. The major transportation routes in the Camas include:

- SR-14,
- SR-500,
- Burlington Northern Santa Fe railroad, and
- 3rd Avenue.

All of these transportation corridors go through the Lower Washougal wellfield capture zone and are very close to the individual supply wells. A major spill along any of these routes could adversely impact groundwater pumped from any well in the Camas supply wells.

The Washington State Department of Transportation (WDOT) is planning to install a stormwater infiltration facility along the north side of SE 11th Avenue, near the City's wastewater treatment plant. PGG and the City are working with DOT to help ensure that this facility does not adversely impact water quality in the Alluvial Aquifer.

About 32 to 45 Burlington Northern Santa Fe (BNSF) freight trains pass through the Washougal area on a daily basis (pers. comm. Read Fay, BNSF). Roughly 25% of the containers may contain hazardous materials (including petrochemicals). Maximum speed of these trains does not exceed 45 to 50 miles per hour. These low speeds and the durability of the tank cars minimize the possibility of a spill in the unlikely event of a

derailment. BNSF has their own spill response plan and contracts with local firms to take handle any hazardous material problems.

4.4 Wellhead Susceptibility/Vulnerability Analysis

The sensitivity of the City's groundwater sources to potential contamination was evaluated by assessing the relative susceptibility and vulnerability of the Lower Washougal wellfield. Susceptibility refers to the estimated ease of contaminant transport from the land surface to the aquifer. Vulnerability accounts for the potential of contaminant releases at the land surface.

4.4.1 Alluvial Aquifer – Lower Washougal Wellfield

As described in Section 2.2.1, the PAA occurs in the floodplains of the Columbia and Washougal rivers and is predominantly comprised of permeable sand, gravel and cobble deposits. Reported depth to groundwater in the aquifer is as little as 30 feet below land surface in supply wells completed at the Lower Washougal wellfield. While some fine-grained or cemented zones are noted above the shallow water table in drilling logs, in many cases they are absent in the logs of neighboring wells. Therefore, no laterally extensive low permeability layer exists between the land surface and the water table to protect the PAA from contaminants released at the land surface. The aquifer is therefore considered to exhibit relatively high susceptibility.

Several natural mechanisms exist for attenuation of pollutant loading to the alluvial aquifer. While these mechanisms are probably benefiting groundwater quality under current conditions, they do not reduce the aquifer's susceptibility rating. Percolation of recharge through the unsaturated zone (from the land surface to the water table) supports some reduction of selected contaminants via: (1) adsorption to particulates and oxides; (2) precipitation in aerated zones; and (3) biodegradation. However, the course texture of the sediments and general lack of organic matter suggests that the unsaturated zone offers minor contaminant attenuation relative to more silty, organic soils. Dilution via mixing with uncontaminated recharge in the unsaturated zone and the alluvial aquifer also serves to reduce contaminant concentrations. Because it is nearly certain that *some* contaminant loading occurs at the land surface (e.g., from known contaminated sites, urban runoff and septic systems), the fact that historic groundwater quality monitoring has detected minimal contamination supports the value of these two processes. However, lack of contaminant detection in the City's wells does not mean that contamination is not reaching the water table in adjacent areas. It is important to understand that these natural attenuation processes are not likely to offer sufficient protection against a significant contaminant spill or release at the land surface.

Aquifer vulnerability is typically expressed as a risk factor, calculated by multiplying ratings reflecting the ease of contaminant transport to the water table (susceptibility) by the potential for contaminant releases at the land surface. Thus, the risk of groundwater contamination depends both on the hydrogeologic framework and the activities conducted at the land surface. In the case of Camas, the PAA should be considered *highly*

vulnerable to potential contamination. While active, known/confirmed sources of groundwater contamination are limited, potential sources of contamination include:

- Known and unknown UST's and LUST's;
- Hazardous waste generators;
- Industrially or commercially zoned areas and related parcels of concern;
- Dry wells and septic tanks;
- Transportation spills; and,
- Other potential sources.

In addition to the risks associated with contaminant loading and the hydrogeologic framework, additional risk arises from the fact that most of the City's wells are clustered in close proximity to each other and may be susceptible to the same contamination events. Only Well 13 is located such that it's capture zone does not merge with the other Lower Washougal supply wells. Should groundwater contamination be detected at the main wellfield (e.g., Well No. 5-8 and 10-12), the City has few backup options for supply. In this event, the City would need to rely on its surface water sources, Wells 9 and 13, and the intertie with Washougal. These options would not supply the City's entire water demand on a sustained basis, particularly during the high demand summer months.

5 References

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Table 1. Summary of Land Use Types of Concern

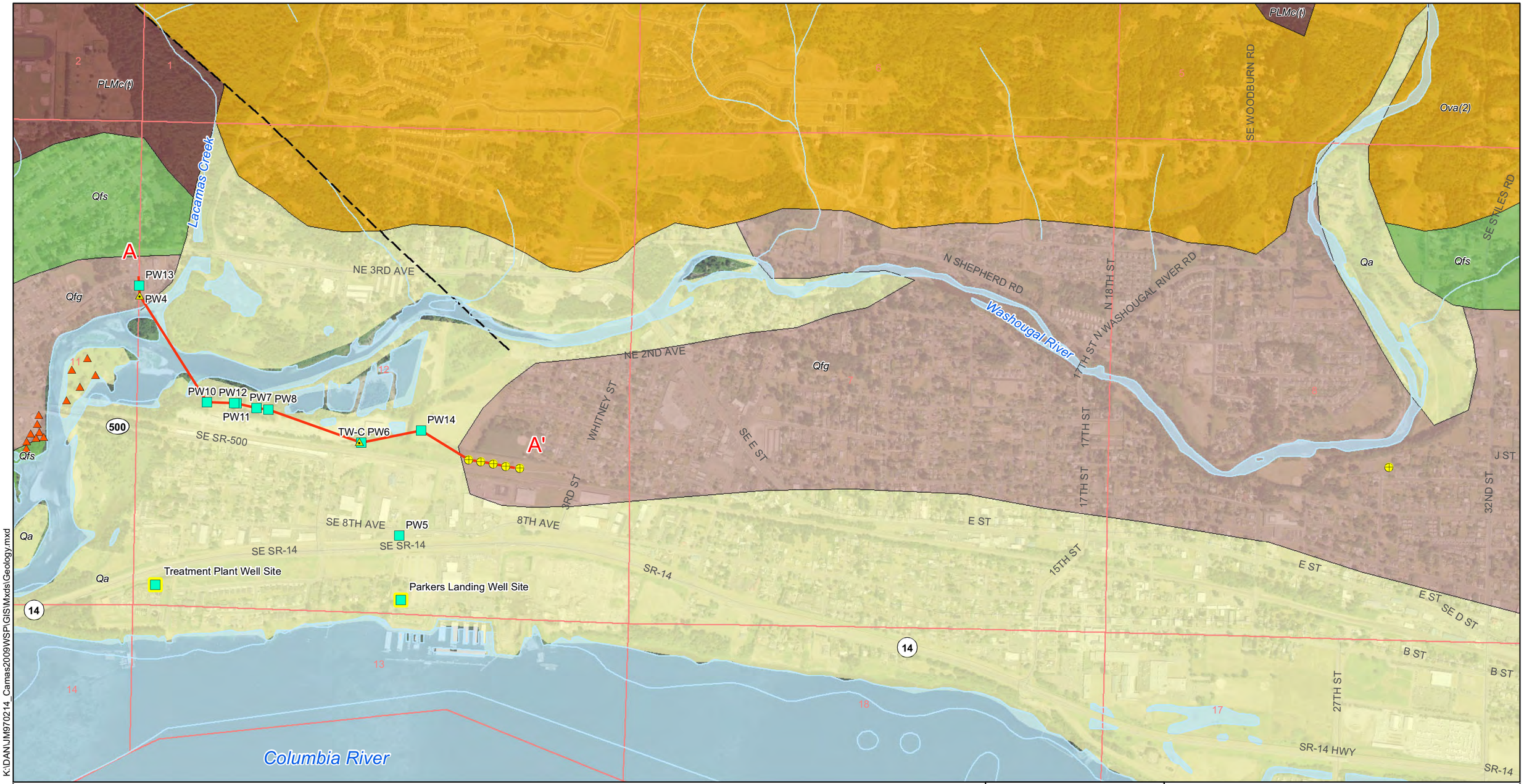
Parcel Land-Use Description	Number of Parcels Within CARA
Auto Body Shop	1
Bio-Filtration Swales/Ponds	1
Boats and marine accessories.	1
Drive Through Car Wash	7
Electric power boosters, transformers, sub-stations, right-of-ways.	1
Electric power operating, maintenance, and repair building.	2
Feedlots.	1
Fleet Operation Centers & Storage	4
Gas storage tanks, pumping, distribution, pipelines, production.	2
General repair & service garages	8
Health Clinics: Medical / Dental / Other	1
Medical & Dental Laboratories	1
Mfg - Lumber & Wood Products	1
Mfg - Machinery	4
Mfg - Miscellaneous	1
Motor vehicle dealers, new cars and small trucks,	3
Parking Lot: Gravel, for adjoining building	8
RETAIL AUTOMOTIVE AND ALLIED	1
Rock quarry, crushing, sand and gravel pits.	3
SERVICE REPAIR SHOP	8
Service Station w/ Tanks & Pumps or Card Lock Station	1
Sewage Related Bldg or Structure	4
Tires (includes retread tires), batteries, parts and accessories dealers	3
Veterinarians / Small Animal Hospitals.	1

Table 2. Summary Data for Parcels of Concern Within Camas Wellhead Protection Capture Zone

Parcel Serial Number	Owner Name	Owner Address	Site Address	Legal Description	Buisness Description	Zoning Abbreviation	WHPZ	
73134007	NORTHWEST PIPELINE	PO BOX 58900, SALT LAKE CITY, UT 84158	30 C ST, WASHOUGAL	#7 DAVID PARKER DLC .45A	Gas storage tanks, pumping, distribution, pipelines, product	LI	6-Month	1
73134153	HAMBLETON BROS LUMBER CO	PO BOX 285, WASHOUGAL, WA 98671	335 A ST, WASHOUGAL	#153, #154, #178 D. C. PARKER DLC 16.69 A	Mfg - Lumber & Wood Products	HI	6-Month	2
73134157	PORT OF CAMAS WASHOUGAL	24 A ST, WASHOUGAL, WA 98671	WASHOUGAL	#157 DAVID PARKER DLC 2.89A	Parking Lot: Gravel, for adjoining building	CH	6-Month	3
73134161	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA 98671	115 S 1ST AV, WASHOUGAL	#161 DAVID C PARKER DLC 1.72A	Motor vehicle dealers, new cars and small trucks,	CH	6-Month	4
73134170	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA 98671	WASHOUGAL	#170 DAVID C PARKER DLC	Electric power operating, maintenance, and repair building.	LI	6-Month	5
73139080	PORT OF CAMAS WASHOUGAL	24 S A ST, WASHOUGAL, WA 98671	115 S 1ST ST, WASHOUGAL	PARKERSVILLE LOTS 1, 2, 3, 4, 5 BLK 10	Boats and marine accessories.	CH	6-Month	6
73139085	PORT OF CAMAS WASHOUGAL	24 A ST, WASHOUGAL, WA 98671	WASHOUGAL	PARKERSVILLE LOTS 6 & 7 BLK 10	Parking Lot: Gravel, for adjoining building	CH	6-Month	7
73139087	PORT OF CAMAS WASHOUGAL	24 A ST, WASHOUGAL, WA 98671	WASHOUGAL	PARKERSVILLE LOTS 8 & 9 BLK 10	Parking Lot: Gravel, for adjoining building	CH	6-Month	8
73139089	PORT OF CAMAS WASHOUGAL	24 A ST, WASHOUGAL, WA 98671	WASHOUGAL	PARKERSVILLE LOT 10 BLK 10	Parking Lot: Gravel, for adjoining building	CH	6-Month	9
73139090	PORT OF CAMAS WASHOUGAL	24 A ST, WASHOUGAL, WA 98671	WASHOUGAL	PARKERSVILLE BLK 13	Parking Lot: Gravel, for adjoining building	CH	6-Month	10
87021000	GUNDERSON BEVERLY A TRUSTEE	2375 SE 8TH AVE, CAMAS, WA 98607	2456 SE 8TH AV, CAMAS	ORCHARD HOME WASHOUGAL #2 LOT 1 AKA #1 LOT 1 SP3-341 3.12A	RETAIL AUTOMOTIVE AND ALLIED	HI	6-Month	11
87053000	TIDLAND CORPORATION	2305 SE 8TH AVE, CAMAS, WA 98607	2305 SE 8TH AV, CAMAS	ORCHARD HOME WASHOUGAL #4 LOT 2 1.91A	Mfg - Machinery	HI	6-Month	12
87054000	TIDLAND CORPORATION	2305 SE 8TH AVE, CAMAS, WA 98607	CAMAS	ORCHARD HOME WASHOUGAL #5 LOT 2 .23A	Mfg - Machinery	HI	6-Month	13
87260000	C B I LLC	2305 SE 8TH AVE, CAMAS, WA 98607	2380 SE 8TH AV, CAMAS	ORCHARD HOME WASHOUGAL #2 LOT 9 .17A	Mfg - Miscellaneous	LI	6-Month	14
87360000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA 98607	1129 SE POLK ST, CAMAS	ORCHARD HOME WASHOUGAL #1 LOT 16 3.02A	Sewage Related Bldg or Structure	RC	6-Month	15
87365000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA 98607	CAMAS	ORCHARD HOME WASHOUGAL #2 LOT 16	Sewage Related Bldg or Structure	RC	6-Month	16
87451000	CORAL PROPERTIES LLC	14313 NE 20TH AVE A-104, VANCOUVER, WA 98686	1846 NE 3RD AV, CAMAS	RIVER VIEW ADDN TO CAMAS #3 LOT 8	Motor vehicle dealers, new cars and small trucks,	RC	6-Month	17
87452000	CORAL PROPERTIES LLC	14313 NE 20TH AVE A-104, VANCOUVER, WA 98686	CAMAS	RIVER VIEW ADDN TO CAMAS #4 LOT 8 & #3 LOT 9	Motor vehicle dealers, new cars and small trucks,	RC	6-Month	18
87460000	CORAL PROPERTIES LLC	14313 NE 20TH AVE A-104, VANCOUVER, WA 98686	1904 NE 3RD AV, CAMAS	RIVER VIEW ADDN TO CAMAS #1 LOT 9	General repair & service garages	RC	6-Month	19
87500000	EPJLM LLC	2845 NW LOGAN CIR, CAMAS, WA 98607	2016 NE 3RD AV, CAMAS	RIVER VIEW ADD TO CAMAS #1 #4 LOT 10 #2 LOT 11	Health Clinics: Medical / Dental / Other	RC	6-Month	20
88630000	TIDLAND CORPORATION	2305 SE 8TH AVE, CAMAS, WA 98607	754 SE UNION ST, CAMAS	OAK PARK ADDN WASHOUGAL LOT 6 BLK 8	Mfg - Machinery	HI	6-Month	21
88640000	TIDLAND CORPORATION	2305 SE 8TH AVE, CAMAS, WA 98607	2205 SE 8TH AV, CAMAS	OAK PARK ADDN WASHOUGAL LOTS 7 & 8 BLK 8	Mfg - Machinery	HI	6-Month	22
89861000	ENCON PACIFIC LLC	1660 LINCOLN ST STE 1800, DENVER, CO 80264	1635 SE 6TH AV, CAMAS	#32 OF DAVID C PARKER DLC 4.98A	Rock quarry, crushing, sand and gravel pits.	HI	6-Month	23
89882000	BRAMBLE ACRES LLC	4206 NE 261ST AVE, CAMAS, WA 98607	2459 NE 3RD LP, CAMAS	#64 OF DAVID C PARKER DLC .50A	Medical & Dental Laboratories	RC	6-Month	24
89908000	NORTHWEST PIPELINE	PO BOX 58900, SALT LAKE CITY, UT 84158	CAMAS	#135 DAVID C PARKER DLC 4.17A	Gas storage tanks, pumping, distribution, pipelines, product	MF-24	6-Month	25
89932000	CITY OF CAMAS	430 NE EVERETT ST, CAMAS, WA 98607	CAMAS	#192 DAVID PARK DLC 18.24A M/L	Rock quarry, crushing, sand and gravel pits.	HI	6-Month	26
91045163	CITY OF CAMAS	613 NE 4TH AVE, CAMAS, WA 98607	CAMAS	#163 DAVID PARKER DLC 4.39A	Electric power boosters, transformers, sub-stations, right-o	R1-7.5	6-Month	27
91045167	SONDEREN ENTERPRISES LLC	6590 SW LOMBARD AVE, BEAVERTON, OR 97008	3136 NE 3RD AV, CAMAS	#176-A D C PARKER DLC 2.13A	Tires (includes retread tires), batteries, parts and accesso	RC	6-Month	28
96158768	BUCK STEVEN E	PO BOX 324, WASHOUGAL, WA 98671	921 4TH ST, WASHOUGAL	RIVERSIDE ESTATES LOT 5 SUB 96	Auto Body Shop	CC	6-Month	29
127950000	CLARK PUBLIC UTILITIES	PO BOX 8900, VANCOUVER, WA 98668	WASHOUGAL	#115 DAVID C PARKER DLC .96A	Electric power operating, maintenance, and repair building.	LI	6-Month	30
700120000	COLUMBIA ROCK PRODUCTS INC	PO BOX 1067, CAMAS, WA 98607	1635 SE 6TH AV, CAMAS	BN RY LEASE 229,056	Rock quarry, crushing, sand and gravel pits.	HI	6-Month	**31**
71355005	TOWNSEND GREG & TOWNSEND MONICA	401 6TH ST, WASHOUGAL, WA 98671	401 C ST, WASHOUGAL	#26-A #453-A #624-A #619-A #640-A AKA LOT 2 SP2-554 1.04A	Veterinarians / Small Animal Hospitals.	CH	1 Year	1
73134116	MUYSKENS DIRK & HOMA DARLENE ETAL	PO BOX 926, RIDGEFIELD, WA 98642	453 C ST, WASHOUGAL	#116 OF D C PARKER DLC 1.11A	Parking Lot: Gravel, for adjoining building	LI	1 Year	2
73134155	MCGREW ROBERT W & MCGREW KATHARINA TRUSTEES	MCGREW FAMILY TRUST, WASHOUGAL, WA 98671	450 C ST, WASHOUGAL	#155 D C PARKER DLC .38A	SERVICE REPAIR SHOP	CH	1 Year	3
75357048	M & M CARWASH INC	PO BOX 812, BORING, OR 97009	WASHOUGAL	R B JOHNSTON TTS LOT 12 BLK 2	Drive Through Car Wash	CV	1 Year	4
75357049	M & M CARWASH INC	PO BOX 832, BORING, OR 97009	WASHOUGAL	R B JOHNSTON TT LOT 12 BLK 2 (SEE 075357-048-050 LAND AV)	Drive Through Car Wash	CV	1 Year	5
75357050	M & M CARWASH INC	PO BOX 832, BORING, OR 97009	WASHOUGAL	R B JOHNSTON TRACTS LOT 13 BLK 2	Drive Through Car Wash	CV	1 Year	6
75357051	M & M CARWASH INC	PO BOX 832, BORING, OR 97009	WASHOUGAL	R B JOHNSTON TRACTS LOT 14 BLK 2	Drive Through Car Wash	CV	1 Year	7
91045582	KITTERMAN LLC 45.6%	811 NE 112TH AVE SUITE 104, VANCOUVER, WA 98662	CAMAS	WEIR PARK #1 LOT 7 BLK 1	Parking Lot: Gravel, for adjoining building	RC	1 Year	8
91045584	KITTERMAN LLC 45.6%	811 NE 112TH AVE SUITE 104, VANCOUVER, WA 98662	CAMAS	WEIR PARK #1 LOT 8 BLK 1	Parking Lot: Gravel, for adjoining building	RC	1 Year	9
91045652	MANBER MIRIAM TRUST 1/3 INT	555 12TH ST STE 1400, OAKLAND, CA 94607	3440 NE 3RD AV, CAMAS	WEIR PARK LOTS 3 & 4 BLK 5	Tires (includes retread tires), batteries, parts and accesso	RC	1 Year	10
91045666	FOUNTAIN ROBERT & FOUNTAIN NANCY	114 SE WEIR ST, CAMAS, WA 98607	114 SE WEIR ST, CAMAS	WEIR PARK LOT 16 BLK 5	General repair & service garages	RC	1 Year	**11**
71360000	HIGGINSON BLAINE & HIGGINSON BRIAN	984 17TH ST, WASHOUGAL, WA 98671	984 17TH ST, WASHOUGAL	#19C OF OUGH DLC .50A	SERVICE REPAIR SHOP	R1-10	5 Year	1
71527002	R & T AUTO BODY INC	1434 E ST, WASHOUGAL, WA 98671	1434 E ST, WASHOUGAL	#275 OF RICH OUGH DLC	General repair & service garages	CC	5 Year	2
71528000	R & T AUTO BODY INC	1434 E ST, WASHOUGAL, WA 98671	1434 E ST, WASHOUGAL	#276 OF RICH OUGH DLC	General repair & service garages	CC	5 Year	3
71542000	BKS ENTERPRISES INC	1641 E ST, WASHOUGAL, WA 98671	1641 E ST, WASHOUGAL	#292 OF RICH OUGH DLC	Drive Through Car Wash	CV	5 Year	4
71543000	VAUGHN PATRICIA	462 LILLIAN LN, ROSEBURG, OR 97470	1423 E ST, WASHOUGAL	#293 OF RICH OUGH DLC	SERVICE REPAIR SHOP	CV	5 Year	5
71559000	MALFAIT RONALD & MALFAIT SHERYL	31914 SE 17TH ST, WASHOUGAL, WA 98671	1022 E ST, WASHOUGAL	#315 OF RICH OUGH DLC	Drive Through Car Wash	CC	5 Year	6
71592000	MALFAIT RONALD & MALFAIT SHERYL	31914 SE 17TH ST, WASHOUGAL, WA 98671	WASHOUGAL	#367 OF RICH OUGH DLC	Drive Through Car Wash	CC	5 Year	7
71622000	WASHOUGAL SCHOOL DIST #112	2349 B ST, WASHOUGAL, WA 98671	WASHOUGAL	#420 OF OUGH DLC	Fleet Operation Centers & Storage	R1-7.5	5 Year	8
71666000	MALFAIT RONALD & MALFAIT SHERYL	31914 SE 17TH ST, WASHOUGAL, WA 98671	1138 E ST, WASHOUGAL	#473 OF RICH OUGH DLC	General repair & service garages	CC	5 Year	9
71671002	GATEWAY COMMUNITY CHURCH WASHOUGAL	1235 E ST, WASHOUGAL, WA 98671	1325 E ST, WASHOUGAL	#479 OF OUGH DLC .11A	SERVICE REPAIR SHOP	CV	5 Year	10
71680000	MALFAIT RONALD S	31914 SE 17TH ST, WASHOUGAL, WA 98671	1250 E ST, WASHOUGAL	#489 OF RICH OUGH DLC .22A	Service Station w/ Tanks & Pumps or Card Lock Station	CC	5 Year	11
71683000	COLUMBIA ELECTRIC INC	PO BOX 473, WASHOUGAL, WA 98671	1338 E ST, WASHOUGAL	#496 OF RICH OUGH DLC .21A	SERVICE REPAIR SHOP	CC	5 Year	12
71706000	MALFAIT RONALD & MALFAIT SHERYL	31914 SE 17TH ST, WASHOUGAL, WA 98671	1204 E ST, WASHOUGAL	#530 OF OUGH DLC .25A	Tires (includes retread tires), batteries, parts and accesso	CC	5 Year	13
71717002	MAHRE DONALD A (C/S)	1403 SE 283RD AVE, CAMAS, WA 98607	1315 E ST, WASHOUGAL	#553 OF OUGH DLC .14A	SERVICE REPAIR SHOP	CV	5 Year	14
71741000	MAHON JENIFER & MAHON JOHN A	1005 I ST, WASHOUGAL, WA 98671	1005 I ST, WASHOUGAL	#589 OF OUGH DLC .35A	Feedlots.	R1-7.5	5 Year	15
71792000	HATTEN RANDALL & HATTEN BRENDA	PO BOX 141, WASHOUGAL, WA 98671	1320 E ST, WASHOUGAL	#662 OF RICHARD OUGH DLC .31A	SERVICE REPAIR SHOP	CC	5 Year	16
71832000	VAUGHN PATRICIA	462 LILLIAN LN, ROSEBURG, OR 97470	1405 E ST, WASHOUGAL	#714 RICHARD OUGH DLC .23A	General repair & service garages	CV	5 Year	17
71886000	JENSEN RONALD & JENSEN DONNA TRUSTEE	982 E ST, WASHOUGAL, WA 98671	1022 E ST, WASHOUGAL	#777 RICHARD OUGH DLC	SERVICE REPAIR SHOP	CC	5 Year	18
71910000	SAMPLE RONALD N & LILJA-SAMPLE NANCY	2100 NE 249TH AVE, CAMAS, WA 98607	WASHOUGAL	#803 RICHARD OUGH DLC	General repair & service garages	CC	5 Year	19
75358010	WASHOUGAL SCHOOL DIST #112	2349 B ST, WASHOUGAL, WA 98671	971 E ST, WASHOUGAL	ELLS SUB-DIV LOT 1	Fleet Operation Centers & Storage	R1-7.5	5 Year	20
75359586	RADFORD BRIAN J	3000 H ST, WASHOUGAL, WA 98671	730 E ST, WASHOUGAL	MIDLAND ACRE REPLT BLKS 1-5 & TTA #2 LTS 24 Z 26 BLK 1	General repair & service garages	CV	5 Year	21
75359644	WASHOUGAL SCHOOL DIST #112	2349 B ST, WASHOUGAL, WA 98671	995 E ST, WASHOUGAL	MIDLAND ACRES REPLAT BLKS 1-5 & TT A #1 LOT 2 BLK A	Fleet Operation Centers & Storage	R1-7.5	5 Year	22
75359646	WASHOUGAL SCHOOL DIST #112	2349 B ST, WASHOUGAL, WA 98671	WASHOUGAL	MIDLAND ACRE REPLAT BLKS 1-5 & TT A #2 LOT 2 BLK A	Fleet Operation Centers & Storage	R1-7.5	5 Year	23
131901042	CITY OF WASHOUGAL	1701 C ST, WASHOUGAL, WA 98671	WASHOUGAL	AUTUMN SLOPE TT A SUB 2004	Bio-Filtration Swales/Ponds	R1-10	5 Year	**24**
87124000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA 98607	CAMAS	ORCHARD HOME WASHOUGAL G,H,& I LOT 4 .17A	Sewage Related Bldg or Structure	LI	CARA	1
89924000	CITY OF CAMAS	616 NE 4TH AVE, CAMAS, WA 98607	CAMAS	#183A DAVID C PARKER DLC 1 A M/L	Sewage Related Bldg or Structure	RC	CARA	**2**

Table 3. Summary of Environmental Sites of Concern

ID	Facility Name	Facility ID	WHPZ	Release	Underground Storage Tank	Leaking Underground Storage Tank	Total Tank Volume	Hazardous Materials	Cleanup Site	Halogenated Organic Compounds	EPA Priority Pollutants	PCB	Petroleum Products	Non Halogenated Solvents	Arsenic
1	Camas Washougal Port	92847997	6-Month	Y	Y	Y	22500	N	N						
2	Chevron Bulk Plant Camas	1043	6-Month	Y	N	N		N	Y	C	C		C	C	
3	Clark Public Utility Dist C St	5352681	6-Month	N	Y	N		N	N						
4	Columbia Storage Inc 2nd St	11338232	6-Month	N	N	N		Y	N						
5	Columbia Warehouse	37125488	6-Month	N	Y	N	550	Y	N						
6	Hambleton Bros Log Yard	4399598	6-Month	Y	N	N		N	Y		C	C	C		
7	Jimbos Deli Mart 2	86429735	6-Month	N	Y	N	60000	N	N						
8	Northwest Pipeline Gp Washougal M/S	14447751	6-Month	Y	N	N		Y	Y		C				C
9	Tarr Inc Washougal	3264254	6-Month	N	N	N		Y	N						
10	Tidland Corp	88277363	6-Month	N	N	N		Y	N						
11	Tidland Corporation	7282918	6-Month	N	Y	N	550	N	N						
12	Triangle Resources	3153967	6-Month	N	N	N		N	N						
13	Us Doe Bpa Camas Substation	3811629	6-Month	N	N	N		Y	N						
14	All Seasons Auto Centers Inc Camas	18768638	1 Year	N	N	N		Y	N						
15	Brass Lamp Motor Inn	64124152	1 Year	N	N	N		Y	N						
16	Goodyear Tire Camas	85837922	1 Year	Y	Y	Y	3000	N	Y						
17	Helland Brothers Ss	69936158	1 Year	N	N	N		Y	N						
18	Schucks Auto Supply Camus	52218486	1 Year	N	N	N		Y	N						
19	Washougal Electric & Sheet Metal Inc	16327542	1 Year	N	Y	N	550	N	N						
20	West Coast Marine Cleaning Inc	39956434	1 Year	N	N	N		Y	N						
21	Asher Engine Service	94778244	5 Year	N	N	N		Y	N						
22	Clark County Pub Wks Washougal Site	95756539	5 Year	N	Y	N	16500	N	N						
23	Hi Way Fuel	22538744	5 Year	Y	Y	Y	103500	N	N						
24	Napa Washougal	79581825	5 Year	N	N	N		Y	N						
25	Overton Mfg Inc	49392144	5 Year	N	N	N		Y	N						
26	S & S Food Mart	64113396	5 Year	N	Y	N	45000	Y	N						
27	Washougal School Dist Bus Garage	48371594	5 Year	N	Y	N		N	N						
28	Washougal Shell	57872946	5 Year	N	Y	N		N	N						
29	Camas City Operations Center	38772238	CARA	N	N	N		Y	N						
30	Camas City Well 11 & 12	994431	CARA	N	N	N		Y	N						
31	Camas City Well 3	9810684	CARA	N	N	N		Y	N						
32	Camas Stp	74959167	CARA	N	N	N		Y	N						
33	Columbia Rock Concrete Products Inc	5016308	CARA	Y	N	N		N	Y		S		C		
34	Gk Construction & Equipment Rentals	4168647	CARA	N	N	N		Y	N						
35	Heraeus Shin Etsu America	83917959	CARA	N	N	N		Y	N						



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- Camas Supply Well
- Camas Proposed Supply Well
- Washougal Supply Well
- Georga Pacific Supply Well
- Cross Section Alignment
- Other Well in Cross Section

Geologic Units (DGER 100K)

- Qfs - outburst flood deposits, sand and silt, late Wisconsinan
- Qa - alluvium
- Qfg - outburst flood deposits, gravel
- Ova(2) - Andesite flows
- PLM(t) - continental sedimentary deposits or rocks (Troutdale Formation)
- Normal Fault

0 Feet 1,000

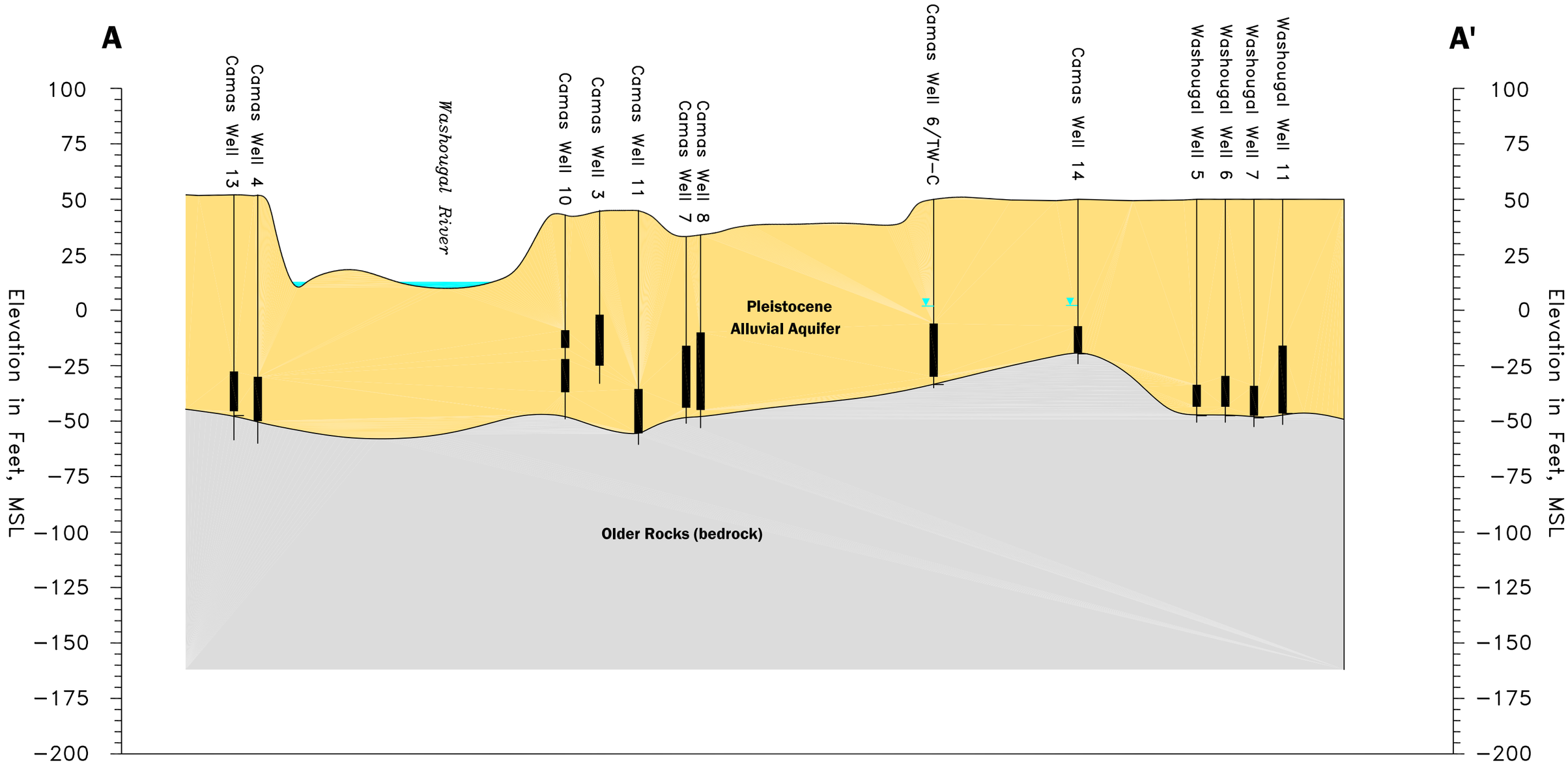
N

2007 Aerial Photo from Clark County

Figure 1
Surficial Geology, Cross Section & Wellfields

Camas Wellhead Protection Plan

PgG



LEGEND

Well Water Level

Well Completion Interval

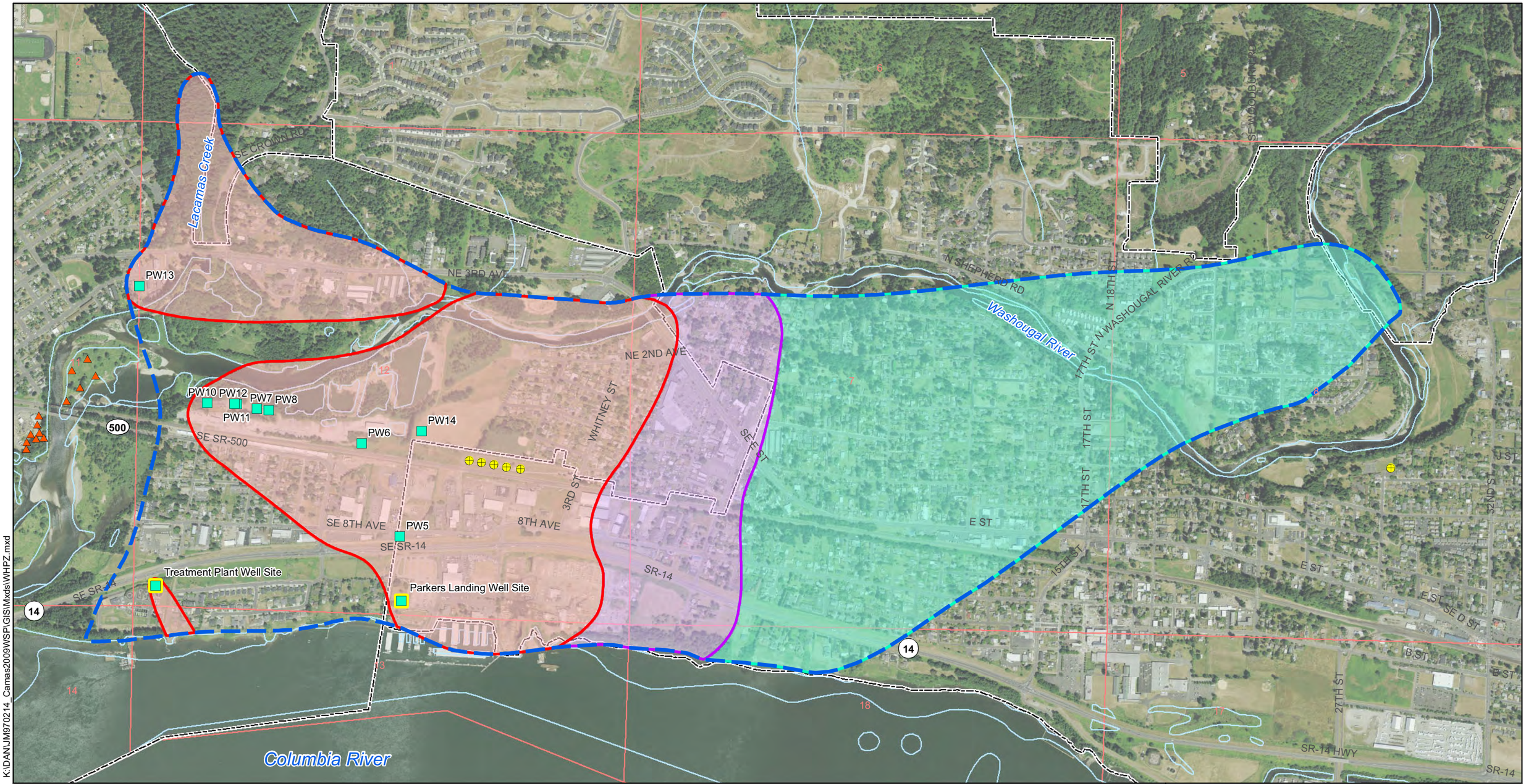
Horizontal Scale in Feet
0 250 500
0 25 50
Vertical Scale in Feet

FIGURE 2
Hydrogeologic Cross Section A-A'

City of Camas
Replacement Wells

JM9702.06, XSECA.DWG, May/2003

PgG



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- Camas Supply Well
- Camas Proposed Supply Well
- Washougal Supply Well
- Georga Pacific Supply Well

Wellhead Protection Capture Zones (WHPP-3 Scenario)

- 6 Month Capture Zone
- 1 Year Capture Zone
- 5 Year Capture Zone

- Critical Aquifer Recharge Area (CARA)
- City Limits

0 Feet 1,000

N

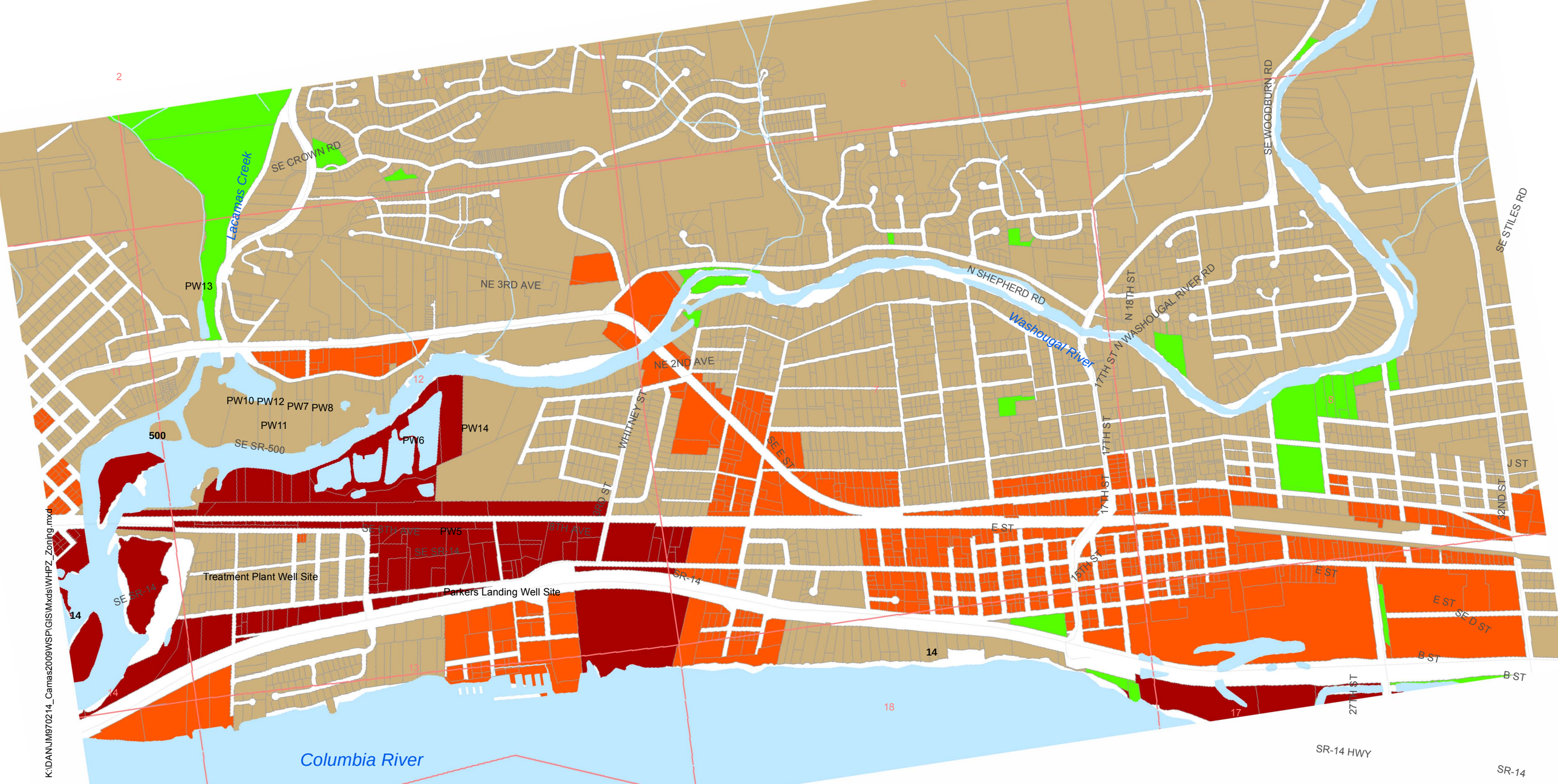
2007 Aerial Photo from Clark County

Figure 3

City of Camas Wellhead Protection Capture Zones

Camas Wellhead Protection Plan

PgG



Camas Supply Well
Camas Proposed Supply Well
Washougal Supply Well
Georga Pacific Supply Well
City Limits
Parcels of Concern

Parcels by Zoning Categories
Industrial
Commercial
Residential
Agriculture
Parks

Critical Aquifer Recharge Area (CARA)
6 Month Capture Zone
1 Year Capture Zone
5 Year Capture Zone

0 Feet 1,000

2007 Aerial Photo from Clark County

Figure 4
Zoning Categories

Camas Wellhead
Protection Plan

DOE Sites of Concern

Known Release

Table 3 ID → 11 ← Cleanup Site

UST/LUST

Hazardous Materials

Refer to Section 4.3 and Table 3 for description.

Drywells

Septic Systems

WSDOT Infiltration Area

City Limits

Camas Supply Well

Camas Proposed Supply Well

Washougal Supply Well

Georga Pacific Supply Well

Critical Aquifer Recharge Area (CARA)

6 Month Capture Zone

1 Year Capture Zone

5 Year Capture Zone

0 Feet 1,000

2007 Aerial Photo from Clark County

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Figure 5
Hazardous Sites

Camas Wellhead Protection Plan

PgG

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Appendix A

Environmental Sites Information

Facility/Site: 1043 CHEVRON BULK PLANT CAMAS

Also known as: CHEVRON BULK PLANT CAMAS, TRIANGLE RESOURCES

Larger Map

Larger Map

Address

SE 6TH AVE & SE UNION AVE

CAMAS WA 98607

Decimal Coordinates

Latitude: 45.58285

Longitude: -122.38523

Geographic Information

Ecology Region: SWRO

County: Clark

Legislative District: 18

Congressional District: 3

WRIA: 28

Tribal Land: No

Ecology Interactions

Interaction Description	Ecology Program	Ecology Program Phone	Program ID	Start Date	End Date
State Cleanup Site	TOXICS	(360) 407-7224		5/23/1990	

Industrial Codes (External Links Below)

Report generated on 08-05-2009

Clark COUNTY

Site ID: **1043** **CHEVRON BULK PLANT CAMAS**

LOCATION

Address: SE 6TH AVE & SE UNION AVE
CAMAS, 98607

Lat/Long: 45.582 -122.385

Township/Range/Section: 1N 3E 48

(View Map)

Legislative District: 18

Congressional District: 3

STATUS

Ecology Status: RA in Progress
Independent Status:
Site Type:
Statute: MTCA only
WARM BIN#: 2
Brownfield: ☐ **Restrictive Covenant:** ☐ **PSI:** ☐
No Further Action (NFA):

Responsible Unit: SOUTHWEST
Site Manager: SCHMALL, ROD
Entered Date: 5/23/1990
Last Update Date: 1/24/2008
LUST ID:
ERTS ID:
NFA Date:

(View Site Web Page)

SITE ACTIVITIES

Activity	Status	Start Date	End Date	Legal Mechanism	Project Manager
Site Hazard Assessment	Completed	2/10/1995	6/29/1995		SOUTHWEST REGION
Hazardous Sites Listing	Completed	8/22/1995	8/22/1995		SOUTHWEST REGION
Remedial Investigation/Feasibility Study	In Process	10/20/2003	7/1/2010	Agreed Order	SCHMALL, ROD

AFFECTED MEDIA & CONTAMINANTS DATA

Contaminants:

Media	2	3	7	9
Soil- C		C	C	C
Groundwater- C	C		C	C

CONTAMINANT KEY

#1 = Base/Neutral Organics
#2 = Halogenated Organics
#3 = Metals-Priority Pollutants
#4 = Metals-Other
#5 = PCB
#6 = Pesticides
#7 = Petroleum Products
#8 = Phenolic Compounds
#9 = Non-Halogenated Solvents
#10 = Dioxins
#11 = PAH
#12 = Reactive Wastes
#13 = Corrosive Wastes
#14 = Radioactive Wastes
#15 = Conventional Contaminants, Organic
#16 = Conventional Contaminants, Inorganic
#17 = Asbestos
#18 = Arsenic
#19 = MTBE
#20 = Unexploded Ordnance (UXO)
(21-24 Sediment only)
#21 = Tributyl Tin
#22 = Bioassay/Benthic Failures
#23 = Wood Debris
#24 = Other

PCB = PolyChlorinated BiPhenyls PAH = Polynuclear Aromatic Hydrocarbons MTBE = Methyl Tertiary-Butyl Ether

B = Below MTCA Cleanup Levels; C = Confirmed; R = Remediated; S = Suspected

COUNTY - CLARK (1 sites)

Site Name: CHEVRON BULK PLANT CAMAS

FS ID: 1043

Address SE 6TH AVE & SE UNION AVE
CAMAS, WA 98607

(View Map) Lat: 45.58285 / Long: -122.38523

Rank 2
PSI ☐
VCP ☐
Brownfield ☐

Entered Date May 23, 1990
Last Update January 24, 2008
Resp. Unit Southwest
Ecology Status RA in Progress

ACTIVITY	STATUS	START	END	LEGAL
Site Hazard Assessment	C	2/10/1995	6/29/1995	
Hazardous Sites Listing	C	8/22/1995	8/22/1995	
Remedial Investigation/Feasibility Study	I	10/20/2003	7/1/2010	Agreed Order

Media	Contaminant 2	3	7	9
Soil- C		C	C	C
Groundwater- C	C		C	C

*hover over boxes above for details

Report Statistics

Number of Counties.	1	Number of Brownfield Sites	0
Total Number of Resp. Units	1	Number of VCP Sites	0
Number of Regions	1	Number of Puget Sound Initiative Sites	0
Total Number of Sites	1	Number of Ranked Sites	1

Continued from Page 1

warehouse, near a *sump* (pit which collects excess liquid) on the east side of the site, and beneath a sand trap near the former garage. Petroleum constituents, gasoline, and lead have been discovered in groundwater samples. In November 1994, more than 550 cubic yards (55 dump truck loads) of petroleum-contaminated soil were removed and disposed of. The property was sold in November 1994 to a wood recycling company, Triangle Resources.

What Is Being Done?

The agreed order requires Chevron to conduct a remedial investigation/feasibility study (RI/FS) and risk assessment of lead and petroleum-contaminated soil and groundwater. The remedial investigation will determine the nature, extent, and magnitude of site contamination. The risk assessment will measure the threats to human health and the environment. The feasibility study will evaluate site cleanup alternatives. Ecology will oversee implementation of the agreed order to ensure that all parts of the agreed order are fulfilled.

What Happens Next?

Public comment on the proposed agreed order will be considered and the order will be modified, if necessary, based on the comments received. The work for the remedial investigation/feasibility study and risk assessment should be completed by Summer 2004. Further formal public comment opportunities will occur after the remedial investigation/feasibility study and risk assessment are completed, and a draft cleanup action plan is prepared.

Ecology Wants Your Comments!

You are invited to review and comment on the proposed agreed order through **September 19, 2003**. The public comment period presents an opportunity to have your ideas and comments heard by Ecology. Information repositories, which include the agreed order, have been set up at the locations listed in the box on page one. To review more detailed site documents than those in the information repositories, contact Ecology's Southwest Regional Office records center at (360) 407-6365 to schedule an appointment.

Please submit your written comments to Marcel Szyszkowski, Site Manager, at the Ecology address listed in the box on page one. Ecology will review and respond to all comments received, and may revise the agreed order. Updates of site activities will be provided to those who submit comments or request to be placed on the site mailing list. (If you received this fact sheet directly from Ecology, you are already on the site mailing list.)

Ecology is an Equal Opportunity Employer.

CHEVRON BULK PLANT, CAMAS

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Agreed Order for RI/FS Proposed

The Washington Department of Ecology and Chevron have agreed to a Model Toxics Control Act (MTCA, Chapter 70.105D RCW) order to conduct a remedial investigation/feasibility study (RI/FS) of lead and petroleum-contaminated soil and groundwater at the Chevron Bulk Plant, Camas site. The agreed order is a legal document formalizing an agreement between Ecology and potentially liable persons (PLP's), to ensure that proposed site cleanup activities are conducted in a timely fashion, in accordance with MTCA and other applicable laws and regulations.

Your comments on the proposed agreed order are welcome through **September 19, 2003**. The box to the right provides information about where to review the agreed order, as well as where to submit comments.

Site Background

The 1.5-acre former Chevron Bulk Plant, Camas site is located at 612 SE Union Street. The site was a bulk fuel terminal which was decommissioned in 1983. Railroad spurs border the site to the north and east. A garage was formerly located in the northwest corner of the site and a warehouse building was in the south portion. An office building remains on-site. The site is about 800 feet southeast from the Washougal River. The Columbia River is about 1700 feet south of the site. Drinking water wells for the City of Camas are about 250 feet north and about 1000 feet southeast of the site. Area groundwater flows northwest, southwest, and south.

Five above-ground fuel tanks and pumps, associated piping, and some buildings were removed in 1984. A fuel oil underground storage tank was removed in 1990. Although site files do not indicate where lead and other gasoline additives were stored, they were likely on-site since there is lead contamination in soil and groundwater.

Ecology conducted a site initial investigation in November 1992. In August 1995, the site was ranked on the Hazardous Sites List as a 2 (1 being high priority, 5 being low). Chevron Bulk Plant, Camas received its score based on its impact to groundwater and human health.

Site investigations, including soil and groundwater sampling, occurred between October 1987 and November 1995. Petroleum constituents and lead above cleanup levels have been detected in soil underneath the former loading racks, pumps, and above-ground storage tanks as well as in the area of the former

Continued on Page 2

August 2003

FACT SHEET

Ecology Southwest Regional Office
Toxics Cleanup Program
300 Desmond Drive SE
P.O. Box 47775
Olympia, WA 98504-7775
(360) 407-6300 (voice)
(360) 407-6306 (TDD)
e-mail mszy461@ecy.wa.gov

PUBLIC COMMENT PERIOD ON AGREED ORDER:

August 18, 2003 to September 19, 2003

Comments and requests for updates should be directed to Marcel Szyszkowski, Site Manager, at the Ecology address listed above or at (360) 407-6363.

INFORMATION REPOSITORIES

The agreed order can be reviewed at the following locations:

www.ecy.wa.gov/programs/tcp/sites/sites_information.html then click on the appropriate county

www.ecy.wa.gov, then click on "Public Events Calendar page"

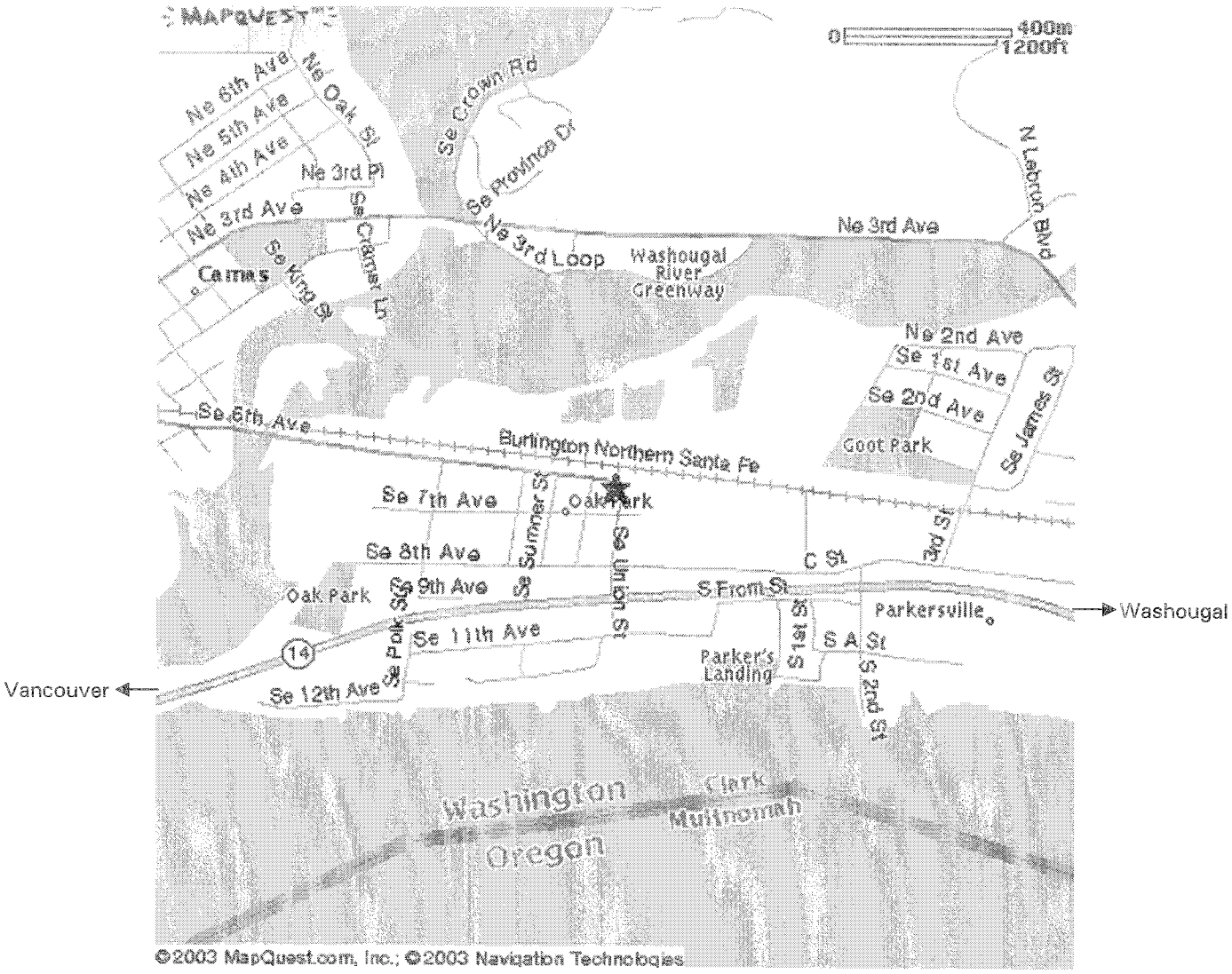
Ecology Southwest Regional Office address listed above

Camas Library
625 NE 4th Avenue
Camas, WA 98607-2109
(360) 834-4692

Printed on Recycled Paper

If you have special accommodation needs, please call (360) 407-6300, (360) 407-6306 (TDD), 711, or 1-800-833-6388 (TTY).

Continued from Page 2



No NAICS information is available for this facility site.

SIC Code	SIC Description
2999	PETROLEUM & COAL PRODUCTS

Report generated on 08-05-2009

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by:	)	
	)	AGREED ORDER
Chevron U.S.A. Products Company	)	No. 02TCPSR-3991
Former Chevron Bulk Facility #207407	)	
(100-1840)	)	
SE 6th Avenue and SE Union Street	)	
Camas, WA	)	

TO: Chevron Products Company
A ChevronTexaco Company
Attn: Jon. N. Robbins, Senior Counsel
P.O. Box 6004
6001 Bollinger Canyon Rd. Room T4276
San Ramon, CA 94583-0904

I.
JURISDICTION

This Agreed Order ("Order") is issued pursuant to the authority of RCW 70.105D.050(1).

II.
FINDINGS OF FACT

Ecology makes the following Findings of Fact, without admission of such facts by the Chevron Products Company (Chevron).

SITE DESCRIPTION: The project site is a former Bulk Terminal located on the southeast corner of the intersection of SE Sixth Avenue and SE Union Street in Camas, Washington. Chevron no longer has any leasehold or other real or personal property interest in the Site.. The site was decommissioned in 1983, and the aboveground storage tanks (ASTs) pumps and associated piping were removed in 1984. Railroad spurs bordered the site to the north and east. A garage was formerly located in the northwest corner of the site, and a warehouse building formerly occupied the southern portion of the irregularly shaped property. According to the documents reviewed, an office building remains on the southern portion of the property. The documents reviewed did not state the year operations began at this site.

RECEPTORS: The site is approximately 800 feet southeast from the Washougal River. The Columbia River is located approximately 1,700 feet south of the site. There are also groundwater production wells for the city of Camas located approximately 250 feet north of the site (Municipal well #6), and approximately 1,000 feet southeast of the site (Municipal well #5).

SITE INVESTIGATIONS: Investigations have been performed at the site between October 1987 and November 1995. A total of nine soil borings have been drilled on the site. Seven of these borings were completed as groundwater monitoring wells (MW). Wells MW-1 through MW-4 were completed to 22 feet below grade (bg) and have never generated groundwater. Groundwater monitoring wells MW-5 through MW-7 were completed to approximately 44 feet bg. Depth to groundwater in these wells has ranged from approximately 31 to 44 feet bg. The last groundwater sampling event was performed on November 27, 1995.

Eighteen test pits were also completed to a maximum depth of 15 feet bg across the site in September 1994.

SOIL CONDITIONS: Soils observed on site consist of silty sand or gravelly silt to approximately five feet bg, overlying sandy or silty gravel. Boulders were encountered at 20 feet bg. Concentrations of petroleum hydrocarbons exceeding Washington State Model Toxics Control Act (MTCA) Method A cleanup levels have been detected in soil beneath the former loading racks, pumps and ASTs to 20 feet bg. Concentrations of TPH exceeding MTCA Method A cleanup levels were also detected in the area of the former warehouse, near a sump on the east side of the site, and beneath a sand trap near the former garage.

GROUNDWATER CONDITIONS: Groundwater gradient has been observed to the northwest, southwest, and south. Depth to groundwater has ranged from approximately 31 feet bg to 44 feet bg. Concentrations of TPH-gasoline, TPH-diesel, TPH-oil and BTEX compounds have never been detected in groundwater samples collected from monitoring wells MW-6 and MW-7 above laboratory reporting limits. Concentrations of TPH-gasoline up to 3,600 parts per billion (ppb) have been detected in Well MW-5. Concentrations of BTEX compounds have ranged from non-detectable levels to 120 ppb in Well MW-5. Groundwater has not been sampled since November 1995.

REMEDIATION ACTIVITIES: In November 1994, 830 cubic yards of soil was excavated from six areas of the facility. The soil was placed through a vibratory screen, and approximately 200 cubic yards of rock greater than 3" in diameter was segregated. Approximately 790 tons of soil was hauled off site for disposal. Wells MW-1 through MW-4 were properly abandoned during this project.

Following excavation activities, confirmation soil samples were collected from the bottom of the excavations. Laboratory analytical results indicate that soil above MTCA cleanup levels remains beneath the former loading rack at 11 feet, and beneath the former ASTs at approximately 15 feet bg.

III.
ECOLOGY DETERMINATIONS

1. Chevron was an "owner or operator" as defined at RCW 70.105D.020(11) of a "facility" as defined in RCW 70.105D.020(4).
2. The facility, which consists of approximately one acre of property known as the former Chevron Site (Site), is located at SE 6th Avenue and SE Union Street, Camas, Washington.
3. The substances found at the Site as described above are "hazardous substances" as defined at RCW 70.105D.020(7).
4. Based on the presence of these hazardous substances at the Site and all factors known to Ecology, there is a release or threatened release of hazardous substances from the Site, as defined at RCW 70.105D.020(19).
5. By a letter dated April 22, 2002, Ecology notified Chevron of its status as a "potentially liable person" under RCW 70.105D.040 after notice and opportunity for comment. By a letter of May 22, 2002 Chevron accepted Ecology's determination that Chevron is a "potentially liable person" under RCW 70.105D.040.
6. Pursuant to RCW 70.105D.030(1) and 70.105D.050, Ecology may require potentially liable persons to investigate or conduct other remedial actions with respect to the release or threatened release of hazardous substances, whenever it believes such action to be in the public interest.
   Based on the foregoing facts, Ecology believes the remedial actions required by this Order are in the public interest.

IV.
WORK TO BE PERFORMED

Based on the foregoing Facts and Determinations, it is hereby ordered that Chevron perform the following activities and that these activities be conducted in accordance with Chapter 173-340 WAC unless otherwise specifically provided for herein.

The activities in this Order are designed to remediate the potential risks posed to human health and the environment from the Site. Specifically, work to be performed includes, but is not limited to: 1) reduce the risk of further contaminant migration to the groundwater beneath the site; 2) conduct and prepare a RI/RA/FS of the Site; 3) implement the recommendations of the RI/RA/FS.

Based on the foregoing Facts and Determinations, it is hereby ordered that Chevron conduct remedial activities at the Site according to the requirements of this Order. In order to carry out the remedial actions required under this Order, Chevron shall produce the reports and carry out the activities specified in this section. All activities shall be conducted in accordance with Chapter 173-340 WAC unless otherwise specifically provided for herein.

1. WORK PLAN WITH SAP/HASP

A work plan which includes a sampling and analysis plan (SAP) and a Site health and safety plan (HASP) will be prepared to comply with WAC 173-340-810 and 820. A single work plan will be prepared for the entire Site. The SAP will propose a scope of work to evaluate known environmental concerns at the site.

a) Chevron shall submit a draft work plan to Ecology for characterization of the extent of soil and groundwater contamination at the Site. The work plan shall contain a SAP which will identify but not be limited to the proposed number of soil test locations and groundwater monitoring locations; approximate depths of samples and borings (as appropriate); sampling and analysis scheme including a quality assurance/quality control (QA/QC) plan; and a HASP for field work. The draft work plan shall include a schedule for implementation. The draft work plan shall be submitted within ninety (90) calendar days of the effective date of this Order. Ecology shall review and provide written comments within thirty (30) calendar days of receipt of the draft work plan. Chevron shall submit a final work plan within thirty (30) calendar days of receipt of Ecology's comments.

2. REMEDIAL INVESTIGATION/RISK ASSESSMENT/FEASIBILITY STUDY (RI/RA/FS)

Chevron shall conduct a remedial investigation (RI), risk assessment (RA) and a feasibility study (FS) at the Site to address the substantive requirements of WAC 173-340-350 and 360. The RI will evaluate the distribution of contaminants in soil and groundwater at the Site. Based on these data, the RA and FS will be performed to evaluate a range of remedial technologies to mitigate Site conditions that pose an unacceptable risk to human health and/or the environment.

a) The approved work plan outlined in Subsection 1a of this Order will be implemented. The RI work plan will include a scope of work to characterize the nature and extent of soil and groundwater impacts at the Site. Should additional RI work be needed to characterize the distribution of contaminants in soil and groundwater, a supplemental RI work plan will be submitted for review by Ecology.

b) Once all RI work is complete, Chevron shall perform a RA and focused FS (in the event that Site media exceed cleanup standards that are appropriate for the use of the property). Chevron shall then submit to Ecology a report of the results of the RI/RA/FS. The report shall include, as appropriate, Site location maps and physical setting description; soil characterization; surface and subsurface soil sampling results (analytical data as well as field logs); soil, groundwater, and sediment characterization; description of monitoring well installation; well logs; drilling logs; results of soil, groundwater, and sediment sampling; hydraulic characterization; recommendations including estimates of volumes and areas of media requiring remediation; evaluation of realistic exposure pathways and exposed populations; evaluation of a range of proven and reliable remedial alternatives that mitigate risks; summary; and conclusions.

c) The draft RI/RA/FS report shall be submitted to Ecology for review and comment within ninety (90) calendar days of completion of field work and receipt of analytical results. Ecology shall provide written comments within forty-five (45) calendar days of receipt of the draft report. Chevron shall complete a final report within thirty (30) calendar days of receipt of Ecology's comments.

3. OTHER SITE WORK NOT INCLUDED IN WORK ITEMS 1 THROUGH 2

No investigative or remedial work shall be done at the Site unless the work is done under the MTCA process in conjunction with this Order. Ecology may amend the Order if the proposed additional work is considered significant.

4. SCHEDULE

1. Draft Work Plan	Within 90 days of the effective date of this Order.
2. Ecology's comments on Draft Work Plan	Within 30 days of the receipt of the Draft Work Plan.
3. Final Work Plan	Within 30 days of the receipt of Ecology's comments
4. RI/RA/FS Draft Report	Within 90 days of completion of field work and receipt of analytical results, but not later than 180 days of the effective date of this Order.
5. Ecology's comments on Draft RI/RA/FS Report	Within 45 days of the receipt of the RI/RA/FS Draft report.
6. RI/RA/FS Final Report	Within 30 days of the receipt of the Ecology's comments.

V.
TERMS AND CONDITIONS OF ORDER

1. **Definitions.**
Unless otherwise specified, the definitions set forth in ch. 70.105D RCW and ch. 173-340 WAC shall control the meanings of the terms used in this Order.

2. **Public Notices.**
RCW 70.105.D,030(2)(a) requires that, at a minimum, this Order be subject to concurrent public notice. Ecology shall be responsible for providing such public notice and reserves the right to modify or withdraw any provisions of this Order should public comment disclose facts or considerations which indicate to Ecology that the Order is inadequate or improper in any respect.

3. **Remedial Action Costs.**
Chevron U.S.A. Products Company (Chevron) shall pay to Ecology costs incurred by Ecology as defined in WAC 173-340-550(2). Chevron shall pay the required amount within 90 days of receiving from Ecology an itemized statement of costs that includes a summary of costs incurred, an identification of involved staff, the amount of time spent by involved staff members on the project and a general description of work performed if requested by Chevron. Itemized statements shall be prepared quarterly. Failure to pay Ecology's costs within 90 days of receipt of the general description will result in interest charges.

4. **Designated Project Coordinators.**
The project coordinator for Ecology is:
Name: Marcel Szyszkowski, P.E.
Address: Southwest Regional Office
PO Box 47775, Olympia, WA 98504-7775
Telephone: (360) 407-6363
E-mail: mszy461@ecy.wa.gov

The project coordinator for Chevron is:
Name: Brett Hunter
Address: P.O. Box 6004
6001 Bollinger Canyon Rd. Rm. L4064
San Ramon, CA 94583-0904

The project coordinator(s) shall be responsible for overseeing the implementation of this Order. To the maximum extent possible, communications between Ecology and Chevron, and all documents, including reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order, shall be directed through the project coordinator(s). Should Ecology or Chevron change project coordinator(s), written notification shall be provided to Ecology or Chevron at least ten (10) calendar days prior to the change.

5. **Performance.**
All work performed pursuant to this Order shall be under the direction and supervision, as necessary, of a professional engineer or professional hydrogeologist, or similar expert, with appropriate training, experience and expertise in hazardous waste site investigation and cleanup. Chevron shall notify Ecology as to the identity of such engineer(s) or hydrogeologist(s), and of any contractors and subcontractors to be used in carrying out the terms of this Order in advance of their involvement at the Site. Chevron shall provide a copy of this Order to all agents, contractors, and subcontractors retained to perform work required by this Order and shall ensure that all work undertaken by such agents, contractors and subcontractors will be in compliance with this Order.

Except where necessary to abate an emergency situation, Chevron shall not perform any remedial actions at the former Chevron Site outside that required by this Order unless Ecology concurs, in writing, with such additional remedial actions.

WAC 173-340-400(7)(b)(i) requires that "construction" performed on the Site must be under the supervision of a professional engineer registered in Washington.

6. Access.
Upon providing at least twenty four (24) hours notice to Chevron, Ecology or any Ecology authorized representative shall have the authority to enter and freely move about the Site at all reasonable times for the purposes of, inter alia: inspecting records, operation logs, and contracts related to the work being performed pursuant to this Order; reviewing the progress in carrying out the terms of this Order; conducting such tests or collecting samples as Ecology or the project coordinator may deem necessary; using a camera, sound recording, or other documentary type equipment to record work done pursuant to this Order; and verifying the data submitted to Ecology by Chevron. By signing this Order, Chevron agrees that this Order constitutes reasonable notice of access, and agrees to allow access to the Site at all reasonable times for purposes of overseeing work performed under this Order. Ecology shall allow split or replicate samples to be taken by Chevron during an inspection unless doing so interferes with Ecology's sampling. Ecology shall provide Chevron reasonable notice before any sampling event. Chevron shall allow split or replicate samples to be taken by Ecology and shall provide seven (7) days notice before any sampling activity.

7. **Public Participation**.
Chevron shall prepare and/or update a public participation plan for the Site. Ecology shall maintain the responsibility for public participation at the Site.

8. **Retention of Records**.
Chevron shall preserve in a readily retrievable fashion, during the pendency of this Order and for ten (10) years from the date of completion of the work performed pursuant to this Order, all records, reports, documents, and underlying data in its possession relevant to this Order. Should any portion of the work performed hereunder be undertaken through contractors or agents of Chevron, Chevron agrees to include in their contract with such contractors or agents a record retention requirement meeting the terms of this paragraph.

9. **Dispute Resolution**.
Chevron may request Ecology to resolve disputes which may arise during the implementation of this Order. Such request shall be in writing and directed to the signatory, or his/her successor(s), to this Order. Ecology resolution of the dispute shall be binding and final. Chevron is not relieved of any requirement of this Order during the pendency of the dispute and remains responsible for timely compliance with the terms of the Order unless otherwise provided by Ecology in writing.

10. **Reservation of Rights/No Settlement**.
This Order is not a settlement under ch. 70.105D RCW. Ecology's signature on this Order in no way constitutes a covenant not to sue or a compromise of any Ecology rights or authority. Ecology will not, however, bring an action against Chevron to recover remedial action costs paid to and received by Ecology under this Order. In addition, Ecology will not take additional enforcement actions against Chevron to require those remedial actions required by this Order, provided Chevron complies with this Order.

Ecology reserves the right, however, to require additional remedial actions at the Site should it deem such actions necessary.

Ecology also reserves all rights regarding the injury to, destruction of, or loss of natural resources resulting from the releases or threatened releases of hazardous substances from the former Chevron facility.

In the event Ecology determines that conditions at the Site are creating or have the potential to create a danger to the health or welfare of the people on the Site, or in the surrounding area, or to the environment, Ecology may order Chevron to stop further implementation of this Order for such period of time as needed to abate the danger.

11. Transference of Property.
No voluntary or involuntary conveyance or relinquishment or title, easement, leasehold, or other interest in any portion of the Site shall be consummated by Chevron without provision for continued implementation of all requirements of this Order and implementation of any remedial actions found to be necessary as a result of this Order.

Prior to transfer of any legal or equitable interest Chevron may have in the Site or any portions thereof, Chevron shall serve a copy of this Order upon any prospective purchaser, lessee, transferee, assignee, or other successor in

such interest. At least thirty (30) days prior to finalization of any transfer, Chevron shall notify Ecology of the contemplated transfer.

12. Compliance with Applicable Laws.
    A. All actions carried out by Chevron pursuant to this Order shall be done in accordance with all applicable federal, state, and local requirements, including requirements to obtain necessary permits, except as provided in paragraph B of this section.
    B. Pursuant to RCW 70.105D.090(1), the substantive requirements of chapters 70.94,70.95,70.105,75.20,90.48, and 90.58 RCW and of any laws requiring or authorizing local government permits or approvals for the remedial action under this Order that are known to be applicable at the time of issuance of the Order have been included in Attachment A and are binding and enforceable requirements of the Order.

Chevron has a continuing obligation to determine whether additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order. In the event Chevron determines that additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order, it shall promptly notify Ecology of this determination. Ecology shall determine whether Ecology or Chevron shall be responsible to contact the appropriate state and/or local agencies. If Ecology so requires, Chevron shall promptly consult with the appropriate state and/or local agencies and provide Ecology with written documentation from those agencies of the substantive requirements those agencies believe are applicable to the remedial action. Ecology shall make the final determination on the additional substantive requirements that must be met by Chevron and how Chevron must meet those requirements. Ecology shall inform Chevron in writing of these requirements. Once established by Ecology, the additional requirements shall be enforceable requirements of this Order. Chevron shall not begin or continue the remedial action potentially subject to the additional requirements until Ecology makes its final determination.

Ecology shall ensure that notice and opportunity for comment is provided to the public and appropriate agencies prior to establishing the substantive requirements under this section.

    C. Pursuant to RCW 70.105D.090(2), in the event Ecology determines that the exemption from complying with the procedural requirements of the laws referenced in RCW 70.105D.090(1) would result in the loss of approval from a federal agency which is necessary for the state to administer any federal law, the exemption shall not apply and Chevron shall comply with both the procedural and substantive requirements of the laws referenced in RCW 70.105D.090(1), including any requirements to obtain permits.

VI.
SATISFACTION OF THIS ORDER

The provisions of this Order shall be deemed satisfied upon Chevron's receipt of written notification from Ecology that Chevron has completed the remedial activity required by this Order, as amended by any modifications, and that all other provisions of this Order have been complied with.

VII.
ENFORCEMENT

1. Pursuant to RCW 70.105D.050, this Order may be enforced as follows:
    A. The Attorney General may bring an action to enforce this Order in a state or federal court.
    B. The Attorney General may seek, by filing an action, if necessary, to recover amounts spent by Ecology for investigative and remedial actions and orders related to the Site.
    C. In the event Chevron refuses, without sufficient cause, to comply with any term of this Order, Chevron will be liable for:
        (1) up to three times the amount of any costs incurred by the state of Washington as a result of its refusal to comply; and
        (2) Civil penalties of up to $25,000 per day for each day it refuses to comply.
    D. This Order is not appealable to the Washington Pollution Control Hearings Board. This Order may be reviewed only as provided under Section 6 of ch. 70.105D RCW.

Effective date of this Order: _____

CHEVRON

By _____
David Wickland
Office Manager
Chevron Environmental Management Company
San Ramon, CA

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

By _____
Rebecca S. Lawson, P.E.
Regional Section Manager
Southwest Regional Office
Toxics Cleanup Program

ATTACHMENT A

The known permits and rules that are pertinent to this Order and their respective substantive requirements are listed below. A contact and phone number are provided for the state agency or local government that would typically administer each permit or applicable regulations. Ecology will make a final determination regarding which substantive requirements will apply in situations where requirements conflict.

Regulations pertinent to this action:

1. State of Washington, Hazardous Waste Management, Ecology (Contact: Dee Williams, 360-690-7120)

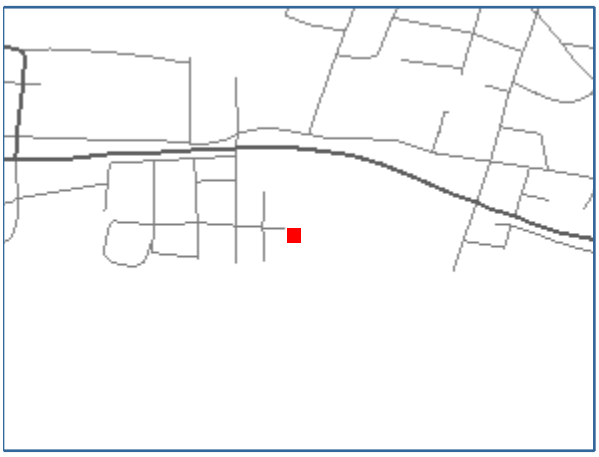
- The remedial action shall provide for management or disposal of dangerous wastes or hazardous wastes in a manner in compliance with regulations under Chapter 173-303-WAC. Wastes shall be designated and managed in compliance with the Site Work Plans. Hazardous waste manifests shall be used to track the transfer and disposal of hazardous wastes.

2. Local Health Department - Solid Waste Regulations (Contact: Gary Bickett, 360-397-8061)

- This project shall comply with Southwest Washington Health District provisions for acceptance of any soils to be disposed of at a landfill in the State of Washington, according to criteria developed for the specific Site.

Facility/Site: 4399598 HAMBLETON BROS LOG YARD

Also known as: HAMBLETON BROS LOG YARD, HAMBLETON LOG POND



Larger Map

Larger Map

Address

335 S A ST

WASHOUGAL WA 98671-2138

Decimal Coordinates

Latitude: 45.57889

Longitude: -122.37611

Geographic Information

Ecology Region: SWRO

County: Clark

Legislative District: 18

Congressional District: 3

WRIA: 28

Tribal Land: No

Ecology Interactions

Interaction Description	Ecology Program	Ecology Program Phone	Program ID	Start Date	End Date
State Cleanup Site	TOXICS	(360) 407-7224		10/15/2008	
General Permit Storm Water Ind	WATQUAL	(360) 407-6400	SO3002129	9/20/2002	

Report generated on 08-05-2009

Clark COUNTY

Site ID: **4399598** **HAMBLETON BROS LOG YARD**

LOCATION

Address: 335 S A ST
WASHOUGAL, 98671-2138

Lat/Long: 45.578 -122.376
Township/Range/Section: 1N 3E 13
(View Map)

Legislative District: 18
Congressional District: 3

STATUS

Ecology Status: Awaiting SHA
Independent Status:
Site Type:
Statute: MTCA only
WARM BIN#:
Brownfield: ☐ **Restrictive Covenant:** ☐ **PSI:** ☐
No Further Action (NFA):

Responsible Unit: SOUTHWEST
Site Manager: MATTHEWS, CRIS
Entered Date: 10/16/2008
Last Update Date: 10/16/2008
LUST ID:
ERTS ID:
NFA Date:

SITE ACTIVITIES

Activity	Status	Start Date	End Date	Legal Mechanism	Project Manager
Site Discovery/Report Received	Completed	10/15/2008	10/15/2008		MATTHEWS, CRIS
Early Notice Letter(s)	Completed	10/16/2008	10/16/2008		CROSS, KIM

AFFECTED MEDIA & CONTAMINANTS DATA

Contaminants:

Media	3	5	7	8	11
Soil- C	C	C	C		
Groundwater- C	C				
Sediment- C	C			C	
Surface Water- C	C		C	C	C

CONTAMINANT KEY

#1 = Base/Neutral Organics
#2 = Halogenated Organics
#3 = Metals-Priority Pollutants
#4 = Metals-Other
#5 = PCB
#6 = Pesticides
#7 = Petroleum Products
#8 = Phenolic Compounds
#9 = Non-Halogenated Solvents
#10 = Dioxins
#11 = PAH
#12 = Reactive Wastes
#13 = Corrosive Wastes
#14 = Radioactive Wastes
#15 = Conventional Contaminants, Organic
#16 = Conventional Contaminants, Inorganic
#17 = Asbestos
#18 = Arsenic
#19 = MTBE
#20 = Unexploded Ordnance (UXO)
(21-24 Sediment only)
#21 = Tributyl Tin
#22 = Bioassay/Benthic Failures
#23 = Wood Debris
#24 = Other

PCB = PolyChlorinated BiPhenyls PAH = Polynuclear Aromatic Hydrocarbons MTBE = Methyl Tertiary-Butyl Ether

B = Below MTCA Cleanup Levels; C = Confirmed; R = Remediated; S = Suspected

Industrial Codes (External Links Below)

No NAICS information is available for this facility site.

SIC Code	SIC Description
2421	SAWMILLS & PLANNING MILLS, GEN
5031	LUMBER, PLYWOOD, AND MILLWORK

Report generated on 08-05-2009

COUNTY - CLARK (1 sites)

Site Name: HAMBLETON BROS LOG YARD

FS ID: 4399598

Address 335 S A ST
WASHOUGAL, WA 98671
(View Map) Lat: 45.57888 / Long: -122.37611

Rank ---
PSI ☐
VCP ☐
Brownfield ☐

Entered Date October 16, 2008
Last Update October 16, 2008
Resp. Unit Southwest
Ecology Status Awaiting SHA

ACTIVITY	STATUS	START	END	LEGAL
Site Discovery/Report Received	C	10/15/2008	10/15/2008	
Early Notice Letter(s)	C	10/16/2008	10/16/2008	

Media	Contaminant 3	5	7	8	11
Soil- C	C	C	C		
Groundwater- C	C				
Sediment- C	C			C	
Surface Water- C	C		C	C	C

*hover over boxes above for details

Report Statistics

Number of Counties.	1	Number of Brownfield Sites	0
Total Number of Resp. Units	1	Number of VCP Sites	0
Number of Regions	1	Number of Puget Sound Initiative Sites	0
Total Number of Sites	1	Number of Ranked Sites	0

COUNTY - CLARK (1 sites)

Site Name: COLUMBIA ROCK CONCRETE PRODUCTS INC

FS ID: 5016308

Address 1615 SE 6TH AVE
CAMAS, WA 98607
(View Map) Lat: 45.58388 / Long: -122.39166

Rank 2
PSI ☐
VCP ☐
Brownfield ☐

Entered Date April 26, 2004
Last Update February 7, 2008
Resp. Unit Southwest
Ecology Status Ranked, Awaiting RA

ACTIVITY	STATUS	START	END	LEGAL
Initial Investigation	C	9/11/2003	4/26/2004	
Early Notice Letter(s)	C	4/26/2004	4/26/2004	
Site Hazard Assessment	C	2/27/2006	1/4/2007	
Hazardous Sites Listing	C	1/4/2007	1/4/2007	

Media	Contaminant	
	3	7
Soil- C	S	C
Groundwater- C	C	S

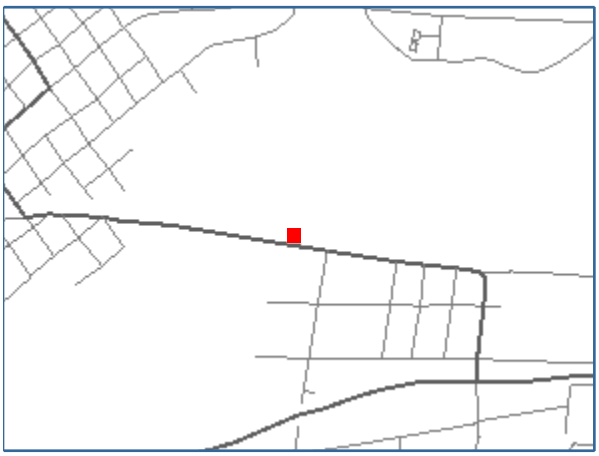
*hover over boxes above for details

Report Statistics

Number of Counties.	1	Number of Brownfield Sites	0
Total Number of Resp. Units	1	Number of VCP Sites	0
Number of Regions	1	Number of Puget Sound Initiative Sites	0
Total Number of Sites	1	Number of Ranked Sites	1

Facility/Site: 5016308 COLUMBIA ROCK CONCRETE PRODUCTS INC

Also known as: COLUMBIA ROCK CONCRETE PRODUCTS INC



Larger Map

Larger Map

Address

1615 SE 6TH AVE

CAMAS WA 98607

Decimal Coordinates

Latitude: 45.58389

Longitude: -122.39167

Geographic Information

Ecology Region: SWRO

County: Clark

Legislative District: 18

Congressional District: 3

WRIA: 28

Tribal Land: No

Ecology Interactions

Interaction Description	Ecology Program	Ecology Program Phone	Program ID	Start Date	End Date
State Cleanup Site	TOXICS	(360) 407-7224		9/11/2003	

Report generated on 08-05-2009

Clark COUNTY

Site ID: **5016308** **COLUMBIA ROCK CONCRETE PRODUCTS INC**

LOCATION

Address: 1615 SE 6TH AVE
CAMAS, 98607

Lat/Long: 45.583 -122.391
Township/Range/Section: 1N 3E 48
(View Map)

Legislative District: 18
Congressional District: 3

STATUS

Ecology Status: Ranked, Awaiting RA
Independent Status:
Site Type:
Statute: MTCA only
WARM BIN#: 2
Brownfield: ☐ **Restrictive Covenant:** ☐ **PSI:** ☐
No Further Action (NFA):

Responsible Unit: SOUTHWEST
Site Manager: SOUTHWEST REGION
Entered Date: 4/26/2004
Last Update Date: 2/7/2008
LUST ID:
ERTS ID:
NFA Date:

SITE ACTIVITIES

Activity	Status	Start Date	End Date	Legal Mechanism	Project Manager
Early Notice Letter(s)	Completed	4/26/2004	4/26/2004		CROSS, KIM
Initial Investigation	Completed	9/11/2003	4/26/2004		COUNTY HEALTH-SW
Site Hazard Assessment	Completed	2/27/2006	1/4/2007		LOCAL GOVERNMENT-SW
Hazardous Sites Listing	Completed	1/4/2007	1/4/2007		SOUTHWEST REGION

AFFECTED MEDIA & CONTAMINANTS DATA

Contaminants:

Media	3	7
Soil- C	S	C
Groundwater- C	C	S

CONTAMINANT KEY

#1 = Base/Neutral Organics
#2 = Halogenated Organics
#3 = Metals-Priority Pollutants
#4 = Metals-Other
#5 = PCB
#6 = Pesticides
#7 = Petroleum Products
#8 = Phenolic Compounds
#9 = Non-Halogenated Solvents
#10 = Dioxins
#11 = PAH
#12 = Reactive Wastes
#13 = Corrosive Wastes
#14 = Radioactive Wastes
#15 = Conventional Contaminants, Organic
#16 = Conventional Contaminants, Inorganic
#17 = Asbestos
#18 = Arsenic
#19 = MTBE
#20 = Unexploded Ordnance (UXO)
(21-24 Sediment only)
#21 = Tributyl Tin
#22 = Bioassay/Benthic Failures
#23 = Wood Debris
#24 = Other

PCB = PolyChlorinated BiPhenyls PAH = Polynuclear Aromatic Hydrocarbons MTBE = Methyl Tertiary-Butyl Ether

B = Below MTCA Cleanup Levels; C = Confirmed; R = Remediated; S = Suspected

Industrial Codes (External Links Below)

No NAICS information is available for this facility site.

SIC Code	SIC Description
3272	CONCRETE PRODUCTS, NEC

Report generated on 08-05-2009

Facility/Site: HI WAY FUEL 22538744

Also known as:

Larger Map

Larger Map

Address

1250 E ST

WASHOUGAL WA 98671

Decimal Coordinates

Latitude: 45.58122

Longitude: -122.35839

Geographic Information

Ecology Region: SWRO

County: Clark

Legislative District: 18

Congressional District: 3

WRIA: 28

Tribal Land: No

Ecology Interactions

Interaction Description	Ecology Program	Ecology Program Phone	Program ID	Start Date	End Date
LUST Facility	TOXICS	(360) 407-7224	102163	8/21/1996	
Underground Storage Tank	TOXICS	(360) 407-7224	102163	6/1/1978	

Report generated on 08-05-2009

Leaking Underground Storage Tanks List

August 6, 2009

Legend on last page.

Southwest Region

Clark County, City of Washougal

	Facility Site ID:	UST ID:	Lat/Long:
HI-WAY FUEL 1250 E ST WASHOUGAL, 98671	22538744	102163	45.58122 -122.35839

Release ID: 377975

Media Affected:	Status:	Status Date:
Ground Water, Soil	Awaiting Cleanup	11/12/1996
	Cleanup Started	8/21/1996

About the Leaking Underground Storage Tanks Site List:

The Cleanup Status assigned by the Department of Ecology to a Leaking Underground Tank Site is based on an informal review of the information we have received regarding the cleanup. A formal review could determine that the site has not been cleaned up to Model Toxics Control Act standards. Formal reviews including potential No Further Action determinations are available under the fee-based Voluntary Cleanup Program.

Cleanup Status Definitions:

Awaiting Cleanup -- Discovered or reported release, yet no active cleanup measures taken; or,
Site check (identified the source) begun or completed, yet no active cleanup measures taken; or,
Site characterization begun or completed, yet no active cleanup measures taken.

Cleanup Started -- Responsible party has initiated physical, biological, or chemical management of release (e.g. soil excavated, groundwater pumped, vapors extracted, free product removed, oxygen added, etc.). Site investigations and emergency responses (e.g. venting explosive vapors, providing bottled water) do not qualify as activities under Cleanup Started.

Monitoring -- Groundwater monitoring is the only activity occurring at the site; or, Site has been characterized, only low levels of soil and/or groundwater contamination remain, and natural attenuation is the chosen cleanup method; or, Confirmational monitoring following active cleanup measures.

Reported Cleaned Up -- Owner or consultant reports that contamination has been cleaned up; and/or.
Some soil contamination may remain under existing structures or in otherwise inaccessible areas if groundwater is not threatened and there has been no migration of contamination into the structure; and,
Cleanup report has not been formally reviewed by Ecology. A formal review could determine that the site has not been cleaned up to MTCA standards.

No Further Action -- Cleanup report has been formally reviewed by Ecology under the fee-based Voluntary Cleanup Program and resulted in a No Further Action status; and, Institutional controls may have been required due to soil contamination that may remain under existing structures or in otherwise inaccessible areas.

TCP/TCP_web_reporting/LUSTList.rdl

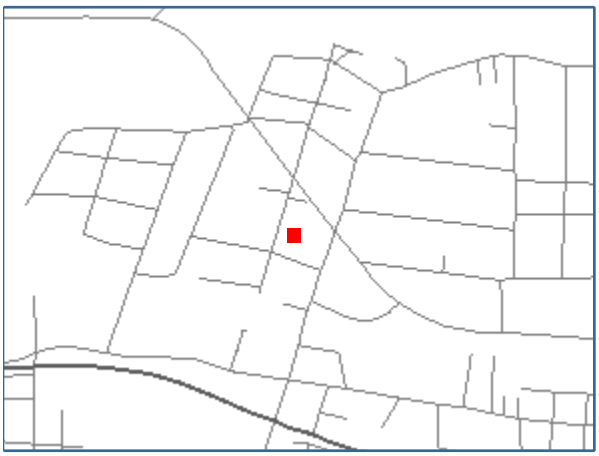
Industrial Codes (External Links Below)

No NAICS information is available for this facility site.	No SIC information is available for this facility site.

Report generated on 08-05-2009

Facility/Site: 85837922 GOODYEAR TIRE CAMAS

Also known as: GOODYEAR TIRE CAMAS, SCHUCKS AUTO SUPPLY



Larger Map

Larger Map

Address

3440 3RD AVE

CAMAS WA 98607

Decimal Coordinates

Latitude: 45.5838

Longitude: -122.36929

Geographic Information

Ecology Region: SWRO

County: Clark

Legislative District: 18

Congressional District: 3

WRIA: 28

Tribal Land: No

Ecology Interactions

Interaction Description	Ecology Program	Ecology Program Phone	Program ID	Start Date	End Date
Voluntary Cleanup Sites	TOXICS	(360) 407-7224		8/3/2001	9/6/2001
LUST Facility	TOXICS	(360) 407-7224	496977	5/27/1999	9/6/2001

Report generated on 08-05-2009

Clark COUNTY

Site ID: 85837922 GOODYEAR TIRE CAMAS

LOCATION

Address: 3440 3RD AVE
CAMAS, 98607

Lat/Long: 45.583 -122.369
Township/Range/Section: 1N 4E 53
(View Map)

Legislative District: 18
Congressional District: 3

STATUS

Ecology Status: RA and all other activities completed
Independent Status:
Site Type: VCP
Statute: MTCA only
WARM BIN#:
Brownfield: ☐ **Restrictive Covenant:** ☐ **PSI:** ☐
No Further Action (NFA): NFA after assessment, IRAP, or VCP

Responsible Unit: SOUTHWEST
Site Manager: SZYSZKOWSKI, MARCEL
Entered Date: 8/3/2001
Last Update Date: 3/7/2002
LUST ID: 496977
ERTS ID:
NFA Date: 9/4/2001

SITE ACTIVITIES

Activity	Status	Start Date	End Date	Legal Mechanism	Project Manager
Site Discovery/Report Received	Completed	5/1/1999	5/27/1999	Independent	SZYSZKOWSKI, MARCEL
Routine Cleanup	Completed	5/27/1999	9/13/1999	Independent	SZYSZKOWSKI, MARCEL
Voluntary Cleanup Program	Completed	8/3/2001	9/6/2001	Independent	SZYSZKOWSKI, MARCEL

AFFECTED MEDIA & CONTAMINANTS DATA

Media	Contaminants: 2	7
Soil- R	R	R

CONTAMINANT KEY

#1 = Base/Neutral Organics
#2 = Halogenated Organics
#3 = Metals-Priority Pollutants
#4 = Metals-Other
#5 = PCB
#6 = Pesticides
#7 = Petroleum Products
#8 = Phenolic Compounds
#9 = Non-Halogenated Solvents
#10 = Dioxins
#11 = PAH
#12 = Reactive Wastes
#13 = Corrosive Wastes
#14 = Radioactive Wastes
#15 = Conventional Contaminants, Organic
#16 = Conventional Contaminants, Inorganic
#17 = Asbestos
#18 = Arsenic
#19 = MTBE
#20 = Unexploded Ordnance (UXO)
(21-24 Sediment only)
#21 = Tributyl Tin
#22 = Bioassay/Benthic Failures
#23 = Wood Debris
#24 = Other

PCB = PolyChlorinated BiPhenyls PAH = Polynuclear Aromatic Hydrocarbons MTBE = Methyl Tertiary-Butyl Ether

B = Below MTCA Cleanup Levels; C = Confirmed; R = Remediated; S = Suspected

VOLUNTARY CLEANUP PROGRAM DETAILS

VCP#	Submitted	10-day PM	Project Status	Status Date
SW0350	8/3/2001	n/a	Project Completed	3/7/2002

Project Activity	Activity Status	Status Date	Decision Date	90-day PM
Final Cleanup Report	Completed Consultation	8/3/2001	9/4/2001	n/a

* PM = Performance Measure

Underground Storage Tank	TOXICS	(360) 407-7224	496977	5/10/1999	1/23/2007

Industrial Codes (External Links Below)

No NAICS information is available for this facility site.

SIC Code	SIC Description
5014	TIRES AND TUBES

Report generated on 08-05-2009

Appendix Q

Watershed Control Program

WATERSHED PROTECTION PROGRAM

The City of Camas Watershed consists of two watershed areas in the Washougal River Drainage System. Jones Creek and Boulder Creek have their own distinct watersheds that water is collected from for the City of Camas. Both watersheds are bordered by Department of Natural Resources property and Longview Fibre property. The City of Camas owns a total of 1,720 acres combined in these watersheds.

City personnel patrol a part of the watershed each time that they visit the screen chambers for cleaning. This occurs on Mondays and Fridays during most of the year. During the fall when the leaves are falling, daily visits are necessary. Patrolling of upstream areas of the watershed are done on an annual basis. If beaver dams are located, a trapper is notified to remove them from locations upstream from water intakes.

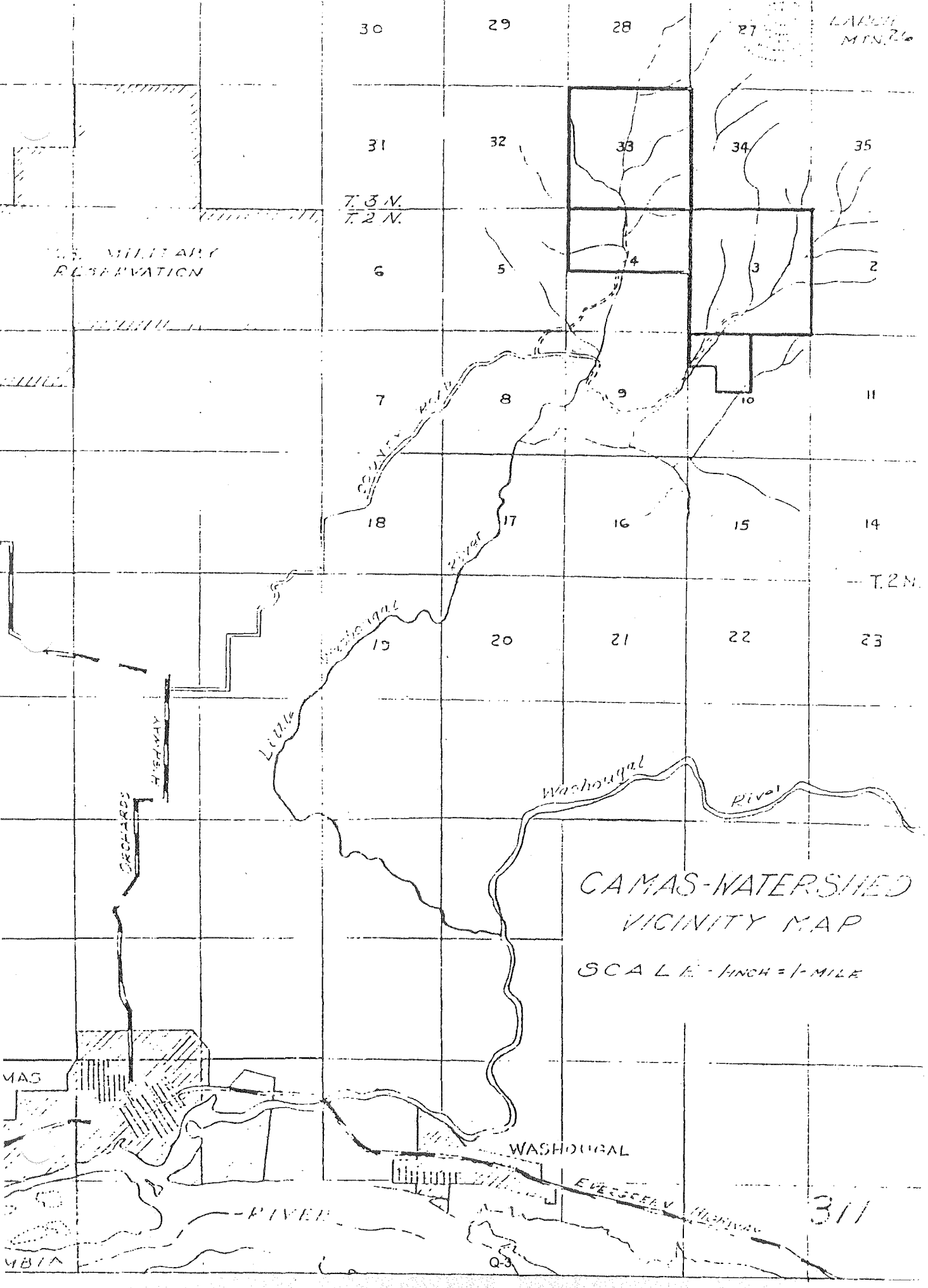
The City of Camas has agreements with all neighboring property to owners to notify city personnel of any activities anticipated in the watershed areas. Activities of concern include spraying, fertilizing, logging, road building, etc. We are fortunate that our neighboring property owners are interested in preserving the watershed and have thus far been very cooperative. In 1986, the DNR wanted to perform some fertilizing of a stand of timber in the watershed. With the help of the Department of Health, a sampling plan was established that would be required of them if they did the fertilizing. After a cost analysis was done, they determined that the gain would not equal the expense of the sampling program.

Near the Jones Creek Watershed is a recreational vehicle area that is patrolled by DNR personnel. The City of Camas and the DNR have cooperatively performed sign posting, gating and we are in the process of planning fencing of portions of the watershed to keep people and vehicles out. The City's service entrances are also gated and posted to keep people from entering. The City's goal is to prohibit all entrance into the watershed area. Chapter 13.56 of the Camas Municipal Code prohibits entry into the watershed and establishes a penalty for trespass.

The long term goal of the City of Camas is to purchase all of the property within the Jones and Boulder Creek watershed areas. This purchase was recently placed on the Capital Improvement Plan for the years 2010-2014.

The continued efforts to protect the water quality in the watershed can be summarized by the following:

- Review all activities in and around the watershed through SEPA checklist review process.
- Patrol watershed on regular basis.
- Coordinate efforts with DNR to maintain signs, gates, fences, etc.
- Maintain agreements with neighboring property owners.
- Purchase all property within the watersheds.


CAMAS-WATERSHED
VICINITY MAP
SCALE - 1 INCH = 1 MILE
T. 3 N.
T. 2 N.
T. 2 N.
MILITARY
RESERVATION
LARCH
MTN.
Washougal
River
Little
Washougal
River
ORCHARDS
HIGHWAY
WASHOUGAL
EVERGREEN HIGHWAY
RIVER
311
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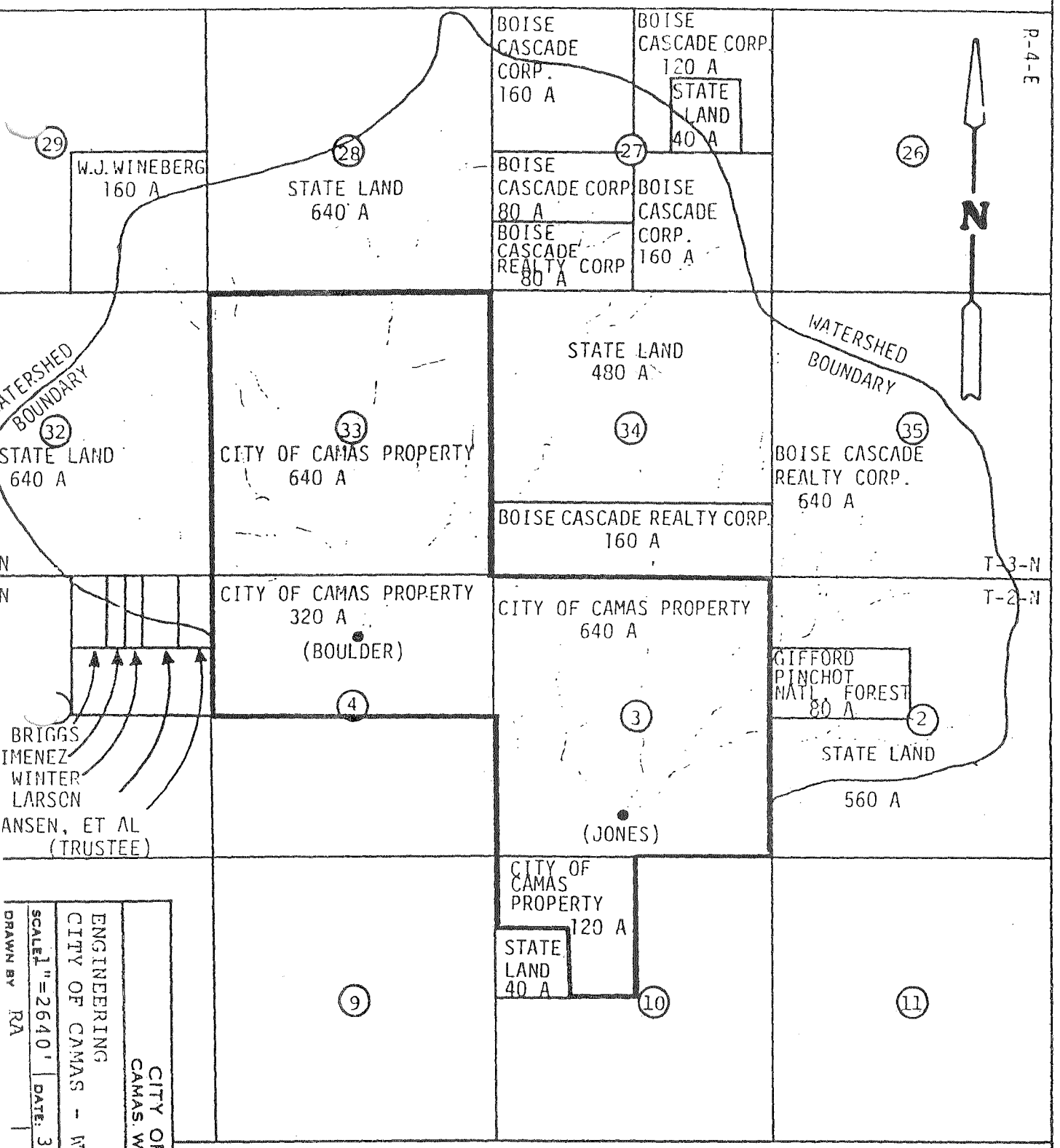


CITY OF CAMAS, WASHINGTON
BOULDER CREEK AND JONES CREEK WATERSHED

CITY OF CAMAS
IS A WATER PURVEYOR OF
A CLASS 1 SYSTEM

CITY OF CAMAS
CAMAS, WASHINGTON
DEPARTMENT
ENGINEERING
CITY OF CAMAS - WATERSHED
SCALE 1"=2640'
DATE 3-11-83
DRAWN BY RA
SHEET 1

Appendix R

Consistency Statement

Washington State Department of Health

Local Government Consistency Review Checklist

A consistency review between DOH planning and engineering documents and adopted comprehensive plans and development regulations is required in certain situations. This checklist may be used to document the consistency review as required in WAC 246-290-108. A consistency review is required for each local government with jurisdiction over the applicable service area.

Water System Name: Camas Municipal Water & Sewer System PWS ID: 10800

Planning Document Title: Water System Plan Plan Date: June 2010

Local Government with Jurisdiction: City of Camas

Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
The applicable service area is consistent with the land use and zoning in the adopted comprehensive plan and adopted development regulations.	3-2, Figure 3-1	Yes
For Water System Plans: The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection was used, the alternative growth projection and methodology proposed is acceptable based on explanation given.	3-24, 3-25, 3-26	Yes
For Water System Plans: Provisions of water service for new service connections are consistent with the adopted comprehensive plan and adopted development regulations.	2-11	Yes
For city-owned systems only: All utility service extension ordinances regarding water service are included in the plan. These policies are consistent with the adopted comprehensive plan and adopted development regulations.		N/A
Other relevant elements related to water supply (as determined by DOH) is consistent with the adopted comprehensive plan and adopted development regulations.	Appendix P, Q Chapter 8	Yes
Where the local government with jurisdiction did not provide a Consistency Review: Provide documentation of efforts taken and amount of time provided. Include: name of contact, date, type of effort attempted, and response from local agency.		N/A

I certify that the above statements are true to the best of my knowledge and that these statements support the conclusion that the subject-planning document is consistent with adopted comprehensive plans, development regulations, and other policies.

Oliver Orjiako 6-9-2010

Signature Date

OLIVER ORJIAKO, DIRECTOR, CLARK COUNTY COMMUNITY PLANNING

Printed Name, Title, & Jurisdiction

****For any issues of inconsistency, please document the inconsistency, including the citation from the comprehensive plan or development regulation. Provide direction on how this inconsistency can be resolved.****

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Local Government Consistency Review Checklist

Water System Name: Camas Municipal Water & Sewer System PWS ID: 10800

Planning/Engineering Document Title: Draft Water System Plan Plan Date: January 2010

Local Government with Jurisdiction: City of Camas

WAC 246-290-108 Consistency with local plans and regulations:
Consistency with local plans and regulations applies to planning and engineering documents under WAC 246-290-106, 246-290-107, and 246-290-110(4)(b (ii).

1) Municipal water suppliers must include a consistency review and supporting documentation in its planning or engineering document describing how it has addressed consistency with **local plans and regulations**. This review must include specific elements of local plans and regulations, as they reasonably relate to water service as determined by Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	Figures 3-1, 3-1A	Yes
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	3-10, 3-24 through 3-26	Yes
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.	2-10, 2-11	Yes
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].	2-11	Yes
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Reclaimed Water plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans.	Chapter 8, Appendices P, Q	Yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature 6-3-10 Date

Phillip Bourquin, Community Development Director, City of Camas
Printed Name, Title, & Jurisdiction

Consistency Review Guidance

For Use by Local Governments and Municipal Water Suppliers

This checklist may be used to meet the requirements of WAC 246-290-108. When using an alternative format, it must describe all of the elements; 1a), b), c), d), and e), when they apply.

For **water system plans (WSP)**, a consistency review is required for the retail service area and any additional areas where a municipal water supplier wants to expand its water right's place of use.

For **small water system management programs**, a consistency review is only required for areas where a municipal water supplier wants to expand its water right's place of use. If no water right place of use expansion is requested, a consistency review is not required.

For **engineering documents**, a consistency review is required for areas where a municipal water supplier wants to expand its water right's place of use (water system plan amendment is required). For non-community water systems, a consistency review is required when requesting a place of use expansion. All engineering documents must be submitted with a service area map per WAC 246-290-110(4)(b)(ii).

A) Documenting Consistency: Municipal water suppliers must document all of the elements in a consistency review per WAC 246-290-108.

1 a) Provide a copy of the adopted **land use/zoning** map corresponding to the service area. The uses provided in the WSP should be consistent with the adopted land use/zoning map. Include any other portions of comprehensive plans or development regulations that are related to water supply planning.

1 b) Include a copy of the **six-year growth projections** that corresponds to the service area. If the local population growth rate projections are not used, provide a detailed explanation on why the chosen projections more accurately describe the expected growth rate. Explain how it is consistent with the adopted land use.

1c) Include water service area policies and show that they are consistent with the **utility service extension ordinances** within the city or town boundaries. This applies to cities and towns only.

1 d) Include all **service area policies** for how new water service will be provided to new customers.

1 e) **Other relevant elements** related to water supply planning as determined by the department (DOH). See Local Government Consistency – Other Relevant Elements, Policy B.07, September 2009.

B) Documenting an Inconsistency: Please document the inconsistency, include the citation from the comprehensive plan or development regulation, and provide direction on how this inconsistency can be resolved.

C) Documenting Lack of Consistency Review by Local Government: Where the local government with jurisdiction did not provide a consistency review, document efforts made and the amount of time provided to the local government for their review. Please include: name of contact, date, and efforts made (letters, phone calls, and e-mails). In order to self-certify, please contact the DOH Planner.

The Department of Health is an equal opportunity agency. For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388).

Appendix S

Detailed Cost Estimates

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-2
Forest Home Booster Station Upgrade

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 20,400	$ 20,400
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 20,000	$ 20,000
4	CMU Building	500 SF	$ 200	$ 100,000
5	Piping and Appurtanences	1 EA	$ 50,000	$ 50,000
6	Booster Pumps	2 EA	$ 15,000	$ 30,000
7	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 45,000	$ 45,000
8	Automatic Transfer Switch	LUMP SUM	$ 6,500	$ 6,500

Subtotal	$ 274,900
Tax rate (8.2%)	22,542
Subtotal:	$ 297,442
Contingency (25%)	$ 74,358
Total Estimated Construction Cost	**$ 371,800**
Engineering and AdministrativeCosts (25%):	$ 93,000
Total Estimated Project Cost	**$ 464,800**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Transmission System Improvement

PROJECT NUMBER: T-2 **ESTIMATED COST:** $ 464,800

PRESSURE ZONE: 455 **YEAR TO BE COMPLETED:** 2012

PROJECT DESCRIPTION:

Forest Home Booster Station Upgrade

Upgrade from 1,000 gpm to 2,500 gpm. Includes a new building, 2 pumps, and auxillary generator

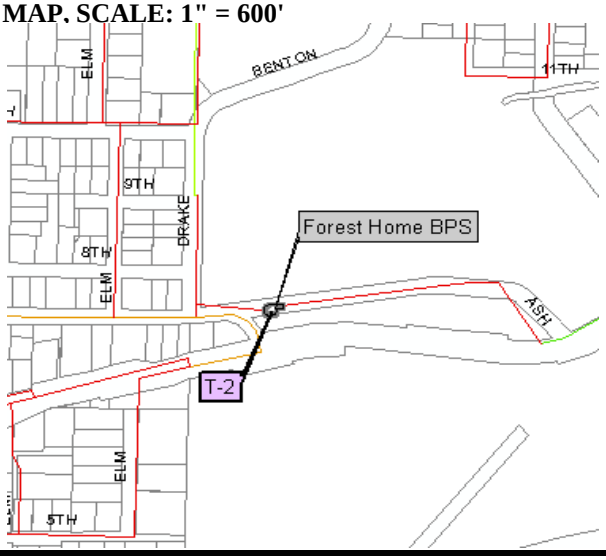
PROJECT BENEFIT:

To meet 6-year demands in the 455 Zone

COMMENTS:

Interium project as the Cemetery Reservoir and Booster Station are being constructed.

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering		93,000				
Construction		107,000	264,800			
Construction Management, Administration						
TOTAL	0	200,000	264,800	0	0	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,T-2

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-3
Forest Home Transmission Upgrade

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 16,000	$ 16,000
2	12-inch D.I. Water Pipe, Including Fittings	1,400 LF	$ 75	$ 105,000
3	Locate Existing Utilities	LUMP SUM	$ 4,000	$ 4,000
4	Erosion Control	LUMP SUM	$ 4,000	$ 4,000
5	Additional Pipe Fittings	1,150 LB	$ 2.50	$ 2,900
6	Trench Safety Systems	LUMP SUM	$ 2,800	$ 2,800
7	12-inch Gate Valves	2 EA	$ 2,250	$ 5,300
8	Fire Hydrants	4 EA	$ 4,000	$ 14,000
9	Gravel Backfill	1,312 TN	$ 15	$ 19,700
10	Foundation Gravel	148 TN	$ 35	$ 5,200
11	Asphalt Concrete Pavement Repair	109 TN	$ 80	$ 8,800
12	Crushed Surfacing, Top Course	100 TN	$ 25	$ 2,600
13	Cold Mix Asphalt	74 TN	$ 150	$ 11,100
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 7,000	$ 7,000
	Subtotal			$ 211,400
	Tax rate (8.2%)			17,335
	Subtotal:			$ 228,735
	Contingency (25%)			$ 57,265
	Total Estimated Construction Cost			**$ 286,000**
	Engineering and Administrative Costs (25%):			$ 72,000
	Total Estimated Project Cost			**$ 358,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Transmission System Improvement

PROJECT NUMBER: T-3 **ESTIMATED COST:** $ 358,000

PRESSURE ZONE: 343 and 455 **YEAR TO BE COMPLETED:** 2012

PROJECT DESCRIPTION:

Forest Home Transmission Upgrade

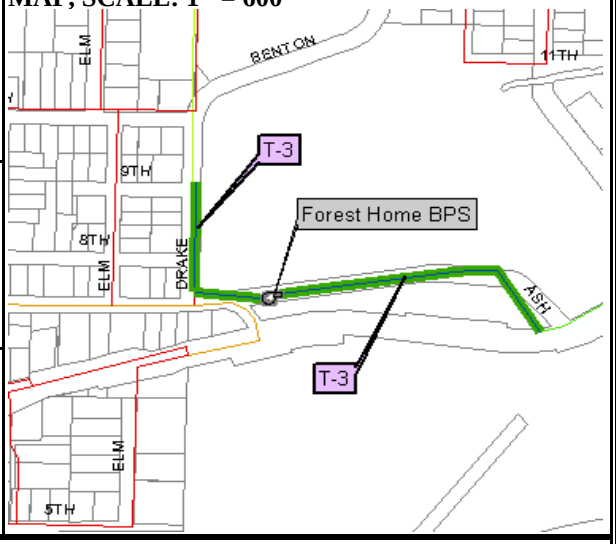
Replace approximately 1,400 LF of 6-inch pipe with 12-inch DI

PROJECT BENEFIT:

Increase transmission from the Washougal Wellfield to meet demands in the 455 Zone.

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering		72,000				
Construction		78,000	208,000			
Construction Management, Administration						
TOTAL	0	150,000	208,000	0	0	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,T-3

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-4
Crown Road 24-inch Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 131,000	$ 131,000
2	24-inch D.I. Water Pipe, Including Fittings	7,800 LF	$ 110	$ 858,000
3	Locate Existing Utilities	LUMP SUM	$ 31,300	$ 31,300
4	Erosion Control	LUMP SUM	$ 31,300	$ 31,300
5	Additional Pipe Fittings	5,460 LB	$ 2.50	$ 13,650
6	Trench Safety Systems	LUMP SUM	$ 15,600	$ 15,600
7	24-inch Butterfly Valves	13 EA	$ 27,500	$ 357,500
8	Fire Hydrants	20 EA	$ 4,000	$ 78,000
9	Gravel Backfill	6,356 TN	$ 15	$ 95,400
10	Foundation Gravel	715 TN	$ 35	$ 25,100
11	Asphalt Concrete Pavement Repair	530 TN	$ 80	$ 42,400
12	Crushed Surfacing, Top Course	486 TN	$ 25	$ 12,200
13	Cold Mix Asphalt	358 TN	$ 150	$ 53,700
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 10,000	$ 10,000
	Subtotal			$ 1,758,150
	Tax rate (8.2%)			144,168
	Subtotal:			$ 1,902,318
	Contingency (25%)			$ 475,682
	Total Estimated Construction Cost:			**$ 2,378,000**
	Engineering and Administrative Costs (25%):			$ 595,000
	Total Estimated Project Cost:			**$ 2,973,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Transmission System Improvement

PROJECT NUMBER: T-4 **ESTIMATED COST:** $ 2,973,000

PRESSURE ZONE: 343 and 542 **YEAR TO BE COMPLETED:** 2012

PROJECT DESCRIPTION:

Crown Road 24-inch Transmission Main

Install approximately 7,800 LF of DI main on the suction and discharge of the Crown Rd Booster Station to connect the 343 Zone to the 542 Zone.

PROJECT BENEFIT:

Increase transmission from the Washougal Wellfield to supply growth in the 542 Zone and NUGA.

COMMENTS:

Dependant on the rate of growth in the NUGA and 542 Zone.

MAP, SCALE: 1" = 3000'

SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering		595,000				
Construction		405,000	1,973,000			
Construction Management, Administration						
TOTAL	0	1,000,000	1,973,000	0	0	0

FUNDING SOURCE:

Developers: equivalent of an 8-inch main, approximately $1,465,000. Capital Fund: the remaining portion of the upgrade to 24-inch, approximately $1,508,000

CIP Forms.XLS,T-4

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-5
Crown Road Booster Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 31,200	$ 31,200
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 25,000	$ 25,000
4	CMU Building	500 SF	$ 200	$ 100,000
5	Piping and Appurtanences	1 EA	$ 50,000	$ 50,000
6	Booster Pumps	4 EA	$ 15,000	$ 60,000
7	Auxilary Power Generator	LUMP SUM	$ 50,000	$ 50,000
8	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 95,000	$ 95,000
9	Automatic Transfer Switch	LUMP SUM	$ 6,500	$ 6,500

Subtotal	$ 420,700
Tax rate (8.2%)	34,497
Subtotal:	$ 456,000
Contingency (25%)	$ 114,000
Total Estimated Construction Cost	**$ 570,000**
Engineering and AdministrativeCosts (25%):	$ 143,000
Total Estimated Project Cost	**$ 713,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Transmission System Improvement

PROJECT NUMBER: T-5 **ESTIMATED COST:** $ 713,000

PRESSURE ZONE: 542 **YEAR TO BE COMPLETED:** 2012

PROJECT DESCRIPTION:

Crown Road Booster Station

3,200 gpm booster station, includes new building, 4 pumps, and auxillary power generator

PROJECT BENEFIT:

Increase transmission from Washougal Wellfield to meet growth in the 542 Zone and NUGA.

COMMENTS:

Developers will pay for 70 percent of this project,

MAP, SCALE: 1" = 600'

SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering		143,000				
Construction		157,000	413,000			
Construction Management, Administration						
TOTAL	0	300,000	413,000	0	0	0

FUNDING SOURCE:

Developers: 70 percent, approximately $500,000. Capital Fund: remaining portion of project cost, approximately $213,000.

CIP Forms.XLS,T-5

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-7
NUGA 544 Zone - 24 inch Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 150,000	$ 150,000
2	24-inch D.I. Water Pipe, Including Fittings	19,650 LF	$ 110	$ 2,161,500
3	Locate Existing Utilities	LUMP SUM	$ 20,000	$ 20,000
4	Erosion Control	LUMP SUM	$ 20,000	$ 20,000
5	Additional Pipe Fittings	13,760 LB	$ 3.50	$ 48,160
6	Trench Safety Systems	LUMP SUM	$ 39,300	$ 39,300
7	24-inch Butterfly Valves	33 EA	$ 27,500	$ 907,500
8	Fire Hydrants	50 EA	$ 4,000	$ 200,000
9	Gravel Backfill	16,011 TN	$ 15	$ 240,167
10	Foundation Gravel	1,801 TN	$ 35	$ 63,044
11	Asphalt Concrete Pavement Repair	1,334 TN	$ 80	$ 106,741
12	Crushed Surfacing, Top Course	1,225 TN	$ 25	$ 30,621
13	Cold Mix Asphalt	901 TN	$ 150	$ 135,094
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 4,165,126
	Tax rate (8.2%)			341,540
	Subtotal:			$ 4,506,667
	Contingency (25%)			$ 1,126,333
	Total Estimated Construction Cost			**$ 5,633,000**
	Engineering and Administrative Costs (25%):			$ 1,408,000
	Total Estimated Project Cost			**$ 7,041,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-8
Transmission from Cemetery Reservoir to 290 Zone

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 23,000	$ 23,000
2	12-inch D.I. Water Pipe, Including Fittings	2,300 LF	$ 75	$ 172,500
3	Locate Existing Utilities	LUMP SUM	$ 6,000	$ 6,000
4	Erosion Control	LUMP SUM	$ 6,000	$ 6,000
5	Additional Pipe Fittings	1,150 LB	$ 2.50	$ 2,900
6	Trench Safety Systems	LUMP SUM	$ 4,600	$ 4,600
7	12-inch Gate Valves	4 EA	$ 2,250	$ 8,700
8	Fire Hydrants	6 EA	$ 4,000	$ 23,000
9	Gravel Backfill	1,312 TN	$ 15	$ 19,700
10	Foundation Gravel	148 TN	$ 35	$ 5,200
11	Asphalt Concrete Pavement Repair	109 TN	$ 80	$ 8,800
12	Crushed Surfacing, Top Course	100 TN	$ 25	$ 2,600
13	Cold Mix Asphalt	74 TN	$ 150	$ 11,100
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 7,000	$ 7,000
	Subtotal			$ 304,100
	Tax rate (8.2%)			24,936
	Subtotal:			$ 329,036
	Contingency (25%)			$ 81,964
	Total Estimated Construction Cost:			**$ 411,000**
	Engineering and Administrative Costs (25%):			$ 103,000
	Total Estimated Project Cost:			**$ 514,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-9
Cemetery Booster Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 34,400	$ 34,400
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 25,000	$ 25,000
4	CMU Building	500 SF	$ 200	$ 100,000
5	Piping and Appurtanences	1 EA	$ 50,000	$ 50,000
6	Booster Pumps	4 EA	$ 25,000	$ 100,000
7	Auxilary Power Generator	LUMP SUM	$ 50,000	$ 50,000
8	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 95,000	$ 95,000
9	Automatic Transfer Switch	LUMP SUM	$ 6,500	$ 6,500

Subtotal	$ 463,900
Tax rate (8.2%)	38,040
Subtotal:	$ 501,940
Contingency (25%)	$ 125,460
Total Estimated Construction Cost	**$ 627,400**
Engineering and AdministrativeCosts (25%):	$ 156,850
Total Estimated Project Cost	**$ 784,250**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-10
Transmission from Cemetery BS to 455 Zone

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 56,000	$ 56,000
2	16-inch D.I. Water Pipe, Including Fittings	4,200 LF	$ 100	$ 420,000
3	Locate Existing Utilities	LUMP SUM	$ 20,000	$ 20,000
4	Erosion Control	LUMP SUM	$ 20,000	$ 20,000
5	Additional Pipe Fittings	2,520 LB	$ 2.50	$ 6,300
6	Trench Safety Systems	LUMP SUM	$ 8,400	$ 8,400
7	16-inch Butterfly Valves	7 EA	$ 10,000	$ 70,000
8	Fire Hydrants	11 EA	$ 4,000	$ 42,000
9	Gravel Backfill	2,738 TN	$ 15	$ 41,067
10	Foundation Gravel	308 TN	$ 35	$ 10,780
11	Asphalt Concrete Pavement Repair	228 TN	$ 80	$ 18,252
12	Crushed Surfacing, Top Course	209 TN	$ 25	$ 5,236
13	Cold Mix Asphalt	154 TN	$ 150	$ 23,100
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 10,000	$ 10,000
	Subtotal			$ 754,135
	Tax rate (8.2%)			61,839
	Subtotal:			$ 815,974
	Contingency (25%)			$ 204,026
	Total Estimated Construction Cost:			**$ 1,020,000**
	Engineering and Administrative Costs (25%):			$ 255,000
	Total Estimated Project Cost:			**$ 1,275,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-12
Lower Prune Hill Booster Station Upgrade

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 21,200	$ 21,200
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 25,000	$ 25,000
4	CMU Building	500 SF	$ 200	$ 100,000
4	Piping and Appurtanences	1 EA	$ 50,000	$ 50,000
5	Booster Pump	2 EA	$ 15,000	$ 30,000
6	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 50,000	$ 50,000
7	Automatic Transfer Switch	LUMP SUM	$ 6,500	$ 6,500
	Subtotal			$ 285,700
	Tax rate (8.2%)			23,427
	Subtotal:			$ 309,127
	Contingency (25%)			$ 77,273
	Total Estimated Construction Cost			**$ 386,400**
	Engineering and AdministrativeCosts (25%):			$ 96,600
	Total Estimated Project Cost			**$ 483,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-13
Lacamas Booster Station Upgrade

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 7,700	$ 7,700
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 17,000	$ 17,000
4	Piping and Appurtanences	1 EA	$ 10,000	$ 10,000
5	Booster Pump	1 EA	$ 15,000	$ 15,000
6	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 45,000	$ 45,000
7	Automatic Transfer Switch	LUMP SUM	$ 6,500	$ 6,500

Subtotal.....	$ 104,200
Tax rate (8.2%).....	8,544
Subtotal:.....	$ 112,744
Contingency (25%).....	$ 28,156
Total Estimated Construction Cost:.....	**$ 140,900**
Engineering and AdministrativeCosts (25%):.....	$ 35,225
Total Estimated Project Cost:.....	**$ 177,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-14
20-inch Suction Side Transmission to Lacamas Booster Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 76,000	$ 76,000
2	20-inch D.I. Water Pipe, Including Fittings	5,000 LF	$ 105	$ 525,000
3	Locate Existing Utilities	LUMP SUM	$ 20,000	$ 20,000
4	Erosion Control	LUMP SUM	$ 20,000	$ 20,000
5	Additional Pipe Fittings	3,250 LB	$ 3.50	$ 11,400
6	Trench Safety Systems	LUMP SUM	$ 10,000	$ 10,000
7	20-inch Butterfly Valves	8 EA	$ 20,000	$ 166,700
8	Fire Hydrants	13 EA	$ 4,000	$ 50,000
9	Gravel Backfill	3,667 TN	$ 15	$ 55,000
10	Foundation Gravel	413 TN	$ 35	$ 14,500
11	Asphalt Concrete Pavement Repair	306 TN	$ 80	$ 24,500
12	Crushed Surfacing, Top Course	281 TN	$ 25	$ 7,100
13	Cold Mix Asphalt	206 TN	$ 150	$ 31,000
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 10,000	$ 10,000
	Subtotal			$ 1,024,200
	Tax rate (8.2%)			83,984
	Subtotal:			$ 1,108,184
	Contingency (25%)			$ 276,816
	Total Estimated Construction Cost			**$ 1,385,000**
	Engineering and Administrative Costs (25%):			$ 346,000
	Total Estimated Project Cost			**$ 1,731,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-15
Replace 14-inch Steel Transmission from Butler Site to 455 Zone

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 69,000	$ 69,000
2	14-inch D.I. Water Pipe, Including Fittings	6,000 LF	$ 85	$ 510,000
3	Locate Existing Utilities	LUMP SUM	$ 16,500	$ 16,500
4	Erosion Control	LUMP SUM	$ 16,500	$ 16,500
5	Additional Pipe Fittings	3,300 LB	$ 3.50	$ 11,600
6	Trench Safety Systems	LUMP SUM	$ 12,000	$ 12,000
7	14-inch Butterfly Valves	10 EA	$ 6,500	$ 65,000
8	Fire Hydrants	15 EA	$ 4,000	$ 60,000
9	Gravel Backfill	3,911 TN	$ 15	$ 58,700
10	Foundation Gravel	440 TN	$ 35	$ 15,400
11	Asphalt Concrete Pavement Repair	326 TN	$ 80	$ 26,100
12	Crushed Surfacing, Top Course	299 TN	$ 25	$ 7,500
13	Cold Mix Asphalt	220 TN	$ 150	$ 33,000
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 20,000	$ 20,000
	Subtotal			$ 924,300
	Tax rate (8.2%)			75,793
	Subtotal:			$ 1,000,093
	Contingency (25%)			$ 249,907
	Total Estimated Construction Cost			**$ 1,250,000**
	Engineering and Administrative Costs (25%):			$ 313,000
	Total Estimated Project Cost			**$ 1,563,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-16
Crown Road Booster Station Upgrade

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 3,500	$ 3,500
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 2,000	$ 2,000
4	Piping and Appurtanences	1 EA	$ 5,000	$ 5,000
5	Booster Pump	2 EA	$ 15,000	$ 30,000
6	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 4,000	$ 4,000
	Subtotal			$ 47,500
	Tax rate (8.2%)			3,895
	Subtotal:			$ 51,395
	Contingency (25%)			$ 12,805
	Total Estimated Construction Cost			**$ 64,200**
	Engineering and AdministrativeCosts (25%):			$ 16,050
	Total Estimated Project Cost			**$ 80,250**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-17
12-inch along Polk Street for Well 16 transmission

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 23,000	$ 23,000
2	12-inch D.I. Water Pipe, Including Fittings	2,300 LF	$ 75	$ 172,500
3	Locate Existing Utilities	LUMP SUM	$ 6,000	$ 6,000
4	Erosion Control	LUMP SUM	$ 6,000	$ 6,000
5	Additional Pipe Fittings	1,150 LB	$ 2.50	$ 2,900
6	Trench Safety Systems	LUMP SUM	$ 4,600	$ 4,600
7	12-inch Gate Valves	4 EA	$ 2,250	$ 8,700
8	Fire Hydrants	6 EA	$ 4,000	$ 23,000
9	Gravel Backfill	1,312 TN	$ 15	$ 19,700
10	Foundation Gravel	148 TN	$ 35	$ 5,200
11	Asphalt Concrete Pavement Repair	109 TN	$ 80	$ 8,800
12	Crushed Surfacing, Top Course	100 TN	$ 25	$ 2,600
13	Cold Mix Asphalt	74 TN	$ 150	$ 11,100
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 7,000	$ 7,000
	Subtotal			$ 304,100
	Tax rate (8.2%)			24,936
	Subtotal:			$ 329,036
	Contingency (25%)			$ 81,964
	Total Estimated Construction Cost			**$ 411,000**
	Engineering and Administrative Costs (25%):			$ 103,000
	Total Estimated Project Cost			**$ 514,000**

City of Camas
Preliminary Project Cost Estimate
Transmission and Booster Station Improvement T-18
Jones and Boulder Creek Transmisssion Improvements

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 306,000	$ 306,000
2	10-inch D.I. Water Pipe, Including Fittings	48,000 LF	$ 60	$ 2,880,000
3	Locate Existing Utilities	LUMP SUM	$ 74,000	$ 74,000
4	Erosion Control	LUMP SUM	$ 74,000	$ 74,000
5	Additional Pipe Fittings	22,560 LB	$ 2.50	$ 56,400
6	Trench Safety Systems	LUMP SUM	$ 96,000	$ 96,000
7	10-inch Gate Valves	80 EA	$ 1,800	$ 144,000
8	Gravel Backfill	23,467 TN	$ 15	$ 352,000
9	Foundation Gravel	2,640 TN	$ 35	$ 92,400
10	Crushed Surfacing, Top Course	1,795 TN	$ 25	$ 44,900
11	Connections to Existing System	2 EA	$ 1,500	$ 3,000
12	Traffic Control	LUMP SUM	$ 2,000	$ 2,000
	Subtotal			$ 4,124,700
	Tax rate (8.2%)			338,225
	Subtotal:			$ 4,462,925
	Contingency (25%)			$ 1,116,075
	Total Estimated Construction Cost			**$ 5,579,000**
	Engineering and Administrative Costs (25%):			$ 1,395,000
	Total Estimated Project Cost			**$ 6,974,000**

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-1
15,600 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 151,000	$ 151,000
2	12-inch D.I. Water Pipe, Including Fittings	15,600 LF	$ 75	$ 1,170,000
3	Locate Existing Utilities	LUMP SUM	$ 37,000	$ 37,000
4	Erosion Control	LUMP SUM	$ 37,000	$ 37,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	26 EA	$ 2,250	$ 58,500
8	Fire Hydrants	39 EA	$ 4,000	$ 156,000
9	Gravel Backfill	8,898 TN	$ 15	$ 133,467
10	Foundation Gravel	1,001 TN	$ 35	$ 35,035
11	Asphalt Concrete Pavement Repair	741 TN	$ 80	$ 59,319
12	Crushed Surfacing, Top Course	681 TN	$ 25	$ 17,017
13	Cold Mix Asphalt	501 TN	$ 150	$ 75,075
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 2,030,912
	Tax rate (8.2%)			166,535
	Subtotal:			$ 2,197,447
	Contingency (25%)			$ 549,553
	Total Estimated Construction Cost			**$ 2,747,000**
	Engineering and Administrative Costs (25%):			$ 687,000
	Total Estimated Project Cost			**$ 3,434,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-2
5,300 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 57,000	$ 57,000
2	12-inch D.I. Water Pipe, Including Fittings	5,300 LF	$ 75	$ 397,500
3	Locate Existing Utilities	LUMP SUM	$ 14,000	$ 14,000
4	Erosion Control	LUMP SUM	$ 14,000	$ 14,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	9 EA	$ 2,250	$ 19,875
8	Fire Hydrants	13 EA	$ 4,000	$ 53,000
9	Gravel Backfill	3,023 TN	$ 15	$ 45,344
10	Foundation Gravel	340 TN	$ 35	$ 11,903
11	Asphalt Concrete Pavement Repair	252 TN	$ 80	$ 20,153
12	Crushed Surfacing, Top Course	231 TN	$ 25	$ 5,781
13	Cold Mix Asphalt	170 TN	$ 150	$ 25,506
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 765,563
	Tax rate (8.2%)			62,776
	Subtotal:			$ 828,339
	Contingency (25%)			$ 206,661
	Total Estimated Construction Cost			**$ 1,035,000**
	Engineering and Administrative Costs (25%):			$ 259,000
	Total Estimated Project Cost			**$ 1,294,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-3
1,900 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 26,000	$ 26,000
2	12-inch D.I. Water Pipe, Including Fittings	1,900 LF	$ 75	$ 142,500
3	Locate Existing Utilities	LUMP SUM	$ 7,000	$ 7,000
4	Erosion Control	LUMP SUM	$ 7,000	$ 7,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	3 EA	$ 2,250	$ 7,125
8	Fire Hydrants	5 EA	$ 4,000	$ 19,000
9	Gravel Backfill	1,084 TN	$ 15	$ 16,256
10	Foundation Gravel	122 TN	$ 35	$ 4,267
11	Asphalt Concrete Pavement Repair	90 TN	$ 80	$ 7,225
12	Crushed Surfacing, Top Course	83 TN	$ 25	$ 2,073
13	Cold Mix Asphalt	61 TN	$ 150	$ 9,144
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 349,089
	Tax rate (8.2%)			28,625
	Subtotal:			$ 377,714
	Contingency (25%)			$ 94,286
	Total Estimated Construction Cost			**$ 472,000**
	Engineering and Administrative Costs (25%):			$ 118,000
	Total Estimated Project Cost			**$ 590,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-4
11,200 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 111,000	$ 111,000
2	12-inch D.I. Water Pipe, Including Fittings	11,200 LF	$ 75	$ 840,000
3	Locate Existing Utilities	LUMP SUM	$ 27,000	$ 27,000
4	Erosion Control	LUMP SUM	$ 27,000	$ 27,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	19 EA	$ 2,250	$ 42,000
8	Fire Hydrants	28 EA	$ 4,000	$ 112,000
9	Gravel Backfill	6,388 TN	$ 15	$ 95,822
10	Foundation Gravel	719 TN	$ 35	$ 25,153
11	Asphalt Concrete Pavement Repair	532 TN	$ 80	$ 42,588
12	Crushed Surfacing, Top Course	489 TN	$ 25	$ 12,217
13	Cold Mix Asphalt	359 TN	$ 150	$ 53,900
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 1,490,181
	Tax rate (8.2%)			122,195
	Subtotal:			$ 1,612,375
	Contingency (25%)			$ 402,625
	Total Estimated Construction Cost			**$ 2,015,000**
	Engineering and Administrative Costs (25%):			$ 504,000
	Total Estimated Project Cost			**$ 2,519,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-5
2,600 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 33,000	$ 33,000
2	12-inch D.I. Water Pipe, Including Fittings	2,600 LF	$ 75	$ 195,000
3	Locate Existing Utilities	LUMP SUM	$ 8,000	$ 8,000
4	Erosion Control	LUMP SUM	$ 8,000	$ 8,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	4 EA	$ 2,250	$ 9,750
8	Fire Hydrants	7 EA	$ 4,000	$ 26,000
9	Gravel Backfill	1,483 TN	$ 15	$ 22,244
10	Foundation Gravel	167 TN	$ 35	$ 5,839
11	Asphalt Concrete Pavement Repair	124 TN	$ 80	$ 9,886
12	Crushed Surfacing, Top Course	113 TN	$ 25	$ 2,836
13	Cold Mix Asphalt	83 TN	$ 150	$ 12,513
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 434,569
	Tax rate (8.2%)			35,635
	Subtotal:			$ 470,203
	Contingency (25%)			$ 117,797
	Total Estimated Construction Cost			**$ 588,000**
	Engineering and Administrative Costs (25%):			$ 147,000
	Total Estimated Project Cost			**$ 735,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-6
7,900 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 81,000	$ 81,000
2	12-inch D.I. Water Pipe, Including Fittings	7,900 LF	$ 75	$ 592,500
3	Locate Existing Utilities	LUMP SUM	$ 20,000	$ 20,000
4	Erosion Control	LUMP SUM	$ 20,000	$ 20,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	13 EA	$ 2,250	$ 29,625
8	Fire Hydrants	20 EA	$ 4,000	$ 79,000
9	Gravel Backfill	4,506 TN	$ 15	$ 67,589
10	Foundation Gravel	507 TN	$ 35	$ 17,742
11	Asphalt Concrete Pavement Repair	375 TN	$ 80	$ 30,040
12	Crushed Surfacing, Top Course	345 TN	$ 25	$ 8,618
13	Cold Mix Asphalt	253 TN	$ 150	$ 38,019
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 1,085,632
	Tax rate (8.2%)			89,022
	Subtotal:			$ 1,174,654
	Contingency (25%)			$ 293,346
	Total Estimated Construction Cost			**$ 1,468,000**
	Engineering and Administrative Costs (25%):			$ 367,000
	Total Estimated Project Cost			**$ 1,835,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement N-7
5,700 LF of 12-inch NUGA Transmission Main

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 61,000	$ 61,000
2	12-inch D.I. Water Pipe, Including Fittings	5,700 LF	$ 75	$ 427,500
3	Locate Existing Utilities	LUMP SUM	$ 15,000	$ 15,000
4	Erosion Control	LUMP SUM	$ 15,000	$ 15,000
5	Additional Pipe Fittings	7,800 LB	$ 3.50	$ 27,300
6	Trench Safety Systems	LUMP SUM	$ 31,200	$ 31,200
7	12-inch Gate Valves	10 EA	$ 2,250	$ 21,375
8	Fire Hydrants	14 EA	$ 4,000	$ 57,000
9	Gravel Backfill	3,251 TN	$ 15	$ 48,767
10	Foundation Gravel	366 TN	$ 35	$ 12,801
11	Asphalt Concrete Pavement Repair	271 TN	$ 80	$ 21,674
12	Crushed Surfacing, Top Course	249 TN	$ 25	$ 6,218
13	Cold Mix Asphalt	183 TN	$ 150	$ 27,431
14	Connections to Existing System	2 EA	$ 1,500	$ 3,000
15	Traffic Control	LUMP SUM	$ 40,000	$ 40,000
	Subtotal			$ 815,266
	Tax rate (8.2%)			66,852
	Subtotal:			$ 882,118
	Contingency (25%)			$ 220,882
	Total Estimated Construction Cost			**$ 1,103,000**
	Engineering and Administrative Costs (25%):			$ 276,000
	Total Estimated Project Cost			**$ 1,379,000**

Refer to the 2010 Utility Rate Study by FCS Group for detail on eligible SDC credit amounts.

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement D-4
UPH PRV adjustments and looping around NW Astor

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 14,000	$ 14,000
2	8-inch D.I. Water Pipe, Including Fittings	1,600 LF	$ 50	$ 80,000
3	Locate Existing Utilities	LUMP SUM	$ 3,000	$ 3,000
4	Erosion Control	LUMP SUM	$ 3,000	$ 3,000
5	Additional Pipe Fittings	720 LB	$ 16.00	$ 11,520
6	Trench Safety Systems	LUMP SUM	$ 3,200	$ 3,200
7	8-inch Gate Valves	3 EA	$ 1,200	$ 3,200
8	Fire Hydrants	4 EA	$ 4,000	$ 16,000
9	Gravel Backfill	782 TN	$ 15	$ 11,733
10	Foundation Gravel	88 TN	$ 35	$ 3,080
11	Asphalt Concrete Class B	533 SQ YD	$ 5	$ 2,400
12	Sawcutting	3,200 LF	$ 5	$ 16,000
13	Crushed Surfacing, Top Course	60 TN	$ 25	$ 1,496
14	Cold Mix Asphalt	44 TN	$ 150	$ 6,600
15	Connections to Existing System	5 EA	$ 3,000	$ 15,000
16	Traffic Control	100 HRS	$ 5	$ 450
	Subtotal			$ 190,679
	Tax rate (8.2%)			15,636
	Subtotal:			$ 206,315
	Contingency (25%)			$ 51,685
	Total Estimated Construction Cost			**$ 258,000**
	Engineering and Administrative Costs (25%):			$ 65,000
	Total Estimated Project Cost			**$ 323,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: D-4 **ESTIMATED COST:** $ 323,000

PRESSURE ZONE: 852 **YEAR TO BE COMPLETED:** 2011

PROJECT DESCRIPTION:

UPH PRV adjustments and looping around NW Astor

MAP, SCALE: 1" = 2750'

PROJECT BENEFIT:

Improve fireflow deficiencies

COMMENTS:

SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering		65,000				
Construction		258,000				
Construction Management, Administration						
TOTAL		323,000	0	0	0	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,D-2

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement D-5
Butler Site PRV, 8-inch

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 3,900	$ 3,900
2	PRV, 8-inch	LUMP SUM	$ 48,500	$ 48,500
	Subtotal			$ 52,400
	Tax rate (8.2%)			4,297
	Subtotal:			$ 56,697
	Contingency (25%)			$ 14,203
	Total Estimated Construction Cost			**$ 70,900**
	Engineering and AdministrativeCosts (25%):			$ 17,725
	Total Estimated Project Cost			**$ 89,000**

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement D-6
Couch Street Booster Pump Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 5,200	$ 5,200
2	Booster Pump, 50 gpm	LUMP SUM	$ 65,500	$ 65,500
	Subtotal			$ 70,700
	Tax rate (8.2%)			5,797
	Subtotal:			$ 76,497
	Contingency (25%)			$ 19,103
	Total Estimated Construction Cost			**$ 95,600**
	Engineering and AdministrativeCosts (25%):			$ 23,900
	Total Estimated Project Cost			**$ 120,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: D-6 **ESTIMATED COST:** $ 120,000

PRESSURE ZONE: 455 **YEAR TO BE COMPLETED:** 2012

PROJECT DESCRIPTION:

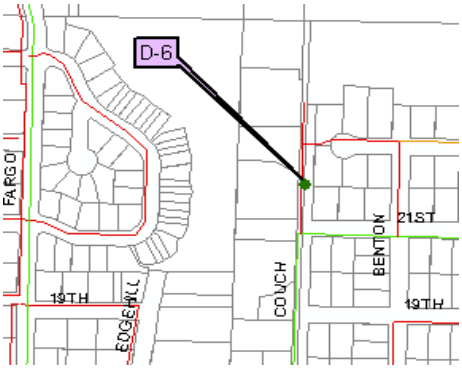
Couch Street Booster Pump Station

PROJECT BENEFIT:

Eliminate peak hour demand deficiencies.

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering						
Construction			120,000			
Construction Management, Administration						
TOTAL	0	0	120,000	0	0	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,D-6

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement D-7
UPH looping from NW 16th to NW 12th Avenue

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 3,000	$ 3,000
2	12-inch D.I. Water Pipe, Including Fittings	300 LF	$ 75	$ 22,500
3	Locate Existing Utilities	LUMP SUM	$ 1,000	$ 1,000
4	Erosion Control	LUMP SUM	$ 1,000	$ 1,000
5	Additional Pipe Fittings	150 LB	$ 16.00	$ 2,400
6	Trench Safety Systems	LUMP SUM	$ 600	$ 600
7	Gravel Backfill	171 TN	$ 15	$ 2,567
8	Foundation Gravel	19 TN	$ 35	$ 674
9	Asphalt Concrete Class B	117 SQ YD	$ 5	$ 525
10	Sawcutting	600 LF	$ 5	$ 3,000
11	Crushed Surfacing, Top Course	13 TN	$ 25	$ 327
12	Cold Mix Asphalt	10 TN	$ 150	$ 1,444
13	Connections to Existing System	2 EA	$ 3,000	$ 6,000
14	Traffic Control	100 HRS	$ 5	$ 450
	Subtotal			$ 45,486
	Tax rate (8.2%)			3,730
	Subtotal:			$ 49,216
	Contingency (25%)			$ 12,784
	Total Estimated Construction Cost			**$ 62,000**
	Engineering and Administrative Costs (25%):			$ 16,000
	Total Estimated Project Cost			**$ 78,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: D-7 **ESTIMATED COST:** $ 78,000

PRESSURE ZONE: 852 **YEAR TO BE COMPLETED:** 2012

PROJECT DESCRIPTION:

UPH looping from NW 16th to NW 12th Ave

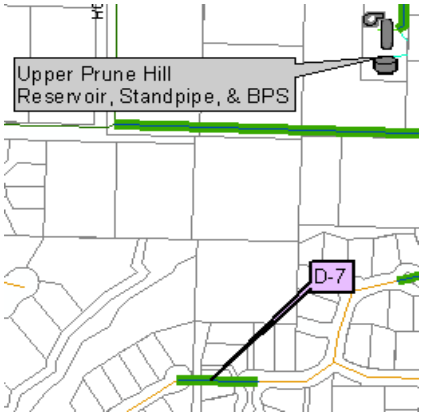
Install 300 LF of DI water main

PROJECT BENEFIT:

Eliminate peak hour deficiencies.

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering			16,000			
Construction			62,000			
Construction Management, Administration						
TOTAL	0	0	78,000	0	0	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,D-7

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement D-8
UPH Standpipe outlet piping upgrade, 24-inch

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 7,000	$ 7,000
2	24-inch D.I. Water Pipe, Including Fittings	320 LF	$ 110	$ 35,200
3	Locate Existing Utilities	LUMP SUM	$ 2,000	$ 2,000
4	Erosion Control	LUMP SUM	$ 2,000	$ 2,000
5	Additional Pipe Fittings	220 LB	$ 16.00	$ 3,520
6	Trench Safety Systems	LUMP SUM	$ 600	$ 600
7	24-inch Butterfly Valves	1 EA	$ 27,500	$ 27,500
8	Gravel Backfill	261 TN	$ 15	$ 3,911
9	Foundation Gravel	29 TN	$ 35	$ 1,027
10	Crushed Surfacing, Top Course	20 TN	$ 25	$ 499
11	Connections to Existing System	2 EA	$ 3,000	$ 6,000
	Subtotal			$ 89,256
	Tax rate (8.2%)			7,319
	Subtotal:			$ 96,575
	Contingency (25%)			$ 24,425
	Total Estimated Construction Cost			**$ 121,000**
	Engineering and Administrative Costs (25%):			$ 30,000
	Total Estimated Project Cost			**$ 151,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: D-8 **ESTIMATED COST:** $ 151,000

PRESSURE ZONE: 852 **YEAR TO BE COMPLETED:** 2020

PROJECT DESCRIPTION:

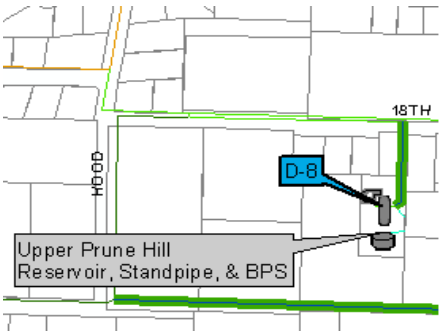
UPH Standpipe Outlet Piping Upgrade, 24-inch
Replace approximately 320 LF of 12-inch outlet piping with 24-inch DI.

PROJECT BENEFIT:

Eliminate peak hour deficiencies.

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR ($1,000s)	2016	2017	2018	2019	2020	2021
Land and Right of Way Acquisition						
Design and Engineering					30,000	
Construction					121,000	
Construction Management, Administration						
TOTAL	0	0	0	0	151,000	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,D-8

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement S-2
2.0 MG Cemetery Reservoir

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 44,000	$ 44,000
2	2.0 MG Reservoir	LUMP SUM	$ 550,000	$ 550,000
3	Earthwork	LUMP SUM	$ 70,000	$ 70,000
4	Site Piping	LUMP SUM	$ 150,000	$ 150,000
5	Landscape and Irrigation	LUMP SUM	$ 50,000	$ 50,000
6	Painting	LUMP SUM	$ 80,000	$ 80,000
7	Electrical	LUMP SUM	$ 350,000	$ 350,000

Subtotal	$ 1,294,000
Tax rate (8.2%)	106,108
Subtotal:	$ 1,400,108
Contingency (25%)	$ 349,892
Total Estimated Construction Cost	**$ 1,750,000**
Engineering and Administrative Costs (25%):	$ 438,000
Total Estimated Project Cost	**$ 2,188,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: S-2 **ESTIMATED COST:** $ 2,188,000

PRESSURE ZONE: existing 343, new 290 **YEAR TO BE COMPLETED:** 2014

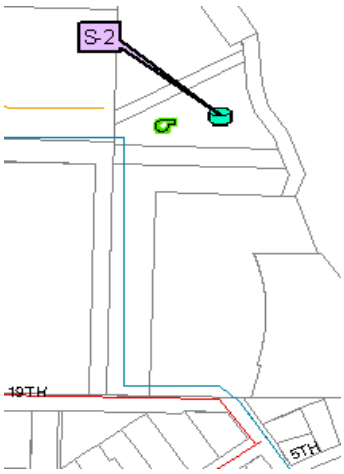
PROJECT DESCRIPTION:

2.0 MG Cemetary Reservoir

PROJECT BENEFIT:

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR ($1,000s)	2010	2011	2012	2013	2014	2015
Land and Right of Way Acquisition						
Design and Engineering					438,000	
Construction					1,750,000	
Construction Management, Administration						
TOTAL	0	0	0	0	2,188,000	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,S-2

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement S-4
2.0 MG Gregg Reservoir

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 44,000	$ 44,000
2	2.0 MG Reservoir	LUMP SUM	$ 550,000	$ 550,000
3	Earthwork	LUMP SUM	$ 70,000	$ 70,000
4	Site Piping	LUMP SUM	$ 150,000	$ 150,000
5	Landscape and Irrigation	LUMP SUM	$ 50,000	$ 50,000
6	Painting	LUMP SUM	$ 80,000	$ 80,000
7	Electrical	LUMP SUM	$ 350,000	$ 350,000
	Subtotal			$ 1,294,000
	Tax rate (8.2%)			106,108
	Subtotal:			$ 1,400,108
	Contingency (25%)			$ 349,892
	Total Estimated Construction Cost			**$ 1,750,000**
	Engineering and Administrative Costs (25%):			$ 438,000
	Total Estimated Project Cost			**$ 2,188,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: S-4 **ESTIMATED COST:** $ 2,188,000

PRESSURE ZONE: **YEAR TO BE COMPLETED:** 2018

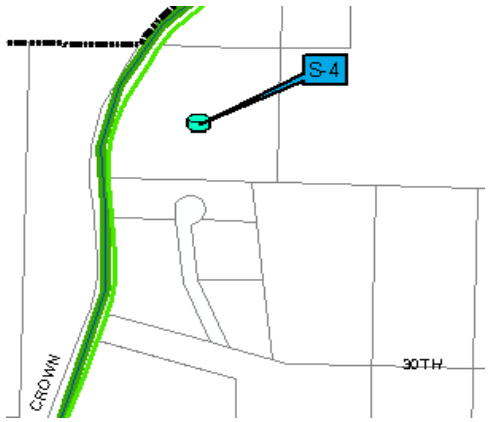
PROJECT DESCRIPTION:

2.0 MG Gregg Reservoir

PROJECT BENEFIT:

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR ($1,000s)	2016	2017	2018	2019	2020	2021
Land and Right of Way Acquisition						
Design and Engineering			438,000			
Construction			1,750,000			
Construction Management, Administration						
TOTAL	0	0	2,188,000	0	0	0

FUNDING SOURCE:

Capital Fund

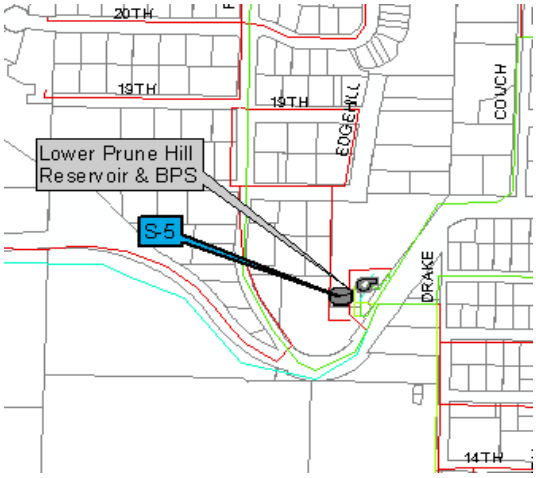
CIP Forms.XLS,S-4

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement S-5
Lower Prune Hill Reservoir Replacement

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 25,000	$ 25,000
2	Decommision and Demolition of Existing	LUMP SUM	$ 85,000	$ 85,000
3	0.5 MG Reservoir	LUMP SUM	$ 200,000	$ 200,000
4	Earthwork	LUMP SUM	$ 70,000	$ 70,000
5	Site Piping	LUMP SUM	$ 150,000	$ 150,000
6	Landscape and Irrigation	LUMP SUM	$ 50,000	$ 50,000
7	Painting	LUMP SUM	$ 80,000	$ 80,000
8	Electrical	LUMP SUM	$ 250,000	$ 250,000
	Subtotal			$ 910,000
	Tax rate (8.2%)			74,620
	Subtotal:			$ 984,620
	Contingency (25%)			$ 246,380
	Total Estimated Construction Cost			**$ 1,231,000**
	Engineering and Administrative Costs (25%):			$ 308,000
	Total Estimated Project Cost			**$ 1,539,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY	
PROJECT TYPE: Distribution System Improvement	
PROJECT NUMBER: S-5	**ESTIMATED COST:** $ 1,539,000
PRESSURE ZONE:	**YEAR TO BE COMPLETED:** 2020
PROJECT DESCRIPTION: Lower Prune Hill Reservoir Replacement	**MAP, SCALE: 1" = 600'**
PROJECT BENEFIT:	
COMMENTS:	



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR ($1,000s)	2016	2017	2018	2019	2020	2021
Land and Right of Way Acquisition						
Design and Engineering					308,000	
Construction					1,231,000	
Construction Management, Administration						
TOTAL	0	0	0	0	1,539,000	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,S-5

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement S-6
2.0 MG Green Mountain Reservoir

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 44,000	$ 44,000
2	2.0 MG Reservoir	LUMP SUM	$ 550,000	$ 550,000
3	Earthwork	LUMP SUM	$ 70,000	$ 70,000
4	Site Piping	LUMP SUM	$ 150,000	$ 150,000
5	Landscape and Irrigation	LUMP SUM	$ 50,000	$ 50,000
6	Painting	LUMP SUM	$ 80,000	$ 80,000
7	Electrical	LUMP SUM	$ 350,000	$ 350,000
	Subtotal			$ 1,294,000
	Tax rate (8.2%)			106,108
	Subtotal:			$ 1,400,108
	Contingency (25%)			$ 349,892
	Total Estimated Construction Cost			**$ 1,750,000**
	Engineering and Administrative Costs (25%):			$ 438,000
	Total Estimated Project Cost			**$ 2,188,000**

CITY OF CAMAS
CAPITAL IMPROVEMENTS PROJECT DESCRIPTION

PROJECT SUMMARY

PROJECT TYPE: Distribution System Improvement

PROJECT NUMBER: S-6 **ESTIMATED COST:** $ 2,188,000

PRESSURE ZONE: **YEAR TO BE COMPLETED:** 2024

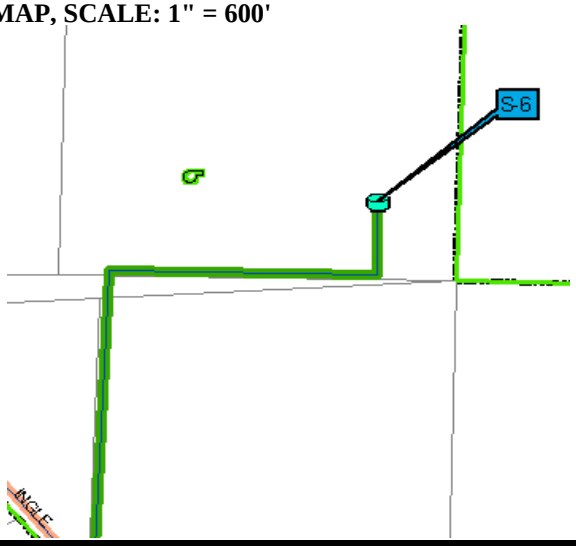
PROJECT DESCRIPTION:

2.0 MG Green Mountain Reservoir

PROJECT BENEFIT:

COMMENTS:

MAP, SCALE: 1" = 600'



SCHEDULE AND FUNDING PLAN

PROJECT COST PER YEAR ($1,000s)	2022	2023	2024	2025	2026	2027
Land and Right of Way Acquisition						
Design and Engineering			438,000			
Construction			1,750,000			
Construction Management, Administration						
TOTAL	0	0	2,188,000	0	0	0

FUNDING SOURCE:

Capital Fund

CIP Forms.XLS,S-6

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement DE-1
DI main between NW Camas Meadows Drive to SE 1st Street

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 43,000	$ 43,000
2	12-inch D.I. Water Pipe, Including Fittings	4,000 LF	$ 75	$ 300,000
3	Locate Existing Utilities	LUMP SUM	$ 10,000	$ 10,000
4	Erosion Control	LUMP SUM	$ 10,000	$ 10,000
5	Additional Pipe Fittings	2,000 LB	$ 16.00	$ 32,000
6	Trench Safety Systems	LUMP SUM	$ 8,000	$ 8,000
7	12-inch Gate Valves	7 EA	$ 2,250	$ 15,000
8	Fire Hydrants	10 EA	$ 4,000	$ 40,000
9	Gravel Backfill	2,281 TN	$ 15	$ 34,222
10	Foundation Gravel	257 TN	$ 35	$ 8,983
11	Asphalt Concrete Class B	1,556 SQ YD	$ 5	$ 7,000
12	Sawcutting	8,000 LF	$ 5	$ 40,000
13	Crushed Surfacing, Top Course	175 TN	$ 25	$ 4,363
14	Cold Mix Asphalt	128 TN	$ 150	$ 19,250
15	Connections to Existing System	2 EA	$ 3,000	$ 6,000
16	Traffic Control	LUMP SUM	$ 5,000	$ 5,000
	Subtotal			$ 582,819
	Tax rate (8.2%)			47,791
	Subtotal:			$ 630,610
	Contingency (25%)			$ 157,390
	Total Estimated Construction Cost:			**$ 788,000**
	Engineering and Administrative Costs (25%):			$ 197,000
	Total Estimated Project Cost:			**$ 985,000**

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement DE-2
UPH looping along NW 16th Avenue

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 14,000	$ 14,000
2	12-inch D.I. Water Pipe, Including Fittings	1,300 LF	$ 75	$ 97,500
3	Locate Existing Utilities	LUMP SUM	$ 3,000	$ 3,000
4	Erosion Control	LUMP SUM	$ 3,000	$ 3,000
5	Additional Pipe Fittings	650 LB	$ 16.00	$ 10,400
6	Trench Safety Systems	LUMP SUM	$ 2,600	$ 2,600
7	12-inch Gate Valves	2 EA	$ 2,250	$ 4,500
8	Fire Hydrants	3 EA	$ 4,000	$ 12,000
9	Gravel Backfill	741 TN	$ 15	$ 11,122
10	Foundation Gravel	83 TN	$ 35	$ 2,920
11	Asphalt Concrete Class B	506 SQ YD	$ 5	$ 2,275
12	Sawcutting	2,600 LF	$ 5	$ 13,000
13	Crushed Surfacing, Top Course	57 TN	$ 25	$ 1,418
14	Cold Mix Asphalt	42 TN	$ 150	$ 6,256
15	Connections to Existing System	2 EA	$ 3,000	$ 6,000
16	Traffic Control	100 HRS	$ 5	$ 450
	Subtotal			$ 190,441
	Tax rate (8.2%)			15,616
	Subtotal:			$ 206,057
	Contingency (25%)			$ 51,943
	Total Estimated Construction Cost			**$ 258,000**
	Engineering and Administrative Costs (25%):			$ 65,000
	Total Estimated Project Cost			**$ 323,000**

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement DE-3
542 Zone looping

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 22,000	$ 22,000
2	12-inch D.I. Water Pipe, Including Fittings	2,000 LF	$ 75	$ 150,000
3	Locate Existing Utilities	LUMP SUM	$ 5,000	$ 5,000
4	Erosion Control	LUMP SUM	$ 5,000	$ 5,000
5	Additional Pipe Fittings	1,000 LB	$ 16.00	$ 16,000
6	Trench Safety Systems	LUMP SUM	$ 4,000	$ 4,000
7	12-inch Gate Valves	3 EA	$ 2,250	$ 6,750
8	Fire Hydrants	5 EA	$ 4,000	$ 20,000
9	Gravel Backfill	1,141 TN	$ 15	$ 17,111
10	Foundation Gravel	128 TN	$ 35	$ 4,492
11	Asphalt Concrete Class B	778 SQ YD	$ 5	$ 3,500
12	Sawcutting	4,000 LF	$ 5	$ 20,000
13	Crushed Surfacing, Top Course	87 TN	$ 25	$ 2,182
14	Cold Mix Asphalt	64 TN	$ 150	$ 9,625
15	Connections to Existing System	2 EA	$ 3,000	$ 6,000
16	Traffic Control	100 HRS	$ 5	$ 450
	Subtotal			$ 292,109
	Tax rate (8.2%)			23,953
	Subtotal:			$ 316,062
	Contingency (25%)			$ 78,938
	Total Estimated Construction Cost			**$ 395,000**
	Engineering and Administrative Costs (25%):			$ 99,000
	Total Estimated Project Cost			**$ 494,000**

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement DE-4
Decommission 10th Avenue/Francis Street Booster Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 21,000	$ 21,000
2	8-inch D.I. Water Pipe, Including Fittings	2,500 LF	$ 50	$ 125,000
3	Locate Existing Utilities	LUMP SUM	$ 5,000	$ 5,000
4	Erosion Control	LUMP SUM	$ 5,000	$ 5,000
5	Additional Pipe Fittings	1,130 LB	$ 16.00	$ 18,080
6	Trench Safety Systems	LUMP SUM	$ 5,000	$ 5,000
7	8-inch Gate Valves	4 EA	$ 1,200	$ 4,800
8	Fire Hydrants	6 EA	$ 4,000	$ 24,000
9	Gravel Backfill	1,222 TN	$ 15	$ 18,333
10	Foundation Gravel	138 TN	$ 35	$ 4,813
11	Asphalt Concrete Class B	833 SQ YD	$ 5	$ 3,750
12	Sawcutting	5,000 LF	$ 5	$ 25,000
13	Crushed Surfacing, Top Course	94 TN	$ 25	$ 2,338
14	Cold Mix Asphalt	69 TN	$ 150	$ 10,313
15	Connections to Existing System	2 EA	$ 3,000	$ 6,000
16	Traffic Control	100 HRS	$ 5	$ 450
	Subtotal			$ 278,876
	Tax rate (8.2%)			22,868
	Subtotal:			$ 301,744
	Contingency (25%)			$ 75,256
	Total Estimated Construction Cost			**$ 377,000**
	Engineering and Administrative Costs (25%):			$ 94,000
	Total Estimated Project Cost			**$ 471,000**

City of Camas
Preliminary Project Cost Estimate
Distribution System Improvement DE-5
Upper Green Mountain Booster Station

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 18,400	$ 18,400
2	Clearing and Grubbing	LUMP SUM	$ 3,000	$ 3,000
3	Site Work	LUMP SUM	$ 25,000	$ 25,000
4	CMU Building	250 SF	$ 200	$ 50,000
5	Piping and Appurtanences	1 EA	$ 40,000	$ 40,000
6	Booster Pumps	2 EA	$ 15,000	$ 30,000
7	Auxilary Power Generator	LUMP SUM	$ 25,000	$ 25,000
8	Electrical, Telemetry, and Instrumentation	LUMP SUM	$ 50,000	$ 50,000
9	Automatic Transfer Switch	LUMP SUM	$ 6,500	$ 6,500

Subtotal.....	$ 247,900
Tax rate (8.2%)….....	20,328
Subtotal:.....	$ 268,228
Contingency (25%)……	$ 67,072
Total Estimated Construction Cost:.....	**$ 335,300**
Engineering and AdministrativeCosts (25%):.....	$ 83,825
Total Estimated Project Cost:.....	**$ 419,200**

Appendix T

FCS Group Financial Analysis - DRAFT

ity of Camas
Vater Utility Rate Study
ummary

evenue Requirements	2008	2009	2010	2011	2012	2013
Revenues						
Rate Revenues Under Existing Rates	$ 2,765,100	$ 2,806,576	$ 2,848,675	$ 2,891,405	$ 2,934,776	$ 2,978,798
Non-Rate Revenues	330,300	216,088	232,008	247,410	257,712	273,029
Total Revenues	**$ 3,095,400**	**$ 3,022,664**	**$ 3,080,683**	**$ 3,138,815**	**$ 3,192,487**	**$ 3,251,826**
Expenses						
Cash Operating Expenses	$ 2,325,196	$ 2,607,902	$ 2,709,642	$ 2,815,625	$ 2,925,971	$ 3,041,027
Existing Debt Service	380,659	402,641	403,908	401,061	401,757	400,917
New Debt Service	-	201,605	272,261	272,261	559,428	650,395
Rate Funded System Reinvestment	-	-	-	200,000	200,000	200,000
Total Expenses	**$ 2,705,855**	**$ 3,212,148**	**$ 3,385,811**	**$ 3,688,947**	**$ 4,087,156**	**$ 4,292,338**
Net Surplus (Deficiency)	**$ 389,544**	**$ (189,484)**	**$ (305,128)**	**$ (550,132)**	**$ (894,668)**	**$ (1,040,511)**
% of Rate Revenue	0.00%	6.75%	10.71%	19.03%	30.49%	34.93%
Additions To Meet Coverage	$ (95,165)	$ (125,562)	$ (137,211)	$ -	$ (6,308)	$ (31,308)
Total Surplus (Deficiency)	**$ 294,379**	**$ (315,046)**	**$ (442,339)**	**$ (550,132)**	**$ (900,976)**	**$ (1,071,820)**
% of Rate Revenue	0.00%	11.23%	15.53%	19.03%	30.70%	35.98%
Annual Rate Adjustment	**0.00%**	**14.50%**	**5.00%**	**5.00%**	**5.00%**	**5.00%**
Rate Revenues After Rate Increase	$ 2,765,100	$ 3,145,704	$ 3,424,819	$ 3,650,001	$ 3,889,989	$ 4,145,755
Additional Taxes from Rate Increase	$ -	$ 17,055	$ 28,974	$ 38,150	$ 48,038	$ 58,686
Net Cash Flow After Rate Increase	**389,544**	**132,589**	**242,042**	**170,315**	**12,507**	**67,760**
Coverage After Rate Increases	2.02	1.26	1.41	1.61	1.26	1.29
Sample Monthly Bill (5/8" 11ccf)	$ 20.07	$ 22.98	$ 24.13	$ 25.34	$ 26.60	$ 27.93
Monthly Increase	$ -	$ 2.91	$ 1.15	$ 1.21	$ 1.27	$ 1.33

Notes:

If growth accelerates in NUGAE than need to revisit study. Current study assumes that NUGAE growth begins after 2013

2009 increase is in effect for 9 month (effective March)

City of Camas
Water Utility Rate Study
Summary

Fund Balance	2008	2009	2010	2011	2012	2013
Operating:						
Beginning Balance	$ 479,154	$ 175,000	$ 307,589	$ 549,631	$ 694,264	$ 706,771
Net Cash Flow after Rate Increase	389,544	132,589	242,042	170,315	12,507	67,760
Transfer of Surplus to Capital Fund	(295,362)	-	-	(25,682)	-	(24,688)
Ending Balance	$ 573,336	$ 307,589	$ 549,631	$ 694,264	$ 706,771	$ 749,842
Minimum Target Balance	*$ 573,336*	*$ 643,044*	*$ 668,131*	*$ 694,264*	*$ 721,472*	*$ 749,842*
90 Day Target	90	43	74	90	88	90
Capital						
Beginning Balance	$ 181,256	$ (100,000)	$ 202,304	$ 206,537	$ 279,216	$ 204,313
plus: Rate Funded System Reinvestment	-	-	-	200,000	200,000	200,000
plus: Grants / Developer Donations / Other Outside Sources	-	390,000	2,232,968	363,657	-	2,676,451
plus: Transfer from REET	500,000	-	-	-	-	-
plus: Existing Bond Proceeds	4,084,800	-	-	-	-	-
plus: Connection Charges	189,104	189,104	189,104	189,104	189,104	189,104
plus: Net Debt Proceeds Available for Projects	-	2,140,000	750,000	-	3,220,000	1,020,000
plus: Interest Earnings	5,673	-	6,331	6,464	8,739	6,394
plus: Transfer of Surplus from Operating Fund	295,362	-	-	25,682	-	24,688
plus: Direct Rate Funding	-	-	-	-	-	-
Total Capital Funding Sources	5,256,194	2,619,104	3,380,707	991,443	3,897,058	4,320,951
less: Capital Expenditures (inflated)	(5,030,000)	(2,416,800)	(3,174,170)	(712,228)	(3,692,745)	(4,115,044)
Ending Balance	**226,194**	**202,304**	**206,537**	**279,216**	**204,313**	**205,907**
Minimum Capital Contingency Target	*$ 200,000*	*$ 200,000*	*$ 200,000*	*$ 200,000*	*$ 200,000*	*$ 200,000*

City of Camas
Water Utility Rate Study
Capital Improvement Program

Project Costs and O&M Impacts in Year:	2008

(Project costs are escalated using Construction Cost inflation assumptions)

No	Description	Current Cost	Year	Annual O&M Impact	Life in Years	For CFC Calculation: % Upgrade / Expansion	For CFC Calculation: % R&R	Specific Funding Source 1-Enterprise Fund, 2-Grants & Developer Donations		Upgrade / Expansion	R&R	TOTAL ESCALATED COSTS
1								1	Enterprise Fund	$ -	$ -	$ -
2	SR-12 WELL 13 (WELL 4 GW)	1,200,000	2008		50	100%	0%	1	Enterprise Fund	1,200,000	-	1,200,000
3	SR-11 WATER RIGHT PURCHASE	165,000	2021		50	100%	0%	1	Enterprise Fund	165,000	-	274,737
4	"	300,000	2022		50	100%	0%	1	Enterprise Fund	300,000	-	519,503
5								1	Enterprise Fund	-	-	-
6	D-5 8" MAIN ON 8TH FOR FIRE FLOW	50,000	2014		60	0%	100%	1	Enterprise Fund	-	50,000	70,926
7	D-9 OSTENSON CANYON MAIN	800,000	2008		50	100%	0%	1	Enterprise Fund	800,000	-	800,000
8	D-10 FIRE FLOW ON SIERRA ST	50,000	2014		50	50%	50%	1	Enterprise Fund	25,000	25,000	70,926
9	S-1 WEST PRUNE HILL RES ACQUISITION (FEAS/BI	50,000	2009		50	100%	0%	1	Enterprise Fund	50,000	-	53,000
10	T-7 WASHOUGAL RIVER TRANS CROSS	2,500,000	2009		50	100%	0%	1	Enterprise Fund	2,500,000	-	2,500,000
11	WATER FACILITY PLAN UPDATE	130,000	2009		6	50%	50%	1	Enterprise Fund	65,000	65,000	130,000
12	BOULDER CREEK FISH SCREEN PROJ	25,000	2009		50	0%	100%	1	Enterprise Fund	-	25,000	26,500
13	LOWER PRUNE HILL PUMP #4	70,000	2009		20	100%	0%	1	Enterprise Fund	70,000	-	74,200
14	Source Development	20,000	2009		50	100%	0%	1	Enterprise Fund	20,000	-	21,200
15	CROWN RD PS /MAIN LINE INSTALLATION 60% TD	1,064,400	2010		50	100%	0%	2	Grants/Developer Donation	1,064,400	-	1,195,960
16	CROWN RD PS /MAIN LINE INSTALLATION 40% P	709,600	2010		50	100%	0%	2	Grants/Developer Donation	709,600	-	797,307
17	CROWN RD PS /MAIN LINE INSTALLATION 60% TD	393,600	2010		50	100%	0%	1	Enterprise Fund	393,600	-	442,249
18	CROWN RD PS /MAIN LINE INSTALLATION 40% P	262,400	2010		50	100%	0%	1	Enterprise Fund			294,833
19	WELL 14	900,000	2008		50	100%	0%	1	Enterprise Fund	900,000	-	954,000
20	WELL 14	390,000	2008		50	100%	0%	1	Enterprise Fund	390,000	-	413,400
21	D-8 12" LINE FOR AIRPORT FIRE FLOW (2/3 Develo	305,333	2011		50	100%	0%	2	Grants/Developer Donation	305,333	-	383,657
22	D-6 12" LINE FOR AIRPORT FIRE FLOW (1/3 City)	152,667	2011		50	100%	0%	1	Enterprise Fund	152,667	-	181,828
23	D-7 BOOSTER STATION ON COUCH FIRE FL	53,800	2014		50	100%	0%	1	Enterprise Fund	53,800	-	76,316
24	T-2 SUCTION SIDE MAIN ON LAKE RD	1,260,000	2016		60	100%	0%	1	Enterprise Fund	1,260,000	-	1,894,574
25	T-3 ADDITIONAL PUMP ON LACAMAS BS	65,000	2011		50	100%	0%	1	Enterprise Fund	65,000	-	77,416
26	T-8 FOREST HOME BOOSTER UPGRADE	100,000	2014		50	100%	0%	1	Enterprise Fund	100,000	-	141,852
27	NW 38th AVENUE WATER LINE	750,000	2008		60	100%	0%	1	Enterprise Fund	750,000	-	795,000
28	PAC RM/38TH WATER INTERTIE (2/3) Developer	213,333	2010		50	100%	0%	2	Grants/Developer Donation	213,333	-	239,701
29	PAC RM/38TH WATER INTERTIE (1/3) City	106,667	2010		50	100%	0%	1	Enterprise Fund	106,667	-	119,851
30	D-8 8" MAIN ON KLICKITAT FIRE FLOW	62,000	2014		50	100%	0%	1	Enterprise Fund	62,000	-	87,948
31	S-2 WEST PRUNE HILL RES.	2,500,000	2012		50	100%	0%	1	Enterprise Fund	2,500,000	-	3,156,192
32	S-3 WEST PRUNE HILL 12" TRANS. LINE	350,000	2012		50	100%	0%	1	Enterprise Fund	350,000	-	441,867
33	UGA RESERVOIR	1,000,000	2016		60	100%	0%	1	Enterprise Fund	1,000,000	-	1,418,519
34	"	1,600,000	2018		50	100%	0%	1	Enterprise Fund	1,600,000	-	2,368,391
35	UGA PRV (2/3) Developer	74,667	2014		50	100%	0%	2	Grants/Developer Donation	74,667	-	105,916
36	UGA PRV (1/3) City	37,333	2014		50	100%	0%	1	Enterprise Fund	37,333	-	52,958
37	UGA PRV (2/3) Developer	74,667	2015		50	100%	0%	2	Grants/Developer Donation	74,667	-	112,271
38	UGA PRV (1/3) City	37,333	2015		50	100%	0%	1	Enterprise Fund	37,333	-	56,136
39	UGA PRV (2/3) Developer	74,667	2016		50	100%	0%	2	Grants/Developer Donation	74,667	-	119,007
40	UGA PRV (1/3) City	37,333	2016		50	100%	0%	1	Enterprise Fund	37,333	-	59,504
41	UGA PRV (2/3) Developer	74,667	2017		50	100%	0%	2	Grants/Developer Donation	74,667	-	126,148
42	UGA PRV (1/3) City	37,333	2017		50	100%	0%	1	Enterprise Fund	37,333	-	63,074

IN
SW 38th?
SDC?
2007?

City of Camas
Water Utility Rate Study
Capital Improvement Program

Project Costs and O&M Impacts in Year:	2008

(Project costs are escalated using Construction Cost Inflation assumptions)

No	Description	Current Cost	Year	Annual O&M Impact	Life in Years	For CFC Calculation: % Upgrade / Expansion	For CFC Calculation: % R&R	Specific Funding Source 1-Enterprise Fund, 2-Grants & Developer Donations		Upgrade / Expansion	R&R	TOTAL ESCALATED COSTS
43	D-16 12" MAIN LAKE TO 38TH	815,000	2020		50	100%	0%	2	Grants/Developer Donation	815,000	-	1,304,841
44	T-4 TRANSMSN MAIN EVERETT SOUTH	1,130,000	2014		50	100%	0%	1	Enterprise Fund	1,130,000	-	1,602,927
45	T-5 TRANSMSN MAIN EVERETT NORTH	1,130,000	2015		50	100%	0%	1	Enterprise Fund	1,130,000	-	1,699,102
46	UGA BOOSTER STATION	400,000	2014		50	100%	0%	1	Enterprise Fund	400,000	-	567,408
47	WATER FACILITY PLAN UPDATE	150,000	2014		6	50%	50%	1	Enterprise Fund	75,000	75,000	212,778
48	"	150,000	2020		6	50%	50%	1	Enterprise Fund	75,000	75,000	240,155
49	"	150,000	2028		6	50%	50%	1	Enterprise Fund	75,000	75,000	303,872
50	STIEGERWALD SOURCE DEVELOPMENT	1,000,000	2020		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,601,032
51	MISC WATER MAIN REPLACEMENT	400,000	2009		50	30%	70%	1	Enterprise Fund	120,000	280,000	400,000
52	"	75,000	2009		50	30%	70%	1	Enterprise Fund	22,500	52,500	79,500
53	"	75,000	2010		50	30%	70%	1	Enterprise Fund	22,500	52,500	84,270
54	"	75,000	2011		50	30%	70%	1	Enterprise Fund	22,500	52,500	89,326
55	"	75,000	2012		50	30%	70%	1	Enterprise Fund	22,500	52,500	94,686
56	"	75,000	2013		50	30%	70%	1	Enterprise Fund	22,500	52,500	100,367
57	"	75,000	2014		50	30%	70%	1	Enterprise Fund	22,500	52,500	106,389
58	"	75,000	2015		50	30%	70%	1	Enterprise Fund	22,500	52,500	112,772
59	"	75,000	2016		50	30%	70%	1	Enterprise Fund	22,500	52,500	119,539
60	"	75,000	2017		50	30%	70%	1	Enterprise Fund	22,500	52,500	126,711
61	"	75,000	2018		50	30%	70%	1	Enterprise Fund	22,500	52,500	111,018
62	"	75,000	2019		50	30%	70%	1	Enterprise Fund	22,500	52,500	115,459
63	"	75,000	2020		50	30%	70%	1	Enterprise Fund	22,500	52,500	120,077
64	"	75,000	2021		50	30%	70%	1	Enterprise Fund	22,500	52,500	124,881
65	"	75,000	2022		50	30%	70%	1	Enterprise Fund	22,500	52,500	129,876
66	"	75,000	2023		50	30%	70%	1	Enterprise Fund	22,500	52,500	135,071
67	"	75,000	2024		50	30%	70%	1	Enterprise Fund	22,500	52,500	140,474
68	"	75,000	2025		50	30%	70%	1	Enterprise Fund	22,500	52,500	146,093
69	"	75,000	2026		50	30%	70%	1	Enterprise Fund	22,500	52,500	151,936
70	"	75,000	2027		50	30%	70%	1	Enterprise Fund	22,500	52,500	158,014
71	UGA MAIN LINE (2/3) Developer	2,000,000	2013		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	2,676,451
72	UGA MAIN LINE (1/3) City	1,000,000	2013		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,338,226
73	UGA MAIN LINE (2/3) Developer	2,000,000	2014		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	2,837,038
74	UGA MAIN LINE (1/3) City	1,000,000	2014		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,418,519
75	UGA MAIN LINE (2/3) Developer	2,000,000	2015		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,007,261
76	UGA MAIN LINE (1/3) City	1,000,000	2015		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,503,630
77	UGA MAIN LINE (2/3) Developer	2,000,000	2016		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,187,696
78	UGA MAIN LINE (1/3) City	1,000,000	2016		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,593,848
79	UGA MAIN LINE (2/3) Developer	2,000,000	2017		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,378,958
80	UGA MAIN LINE (1/3) City	1,000,000	2017		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,689,479
81	UGA MAIN LINE (2/3) Developer	2,000,000	2018		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	2,960,489
82	UGA MAIN LINE (1/3) City	1,000,000	2018		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,480,244
83	UGA MAIN LINE (2/3) Developer	2,000,000	2019		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,078,908
84	UGA MAIN LINE (1/3) City	1,000,000	2019		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,539,454
85	UGA MAIN LINE (2/3) Developer	2,000,000	2020		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,202,064
86	UGA MAIN LINE (1/3) City	1,000,000	2020		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,601,032
87	UGA MAIN LINE (2/3) Developer	2,000,000	2021		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,330,147
88	UGA MAIN LINE (1/3) City	1,000,000	2021		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,665,074

City of Camas
Water Utility Rate Study
Capital Improvement Program

Project Costs and O&M Impacts in Year:	2008

(Project costs are escalated using Construction Cost Inflation assumptions)

No	Description	Current Cost	Year	Annual O&M Impact	Life in Years	For CFC Calculation % Upgrade / Expansion	For CFC Calculation % R&R	Specific Funding Source 1-Enterprise Fund, 2-Grants & Developer Donations		Upgrade / Expansion	R&R	TOTAL ESCALATED COSTS
89	UGA MAIN LINE (2/3) Developer	2,000,000	2022		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,463,353
90	UGA MAIN LINE (1/3) City	1,000,000	2022		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,731,676
91	UGA MAIN LINE (2/3) Developer	2,000,000	2023		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,601,887
92	UGA MAIN LINE (1/3) City	1,000,000	2023		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,800,944
93	UGA MAIN LINE (2/3) Developer	2,000,000	2024		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,745,962
94	UGA MAIN LINE (1/3) City	1,000,000	2024		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,872,981
95	UGA MAIN LINE (2/3) Developer	2,000,000	2025		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	3,895,801
96	UGA MAIN LINE (1/3) City	1,000,000	2025		50	100%	0%	1	Enterprise Fund	1,000,000	-	1,947,900
97	UGA MAIN LINE (2/3) Developer	2,000,000	2026		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	4,051,633
98	UGA MAIN LINE (1/3) City	1,000,000	2026		50	100%	0%	1	Enterprise Fund	1,000,000	-	2,025,817
99	UGA MAIN LINE (2/3) Developer	2,000,000	2027		50	100%	0%	2	Grants/Developer Donation	2,000,000	-	4,213,698
100	UGA MAIN LINE (1/3) City	1,000,000	2027		50	100%	0%	1	Enterprise Fund	1,000,000	-	2,106,849
101						100%	0%	1	Enterprise Fund	-	-	-
102						100%	0%	1	Enterprise Fund	-	-	-
	Total Capital Projects	$ 69,796,800		$ -		98%	2%			$ 67,866,900	$ 1,667,500	$ 108,022,459
	Total Upgrade/Expansion Projects											105,593,648
	Total R&R Projects											2,428,812
	Projects by Grants / Developer Donations			-						33,406,333	-	54,996,155
	Projects by Enterprise Fund			-						34,460,567	1,667,500	53,026,304

Year	2008$	Inflated
2008	5,030,000	5,030,000
2009	2,280,000	2,416,800
2010	2,825,000	3,174,170
2011	598,000	712,228
2012	2,925,000	3,692,745
2013	3,075,000	4,115,044
Total	16,733,000	108,022,459

FCS GROUP

Consultant Memorandum

To: **Monte Brachmann, Public Works Director, City of Camas** Date: **June 15th, 2009**

From: **Sergey Tarasov, Angie Sanchez Virnoche; FCS GROUP**

CC:

RE **City of Camas Proposed Draft System Development Charges**

INTRODUCTION

As part of the utility rate studies for water, sewer, storm and solid waste utilities completed for the City of Camas, FCS GROUP was also asked to update the water and sewer system development charges (SDCs) and create a new SDC for the storm drainage utility. This memorandum will provide a general overview of SDCs, summarize the methodology used, outline key factors and present the recommended charges.

OVERVIEW

"System Development Charge (or connection) charge" is a generic term referring to charges imposed as a condition of connecting to the utility system. SDCs differ from installation fees in that they are intended as a means of ensuring that new customers bear their equitable share of the cost of the system assets that serve all customers, and are not direct reimbursement for out-of-pocket costs to connect the customer. It is assumed that SDCs are imposed in addition to meter charges, labor and material charges, tap fees, inspection fees, or other non-capital charges related to the immediate expense of connecting a new service.

METHODOLOGY

The purpose of the SDC is two-fold: 1) to provide a source for capital financing and 2) to equitably recover the proportionate share of utility plant-in-service from new customers. In the absence of SDCs, growth-related costs would be borne in large part by existing customers. The cost of the system to be recovered by SDCs can be defined in two parts: an existing cost basis portion, which recover existing costs, and a future cost basis portion, which recover future costs.
Revenues generated from the SDCs can be used to fund capital projects or to pay debt service incurred to finance capital projects, but cannot be used to pay operating and maintenance costs.

There are several documented approaches used in the industry to establish a SDC that is legally defensible if designed properly. Within the range of legally defensible approaches, the choice of the costs the City targets is a matter of policy. It is important that the City follow a methodical and rational approach to consistently determine and implement cost-based SDCs.

Since the calculated charges represent the maximum allowable charge, the City may choose to implement a charge at any level up to the calculated charge. Revenues generated from the charge will vary depending upon whether or not the full charge is implemented (e.g., phase-in strategies). The lower the charge and longer the phase-in period, the less revenue will be collected and available to help pay the cost of these facilities. This loss in revenue could result in delays in completing the

capital improvement program and/or result in increased costs to the City's existing ratepayers through rates for service.

EXISTING COST BASIS

The existing cost basis portion of the charge developed in this study is based on facilities of general benefit, such as storage reservoirs, transmission mains, interceptor trunk lines, etc. It is intended to recognize the current ratepayers' net investment in estimated original cost of the non-donated system assets and the accumulated interest on that investment. For Washington cities and towns, State statute (RCW 35.92.025) and subsequent legal interpretations provide a guideline for connection charges which suggest that such charges should reflect the actual original cost of the utility system, and can include interest on that cost at the rate applicable at the time of construction. Interest can be accumulate for a maximum of ten years from the date of construction, and cannot exceed the original cost of the asset. In addition, outstanding debt principal (less any cash available to buy down debt) is deducted from plant-in-service because new customers will pay their share of debt service through user rates. For this study, the existing cost basis for each utility is based on the City's record of system assets as of December 31, 2007, incorporating the adjustments noted above.

FUTURE COST BASIS

The statue enabling connection charges for cities and towns does not specifically address a charge based on planned future improvements. Common practice and legal opinion suggest that future facilities needed to serve growth, as well as to provide for regulatory system improvement, can be included in the connection charge. It is common practice for Cities and Towns to include up to twenty (20) years of future costs consistent with the planning period used in the City's comprehensive planning process. The future cost basis can include utility capital projects planned for construction and identified in comprehensive system planning documents.

It is important to note that current-year dollars are used when calculating the SDC and not inflated dollars. This approach assumes that the SDC will be updated annually to track construction cost inflation. Projects directly funded by developers, grants, or special property assessments are not included in the calculation. Replacement projects are most often excluded from the calculation unless they are needed to increase the size of the system. The capital improvement program has been allocated between existing and future customers based on engineering and planning criteria.

WATER SYSTEM DEVELOPMENT CHARGE

The City currently uses a cost of service allocation basis approach when calculating the SDC and establishes an individual charge for each customer class based on the results of the cost-of-service functional allocation which includes assignment of costs based on individual customer flow statistics, meter equivalents and number of accounts.

After assessing the current structure and individual class charges it seemed that most class specific SDCs resulted in similar charges with the exception of the industrial class, which demonstrated a significantly higher disproportionate demand on the system based on its size and usage.

From these observations a "general" approach is proposed, which changes the class specific SDC and instead calculates the value of one meter customer equivalent (MCE) and assesses all new system connections based on this equivalent unit buy-in value. This recommended approach is applicable to all customer classes with the exception of the industrial class due to the disproportionate demand placed on the system by these customers. A separate charge is recommended specifically for the industrial class.

DETERMINATION OF THE WATER SYSTEM DEVELOPMENT CHARGES

Existing Cost Basis

As of 2007, water utility total fixed assets equal $37.75 million. Of this amount, approximately $4.83 million was contributed and, therefore, excluded from the cost basis. Calculating 10 years of interest on each allocable asset adds $15.62 million. The water utility's existing cash reserves were less than outstanding debt, and thus an adjustment of $5.72 million was made to account for principal outstanding. After adjusting the utility's total assets for capital contributions and principal outstanding, the total existing cost basis is approximately $42.82 million.

Future Cost Basis

According to the 2008 Draft Water System Plan the City has planned for approximately $69.80 million of capital projects in the water utility between 2008 and 2027. Recognizing the fact that some of the projects will provide capacity beyond the 20-year period, with the help of the City and the consulting engineer working on the Water System Plan, the project costs were reduced based on the capacity they will provide by the end of the 20-year period (this reduction in costs only applies to the non-NUGAE customers since NUGAE customers build out by 2025). The resulting 20-year project capital total was $66.12 million. In addition, the projects were split between projects related to the North Urban Growth Area East (NUGAE), non-NUGAE related projects and projects which benefited both customer groups. The NUGAE portion of total future projects was $54.13 million, non-NUGAE portion was $7.62 million and the cumulative portion was $4.37 million.

From the $66.12 million $34.12 million are considered to be contributed / donated, reducing the future cost basis portion for NUGAE and non-NUGAE customers. In addition to the contributions / donations any project or portion of the project designated as repair and replacement (R&R) was also deducted. The resulting allocable future cost basis was $30.90 million, which was made up of $20.72 million project costs related to NUGAE, $6.10 million of project costs related to non-NUGAE and $4.08 million of project costs related to both customer bases.

Customer Base

Using the detailed customer statistics provided by the City, the water utility had approximately 9,446 meter customer equivalents (MCEs) – MCEs relate to flow factor assumptions that vary by meter size and are established by the American Water Works Association – in 2008, which related specifically to non-NUGAE customers. The consulting engineer working on the Water System Plan provided a growth forecast, by class, for the 20-year study period using flow based equivalent residential units (ERUs). Since a different unit of measure was used in estimating the future demand ERUs than in the calculation of the charge (MCEs), a growth rate was calculated from the demand projection ERUs (percentage growth from current ERU's to 20-year future ERU's) and applied to the MCEs to calculate the 20-year MCEs. With

this assumption in place the City will add 6,780 non-NUGAE MCEs over the next twenty-year period – reaching a total non-NUGAE customer base of 16,226 MCEs.

Since there were no NUGAE customers in place during the study process an alternative approach had to be used estimating the 20-year NUGAE customer base in MCEs. The flow based demand ERUs provided by class were used to develop a ratio between 20-year non-NUGAE ERUs and MCEs. These ratios were then applied to the NUGAE flow based demand ERUs and converted to MCEs for the 20-year period; 5,581 MCEs. The total customer base, NUGAE and non-NUGAE, for the 20-year period is calculated to be 21,807 MCEs.

Calculation of the General Water System Development Charge

The following table shows the calculation of the water system development charge by calculating the existing and the future cost bases.

Water System Development Charge Calculation					
	non-NUGAE		NUGAE		Notes
Existing Allocable Cost	$	42,818,181	$	42,818,181	
Allocable Customer Base		21,807		21,807	Total customer base (existing & future)
Existing Portion	**$**	**1,964**	**$**	**1,964**	
Future Cumulative Cost*	$	4,082,100	$	4,082,100	Capital allocable to NUGAE & non-NUGAE
Allocable Customer Base		12,361		12,361	Total future customers
Future Cumulative Portion	**$**	**330**	**$**	**330**	
Future Cost	$	6,095,575	$	20,720,667	Capital allocable to NUGAE & non-NUGAE
Allocable Customer Base		6,780		5,581	Total future customers
Future Portion	**$**	**899**	**$**	**3,713**	
TOTAL SDC	**$**	**3,193**	**$**	**6,007**	per MCE

Notes: Cumulative costs apply to both NUGAE & non-NUGAE, the remaining future costs apply to each on an individual basis

The table below shows the proposed non-NUGAE and the NUGAE system development charges by meter size using the MCE's to differentiate the demands different meter sizes place on the system.

Meter	MCEs	Proposed	
		Non NUGAE	NUGAE
5/8"	1	$ 3,193	$ 6,007
3/4"	1.5	4,790	9,011
1"	2.5	7,983	15,018
1.5"	5	15,965	30,035
2"	8	25,544	48,056
3"	16	51,088	96,112
4"	25	79,825	150,175
6"	50	159,650	300,350
8"	80	255,440	480,560

As previously mentioned the proposed charges are a calculated ceiling, the City can implement a charge of any level up to the indicated amount.

Separate Industrial Water System Development Charge Alternatives

As previously mentioned the industrial class exhibited high disproportionate demands on the system based on its size and usage compared to other classes. To avoid the remaining classes subsidizing the industrial class a separate industrial system development charge is proposed.

A charge based on MCEs represents the peaking (maximum instantaneous) requirements placed on the system by a customer. The increase in the charge from one meter to the next represents the maximum peaking requirement for that meter size and the relationship between each different size meter to the base 5/8" meter. If every customer class uses water on an equitable basis (usage per MCE) the peaking approach is appropriate. If there are customers who use disproportionate amounts of water on an average daily basis whereby the average usage exceeds the standard MCE factor the peaking methodology alone may not be appropriate. This is because the system is sized not only based on peak demand of the individual customer, but is sized based on the total system requirements of "all" individual customer demands. A large user places a disproportionate demand on other parts of the system such as storage requirements and source of supply and should be charged commensurate with these increased demands. The SDC options proposed address this issue.

Two options are proposed to the City for the Industrial SDC. The first option keeps the City's current methodology and simply updates the industrial charge based on the functional allocation of updated costs. The second approach uses a similar functional allocation approach as the existing methodology, but spreads the "base" costs by ERUs instead of MCEs.

Industrial Option 1

The water system costs were spread based on a functional allocation (base, peak, fire, etc.). The previous study was used since a cost-of-service analysis was not performed during the 2008 update. Similar to the general approach existing and future infrastructure costs were calculated, however instead of dividing through by the applicable total customer base, the costs were spread through by the industrial customer class statistics representing accounts, meter customer equivalents (MCEs) and meter service equivalents (MSEs – related to actual cost of the meter / hardware) depending on the function.

The following table summarizes the Industrial charge for the base 5/8" meter.

Industrial Option 1						
Industrial	Customer/ Account	Meters & Services/MSE	Base / MCE	Peak / MCE	Fire / Account	SDC
non-NUGAE	$ -	$ 393	$ 14,725	$ 2,134	$ 2,567	$ 19,819
NUGAE	$ -	$ 393	$ 29,551	$ 4,326	$ 4,206	$ 38,476

The table below escalates the SDC based on each function and an appropriate factor by meter size.

Meter	MCEs	MSEs	Proposed	
			Non-NUGAE	NUGAE
5/8"	1	1	$ 19,819	$ 38,476
3/4"	1.5	1.1	28,288	55,454
1"	2.5	1.4	45,265	89,449
1.5"	5	1.8	87,569	174,298
2"	8	2.9	138,579	276,362
3"	16	11	276,634	550,561
4"	25	14	429,544	856,633
6"	50	21	853,770	1,706,309
8"	80	29	1,362,684	2,725,763

Industrial Option 2

Similar to the first option the costs were spread based on a functional allocation. In this scenario the costs were based on the customer statistics for the system as a whole to determine unit costs instead of allocating costs based on individual customer statistics first. This approach also spreads "base" costs or total average water flow based on the ERU for the system (283.6 gpd / ERU) instead of MCEs.

The following table summarizes the Industrial charge for the base 5/8" meter and one (1) ERU. When comparing the two options it is important to remember that each industrial class will be multiple ERUs.

Industrial Option 2						
Industrial	Customer/ Account	Meters & Services/MSE	Base / ERU	Peak / MCE	Fire / Account	SDC
non-NUGAE	$ -	$ 393	$ 988	$ 1,147	$ 518	$ 3,045
NUGAE	$ -	$ 393	$ 2,704	$ 2,324	$ 845	$ 6,266

The calculation of system development charges by meter size will depend on the size of meter factors associated with that meters size (as with option 1), in addition the projected demand will be needed to estimate the number of ERUs.

As an example two existing accounts are used to calculate an SDC using both options and compare the outcomes. Two accounts from the existing customer Wafertech are used.

- ✓ The first account (6346) is on a two inch meter and its usage for 2008 was 2,076 ccf.
- ✓ The second account (6344) is on a six inch meter and its usage for 2008 was 296,967 ccf

Option 1 Calculation: two inch meter non-NUGAE customer

Step 1: $0 is added for the customer/account portion of the charge.

Step 2: $393 per MSE representing the Meters & Services portion is multiplied by 2.9 to represent the fact that the meter size is two inches = [$393*2.9 = $1,139.70].

Step 3: $14,725 / MCE representing the "Base" portion is escalated by 8 to represent the meter size = [8 * $14,752 = $117,800]

Step 4: $2,134 / MCE representing the "Peak" portion is escalated by 8 to represent the meter size = [8 * $2,134 = $17,072]

Step 5: $2,567/ account is added representing the Fire portion

Total charge = $138,579 [$0 + $1,139.70 + $117,800 + $17,072 + 2,567]

Similarly, the calculation for the six inch meter would be as follows: Customer ($0) + Meters & Services ($393*21= $8,253) + Base ($14,725*50 = $736,250) + Peak ($2,134*50 = $106,700) + Fire ($2,567) for a combined charge of $853,770.

Option 2 Calculation: two inch meter non-NUGAE customer

Step 1: $0 is added for the customer/account portion of the charge.

Step 2: $393 per MSE representing the Meters & Services portion is multiplied by 2.9 to represent the fact that the meter size is two inches = [$393*2.9 = $1,139.70].

Step 3: $988/ ERU (***this is the change between the options***). Determine the number of ERUs for the customer by dividing the projected annual use of 2,076 ccf by 283.6 gpd (represents 1 ERU). First you must convert ccf to gallons per day (2,076 ccf *748(g/ccf)/365(days/year) = 4,254 gpd. Calculate ERUs = 4,254 gpd / 283.6(gpd/ERU) = 15. Calculate base allocation $988 * 15 = $14,821

Step 4: $1,147 / MCE representing the "Peak" portion is escalated by 8 to represent the meter size = [8 * $1,147 = $9,176]

Step 5: $518/ account is added representing the Fire portion

Total charge = $25,655 [$0 + $1,139.70 + $14,821 + $9,176 + 518]

Similarly, the calculation for the six inch meter would be as follows: Customer ($0) + Meters & Services ($393*21= $8,253) + Base (296,967ccf*748(g/ccf)/365(days/year) = 608,579 gpd, 608,579 gpd/283.6(gpd/ERU) = 2,146 ERUs), 2,146 ERUs * $988 = $2,120,248) + Peak ($1,147*50 = $57,350) + Fire ($518), results in a charge of $2,186,369.

Comparing the resulting charges for the two and six inch meters side by side shows that option two results in lower charges if consumption is lower (two inch meter option one: $138,579; two inch meter option two: $25,655), while the opposite is true if the customers consumption is on the higher side (six inch meter option one: $853,770; six inch meter option two: $2,186,369).

You can find additional examples / comparisons in the technical appendix section.

SEWER

The sewer utility follows the same methodology currently in place where Residential and Commercial I customers are charged a fixed system development charge for the base meter size of 5/8" (Commercial I customers charge increases based on meter size by AWWA flow factors). Commercial II charge is calculated based on functionally allocated costs and established unit costs for flow and strength (Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS)).

DETERMINATION OF THE SEWER SYSTEM DEVELOPMENT CHARGES

Existing Cost Basis

As of 2007, sewer utility total fixed assets equal $43.60 million. Of this amount approximately $6.24 million was contributed and, therefore, excluded from the cost basis. Calculating 10 years of interest on each allocable asset adds $15.62 million. The sewer utility's existing cash reserves were less than outstanding debt, and thus an adjustment of $16.48 million was made to account for principal outstanding. After adjusting the utility's total assets for capital contributions and principal outstanding, the total existing cost basis is approximately $39.77 million.

Future Cost Basis

According to the 2008 Draft Sewer System Plan the City has planned for approximately $102.62 million of capital projects in the sewer utility between 2008 and 2027. Similar to the water utility, recognizing the fact that some of the projects will provide capacity beyond the 20-year period, with the help of the City and the consulting Engineer working on the Sewer System Plan, the project costs were reduced based on the capacity they will provide by the end of the 20-year period (this reduction in costs only applies to the non-NUGAE customers since NUGAE customers build out by 2025). The resulting 20-year project capital total was $79.31 million. In addition, the projects were split between projects related to the NUGAE and non-NUGAE related projects and projects which benefited both customer groups. The NUGAE portion of total projects was $39.26 million, non-NUGAE portion was $35.90 million and the cumulative portion was $4.15 million.

From the $79.31 million $13.70 million are considered to be contributed / donated, reducing the future cost basis portion for NUGAE and non-NUGAE customers. In addition to the contributions / donations any project or portion of the project designated as repair and replacement (R&R) was deducted as well; total R&R deduction was $24.37 million. The resulting allocable future cost basis was $41.27 million,

ORIGINAL SAVE

Presentation of the Sanitation, Water, Sewer & Storm Utility

Rate Forecast

February 2nd, 2009

City Council Workshop

FCS GROUP | 7525 – 166th Ave. NE, Suite D-215, Redmond, WA 98052 ■ 425-867-1802

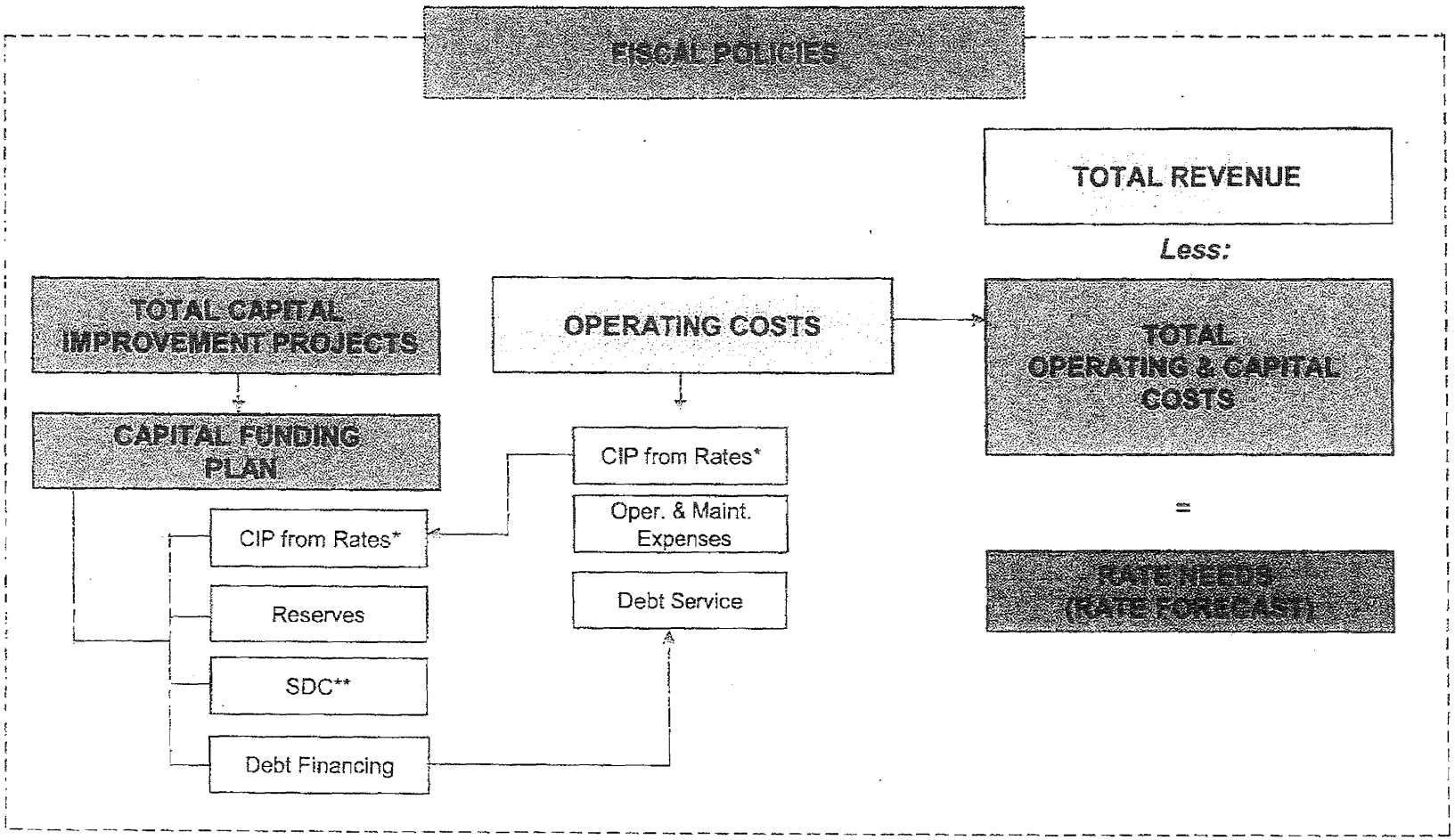
Discussion Outline

- Overview and Development of the Rate Forecast
  - ✓ Sanitation System
  - ✓ Water System
  - ✓ Sewer System
  - ✓ Storm System

Role of the Rate Forecast

- A multi-year forecast that allows for thoughtful planning and is consistent with capital planning
- Determines the amount of revenue necessary to meet <u>all</u> utility system financial obligations
  - ✓ Operating costs
  - ✓ Capital costs
  - ✓ Fund Balances
  - ✓ Financial policies
- Evaluates sufficiency of current rates on a <u>stand-alone</u> basis
- Develops rate implementation strategy
- "Living" forecast that should be checked annually during budget process

Development of the Rate Forecast



**CIP from rates = capital improvement funding supported by rate revenue*
*** SDC = System Development Charge Revenue*

RATE FORECAST

Establishing Overall Revenue Needs

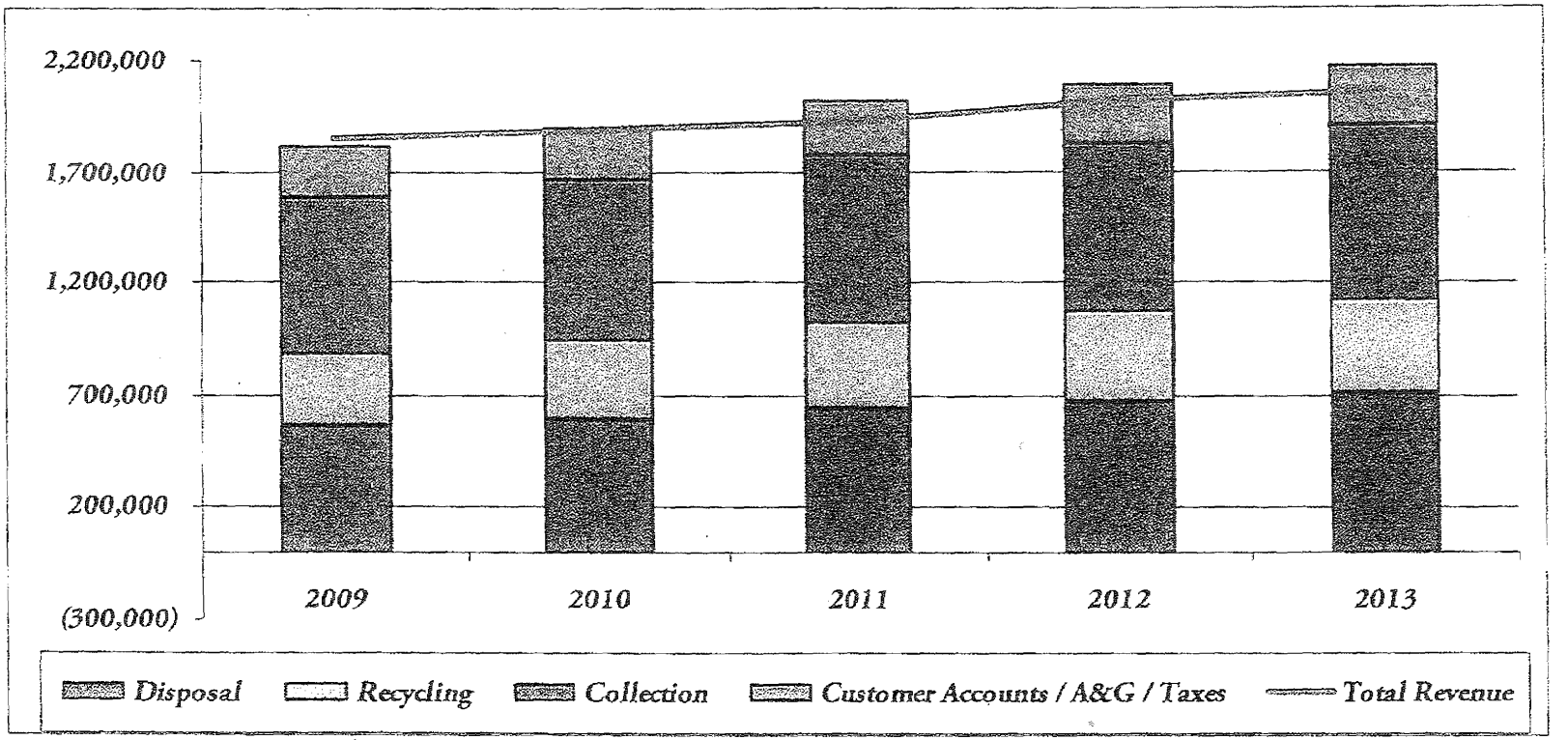
General Assumptions for Rate Forecast - All Utilities

- Time Period Reviewed = 2009-2013
- 2008 budget used as basis for revenue and expenses
- Forecast of revenue includes rate revenue + miscellaneous revenue
  - ✓ Rate revenue growth – utility specific
- Expenses assume the following annual escalation factors
  - ✓ 3.15% general inflation
  - ✓ 5.0% labor inflation
  - ✓ 6.0% Construction inflation
- Two tests completed
  - ✓ Cash flow (revenue less expenses)
  - ✓ Debt service coverage (bond coverage => 1.25)

Sanitation System Rate Forecast

- Fiscal policies
  - ✓ Target reserve levels – 30 days of O&M expenses
- Forecast of revenue (rate revenue + miscellaneous revenue)
  - ✓ 2.0% growth in rate revenue per year
  - ✓ Assumes new Lacamas Heights connections in 2012 (268 residential, 6 commercial) – approximately $50 thousand per year
- North Urban Growth Area (NUGA) expansion growth is assumed to start after the study period of (after 2013)
- 2009 includes $344 thousand for 6,500 new container

Sanitation Rate Forecast Current Rate Levels



Cashflow Surplus (Deficiency)	2009	2010	2011	2012	2013
	$ 67,356	$ 13,160	$ (66,003)	$ (42,185)	$ (84,114)
Rate Increase	0.00%	0.00%	3.43%	2.09%	4.09%
Rate Strategy*	0.00%	2.00%	2.00%	2.00%	2.00%

Annual increases also include meeting reserve targets

Key Considerations Sanitation

- No increase required in 2009
- Rate deficiency beginning in 2011
  - ✓ Rate proposal of 2% per year in 2010 – 2014 to smooth rate impacts
- Existing fund balance above 30 day target

Water System Rate Forecast

- Fiscal policies
  - ✓ Target cash operating reserve level – 90 days of O&M expenses
  - ✓ Capital contingency of $200,000
  - ✓ Rate Funded System Reinvestment - $200,000 starting in 2011
    - Ideally set at average annual capital or annual depreciation expense
    - City currently not specifically funding this cost component
  - ✓ Debt service coverage = >1.25
- Forecast of revenue (rate revenue + miscellaneous revenue)
  - ✓ 1.5% growth in rate revenue per year
  - ✓ NUGA growth assumed after 2013
- Existing debt service obligations
  - ✓ 3 loans = $402k/year

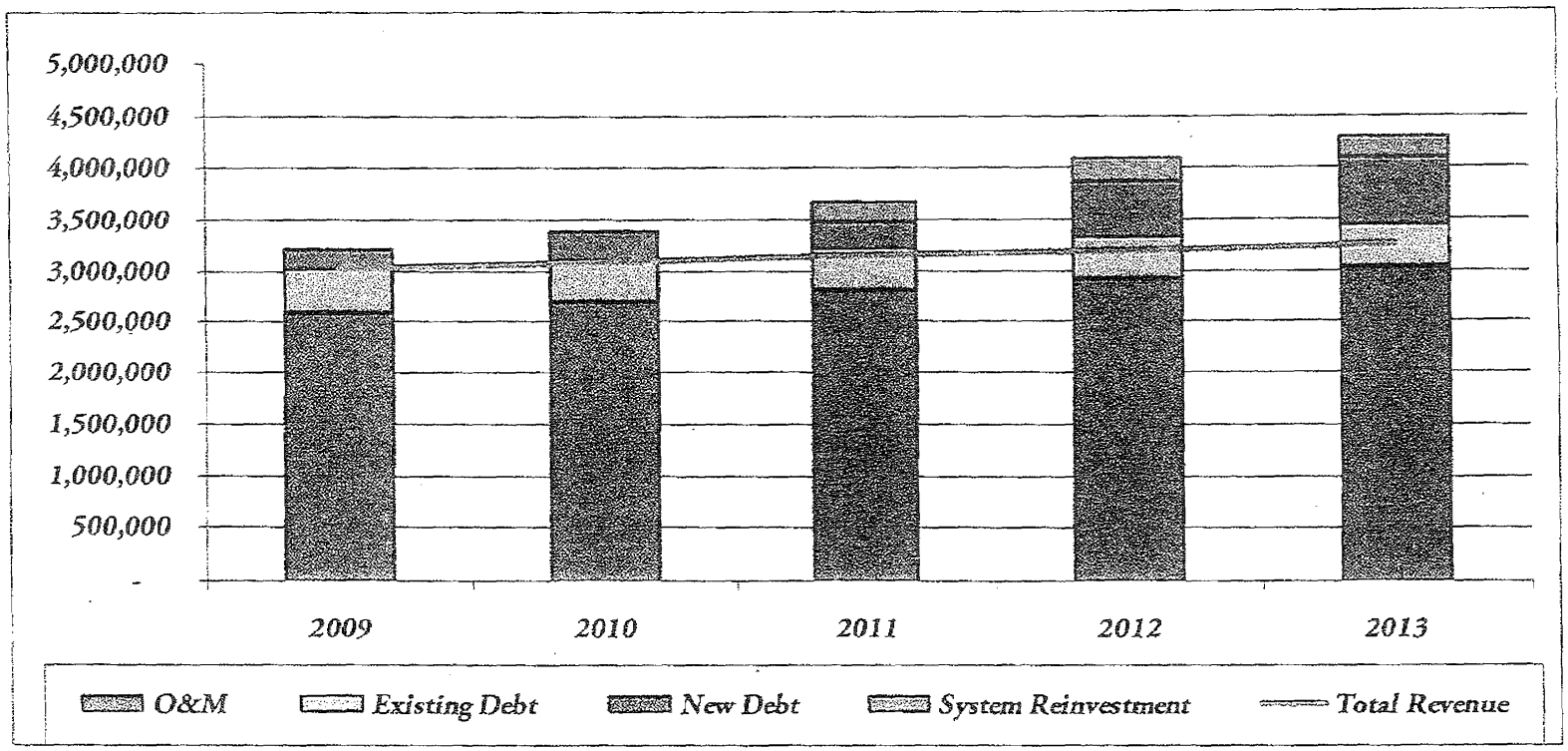
Water Capital Improvement Program

- Capital funding associated with program
  - ✓ $189,000/year SDC revenue (current charge)
  - ✓ $5.7 million developer donations identified
  - ✓ $7.1 million new debt service (total for time period)
  - ✓ $200,000/year rate funded capital beginning in 2011

- New debt service - $201,000 increasing to $650,000 by 2013

Year	Water CIP (2008$)	Water CIP (inflated)
2009	$ 2,280,000	$ 2,416,800
2010	2,825,000	3,174,170
2011	598,000	712,228
2012	2,925,000	3,692,745
2013	3,075,000	4,115,044
Total	$ 11,703,000	$ 14,110,986

Water Rate Forecast Current Rate Levels



Cashflow Surplus (Deficiency)	2009	2010	2011	2012	2013
	$ (315,046)	$ (442,339)	$ (550,132)	$ (900,976)	$ (1,071,820)
Rate Increase	11.23%	15.53%	19.03%	30.70%	35.98%
Rate Strategy*	14.50%	5.00%	5.00%	5.00%	5.00%

* 2009 Rate increase takes into account that the earliest date rates will go into effect is March 2009.

Annual increases also consider meeting reserve targets

Key Considerations Water

- Current rates not sufficient to meet financial obligations in 2009 - 2013
  - ✓ 14.5% increase in 2009 - $2.91 for average single family customer*
  - ✓ 5.0% per year increase 2010 – 2013 - $1.15 - $1.33 increase per month*
- Rate increase driven by:
  - ✓ Capital requirements causing the need for additional debt
  - ✓ New debt service begins 2009 - $200,000 additional expense
  - ✓ 2011 begins funding capital projects from rates
  - ✓ Debt coverage requirements of => 1.25
- Current operating fund balance is below target level of 90 days until 2011
  - ✓ Proposed rate increases are required to reach target levels
  - ✓ Strong fund balance is key factor when looking to securing outside funding
- Capital fund meeting minimum requirement of $200,000

**Assumes a 5/8" single family meter at 11 ccf per month*