2024 Water System Plan

Clark Public Utilities

Water System ID 13333X

February 15, 2024

consor

888 SW 5th Avenue
Suite 1170
Portland, OR 97204

Signed 02/15/2024

Lee H. Odell, P.E.

Table of Contents

Executive Summary

Chapter 1 Description of Water System

Chapter 2 Planning Data and Water Demand Forecasting

Chapter 3 System Analysis

Tables

Figures

Appendices

A Satellite Water System Plans
B Satellite Water System Management Policy
C Agreements (service area, interties, source, wheeling, joint use, cooperation and mutual aid)
D Water Use Efficiency Policy
E 2021 Water Rate Schedules
F Construction Standards
G Clark County Fire Flow Requirements
H Water Quality Monitoring Plan
I Water Quality Regulations
J Hydraulic Model Technical Memorandum
K Wellhead Protection Plan (on file at Clark Public Utilities and Department of Health)
L Consumer Confidence Report
M Emergency Response Plan
N Coliform Sampling Plan
O Cross Connection Control Program
P Capital Improvements Projects (2022 – 2042)
Q SEPA Checklist (for 1,000 or more service connections)

THIS PAGE INTENTIONALLY LEFT BLANK

Acronyms & Abbreviations

A	
ADD	average day demand
AL	action levels
AWWA	American Water Works Association
C	
CCL	Contaminant Candidate List
CCR	Consumer Confidence Report
cfs	cubic feet per second
CIP	capital improvement plan
D	
DEQ	Department of Environmental Quality
E	
EPA	Environmental Protection Agency
EPS	extended period simulation
F	
fps	feet per second
ft	feet
FTE	full-time equivalent
FY	fiscal year
G	
GIS	geographic information system
gpa	gallons per acre
gpcpd	gallons per capita per day
gpepd	gallons per employee per day
gpd	gallons per day
gpm	gallons per minute
H	
HGL	hydraulic grade line
I	
IOCs	inorganic contaminants
in	inch
L	
LCR	Lead and Copper Rule
lf	linear feet
M	
MCGL	maximum contaminant goal levels
MCL	maximum contaminant level
MDD	maximum day demand
MGD	million gallons per day

MG	million gallons
N	
NPDWR	National Primary Drinking Water Regulations
NSDWR	National Secondary Drinking Water Regulations
O	
O&M	operations and maintenance
OWQPs	optimal water quality parameters
P	
PHD	peak hour demand
ppm	parts per million
PRV	pressure reducing valve
psi	pounds per square inch
PSV	pressure sustaining valve
PUD	Asotin County Public Utility District
PVC	polyvinyl chloride
R	
ROV	Remotely Operated Vehicle
RR	Radionuclides Rule
RSMeans	RS Means Heavy Construction Cost Data
RTCR	Revised Total Coliform Rule
S	
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
SMCLs	secondary maximum contaminant levels
SOCs	synthetic organic contaminants
T	
TAZ	traffic analysis zone
TC	total coliform
TCR	Total Coliform Rule
V	
VFD	variable frequency drive
VOCs	volatile organic contaminants
W	
WQP	water quality parameter
WSMP	Water System Master Plan

Executive Summary

Major Findings and Recommendations

There have been two key changes that have significant impact to Clark Public Utilities planning process since the last water system plan update approved by the Washington State Department of Health (DOH) on May 11, 2014. The first is a new program by the DOH Drinking Water Program (DWP) that allows water system plans to be approved for a 10-year period rather than a 6-year period. This water system plan has been prepared for a period of 20 years, but an update will be required within 10 years after approval of this plan.

The second significant change in the water system plan is the evaluation of each separate pressure zone for fire, storage, supply, and pressure using a new comprehensive water system model prepared as part of this water system plan. Previously, the system had been evaluated as a combined utility. DOH has required that each pressure zone be individually evaluated in this water system plan, and the evaluation identified many improvements that have been scheduled throughout the 20-year planning period.

Because of the need to develop these new supply sources, and maintain the aging distribution system, the Utilities Capital Improvement Plan has increased. Clark Public Utilities adopts annual budgets for the Water System, Including Capital Improvements. If and when these capital improvements are budgeted, these larger investments may result in increased water rates for the utility. Budgeted capital improvements will provide an improved level of service including fire flows in areas currently not meeting fire flow levels and increased storage assigned to many of the utilities pressure zones for improved reliability.

There are steps that the Utility has taken to reduce the impact of these water rate increases including:

- Investing in facilities that minimize operational costs to the extent possible.
- Adopting a rate structure that has resulted in significantly fewer large volume water users.
- Managing debt and capital investments to limit debt services costs.

Description of the Water System

Background

Clark Public Utilities is a customer-owned utility providing electrical power, electric distribution and water services in Clark County, Washington. It has been operating as a non-profit municipal corporation since 1938.

The utility began providing water service to the Hazel Dell area in 1951. The system has expanded considerably since then. Today the water utility's distribution system embraces roughly 495 square miles. It serves approximately 101,124[1] people with 39,044 connections. The system also serves the Vancouver's unincorporated urbanizing area, La Center and Yacolt.

[1] 2.59 people per ERU, 2015 Clark County Comprehensive Growth Management Plan.

The Water System Plan update was developed in compliance with Chapter 246-290-100 of the Revised Codes of Washington State. The plan addresses the improvement of existing and construction of new water supply, treatment, storage, and distribution facilities to meet the needs of its customers over the next 20 years.

Existing Facilities

Most of the District's water is provided by the wells located in the Salmon Creek Watershed. The District owns, operates, and maintains 42 wells and a 855-mile network of transmission and distribution lines. Four aquifers are the source of water for the wells. Total production capacity of the Water System is 50.8 million gallons per day (mgd). Water is stored in 38 reservoirs with a combined storage capacity of 24.9 million gallons (MG).

The total pumping capacity is about 36,000 gallons per minute (gpm) from the District's 42 water wells. Transmission and large distribution mains serving the District provide fire flow in addition to peak usage demands. Auxiliary power generators are provided at selected pumping stations. The Water System also includes 53 booster pump stations, 22 satellite systems and 6 system interties. The District considers the Water System's source, storage, and transmission capabilities to be adequate for the District's customers.

Satellite Management Agencies

The *Clark County Coordinated Water System Plan* identifies Clark Public Utilities as the county's satellite system management agency. The water utility operates 22 satellite water systems.

Policies

The Water System Plan presents the water utility's policies concerning the design and operation of the water system; provision of water to adjacent utilities; operation of satellite systems; and provision of service to new developments and individual customers. New policies since the last water system plan include water supply agreements with the Cities of Battle Ground, and Ridgefield.

Planning Data and Water Demand Forecasting

Projected Population

Population projections for the County, included in the Comprehensive Growth Management Plan were used to predict the population growth for the planning period. The County-wide plan calls for a 1.26 percent annual population increase over the next twenty years. Since water resources are difficult to develop, the population projections were extended to a 50-year period. The projected population estimates are expected to grow to 106,000 people by 2032, and to over 120,000 by 2042.

Analysis of the System

The water system plan updated the analysis of the water system with new demands. The Utility completed development and testing of a new hydraulic model and used the model to evaluate the water system.

Design and construction standards have been updated from the 2013 Water System Plan.

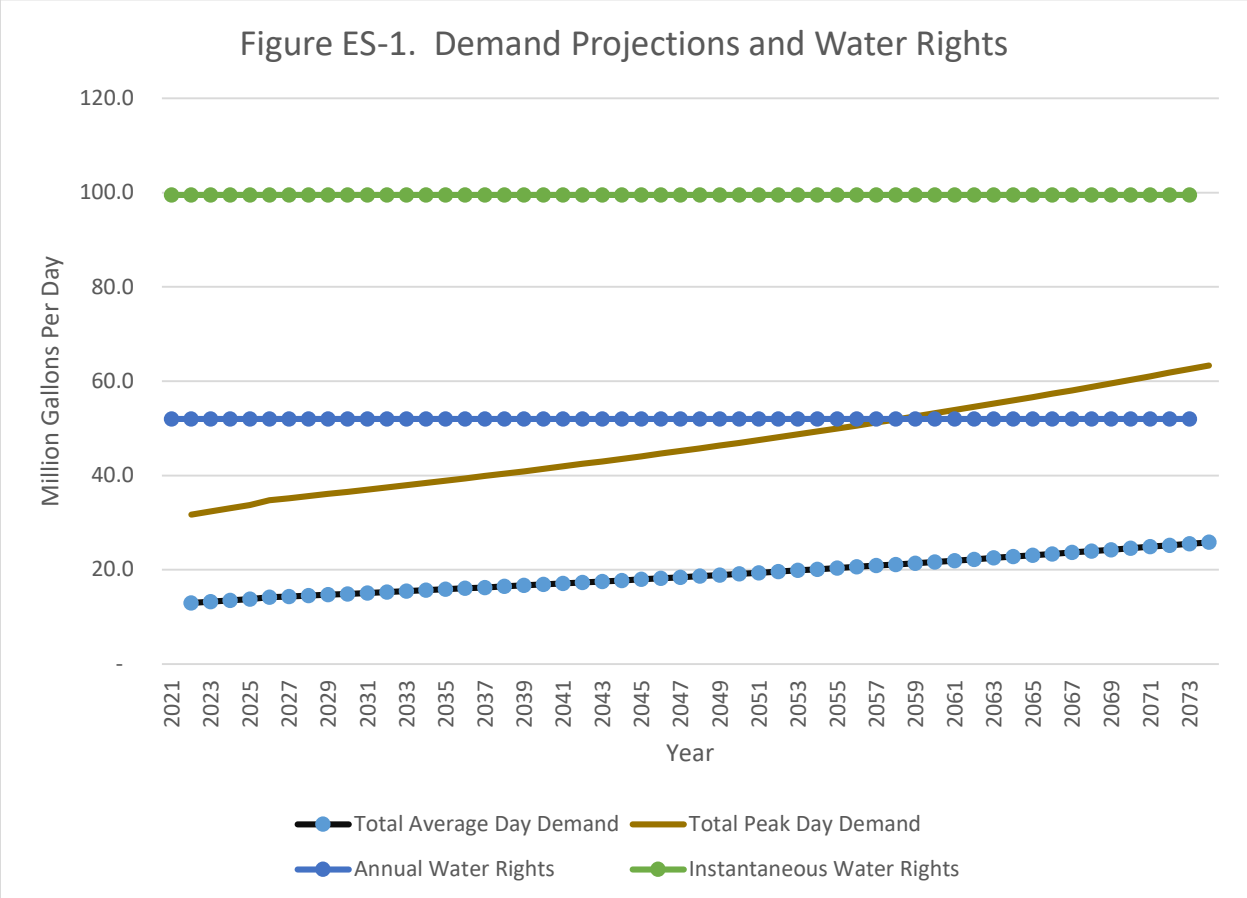
A water quality assessment has been completed. Potential new regulations could mean additional water quality monitoring, adoption of best management practices for the distribution system and potentially

treatment for arsenic if Environmental Protection Agency (EPA) lowers the maximum contaminant level again.

Water Resource Assessment

The Utility has approximately 25,000 gpm of undeveloped source in Carol J. Curtis Wellfield, and approximately 5,000 gpm of undeveloped water supply in the Paradise Point Wellfield. **Figure ES-1** shows the projected water demands and the existing water rights. The utility has a total of 58,687 acre-feet per year of annual water rights, and a total of 69,098 gpm of instantaneous water rights, as shown on **Figure ES-1,** converted to million gallons per day (mgd). The annual water rights limit averages 52 mgd and the instantaneous water rights allows for up to 99.5 mgd. Using all of these water rights will require some modifications to unused water rights capacity and development of the Carol J Curtis Wellfield and the Paradise Point Wellfield.

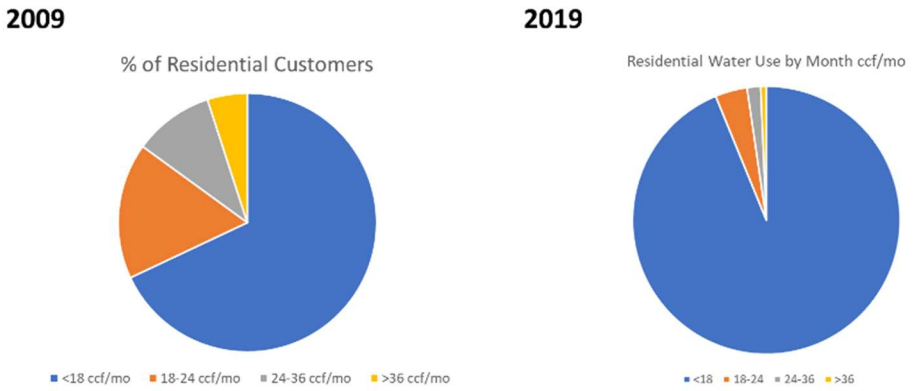
Figure ES-1 | Water Rights and Average Day Demand Projection



Water Conservation

The water utility has adopted a number of measures to encourage water conservation since the last water system plan was adopted. **Figure ES-2** shows that the conservation measures have had a tremendous reduction in the number of large water users. The number of water users using more than 1800 cubic feet per month in 2009 was 32 percent of the customers, and in 2019, less than 6 percent of the customers used 1800 cubic feet of water.

Figure ES-2 | Percentage of Large Residential Water Users in 2009 and 2019



Wellhead Protection Plan

The water utility has updated its Wellhead Protection Plan for its 42 supply wells located throughout the county, consistent with WAC 246-290.135 (4). The plan is aimed at preventing toxins from entering the water supply. It sets forth emergency procedures that will be undertaken in the event a water source is threatened by contamination. An update of the wellhead protection plan is required every two years.

The water utility's wells provide high quality, safe drinking water. Future development of the Carol J. Curtis Wellfield and the Paradise Wellfield may require additional treatment.

Contaminant Inventory

Underground storage tanks were inventoried, since fuel and other toxins that may leak from these facilities present the most significant and widely occurring threat to groundwater quality. Industries using hazardous materials and hazardous waste recovery operations pose another significant risk to groundwater. Other potential sources of contamination include transportation-related spills along I-5, I-205, Highway 99, SR-502 and SR-503.

Wellhead Protection Recommendations

Clark Public Utilities maintains a wellhead protection plan in conjunction with the County and other water suppliers. The wellhead protection plan is incorporated into the Water System Plan. Existing programs include public education and technical assistance concerning the control of contaminants; contaminant source management; water quality monitoring and data management; land use and regulatory controls; coordination of water system planning among purveyors; and strategies for emergency spill response.

Operations Program

Organizational Structure and Staff Responsibility

A board of three elected commissioners governs Clark Public Utilities. The board employs a general manager who is responsible for the day-to-day operation of the agency—both the electric and water utilities. A director manages the water utility. Four managers, who report to the director, oversee various water utility programs areas.

Emergency Response Plan

The plan serves as a guide for water utility employees to follow in restoring water service during a major outage. The plan establishes a communications network that has sufficient flexibility to respond to a wide range of emergency conditions.

Routine and Preventative Maintenance

The water utility recognizes that routine inspection and maintenance of the system limits the occurrence of unexpected, costly emergency repairs. A good preventive maintenance program extends the life of the equipment and ensures that the system operates efficiently and reliably.

Water Quality Sampling and Violation Response Procedures

The DOH is responsible for implementing and enforcing water quality regulations. The utility monitors the water quality of the system for conformance with the federal drinking water standards.

Capital Improvement Plan

The capital improvement plan proposes projects for the improvement of hydraulic and fire-flow for the water system. The plan outlines water source, treatment, storage, and distribution improvements necessary to meet the needs of the water utility's service area over the next 20 years. A summary of the capital improvement projects is shown in **Table ES-1** and described in the following paragraphs.

Table ES-1 | Water System Capital Improvement Program Budget 2022-2032

Capital Improvement Plan	Total for 10 Year Period
Storage Tanks	22,966,000
Booster Pump Stations	5,154,000
Pipelines: Mains & Transmission	40,081,000
Water Source Supply	21,758,000
Meters	3,402,000
Total Capital Budget	**$93,361,000**

Note:
2022 Budget is based on most current costs. All cost estimates provided by Clark Public Utilities.

Carol J. Curtis Wellfield Development

Clark Public Utilities has developed 10 mgd of supply capacity from the Carol J. Curtis Wellfield (CJCW). The utility's water rights allow the development of an additional 40 mgd from the Pleistocene Alluvial Aquifer, and testing is scheduled to begin in 2023.

Paradise Point Wellfield Development

The anticipated water supply from the Paradise Point Wellfield (PPW) in north Clark County is planned to expand from 5 mgd to 15 mgd over the next 10 years to supply water to the north county area.

Water Resource Protection

Resource protection projects for the sand and gravel aquifer include completion of an aquifer flow model, and additional monitoring of the aquifer in the 20-year planning period. Aquifer storage projects may allow water to be pumped from CJCW and PPW and stored in upland wells to mitigate streamflow, recover well levels, or offset peak summer demands.

Resource Mitigation

Resource mitigation projects include stream restoration projects in the Salmon Creek basin, and other projects in the future to offset potential stream-flow impacts.

Additional Reservoir Capacity

Additional reservoir capacity totaling 13.8 MG is needed during the 20-year planning period.

Water Main Repair and Rehabilitation

Major repair and rehabilitation projects include the replacement of steel pipe in the Hazel Dell area and undersized and leaking PVC pipe throughout the system.

Financial Strategy

The primary objective of the plan's financing strategy is to fund growth-related improvements through growth-related revenues and replacement projects through rates and bonds. The capital funding alternatives for the water utility include state and federal grant/loan programs and municipal bonds retired by rate revenue. Internal sources of funding available for capital projects include a combination of system development charges and monthly user rates.

External Funding Sources

The utility has a successful history using many external funding sources including Community Development Block Grants, and loans under the USDA Community Facilities, Drinking Water State Revolving Fund, Public Works Trust Fund, and Community Economic Revitalization Board programs. New federal programs include the Water Infrastructure Financing and Investment Act, which provides long term 40-year loans targeted for larger projects.

Bond Financing

The PUD has historically financed a portion of their capital improvements using municipal, general obligation, revenue, and local utility district bonds, which are issued to secure funds for projects.

Ten Year Capital Improvement Plan

Cost estimates have been made for the improvements scheduled for completion within the next ten years. Capital improvements undertaken between 2023 and 2033 will require approximately $36.4 million. The District's policy has historically been to fund 40 percent of the capital improvements from rates and 60 percent from debt. If the Commission decides to maintain the practice of funding 40 percent of Capital using rate funds, it will put upward pressure on rates to maintain coverage ratios.

Financial Viability

An assessment was made of the financial framework of the water utility, which confirmed its long-term financial viability. This analysis considered the operating budget, operating cash reserve, capital cash reserve, and an index based upon the median household income.

Rates and Charges

The water utility has adjusted rates to provide for operating expenses, repairs, and debt service, and has provided a sufficient margin from which capital additions to the water system have been made. Water sales have increased on average 4.5 percent annually over recent years.

Historic and Projected Revenues and Expenses

Current Water rates for the Utility are still relatively low compared to large northwest water utilities as shown in **Table ES-2**. The historic and projected operating results for the utility's water system for the fiscal years 2012 through 2021 are shown in **Table ES-3**. Future revenues have been based on estimated sales revenues at growth rates of 1.26 percent annually which is equal to the growth rate in the system.

The outstanding debt for the water system consists of revenue bonds issued to fund prior capital improvements and loans. The projection of debt service is based on debt funding approximately 60 percent of capital projects shown in **Table ES-3**, per Clark Public Utilities Funding Policy. The utility must maintain an annual debt service coverage ratio of at least 1.25 times the annual projected debt service expenses for parity bonds to adhere to bond covenants.

Table ES-2 | Monthly Residential Water Retail Bill Comparison (as of April 2021)

Utility	Monthly Bill
Clark Public Utilities	$31.20
Selected Northwest Public Utility Districts and Municipalities	
City of Battle Ground, WA	$37.42
City of Camas, WA	$38.79
City of Ridgefield, WA	$41.78
City of Vancouver, WA	$45.27
City of Washougal, WA	$70.18
Kitsap County PUD, WA	$45.47
City of Longview, WA	$53.88
City of Portland, OR	$84.03
City of Salem, OR	$43.16
Snohomish County PUD, WA	$65.22
City of Seattle, WA	$83.25 off peak/ $94.22 peak
City of Tacoma, WA	$62.48 off peak/ $66.27 peak
Average (excluding the District)	$56.32

Note:
Based on monthly consumption of 1,200 cubic feet and a 3/4" meter.

Table ES-3 | Water System Historical and Projected Water Sales and Revenues

.

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Operating Revenues																	
Water Sales	$16,147	$15,420	$16,308	$17,496	$18,879	$19,117	$19,358	$19,602	$19,849	$20,099	$20,352	$20,608	$20,868	$21,131	$21,397	$21,667	$21,940
Other Revenue	$4,819	$4,010	$4,683	$4,966	$3,423	$3,466	$3,570	$3,677	$3,788	$3,901	$4,018	$4,139	$4,263	$4,391	$4,523	$4,658	$4,798
Total Operating Revenue	$20,966	$19,430	$20,991	$22,462	$22,302	$22,583	$22,928	$23,279	$23,636	$24,000	$24,370	$24,747	$25,131	$25,522	$25,920	$26,325	$26,738
Operating Expenses	$8,945	$9,204	$9,727	$10,296	$10,298	$10,539	$10,855	$11,181	$11,516	$11,862	$12,218	$12,584	$12,962	$13,350	$13,751	$14,164	$14,588
Non-Operating Revenue	$751	$641	$279	$532	$50	$51	$51	$52	$53	$53	$54	$55	$55	$56	$57	$57	$58
Balance Available for Debt Service	$12,772	$10,867	$11,543	$12,698	$12,054	$12,095	$12,124	$12,150	$12,172	$12,191	$12,206	$12,218	$12,225	$12,227	$12,225	$12,219	$12,207
Total Debt Service	$8,724	$8,806	$9,002	$8,414	$9,434	$9,563	$10,198	$10,019	$10,019	$10,019	$10,019	$10,019	$10,019	$10,019	$10,019	$10,019	$10,019
Operating Result	$4,048	$2,061	$2,541	$4,284	$2,620	$2,532	$1,926	$2,131	$2,153	$2,172	$2,187	$2,199	$2,206	$2,208	$2,206	$2,200	$2,188

Operating revenues are expected to increase with additional customer growth. Operating expenses are projected to increase at 3% per year. No Rate increases are included in the projections

.

CHAPTER 1

Description of Water System

1.1 Ownership and Management

Clark Public Utilities is a customer-owned utility with the authority to provide electricity, water, wastewater services, and power generation in Clark County, Washington. All but wastewater services are currently provided by the utility. Clark Public Utilities was initially known as Public Utility District No.1 of Clark County when it was formed by a vote of the people in 1938. It is a not-for-profit municipal corporation organized under the laws of the state of Washington. Clark Public Utilities presently provides electrical service to more than 220,000 customers, water service to approximately 39,000 homes and businesses and owns and operates a 248 MW combustion turbine power generating facility. The operations of the three utility systems are financially independent. Throughout this report the water services operation of the utility will be referred to simply as the *water utility*. The satellite water systems operated by the water utility are in Appendix A. Utility contact information is shown in Table 1-1.

Table 1-1 | Clark Public Utilities Water Utility Contact Information

Primary Contact	Director of Water Services
Mailing Address	Clark Public Utilities, P O Box 8900, Vancouver, WA 98668
Location	Orchards Service Center, 8600 NE 117th Avenue
Phone Number:	(360) 992-8022
Fax Number:	(360) 992-8027
Web Site:	http://www.clarkpud.com/water.htm

The management structure is headed by a board of three elected Commissioners, which establishes policy and sets water rates. The Commissioners serve six-year terms with one of the three positions up for election every two years. A general manager supervises day-to-day operations. Key personnel and authority are detailed in the *Operations* Section.

1.2 System Background and Description

1.2.1 History of Water System Development and Growth

Clark Public Utilities entered the water business in 1951 when 347 customers in the Hazel Dell area requested that the water utility take over the operation of their private water system. This water system expanded to provide service throughout Hazel Dell and surrounding areas. Subsequent growth into the rural area was rapid and the service area now encompasses all of the rural areas outside designated urban growth areas (UGA) plus a significant portion of the City of Vancouver's UGA.

The expansion of the Clark Public Utilities' water system also involved the consolidation of other pre-existing water systems. The most significant of these systems follows: (1) Hockinson in 1980; (2) City of La Center 1992; (3) Meadow Glade 1993. The future capital improvement plan calls for the consolidation of the Town of Yacolt over the next 10 years, which is currently operated as a satellite system.

The water utility depends solely upon groundwater for its water supply. The greatest production volume is from wells located within the Salmon Creek watershed. This area also includes the Hazel Dell service area, which represents the greatest concentration of current water services.

System expansion in recent years has included the addition of transmission mains to increase the ability of the water utility to transfer water among the various pressure zones that are widely dispersed throughout the utility's large service area. The expansion of the system has been in response to requests for water service by new developments. At present, the water utility's distribution system covers most of the major roadways in the rural area and extends into the foothills of eastern Clark County. Future system development will be predominately within the limits of the areas presently served. Exhibit 1 shows Clark Public Utilities' water service area.

1.2.2 Geography

Clark County is located in southwestern Washington. It is bounded on the north by the North Fork of the Lewis River, on the east by the western slopes of the Cascade Mountains, and on the south and west by the Columbia River. Bottomland along the Columbia River transitions to plains and terraces. The terrain rises in the northeast to the foothills of the Cascades where elevations climb to 4,000 feet. The water utility's existing service area is most of Clark County lying north and northeast of the City of Vancouver, with the exceptions of the City of Ridgefield and the City of Battle Ground. The Camas/Washougal area lies to the southeast of the service area.

The county covers approximately 656 square miles with forests covering more than 50 percent of the land area. Major forested areas are in the north and northeast sections of the county. Large tracts of land with little or no development are located in the northeastern sections of the county.

Historically, the existing topography was influenced by geologic forces but more recently by surface water erosion. Down faulting has formed the Chelatchie Prairie and the Yacolt basin areas in the northeastern sections of the county. In general, erosion and deposition, have played a major part in forming the terraced landscape, which occurs in the Fourth Plains area and glacial outwash lowlands along the Columbia River.

Major water bodies include Vancouver Lake in the southwest corner, Lacamas Lake in the southeast corner, and Lake Merwin and Yale reservoirs on the northern boundary. These latter two water bodies were created by dam construction for the generation of electrical power. Major rivers include the North Fork and East Fork of the Lewis River, the Washougal River, and the Columbia River. Stream systems include Salmon, Gee, Cedar, Burnt Bridge, Whipple, and Lacamas Creeks.

Features that present significant barriers to the development of the water transmission network include Interstates 5 and 205, Salmon Creek, and the East Fork of the Lewis River. Clark Public Utilities works closely with the Washington State Department of Transportation to coordinate the installation of water facilities along new or upgraded roadways that increasingly have restricted access.

The range of service elevations has required the use of multiple pressure zones to provide acceptable service. Topographical maps for the area are included in the back of the plan.

1.2.3 Neighboring/Adjacent Purveyors

Exhibit 1 shows the water utility's service area. The water utility's service area is adjacent to the service territories of all other major purveyors' including the cities of Battle Ground, Camas, Ridgefield, Vancouver, and Washougal. By having water service area boundaries with all of the major water purveyors Clark Public

Utilities is in the unique position to provide a regional water facility framework. All of the major purveyors have established water service areas that provide for the future expansion of their existing service areas.

Clark County also contains small water utilities: 21 Group A community, 48 transient non-community (TNC) and non-transient, non-community (NTNC) Group A systems, and 1,182 Group B systems (DOH, March 2022). Most of these water systems are located within Clark Public Utilities' service area; however, none of the smaller systems are expanding. There are 22 satellite systems, which are owned and/or managed by the water utility.

1.2.4 Ordinances and Policies

Water Utility Resolutions and Ordinances:

1. Satellite System Management Policy. Sets conditions for management of satellite systems. A copy of the policy is included in Appendix B.

2. Intertie Agreements. The water utility has six interties with neighboring utilities, The City of Vancouver (1), The City of Ridgefield (2) and The City of Battle Ground (3). A list of interties and capacities is included in this section.

3. Clark County Ordinance No. 1979-11-98, November 21, 1979. The ordinance provides an updated set of standards and criteria for fire protection flows and facilities in the county.

4. Water Utility Resolution No. 3961, December 21, 1984. Adopted the current schedule of fees and charges effective January 1, 1985.

5. Water Utility Resolution No. 4258, February 23, 1988. Adopted rate structure effective March 1, 1988.

6. Salmon Creek Memorandum of Understanding. The water utility, Washington State Department of Ecology, Clark County, and the Washington State DOH signed the memorandum of understanding in January 1992. The memorandum provides conditions for evaluation and allocation of water resources in the Salmon Creek basin. A copy of the memorandum is included in Appendix C.

7. Interlocal Agreement for Establishing Water Utility Service Boundaries between the Cities of Battle Ground, Camas, Ridgefield, Vancouver, Washougal, the Town of Yacolt, and Clark Public Utilities. The agreement was signed in 1999, and it establishes water utility boundaries for the county's water utilities. A copy of the agreement is included in Appendix C.

8. Water Utility Resolution No. 6012, December 7, 1999. Rate schedule for water and wastewater service and schedule of fees and charges for water and wastewater effective December 15, 1999. The rate structure and fees are presented in the *Financing Strategy* Section.

9. Agreement to operate Town of Yacolt water system, October 2, 2000. Yacolt transferred water system over to Clark Public Utilities. Clark Public Utilities received all assets of the water system and assumed all debts. Yacolt received $14,400 from Clark Public Utilities as reimbursement of balance of water fund that was transferred to Clark Public Utilities.

10. A Short-Term Water Supply Agreement with the City of Battle Ground was adopted in 2005. This agreement transferred 1,000 AF/Yr of excess water rights from the City to the water utility, in exchange for providing water supply equal to that amount per year.

11. Water Use Efficiency policy was adopted in January 2008. A copy of the policy is included in Appendix D.

12. Current Rates were adjusted January 1, 2021, in Resolution No. 7196. A Copy of the Resolution is contained in Appendix E.

13. Agreement with the City of Battle Ground Water Supply Aid to Construction Agreement dated July 7, 2020, which provided guidance for the timing and capacity of transmission and booster pump construction along NE 219th Street (SR 502) east of 92nd Avenue to supply water to the City from the Meadowglade pressure zone.

14. Agreement for Water Supply and Aid to Construction with City of Battle Ground dated March 2, 2021, which supersedes the Short-Term Water Supply Agreement and the July 7, 2020, Water Supply Aid to Construction Agreement. This agreement provides for cost sharing of a well, water treatment and transmission costs for improved water supply to the City through the intertie previously constructed.

15. Agreement for Water Supply and Aid to Construction with City of Ridgefield dated February 12, 2021. This agreement provides for cost sharing of a well, water treatment and transmission costs for improved water supply to the City through two interties at 800 NE 264th Street and at 911 N 65th Avenue.

1.3 Inventory of Existing Facilities

1.3.1 General Description of Existing System Facilities and Major Components

Figure 1-1 shows the services area for Clark Public Utilities and Figure 1-2 shows the hydraulic profile for the utility. Table 1-2 shows the pressure zones in the main system along with the number of meters in each zone for 2021.

Table 1-2

PRESSURE ZONE	Number of Meters 2021
147TH ST	9
15TH AVE	16
244TH CT	8
82ND AVE	28
ALPINE HTS	50
ALVA	36
ARMSTRONG	363
BERRY	43
BIG EAST	85
BLACKHAWK	109
BONANZA	34
BOOSTER #149	14
BOOSTER #6 (PFEIFFER)	115
BOOSTER 109 PRV	24

PRESSURE ZONE	Number of Meters 2021
COLE WITTER	68
DOVE CREEK	54
DUBLIN	182
ECHO RIDGE	22
EDGETREE CONDOS	28
FINN HILL	24
GABLE AVE	119
GRIFFELS	2,456
HAZEL DELL	24,888
HEISSON BOOSTER	7
HOCKINSON	3,167
HOCKINSON HIGHLANDS	14
KELLY	40
LA CENTER	760
LOCKWOOD	104
LOWER EARLY DAWN	15
LOWER TAYLOR VALLEY	1
LUDLUM	246
MEADOW GLADE	3,375
MEADOW GLADE BOOSTER	42
METTLER MANOR	22
NORDEEN	80
OSMAN	83
RAWSON	117
RAWSON ROAD UPPER	17
RIVERBEND	11
SKYLINE	7
SOUTHVIEW TERRACE	35
SPRING HILL	39
SUMMER HILLS	90
SUMMER HILLS 1	34
SUMMER HILLS 2	8
TAYLOR VALLEY	70
TITTLE	673
TITTLE BOOSTER	137
UPPER BIG EAST	10
UPPER LA CENTER	815
UPPER VALLEY VIEW	150
VERNERSBERG	27
VISTA PRV	73
GRAND TOTAL	**39,044**

1.3.1.1 Water Sources

The existing water system uses 34 active wells to provide a groundwater supply. The utility also has 10 inactive wells and 3 wells pending source approval. The majority of these wells are located within the Hazel Dell service zone with the remainder being in the Hockinson, La Center, Meadow Glade, Armstrong, Griffles, and Lockwood Creek pressure zones. **Table 1-3** summarizes the active sources available within each pressure zone. Additional detail on existing sources is provided in the *Water Demands* Section. All water sources have master production meters with remote operation and monitoring provided by the water utility's SCADA system.

1.3.1.2 Water Treatment

Table 1-4 summarizes water treatment facilities at each of Clark Public Utilities' wells.

Chlorination - All of the water utility's active water production facilities include disinfection treatment to provide a residual throughout the distribution system. This treatment is achieved using sodium hypochlorite, primarily through on-site generation.

Iron and Manganese Removal - Iron and manganese removal facilities are provided on Paradise Point Wellfield (Installed 2019), Carl J Curtis Wellfield (Installed 2010), Well 110 (installed 1996), Well 15 (installed 1997, rehabilitated 2009), Well 21 (installed 1998), Well 8.2 (2004), Well 13.1 and Well 35 (both 2009). All of the facilities use manganese dioxide ore (AS-721 or AS 741 media) to adsorb dissolved iron and manganese. Chlorine is added prior to the adsorption units to provide continuous regeneration of the manganese dioxide media.

Figure 1-1 | Clark Public Utilities' Existing, Retail & Future Service Area

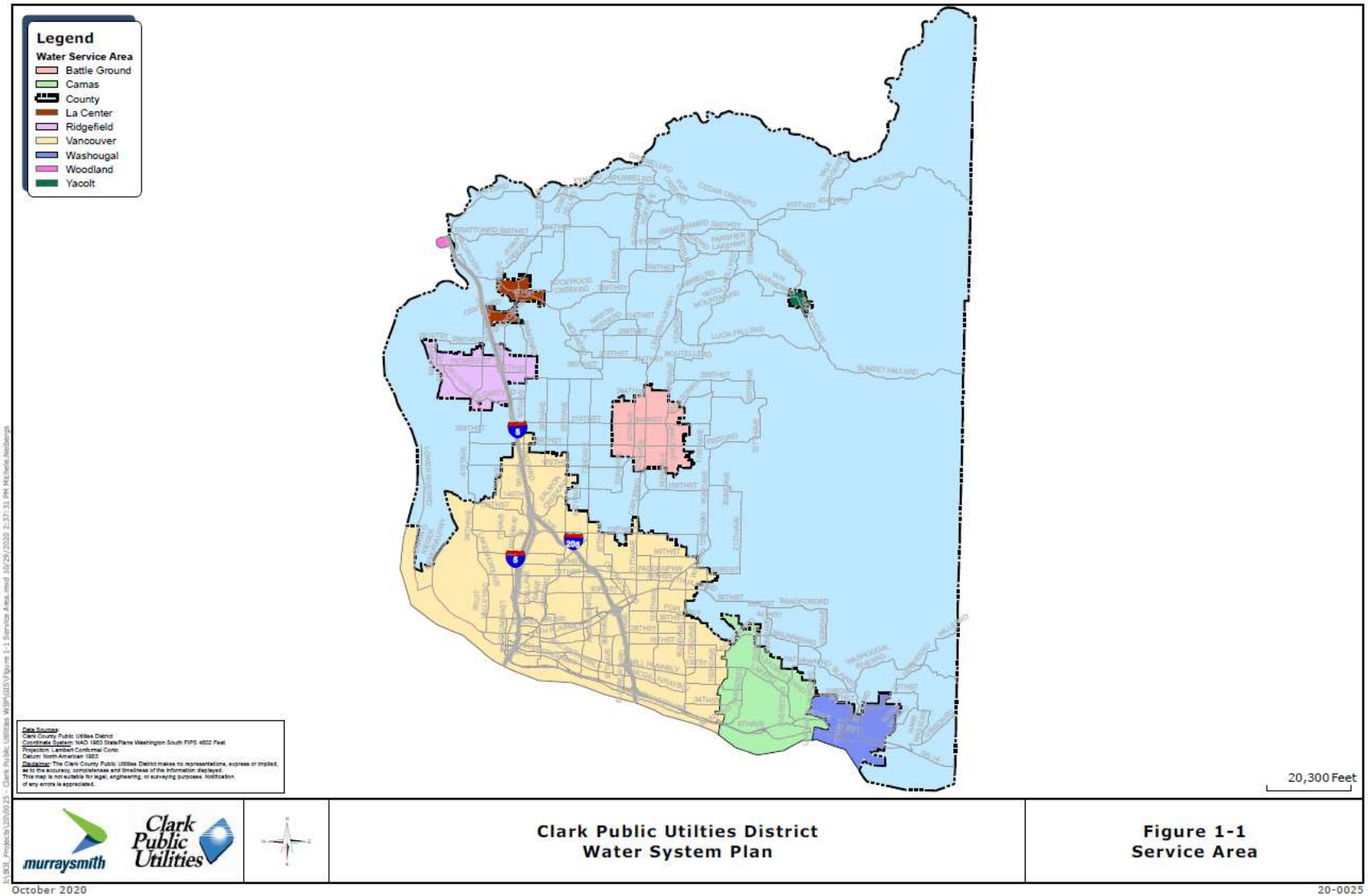


Figure 1-2 | Clark Public Utilities Hydraulic Profile

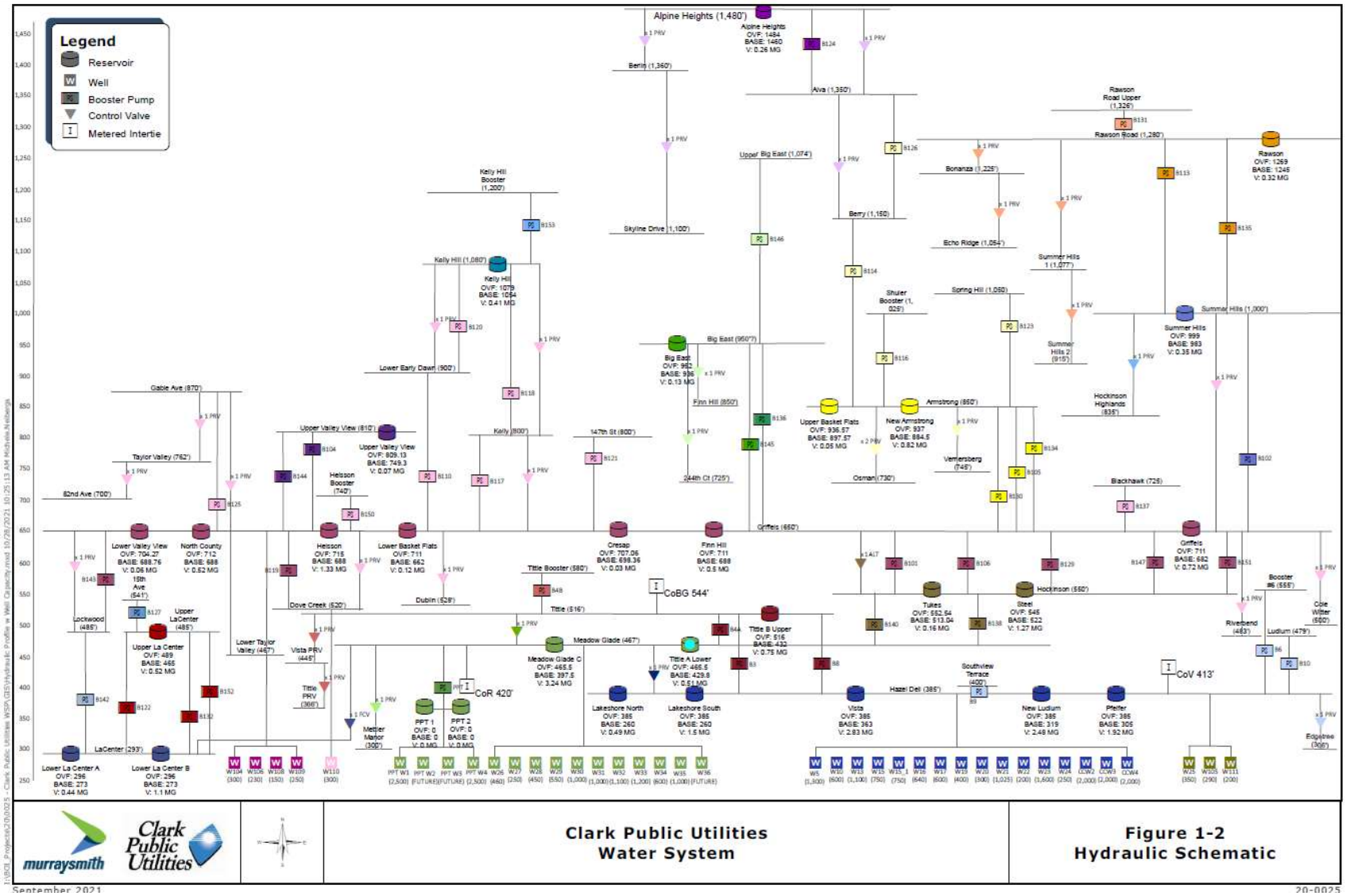


Table 1-3 | Clark Public Utilities Water Source Summary

DOH Source No.	Well No.	Location	Pressure Zone	Water Right Qi (gpm)	Maximum Operating Q (gpm)	Typical Flow Q (gpm)	MDD Flow Q (gpm)
SO3	3	7701 NE 16 Ave.	Hazel Dell	Inactive	Inactive	Inactive	Inactive
S04	4[1]	NE 99 St., East of NE 9 Ave.	Hazel Dell	400	Inactive	Inactive	Inactive
S05	5	7701 NE 16 Ave.	Hazel Dell	1,320	1,360[2]	1,320	1,320
S07	7	NE 26th Ave., South of NE 78 St.	Hazel Dell	1,000	990	790	990
S09	9	NE 23 Ave., South of NE 119 St.	Hazel Dell	800	800	450	800
S10	10	5117 NE 107 St.	Hazel Dell	600	650[2]	550	650
S15	15	NW 21 St. and Bliss Rd.	Hazel Dell	750	750	670	720
S17	17	NE 23 Ave, South of NE 119 St.	Hazel Dell	800	800	600	800
S19	18[1]	NE 11 Ave, North of NE 117 St	Hazel Dell	Inactive	Inactive	Inactive	Inactive
S20	19	218 NW Bassel Rd	Hazel Dell	1,000	960	660	960
S22	20	8608 NE 18 Ave	Hazel Dell	800	780	660	760
S23	HAZ108[1]		Hazel Dell	See S36		Inactive	
S24	22	10500 NE 39 Ave	Hazel Dell	500	480	400	470
S25	23	1919 NE 78 St	Hazel Dell	1,500	1,600	1,500	1,500
S26	24	3614 NE 94 St	Hazel Dell	520	600[2]	520	550
S27	25	14000 NE 97 Ave	Hockinson	350	400	350	400
S28	27	3801 NE 179 St	Meadowglade	270	300[2]	270	300
S29	29	300 NW 277 Cir	Meadowglade	500	550[2]	500	550
S30	30	800 NE 264 St	Meadowglade	1,010	1,100[2]	1,000	1,100
S31	31	18300 NE 85 Ave	Meadowglade	1,200	1300[2]	1,200	1,200
S32	HOC3[1]		Hockinson			Inactive	
S33	104	22901 NE Allworth Rd	Griffels	600	420	290	500
S34	105	13433 NE 119 St	Hockinson	400	480[2]	300	400
S35	106	NE 269 St, West of NE 147 Ave	Griffels	240	280[2]	220	260
S36	108	NE 199 St, East of NE 237 Ave	Griffels	150	180[2]	150	180
S37	109[1]	20605 NE 259 St	Griffels	300	300	300	300

DOH Source No.	Well No.	Location	Pressure Zone	Water Right Qi (gpm)	Maximum Operating Q (gpm)	Typical Flow Q (gpm)	MDD Flow Q (gpm)
S38	110	27001 NE 105 Ave	Dove Creek	Transferred to W110.1		Inactive	
S39	MG 2[1]	Meadow Glade Well 2	Meadowglade	190		Inactive	
S40	MGSO3[1]		Meadowglade	Inactive		Inactive	
S41	28	20400 NE 72 Ave	Meadowglade	530	500	411	500
S42	MG 5[1]	Meadow Glade Well 5	Meadowglade	Transferred to W31		Inactive	
S43	26	15700 NE 88 Ave	Meadowglade	428	650[2]	428	428
S44	301[1]	35003 North Fork Rd	LaCenter	Transferred to Well 30 (830) Inactive			
S45	302[1]	35003 North Fork Rd	LaCenter	Transferred to Well 30 (830) Inactive			
S46	303[1]	35003 North Ford Rd	LaCenter	Transferred to Well 30 (830) Inactive			
S47	304[1]	29601 NE JA Moore Rd	LaCenter	Water rights transferred to Well 30 (830) Inactive			
S48	18.1	NE 11 Ave, North of NE 117 St	Hazel Dell	1,000	800	450	600
S49	21	NE Bassel Rd and NW 2 Ave	Hazel Dell	1,300	1,200	1,150	1,200
S50	33	18300 NE 85 Ave	M.G.	1,200	1250[2]	1,200	1,200
S51	8.2	2400 NW 94 St.	Hazel Dell	1,200	1,100	1,100	1,100
S52	34[3]	NE 259 St. and 18 Ct.	Meadowglade	1,200	1,200	1,200	1,200
S53	32	800 NE 264 St	Meadowglade	1,200	1,200	1,200	1,200
S54	15.1	NW 21 St. and Bliss Rd.	Hazel Dell	1,400	1,200	1,200	1,200
S55	13.1	12201 NW 31 Ave	Hazel Dell	1,200	1,000	1,000	1,000
S56	35	8001 NE 199 St	Meadowglade	1,000	1,100	1,000	1,100
S57	110.1	27001 NE 105 Ave	Dove Creek	400	420	400	400
S58	58 (SGA #2)	5806 NW Fruit Valley Rd	Hazel Dell	2,250	2,250	2,250	2,250
S59	59 (SGA #3)	5806 NW Fruit Valley Rd	Hazel Dell	2,250	2,250	2,250	2,250
S60	Southlake Wellfield (CJCW)	5806 NW Fruit Valley Rd	Hazel Dell	34,722	2,250	2,250	2,250
S61	Van Intertie 72 Ave and 99th St	Hazel Dell					1,000
S62	Van. Intertie 47th Ave and 78th St	Hazel Dell					1,000

DOH Source No.	Well No.	Location	Pressure Zone	Water Right Qi (gpm)	Maximum Operating Q (gpm)	Typical Flow Q (gpm)	MDD Flow Q (gpm)
S63	111	Si Ellen					
S64	Well 64 (SGA 4)	5806 NW Fruit Valley Rd	Hazel Dell	2,250	2,250	2,250	2,250
S65	Paradise Point	32518 NW 31st Ave	Meadowglade	10,000	5,000	5,000	5,000
S66	PP-1	32518 NW 31st Ave	Meadowglade	2,500	2,500	2,500	2,500
S67	PP-4	32518 NW 31st Ave	Meadowglade	2,500	2,500	2,500	2,500

Notes:
1 These wells are either emergency or inactive wells and not in service.
2 Actual operation is limited to Water Right Qi limit by throttling outlet valves.
3 Seasonal
See **Table 4-3** for Additional Water Right Information

Table 1-4 | Clark Public Utilities Summary of Water Treatment Facilities

DOH Source No.	Well	Chlorination (Type, Capacity)	Other Treatment (Type, Date Installed)
S03	#3	Inactive	
S04	# 4	Inactive	
S05	#5	On-site generator, 6 ppd	
S07	# 7	Hypochlorite solution	
S09	# 9	On-site generator, 12 ppd	
S10	#10	On-site generator, 12 ppd	
S15	#15	On-site generator,36 ppd	Fe & Mn Removal, 2009
S17	#17	On-site generator, 12 ppd	
S19	#18	Hypochlorite Solution	
S20	# 19	On-site generator, 24 ppd	
S21	# 16	On-site generator, 6 ppd	
S22	# 20	On-site generator, 6 ppd	
S23	Hazel Dell 108		
S24	# 22	On-site generator, 6 ppd	
S25	# 23	On-site generator, 12 ppd	
S26	#24	On-site generator, 6 ppd	
S27	#25	On-site generator, 6 ppd	
S28	#27	Hypochlorite Solution	
S29	#29	On-site generator, 6 ppd	
S30	#30	On-site generator, 24 ppd	
S31	#31	On-site generator, 24 ppd	
S32	Hockinson SO3		
S33	# 104	Hypochlorite Solution	
S34	# 105	On-site generator, 6 ppd	
S35	# 106	On-site generator, 6 ppd	
S36	# 108	Hypochlorite Solution	
S37	# 109	Hypochlorite Solution	
S38	# 110	Inactive	
S39	MG #2	Inactive	
S40	MG #3	Inactive	
S41	# 28	Hypochlorite, 10 ppd	
S42	# 5	Inactive	
S43	# 26	On-site generator, 6 ppd	
S44	# 301	Inactive	
S45	# 302	Inactive	
S46	# 303	Inactive	
S47	# 304	Inactive	
RS48	# 18.1	Hypochlorite Solution	
S49	# 21	On-site generator, with Well 19	Fe & Mn Removal, 1998

DOH Source No.	Well	Chlorination (Type, Capacity)	Other Treatment (Type, Date Installed)
S50	# 33	On-site generator, with Well 31	
S51	# 8.2	On-site generator 36 ppd	Fe & Mn Removal, 2004
S52	# 34	On-site generator 12 ppd	
S53	# 32	On-site generator with Well 30	
S54	# 15.1	On-site generator Well 15	Fe & Mn Removal, 2009
S55	#13.1	On-site generator 24 ppd	Fe & Mn Removal, 2008
S56	#35	On-site generator 24 ppd	Fe & Mn Removal, 2009
S57	# 110.1	On Site Generator, 12 ppd	Fe & Mn Removal, 1996
S58	58 (SGA #2)	On-site generation 350 ppd	Fe & Mn Removal, 2010
S59	59 (SGA #3)	On-site generation 350 ppd	Fe & Mn Removal, 2010
S60	Carol J Curtis Wellfield (CJCW)	On-site generation 350 ppd	Fe & Mn Removal, 2010
S61	Van Intertie 72 Ave and 99th St		
S62	Van. Intertie 47th Ave and 78th St		
S63	111	Inactive	
S64	Well 64 (SGA 4)	On-site generation 350 ppd	Fe & Mn Removal, 2010
S65	Paradise Point	On-site generation 350 ppd	Fe & Mn Removal, 2019
S66	PP-1	On-site generation 350 ppd	Fe & Mn Removal, 2019
S67	PP-4	On-site generation 350 ppd	Fe & Mn Removal, 2019

1.3.1.3 Water Storage

The existing main water system contains a total of 34 water storage reservoirs. Twenty of these reservoirs are of welded steel construction. The remaining tanks are concrete and bolted steel tanks (although some of the Satellite systems have polyethylene storage tanks). The total volume of the reservoirs is approximately 24.9 MG. However, the operating volume that is available for use is 22 MG; the difference between these two values is the volume of water within standpipe reservoirs that is necessary to provide acceptable water service pressures. **Table 1-5** provides a summary of the existing water storage facilities.

The water storage facilities typically include combined fill and discharge pipes, drain lines, screened overflows, screened air vents, water level gauges, and SCADA monitoring equipment. See the *System Design Standards* section for an evaluation of the water system's storage capacity.

1.3.1.4 Water Transmission and Distribution

The water utility systems contain nearly 855 miles of water mains for the transmission and distribution of water. **Table 1-6** provides a summary of water mains by size and material. All new water mains are PVC with some ductile iron, but the water system still contains some steel, (2 percent primarily in the Hazel Dell service zone) and some asbestos cement pipe (2.5 percent), both of these are significantly lower percentages than in the 2003 water system plan. All steel pipe was installed before 1970. Asbestos cement pipe was installed in the 1970's.

The water system also contains a total of 24 pressure reducing valve (PRV) stations to provide for the regulation of flow from higher to lower hydraulic grade service zones. **Table 1-7** provides details of the

existing PRV stations. See the *System Analysis* Section for an evaluation of the existing water distribution facilities.

1.3.1.5 Water Pumping Stations

The water utility owns and operates 50 booster pump stations, with over 100 individual pumps. Forty-one of the pumps have variable frequency drives (VFDs) to provide a range of flow. Flow of the booster pumps range from as small as 14 gpm to 1,100 gpm. Booster pumping station information is summarized on **Table 1-8**.

Table 1-5 | Clark Public Utilities Water Storage Summary

Pressure Zone	Zone HGL	Reservoir ID	Reservoir Name	GIS Volume	Overflow	Diameter, ft
Big East (169th Street)	780	R12	Big East	0.13	952	37.5
Alpine Heights	1484	R14	Alpine Heights	0.26	<Null>	45
Armstrong	850	R15B	New Armstrong	0.82	937	50
Upper Basket Flats	915?	R22	Upper Basket Flats	0.05	936.57	14
Griffels	650	R13A	Old Griffels	0.06	706.04	24
		R16	Cresap	0.03	707.06	24
		R20	Lower Valley View	0.06	704.27	26.5
		R19	Lower Basket Flats	0.12	711	20
		R23	Finn Hill	0.5	711	61
		R18	Heisson	1.33	715	90
		R13	Griffels	0.72	711	62
Hazel Dell	385	R1	Ludlum	0.47	385	34.25
		R3	Lakeshore North	0.49	385	26
		R6	Lakeshore South	1.5	385	45
		R2	Pfeifer	1.92	385	64
		R4	Vista	2.83	385	148
		R1B	New Ludlum	2.48	385	80
Hockinson	550	R11A	Old Steel	0.06	537.85	25
		R17	Tukes	0.16	552.54	26
		R26	North County	0.52	712	61
		R11B	Steel	1.27	545	95
La Center	280	R31A	Lower La Center A	0.44	296	56
		R31B	Lower La Center B	1.1	296	88.5
Meadow Glade	467	R7A	Meadow Glade A	0.12	452	20
		R7B	Meadow Glade B	0.22	452	26
		R7C	Meadow Glade C	3.24	465.5	90
Rawson	1280	R28	Rawson	0.32	1269	48.5

Pressure Zone	Zone HGL	Reservoir ID	Reservoir Name	GIS Volume	Overflow	Diameter, ft
Summer Hills	1000	R14A	Elk Horn	0.01	992.27	8
		R24	Summer Hills	0.35	999	61
Tittle	516	R5	Tittle B Upper	0.75	516	39
		R10	Tittle A Lower	0.51	465.5	50
Upper La Center	485	R32	Upper La Center	0.52	489	61
Upper Valley View	810	R21	Upper Valley View	0.07	809.13	14

Table 1-6 | Clark Public Utilities Water Transmission & Distribution Pipe Material (Feet in Service)

Diameter (inches)	Cu	Steel	GS	HDPE	PE	AC	C900	C905	CL200	PVC	DI	UNK/ OTH	Sub-total by Size	% by Size
2	0	5,200	1,294	2,673	1,803		2,988		96,750	472	1,056	558	112,794	2.72%
2.5									2413				2,413	0.06%
3					18					151			169	0.00%
4		36,594	1,053		43	5,778	60,169		307,937	607	5,606	414	418,201	10.08%
6		15,818		3268	312	43,706	154,633		785,325	1,000	90,506	132	1,094,700	26.40%
8		5,929		1,517	234	16,907	819,035		882,467	1,812	33,807	3,239	1,764,947	42.56%
10		690		69	39	8,300	15,915		173,492	30	1,194		199,729	4.82%
12		2,366		585	2,643	14,132	307,735		164,832		35,003		527,296	12.72%
14						7,128			14663		41		21,832	0.53%
16				510			3,854	329					4,693	0.11%
Subtotals:	0	66,597	2,347	8,622	5,092	95,951	1,364,329	329	2,427,879	4,072	167,213	4,343	4,146,774	100.00%
% by Material:	0.00%	2.00%	0.10%	0.10%	0.10%	2.50%	34.90%	0.00%	54.80%	0.10%	5.40%	0.10%		
Total Pipe in Service:							4,146,774	Ft						
							855	Miles						

Table 1-7 | Clark Public Utilities Pressure Reducing Valves

ID	Location	Description	Inlet Pressure, psi	Outlet1 Pressure, psi	Outlet2 Pressure, psi	PRV1 Size, In.	PRV2 Size, In.	Pipe Diameter, In.	Elevation, ft.
PRV1	NW 6200 Block on 196 St	Mettler Manor	130	62	55	1.5”	4”	1.5"	154.87
								4"	154.87
PRV2	NW 139th St & NW 10th Ct	Skyview	87	56	50	2	6	Other	177.07
									177.07
PRV3	NE 10 Av. @ 15900 Block	Flow #6 - Jones Sub?	108	70		1.5	4		#N/A
PRV4	2404 NE 156th Ct	Vista Upper	85	50	40	2	4	2"	332
								4"	332
PRV5	NE 155th St & NE 22nd Ave	Vista Lower	94	55		6		4"	241.22
PRV6	3004 NE 160th St	Tittle	76	76	76	4	6	Other	346.66
PRV7	At B109, near 11207 NE 119th St	Prairie	120	60	55	1.5	4	4"	277
								1.5"	277
PRV101	12400 NE 227th Ave	Hockinson Highlands	143	55	45	1.5	4	1.5"	717
								4"	717
PRV102	West of NE 238th Ct on NE 128th St	Summer Hills Lower	122	57	50	1.5	4	1.5"	792.58
								4"	792.58
PRV103	NE 128th St & NE 252nd Ct	Summer Hills Upper	135	60	55	1.5	4	1.5"	945.99
								4"	945.99
PRV104	NE Rawson Rd & NE Bonanza Rd	Bonanza Upper	98	80	75	1.5	4	1.5"	1000.15
								4"	996.93
PRV105	NE 148th St & NE Bonanza Rd	Bonanza Lower	127	52	50	1.5	4	1.5"	932.65
								4"	932.65
PRV106	NE 169th St & NE 222nd Ave	B145	150	62		1.5		1"	<Null>
								1.5"	<Null>
PRV107	NE 227th Ave & NE 174th St	Morgan Creek	145	50	45	1.5	4	1.5"	605.26
								4"	602.56
PRV108	22304 NE 189th St	Finn Hill	122	84	80	1.5	4	1.5"	668
								4"	668

ID	Location	Description	Inlet Pressure, psi	Outlet1 Pressure, psi	Outlet2 Pressure, psi	PRV1 Size, In.	PRV2 Size, In.	Pipe Diameter, In.	Elevation, ft.
PRV109	20010 NE 192nd St	Happy Valley	120	32	30	1	2	1"	440
								2"	448.04
PRV110	21143 NE 242th Ave	Venersborg	178	80	55	1.5	4	1.5"	557
								4"	557
PRV111	25114 NE 227th St	Alpine Hts Lower	174	60		1.5		1.5"	1004.31
PRV112	NE 227th St & NE 257th Ave	Alpine Hts Upper	130	83	70	1.5	4	1.5"	1004.31
								4"	<Null>
PRV113	At B124, near 23001 NE 252nd Ave	Booster 124	166	78	73	1.5	4	1.5"	<Null>
								4"	<Null>
PRV114	At B126, near 24711 NE Berry Rd	Booster 126	152	105	98	1.5	4	1.5"	<Null>
								4"	<Null>
PRV115	NE 229th St & NE 232nd Ave	Osman	144	56	46	1.5	4	1.5"	616.47
								4"	616.47
PRV116	23820 NE Canyon Rd	Canyon Road	135	45		1.5			#N/A
PRV117	17912 NE 219th St	Tukes						1.5"	512.82
PRV118	14108 NE 249th St	Axford Sub	135	65	60	1.5	4	2"	387
								4"	387
PRV119	19514 NE 272nd St	Basket Flats Lower		65					#N/A
PRV120	28501 NE River Bend Dr	Riverbend Dr.	128	30	25	2	4	2"	414.75
								4"	414.12
PRV121	NE 172nd Ave & Cole Witter Rd	Cole Witter	137	65	60	1.5	4	1.5"	350
								4"	350
PRV301	At B119, 29800 NE 112th Ave	B119	145	42		1.5	4	1.5"	<Null>
PRV302	At B143, near 8815 NE Mason Creek Rd	Mason Creek Rd	150	60	55	1.5	4	1.5"	372
								4"	372
PRV303	8300 NE 316th St	Timber Cr Lower	110	55	45	1.5	4	1.5"	443.28
								4"	443.28

ID	Location	Description	Inlet Pressure, psi	Outlet1 Pressure, psi	Outlet2 Pressure, psi	PRV1 Size, In.	PRV2 Size, In.	Pipe Diameter, In.	Elevation, ft.
PRV304	NE 322nd St & NE 82nd Ave	Timber Cr Upper	125	60	55	1.5	4	1.5"	576.92
								4"	576.92
PRV305	NE Lockwood Creek Rd & NE 339th St	Taylor Valley Upper	129	60	50	1.5	4		584.45
								4"	584.45
PRV306	NE Lester Rd & NE 339 St	Taylor Valley Lower	172	47	42	1.5	4	2"	342.58
								4"	343.71
PRV401	At B118, 30704 NE 182nd Ave	Booster 118	134	60	55	1.4	4	1.5"	<Null>
								4"	<Null>
PRV402	At B120, 33314 NE 171st Ct	Booster 120	52		46		4	1.5"	<Null>

Table 1-8 | Clark Public Utilities Booster Pump Stations

Booster Name	Booster No.	Location	Pressure Zone	Assigned to Reservoir	Pump HP	Pump Control	Pump Type	Elev.	Pump Level Setting		Shut Off Point		Operating Point		Max Opt. Point	
									Pump On (ft.)	Pump Off (ft.)	TDH	Q	TDH	Q	TDH	Q
Vista.	3		Tittle	Tittle #4				360	68.0	77.4	370	0	220	900	180	1100
Tittle	4	2805 NE 159 St.	Upper Tittle	N/A	5		C-2 1/2W	430			75	0	70	150	40	300
					15		C-3Y	430			103	0	97	300	80	500
					10		P-4095-5	430			62	0	64	400	36	900
					10		P-4095-5	430			62	0	64	400	36	900
Pfiefer	6	3510 NE 99 St	Pfiefer	N/A	10	VFD	J-10DC 1 1/2	315	50 psi	60 psi	180	0	165	100	130	180
					10	VFD	J-10DC 1 1/2	315	45 psi	50 psi	180	0	165	100	130	180
NE 29 Ave	8	14400 NE 29 Av.	Tittle	Tittle #4	7.5		B1WPS	280			240	0	225	64	160	100
					15		J-15DC2	280	63.8	72.3	200	0	150	250	105	325
					15		J-15DC2	280	59.5	72.3	200	0	150	250	105	325
Ludlum	10	NE 14 Ave and NE 68 St	Ludlum	N/A	5		J-5DB1	317			164	0	125	70	105	82
					10		J-10DB2	317			151	0	115	230	77	300
Meadow Glade	11	20400 NE 89 Ave	Upper MG	N/A	5		J-5DB1-1/2	395			130	0	100	120	70	160
					5		J-5DB1-1/2	395			130	0	100	120	70	160
Steel	101A	19201 NE 164 St	Griffels	Finn Hill #23	25		B2-1/2 ZPLS	520	20.7	21.9	265	0	210	320	170	400
	101B				25		B2-1/2 ZPLS	520	9.2	21.9	265	0	210	320	170	400
Griffels	102	22215 NE 139 St	Summer Hills	Summer Hills #24	20		J-2056HS-T4	686	14.7	15.0	410	0	330	150	216	240
					20		J-2056HS-T4	686	12.8	15.0	410	0	330	150	216	240
Lower Valley View	104	NE 137 Ave, S of NE Valley View	Upper Valley View	Upper Valley View #21	7.5		J-75DB1 1/2	695	33.0	46.8	140	0	130	80	70	160
					7.5		J-75DB1 1/2	695	12.0	46.8	140	0	130	80	70	160
Lower Basket Flats	105	NE 283 St. W of NE 197 Av	Upper Basket Flats	Upper Basket Flats #22	15	VFD	B1 1/2ZPL	662	34.0	37.2	310	0	265	100	160	150
					15	VFD	B1 1/2ZPL	662	18.0	37.2	310	0	265	100	160	150
NE 144 St.	106	18613 NE 144 St	Griffels	Finn Hill #23	15		J-15DC1 1/2	440	17.3	19.6	275	0	265	80	220	160
					15		J-15DC1 1/2	440	3.5	19.6	275	0	265	80	220	160

Booster Name	Booster No.	Location	Pressure Zone	Assigned to Reservoir	Pump HP	Pump Control	Pump Type	Elev.	Pump Level Setting		Shut Off Point		Operating Point		Max Opt. Point	
									Pump On (ft.)	Pump Off (ft.)	TDH	Q	TDH	Q	TDH	Q
Finn Hill	108	NE 224 Ave and NE Finn Hill Rd	Finn Hill	N/A	5		B1WP	640			180	0	165	50	130	80
Prairie H.S.	109	NE 112 Ave and NE 119 St	Hockinson	Steel #11	60		J-GB4-T4	280			328	0	285	500	230	700
Lower Early Dawn	110A	NE 332 St. E. of 161 Av.	Lower Early Dawn	N/A	10	VFD	B 1 1/2 ZPL	560	110 psi	120 psi	240	0	220	85	145	125
	110B				10	VFD	B 1 1/2 ZPL	560	95 psi	110 psi	240	0	220	85	145	125
Bonanza	113	NE Rawson Rd and NE Elkhorn Dr	Bonanza	N/A	20	VFD	B1-1/2ZPLS	930	140 psi	152 psi	345	0	280	120	180	160
					30		B2ZPHS	930	135 psi	150 psi	310	0	280	200	200	345
					30		B2ZPHS	930	127 psi	140 psi	310	0	280	200	200	345
Berry	114	NE 240 Ave and Berry Rd	Berry	N/A	15		J	785			450	0	310	100	190	130
					25		J	785	145 psi	150 psi	445	0	300	215	240	260
					25		J	785	140 psi	154 psi	445	0	300	215	240	260
Shuler	116	NE 229 St and NE 242 Ave	Shuler	N/A	5		J-5DB1	795			175	0	150	53	108	80
Kelly	117	NE 299 St and Kelly Rd	Kelly Rd.	N/A	7.5	VFD	B1WP	540	138 psi	145 psi	240	0	200	80	160	100
					15		JDC2	540	106 psi	124 psi	217	0	205	150	140	300
					15		JDC2	540	96 psi	114 psi	217	0	205	150	140	300
Nordeen	118	30700 NE 181 Ave	Nordeen	N/A	7.5		B1WP	775	110 psi	125 psi	240	0	200	80	160	100
					15		J-DC2	775	100 psi	118 psi	222	0	190	200	140	300
					15		J-DC2	775	80 psi	100 psi	222	0	190	200	140	300
Charter Oak	119	NE 112 Ave and NE 299 St	Griffels	Lower Valley View #20	20			385	12.0	13.8	444	0	277	160	128	250
					20			385	12.3	13.8	444	0	277	160	128	250
Upper Early Dawn	120	16800 NE 322 St	Upper Early Dawn	N/A	3		G-CR4-U	760			363	0	230	30	150	40
					3		G-CR4-U	760			363	0	230	30	150	40
NE 147th St	121	21600 NE 147 St	NE 147 St.	N/A	1		J-1RM2	520			188	0	140	14	93	22
					5		J-5DB1	520			175	0	140	60	115	80
NE 25 Av. - LaCenter	122	33120 NE 24 Av	Finalburg	N/A	7.5		B1WPS	195			240	0	210	75	160	100

Booster Name	Booster No.	Location	Pressure Zone	Assigned to Reservoir	Pump HP	Pump Control	Pump Type	Elev.	Pump Level Setting		Shut Off Point		Operating Point		Max Opt. Point	
									Pump On (ft.)	Pump Off (ft.)	TDH	Q	TDH	Q	TDH	Q
					15		15DC2	195			265	0	248	150	190	300
					15		15DC2	195			265	0	248	150	190	300
Spring Hill	123	27400 NE 212 Ave	Spring Hill	N/A	7.5		B1WPS	800			240	0	230	60	185	90
					15		J-DC2	800			217	0	190	200	140	300
					15		J-DC2	800			217	0	190	200	140	300
Schauer/ Alpine	124	25616 NE 230 St	Schauer/Alpine	N/A	7.5		B1WP	1240			240	0	235	55	195	80
					20		J-DC2	1240			260	0	235	150	195	265
					20		J-DC2	1240			260	0	235	150	195	265
Gable Av	125	NE 339 and Gable Ave	Gable	N/A	15		J-1556L8	620			450	0	405	60	230	120
					25		56230-6	620			445	0	365	150	170	300
					25		56230-6	620			445	0	365	150	170	300
Alva	126	24711 NE Berry Rd (Alva Rd)	Alva	N/A	7.5		B1WP	940			240	0	230	58	155	100
					15		J-DC2	940			215	0	195	175	137	300
					15		J-DC2	940			215	0	195	175	137	300
NW 9th Ave - Lacenter	127	NW 9 Ave, North of Pacific Hwy	NW 9 AV	N/A	7.5		B1WP	145			240	0	237	50	185	90
					20		J20-DC2	145			250	0	225	200	180	300
					20		J20-DC2	145			250	0	225	200	180	300
Rock Creek - Inactive	128															
176th Ave	129	20700 NE 176 Ave	Griffels	L.B.F. #19	20		J-20DC2	415	45.5	47.0	250	0	238	150	180	300
					20		J-20DC2	415	42.5	47.0	250	0	238	150	180	300
Allworth	130	22901 NE Allworth Rd	Armstrong	Armstrong #15	20		J-20DC2	662	12.0	16.0	250	0	225	175	145	350
					20		J-20DC2	662	6.0	16.0	250	0	225	175	145	350
Rawson Fire Station	131	24500 NE Rawson Rd	Upper Rawson	N/A	15	VFD	J-1RM2	1202	241 217 193	265 241 241	265	0				
South View	132	Southview Hights Dr and Cedar	Upper LaCenter	Upper LaCenter #32	15	VFD	B3TPM	180	19.6	22.5	115	0	115	350	75	520
					20	VFD	J20DC2	180	19.6	22.5	265	0	230	200	160	350

Booster Name	Booster No.	Location	Pressure Zone	Assigned to Reservoir	Pump HP	Pump Control	Pump Type	Elev.	Pump Level Setting		Shut Off Point		Operating Point		Max Opt. Point	
									Pump On (ft.)	Pump Off (ft.)	TDH	Q	TDH	Q	TDH	Q
					20		J20DC2	180	19.6	22.5	265	0	230	200	160	350
Proposed	133															
Venersborg	134	NE 242 Ave and NE 209 St	Armstrong	Armstrong #15	20		J-DC2	580	16.0	18.0	235	0	200	200	150	305
					20		J-DC2	580	14.0	18.0	235	0	200	200	150	305
Summer Hills	135	24201 NE 132 Cir	Rawson	N/A	25	VFD	J-DC2	873	145 psi	155 psi	263	0	233	200	160	350
					25	VFD	J-DC2	873	135 psi	145 psi	263	0	233	200	160	350
					50		B32PBH	873	125 psi	140 psi	255	0	250	500	170	900
Alderbrook	136	18900 NE 232 Ave	Alderbrook	N/A	15	VFD	J-15DC1/2	570			225	0	205	100	150	180
					15	VFD	J-15DC1/2	570			225	0	205	100	150	180
					15		J-15DC1/2	570			225	0	205	100	150	180
Black Hawk	137	21901 NE 202 Ave	Blackhawk	N/A	10	VFD	J-DB2	500	82 psi	90 psi	133	0	125	150	95	300
					10	VFD	J-DB2	500	75 psi	81 psi	133	0	125	150	95	300
Maple Grove	138	12100 NE 199 St	Hockinson	Steel #11	40	VFD	J-40DC4	280	13.6	15.2	260	0	245	300	200	600
					40		J-40DC4	280	3.2	15.2	260	0	245	300	200	600
					40		J-40DC4	280	3.2	15.2	260	0	245	300	200	600
Cotton	140	11116 NE 156 St	Hockinson	Steel #11	40	VFD	J-DC4	272	13.1	14.4	260	0	245	300	200	600
					40	VFD	J-DC4	272	8.0	14.4	260	0	245	300	200	600
North Fork	141	35502 N. Fork Rd - Not Built Yet														
Lockwood Cr	142	3918 NE Lockwood Cr	Lockwood Cr	North County #26	25	VFD	B2ZPL	160	20.2	20.9	312	0	255	200	175	300
					25	VFD	B2ZPL	160	8.3	20.9	312	0	255	200	175	300
Mason Cr	143	8900 NE Mason Cr Rd	Griffels	North County #26	25	VFD	B2ZPL	390	18.4	20.7	312	0	255	200	175	300
					25	VFD	B2ZPL	390	8.1	20.7	312	0	255	200	175	300
NE 314 St	144	10700 NE 314 St	Upper Valley View	Upper Valley View #21	15	VFD	B1 1/2ZPLS	570	51.0	55.2	300	0	272	100	180	150
							B1 1/2ZPLS	570	21.0	55.2	300	0	272	100	180	150
NE 169 St	145	22000 NE 169 St	Big East	Big East #12	25	VFD	B2ZPLS	605	3.8	7.5	312	0	182	150	173	300
					25	VFD	B2ZPLS	605	1.5	7.5	312	0	182	150	173	300

Booster Name	Booster No.	Location	Pressure Zone	Assigned to Reservoir	Pump HP	Pump Control	Pump Type	Elev.	Pump Level Setting		Shut Off Point		Operating Point		Max Opt. Point	
									Pump On (ft.)	Pump Off (ft.)	TDH	Q	TDH	Q	TDH	Q
Big East	146	23800 NE 169 St	Upper Big East	N/A	15	VFD	B	738	50 psi	60 psi	300	0	280	75	200	125
					15	VFD	B	738	43 psi	50 psi	300	0	280	75	200	125
NE 139 St	147	18400 NE 139 St	Griffels	Griffels #13	25	VFD	B2-1/2ZPLS	320	10.4	12.5	262	0	230	250	170	400
					25	VFD	B2-1/2ZPLS	320	9.5	12.5	262	0	230	250	170	400

1.3.2 Current Number of Service Connections

Table 1-9 summarizes the water utility's service connections and population, from 2012 to 2020. The water utility currently serves a total of 39,022 (2022) customers, to a population of 101,067 people. During the period of 2012 through 2020 annual growth in connections served has ranged from 1.25 percent to 3.39 percent, averaging 2.31 percent

Table 1-9 | Clark Public Utilities Water Service Connections and Population

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Average Service Connections										
Residential	29,408	29,837	30,356	30,989	31,770	32,847	33,908	34,846	35,271	36,278
Commercial	1,060	1,076	1,094	1,117	1,145	1,184	1,222	1,256	1,327	1,365
Other	665	674	686	700	718	742	746	788	752	750
Total	31,133	31,587	32,136	32,807	33,634	34,774	35,876	36,890	37,350	38,393
Estimated Total Population Served	76,167	77,278	78,622	80,262	82,284	85,074	86,436	89,034	91,352	95,062
Increase from Prior Year:		1.46%	1.74%	2.09%	2.52%	3.39%	3.17%	2.82%	1.25%	2.79%
SFR Consumption (1000 ccf)	343,113	335,558	350,868	382,190	357,535	383,318	412,919	390,893	416,535	467,043
MFR Consumption (1000 ccf)	44,982	48,708	50,858	53,478	56,742	60,565	67,174	66,246	61,319	72,954
Miscellaneous Consumption (1000 ccf)	62,053	61,415	64,881	76,807	72,996	77,882	84,273	76,365	87,240	110,540
Total Consumption (1000 ccf)	450,148	445,681	466,607	512,475	487,273	521,765	564,366	533,504	565,094	650,537

Notes:
1. Population per SFR Connection: 2.9 People
Source: Clark County GMA Planning (OFM Estimates)
2. Multi-family residential population based on 2.2 ERU MFR vs. 2.9 ERU SFR from Clark County data
Percent of ERU in MFR compared to SFR: 76%

1.3.3 Existing Interties

The water utility currently has six interties with adjacent utilities. The intertie at NE 122nd Avenue and 199th Street was historically the primary intertie used by the City of Battle Ground during the summer season. However, since the construction of the intertie at NE 219th Street (SR 502) east of 92nd, both of these interties are active. The third intertie with Battle Ground is used as emergency only. The two interties with the City of Vancouver's system can supply water from Vancouver to the water utility but have never been used. There are two active interties since the last water system plan that can provide water to the City of Ridgefield. The intertie locations and approximate capacities are shown in **Table 1-10**. Future proposed interties with Battle Ground and Ridgefield are discussed in the CIP section.

Table 1-10 | Summary of Clark Public Utilities Emergency Interties

Location	Size	Capacity	Installed	Status	Supply	Connected To
NE 219th Street (SR 502) east of 92nd	12”	1000 gpm	2018	Metered		City of Battle Ground
72 Ave and 99th St	12”	1000 gpm	1979	Emergency / Unmetered	From Vancouver	City of Vancouver
NE 47th Ave and NE 78th Street	10"	1,000 gpm	1979	Emergency / Unmetered	From Vancouver	City of Vancouver
West if S.85 Ave (NE10th Ave) & S. 5th St (NE 264 St)	2” & 8”	1,200 gpm	2003	Emergency / Metered	From Utility	City of Ridgefield
N. 65th Ave (NW 11 Ave) & N. 10th St (NW 279th St)	2” & 8”	1,200 gpm	2005	Limited / Metered	From Utility	City of Ridgefield
N. 65th Ave (NW 11 Ave) & N 20th (NW 289th St)	2” & 6”	1,200 gpm	2006	Limited / Metered	From Utility	City of Ridgefield

Note:
547 gpm is the peak flow recorded by the utility in 2009

1.4 Related Plans

1.4.1 Coordinated Water System Plans

Clark County Coordinated Water System Plan Update (2011). The current update of the CWSP was developed to reflect the changes in zoning that resulted from implementation of growth management planning in Clark County. This update replaced the 1999 update in its entirety. It provides the functional document for CWSP. The 1999, 1991, and 1983 plans provide historical background and conceptual discussion of regional water supply system options. The CWSP is updated as needed. In the summer of 2018 members of local water utility council including water purveyors, Clark County Planning and Clark County Public Health met and discussed updating the plan. It was determined that the plan was current, and no changes were needed.

1.4.2 Comprehensive Land Use Plans

Clark County 20-Year Comprehensive Growth Management Plan (2016 Plan). Among its measures to manage growth and development throughout the county, the plan identifies land uses and development densities appropriate for various areas of the county. It establishes urban growth areas and sets forth policies aimed at encouraging compact orderly development within these urban boundaries, and it defines level of service standards for public facilities. The county plans to update the plan with a completion date in 2025.

1.4.3 Clark Public Utilities Reports

Clark Public Utilities Water Use Efficiency Report (2008). The plan summarizes existing and proposed water conservation activities and goals. It will serve as the water utility’s Water Conservation Plan and will be incorporated into this Water System Plan. A copy of the report is included in Appendix D.

1.5 Existing Service Area Characteristics

Clark Public Utilities’ water system serves the unincorporated, urban, and rural areas of Clark County north and northeast of the City of Vancouver incorporated area. Its service area includes the Hazel Dell, Hockinson and Meadow Glade communities, as well as areas along the Lewis River. The service area includes the City of La Center, the community of Amboy (as a satellite system), and the Town of Yacolt (as a satellite system)

but excludes the cities of Camas and Washougal and portions of Battle Ground, Ridgefield, and Vancouver. Land use patterns and activities within most of the existing service area are predominantly rural residential, with lot sizes of two to five acres.

The Hazel Dell area is predominantly suburban residential, with some commercial/industrial activity along Highway 99. Industrial activity is limited by zoning restriction to those areas along St. Johns Road in the southeast portion of the system, and Highway 99 and Interstate 5, which runs north and south through the middle of the service area. Some commercial activity is found in Hockinson, Brush Prairie, and Venersburg, where higher density residential and commercial uses occur. The remainder of the area is designated as forest, agriculture, and rural farmland uses.

The Clark County Comprehensive Plan identifies eight rural service centers where development densities are permitted that are greater than those allowed elsewhere in rural areas. The water utility provides service to all rural centers except Chelatchie Prairie. It is anticipated that the majority of future water customers will be within the La Center, Battle Ground, Ridgefield, and Vancouver urban fringe areas.

1.6 Future and Retail Service Area Designations

At present, all areas of the county fall within the designated service area of an existing water purveyor. The water utility will probably continue to see modest extensions of distribution mains beyond the areas presently served but most future development of the system should be within the current water service boundary, owing principally to controls on development imposed by the county's Comprehensive Plan and implementing land use regulations, consistent with GMA.

Clark Public Utilities has designated its Future Service Area and Retail Service Area as synonymous with its existing service area. The Retail Service Area designation carries with it a duty to provide water service within the area for all requests, provided the system has capacity, the proposed use is consistent with land use plans, and the system has available water rights. Further service must be provided in a "timely and reasonable" manner. DOH is supposed to provide additional guidance on the definition of timely and reasonable, but it has not been developed to date.

The water utility negotiated water service area boundary adjustments with its neighboring purveyors since the last WSP. These modifications sought to provide for the most efficient provision of public water service supply. All water service area (WSA) boundary adjustments were completed by written agreements and will be reflected in the county's update of the Coordinated Water System Plan.

1.7 Service Area Agreements

Clark Public Utilities has entered into water service area agreements with the adjoining purveyors. Copies of the agreements are included in Appendix C.

1.8 Satellite Management Agencies

The county's Coordinated Water System Plan identifies Clark Public Utilities as the county's satellite system management agency. To date, the water utility operates 22 satellite systems, as compared to twenty-four systems at the time of the previous WSP was developed. Table 1-11 is a list of satellite systems managed by the water utility.

Table 1-11 | Satellite Water Systems Owned & Operated by Clark Public Utilities

Water System	Address	ID Number	Connections	Type
AMBOY	26131 NE 419 ST	46254	120	A
FRENCHMANS BAR PARK	LOWER RIVER ROAD	AA289A	4	A
HAAPA PARK	43501 NE Haapa Rd.	AA215K	2	A
MORNING MEADOWS[1]	1610 NE 194 AV	00950E	25	A
YACOLT	Town of Yacolt	99000V	613	A
ALLEN CANYON ACRES	31000 NW 51 AVE	639898	5	B
DANIELS	NE 276 AV & BRADFORD RD	AA2339	10	B
DOBLER HILL	40500 NE DOBLER HILL RD	05655Y	8	B
KING CORNER	NE 252 ST & NE 68 AV	AA300M	12	B
LEWISVILLE HEIGHTS[2]	23505 NE 120 CT	02126V	12	B
MC KEE ROAD	23519 NE 388 CIR	04478P	3	B
MOUNTAIN GLEN	NE 199 AV & NE 48 ST	AA234G	12	B
PEKIN FERRY	5101 NW PEKIN FERRY RD	08492C	1	B
PROEBSTEL	NE 188 AV NORTH OF NE 73 ST	00736R	3	B
SUNNY MEADOWS	36200 NE 247 AV	02764M	3	B
SWEET BRIAR ESTATES	SE 282 Ave OFF SE 30 CIRCLE	69223	4	B
VERNON ROAD	NE 369 CT. and VERNON RD.	11594	2	B
VIEW ACRES	NE 85 AV & NE 379 ST	00062K	5	B
VIEW RIDGE	NE 114 CT & NE 410 ST	02125B	8	B
ZUMSTEIN	NE 21 AV & NE 406 ST	49651	12	B
BRIDGE ROAD	NW 411th CIRCLE AND BRIDGE ROAD	AB775E	12	B
LIVINGSTON MOUNTAIN	NE 276th AVE off of BRADFORD ROAD	AA2339	3	B

Notes:
1. Within City of Vancouver Water Service Area. Expected to be served by City of Vancouver soon.
2. Within City of Battle Ground Water Service Area

Clark Public Utilities has prepared water system plans for its Group A systems and they are incorporated into this water system plan and included in the appendices. Copies of the existing plans are included in Appendix A.

1.9 Water Utility Service Area Policies

1.9.1 Wholesale Water and Wheeling of Water

The water utility will consider requests for wholesale water sales arrangements only with other major purveyors. It would consider a request for wheeling water through their distribution system. Important considerations include monitoring and control, hydraulic evaluation of the potential impacts, water quality, and water rights changes.

1.9.2 Direct Connection or Satellite System

The water utility requires direct service from its main water system except in circumstances where this service cannot be achieved without unreasonable burden on the applicant in which case a satellite water system may be considered. The water utility is the primary Satellite Management Agency within Clark

County. At present, Clark Public Utilities owns and/or manages 22 satellite water systems located within its own service territory and 4 within the water service areas of other major purveyors.

1.9.3 Design and Performance Standards

The water utility has prepared a comprehensive set of engineering and construction standards for public works projects. All new water system improvements must meet the criteria. The standards are presented in Appendix F.

1.9.4 Non-Participant Resolutions

Resolution pertaining to non-participants is used.

1.9.5 Oversizing Policy

The water utility will provide financial assistance for over-sizing of water facilities when the needs of the system exceed the development's requirements.

1.9.6 System Extension

All extensions to the water utility's system must meet its adopted engineering standards. Where desirable to meet long-term system needs, the water utility will pay for over-sizing facilities as appropriate and funding is available.

1.10 Conditions of Service

1.10.1 Purveyor Responsibilities

The water utility is responsible for providing water that meets quality and quantity standards of the State of Washington and the utility's design standards. The water utility will attempt to minimize service interruptions during maintenance, repair, and construction activities.

1.10.2 Customer Responsibilities

The customer is responsible for payment of all charges incurred from their water service consistent with resolutions and policies approved by the commission and for responding to the water utility's requests for water conservation during emergencies.

1.10.3 Connection Fees

The water utility will assess new or upgrading water customers' system development charges and fees. See the *Financing Strategy* Section for additional detail.

1.10.4 Meter and Materials Requirements

The water utility will provide and install all meters.

1.10.5 Consent

The customer must consent to access by the utility for inspection, maintenance, and repair of water facilities. All new facilities must be located within either the public right-of-way or within a dedicated utility easement.

1.10.6 Cross Connection

The water utility has a comprehensive cross connection control program. When cross-connections are identified or assemblies and/or plumbing is defective the utility will provide assistance to correct the problem but will ultimately terminate service if uncorrected. The customer is responsible for the purchase, installation, maintenance, and annual testing of cross connection control assemblies that meet the utility's standards.

1.10.7 Service Connection Responsibility

Service taps on new mains will be completed by the project proponent provided the water utility has been notified and a water utility inspector is onsite. A party acceptable to the water utility shall make all service taps on existing mains. All connections to existing water facilities require 48-hour prior notification.

1.10.8 Developer Extension Requirements

All developer extensions must meet the water utility's engineering and construction standards including design by a professional engineer. Financing of extensions is the developer's responsibility with the possible addition of utility oversizing by the water utility. Developer extensions involving booster pump stations, reservoirs, new sources, or other facilities besides distribution mains must complete the DOH submittal and review process once they are approved by DOH.

1.10.9 Utility Easements

All piping, pumping, source, storage, and other facilities shall be located on public rights-of-way or dedicated utility easements. Utility easements must be a minimum of 15 feet in width and piping shall be installed no closer than 5 feet from the easement's edge. (See Appendix F)

1.10.10 Design Standards Compliance

Exceptions to the design standards may be considered by the water utility in extreme situations and when a reasonable alternative is suggested.

1.11 Complaints

The water utility evaluates all customer complaints to determine if they indicate a potential problem with the existing water treatment process, system facilities, or operation practices. The utility is responsive to customer concerns and take appropriate action, as applicable, to address water quality or quantity concerns based on available resources and the significance of the problem.

Any complaints about water quality received by the customer service representatives are entered as a service request and flagged with a high importance. The staff review the orders and send them to the Water Quality Specialist for investigation. A monthly report is also generated at the first of every month capturing all water quality issues from the previous month for review.

CHAPTER 2

Planning Data and Water Demand Forecasting

2.1 Current Service Population, Service Connections, Water Use and Equivalent Residential Units

2.1.1 Current Service Population

Clark Public Utilities' water system served an estimated 97,024 people at the end of 2022. This estimate is based on an assumed 2.59 people residence. Clark County's growth in service population, including the Clark Public Utilities' system from 2012 to 2022 are provided in **Table 2-1**.

Table 2-1 | Growth in Service Population

Area	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
County	436,532	441,591	448,505	457,320	465,911	475,238	482,467	489,271	505,013	511,404	516,779
CPU Residential Connections	29,408	29,837	30,356	30,989	31,770	32,847	33,373	34,376	35,271	36,704	37,461
CPU Estimated Population Served	76,167	77,278	78,622	80,262	82,284	85,074	86,436	89,034	91,352	95,062	97,024

Most of the population presently served by the system (94 percent) resides in single-family detached dwelling units.

2.2 Current Service Connections

Historic connections and specific service counts by revenue class and meter size from 2012 to 2020 are provided in **Table 2-2**.

Table 2-2 | Clark Public Utilities Customer Counts by Class, 2012-2020

	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Average Number of Customers											
Residential	29,408	29,837	30,356	30,989	31,770	32,847	33,373	34,376	35,271	36,704	37,461
Commercial	1,060	1,076	1,094	1,117	1,145	1,184	1,253	1,294	1,327	1,381	1,409
Other	665	674	686	700	718	742	758	756	752	783	799
Total	**31,133**	**31,587**	**32,136**	**32,807**	**33,634**	**34,774**	**35,384**	**36,426**	**37,350**	**38,867**	**39,669**

The utility presently has four revenue classes: (1) single family residential; (2) multi-family residential; (3) commercial/industrial; and (4) public authority, in **Table 2-2** commercial/industrial and public authority are grouped together as "Other" because historical data was available in this form. Ninety-four (94) percent of

all water services are in the residential category and this ratio has remained relatively constant during the past several years.

2.3 Water Use Data Collection

The water utility collects data on water production using its SCADA system. This provides for real-time monitoring of system performance as well as the preparation of routine reports and compilation of data for future analysis. Water production and hours of operation are reported daily for each water source. A summary of water production by year is provided in **Table 2-3** for the period of 2012 through 2022. The utility is transitioning to monthly reading of meters with the conversion of automatic meter reading currently under way.

Table 2-3 | Clark Public Utilities Summary of Water System Production 2012-2022

Water Production	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Max Day Production	21.1	21.8	23.4	27.3	23.2	20.5	28.4	32.0	28.6	31.9	38.9
Avg Day Production	10.3	10.1	10.5	11.6	10.7	11.5	12.4	11.8	12.7	12.6	13.3

All water services are metered with bi-monthly readings. The total water consumption by revenue class was determined for the years 2012 to 2020 by Clark Public Utilities finance department and has been provided in **Table 2-4**.

Table 2-4 | Historical Data of Customers, Sales, and Revenue by Customer Class

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Average Service Connections											
Residential	29,408	29,837	30,356	30,989	31,770	32,847	33,908	34,846	35,271	36,704	37,461
Commercial	1,060	1,076	1,094	1,117	1,145	1,184	1,222	1,256	1,327	1,381	1,409
Other	665	674	686	700	718	742	746	788	752	783	799
Total	31,133	31,587	32,136	32,807	33,634	34,774	35,876	36,890	37,350	38,867	39,669
Residential (1000 ccf)	343,113	335,558	350,868	382,190	357,535	383,318	412,919	390,893	416,535	455,123	479,526
Commercial (1000 ccf)	44,982	48,708	50,858	53,478	56,742	60,565	67,174	66,246	61,319	67,000	70,592
Miscellaneous (1000 ccf)	62,053	61,415	64,881	76,807	72,996	77,882	84,273	76,365	87,240	95,322	100,433
Total Consumption (1000 ccf)	450,148	445,681	466,607	512,475	487,273	521,765	564,366	533,504	565,094	617,444	650,551

Note:
Source: 2012 – 2020 Audited Financial Statements of the District, 2021 and 2022 Clark PUD Annual Reports

The residential revenue class consumes the greatest quantity of water though not in the same proportion as its service connection count. In addition to the four revenue classes, the water that has been sold to the City of Battle Ground is detailed separately from the Commercial/Industrial class. Unaccounted for water is shown in

Table 2-5. Distribution leakage is consistently less than 10 percent in the 3-year running average.

Table 2-5 | Distribution System Leakage

Year	Distribution System Leakage	3-Year Running Average
2013	6.3%	8.0%
2014	10.8%	8.5%
2015	9.5%	8.9%
2016	6.9%	9.1%
2017	8.3%	8.2%
2018	7.0%	7.4%
2019	7.7%	7.7%
2020	9.3%	8.0%
2021	8.0%	8.3%
2022	8.6%	8.6%

The water utility accounts for water within its system by comparing water produced at each of its well sites (TP) with authorized consumption (AC). Authorized consumption includes residential, commercial, and public authority meter sales, hydrant meter sales, and other non-revenue producing water (backwashing, flushing, maintenance, and firefighting) to identify the amount of distribution system leakage. The utility currently meters all sources and known connections to its system.

2.4 Equivalent Residential Units

Equivalent residential units (ERUs) are a method of summarizing water demands from non-residential water customers to provide a single value for system capacity evaluation. The basic water demands for residential water services are typically established based on historic records. Non-residential water customers are then converted to ERUs by evaluating their corresponding water demands. While this process simplifies the evaluation, it may understate or overstate maximum daily demand and peak hour demand factors depending on the specific nature of the data available and the demands placed on the system by non-residential customers. The development of ERUs for this water system has been based on the guidelines prepared by DOH in the Water System Design Manual, 2020. The analysis of Clark Public Utilities ERUs is provided in

Table 2-6.

The average daily demand (ADD) per residential service connection has ranged from 229.9 to 249.6 gpd with an average value of 240 gpd for the 3-year average.

The total number of ERUs based on the 2020 residential water consumption is 48,034. The distribution system leakage for water in 2008 was the equivalent of an additional 3,425 ERUs for a system total of 41,374 ERUs. Calculations are shown in

Table 2-6 for ERUs.

Table 2-6 | ERU Equivalent Calculations

	2018	2019	2020	3-Year Average	3-Year Average with Additional Conservation[1]
Average Number of Customers					
Residential	33,908	34,846	35,271	34,675	
Commercial	1,222	1,256	1,327	1,268	
Miscellaneous	746	788	752	762	
Total	**35,876**	**36,890**	**37,350**	**36,705**	
Cubic Feet Delivered (in thousands)					
Residential	412,919	390,893	416,535	406,782	
Commercial	67,174	66,246	61,319	64,913	
Miscellaneous	84,273	76,365	87,240	82,626	
Total	**564,366**	**533,504**	**565,094**	**554,321**	
Average Use Per Customer Class, gallons per connection per day					
Residential	249.6	229.9	242.0	240	228
Commercial	1,126.5	1,080.9	947.0	1,051	
Miscellaneous	2,315.0	1,986.0	2,377.4	2,226	
Equivalent ERUs based on Residential Water Sales Equivalent					
Residential	33,908	34,846	35,271	34,675	
Commercial	5,343	5,491	5,802	5,545	
Miscellaneous	6,906	7,294	6,961	7,054	
Total	46,156	47,632	48,034	47,274	
Distribution System Leakage					
Cubic Feet *1,000	39,506	41,080	52,554	44,380	
ERU Equivalent	3,244	3,662	4,450	3,785	
Total System ERU	42,750	40,354	42,302	48,165	

Note:
1. 287.7 gallons per ERU is used for demand forecasting

2.5 Projected Land Use, Future Population, and Water Demand

2.5.1 Projected Land Use

While a majority of the water utility's customers are concentrated in the Hazel Dell service zone, most of which is within the City of Vancouver UGA. New service connections since the last WSP have reduced the historic pattern of 80 percent being located within this area. Hazel Dell currently accounts for 64 percent of the utility's connections. Meadowglade and Hockinson both have over 3,000 connections. Griffels has over 2,000 connections and the other pressure zones all have less than 1,000 connections.

In the North County area growth is expected to continue in La Center Upper and Lower Pressure zones and as well as large demands to Ilani Casino and the City of Ridgefield. The Paradise Point Water Treatment Plant was constructed in 2019 to supply these areas in addition to the Meadowglade pressure zone and the City of Battle Ground.

Industrial and commercial activity is expected to grow north along Interstate 5 from Hazel Dell. Some commercial activity is also found in Hockinson, Brush Prairie, and Venersburg, where higher density residential and commercial uses occur. The remainder of the area is designated as forest, agriculture, and rural residential (5-, 10-, or 20-acre minimum lot sizes).

Projected land use patterns are expected to follow the existing pattern based on zoning requirements and expected commercial and industrial development. Clark County and each of the cities within the county have developed comprehensive land use plans consistent with the Growth Management Act. The plans designate urban growth boundaries around urban areas, which are expected to provide "urban services." The urban growth boundaries encourage density of population and commercial/industrial activity within the boundary.

Future development is expected to occur primarily in the urban areas, as the County's Growth Management Plan projects 90 percent of new development to be in urban areas. Current population distribution with the service area shows 64 percent of the population in the Hazel Dell area. For planning purposes, this proportion was assumed to remain constant through the planning period (2032 and 2042). This reflects the philosophy of GMA, which encourages growth in and adjacent to areas presently having urban development before permitting development at urban densities outside existing urban areas.

At the same time, the need for adequate and safe water will continue the demand for service throughout the water utility service area. The provision of fire protection is considered a public service. While a public water supply is not essential based on current county ordinances for most residential development, it is often the most practical solution for the limited non-residential activities. The provision of public water within the rural area may be at a lower level of service than that appropriate for urban areas.

As mentioned previously, for planning purposes it was assumed the water utility would provide the opportunity for service to its entire existing, retail, and future service area. This practice is consistent with the objectives of the 2007 Amendment to the 2004 Growth Management Plan.

2.6 Projected Population

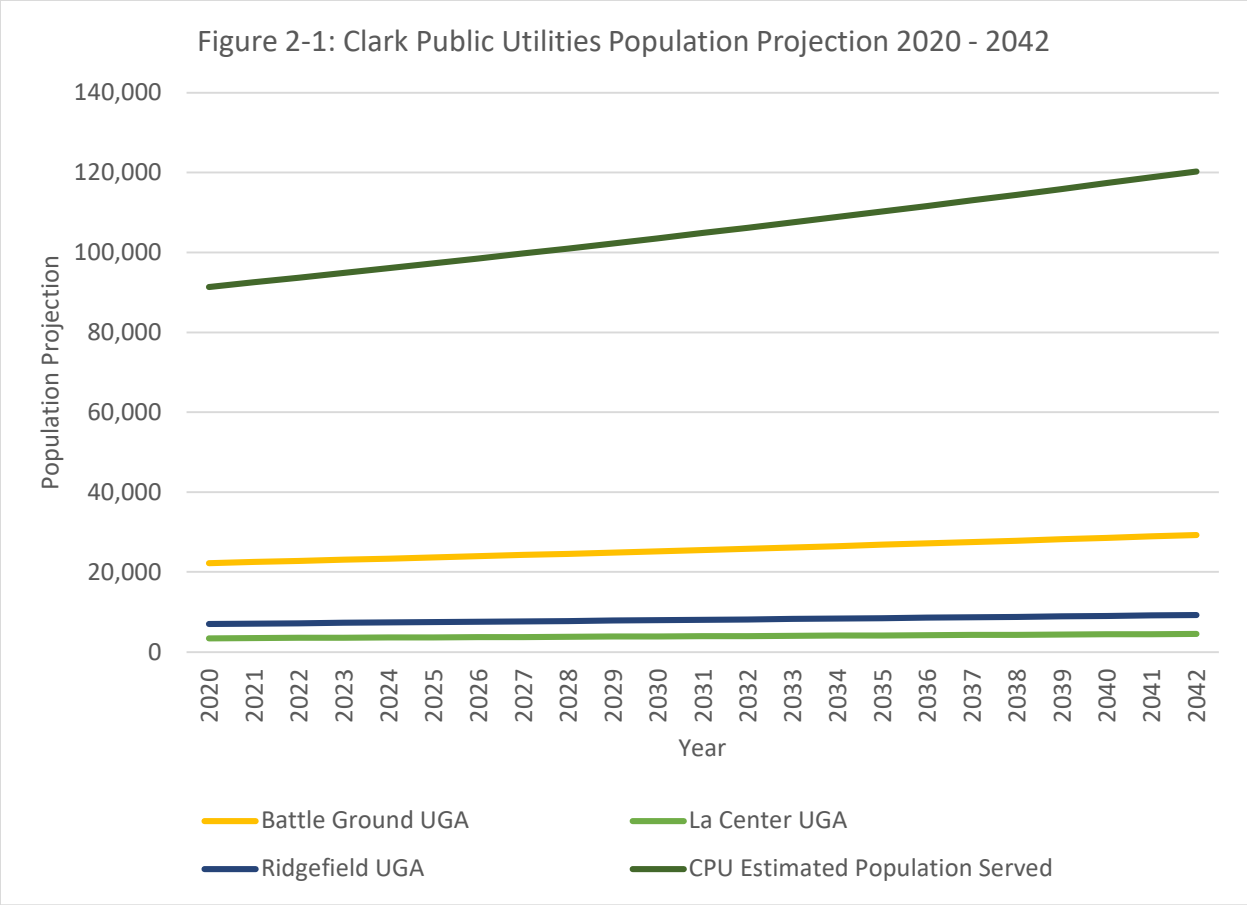
Population projections were analyzed using Washington State OFM population projections for Clark County. Population projections were made using the Clark County 2016 Comprehensive Growth Management Plan with population projections through the planning period of 2035. After 2035, the county growth rate of 1.26 percent was assumed. The population projections are shown in **Table 2-7** and in **Figure 2-1**.

Table 2-7 | Clark Public Utilities Population Projections Based on 2016 Clark County GMA Projections

Municipality	2020	2022	2032	2042
Clark Public Utilities Main System*	91,352	93,668	106,163	120,324

Note: Clark Public Utilities serves parts of the Vancouver UGA, Battle B\Ground UGA, Ridgefield UGA and all of the La Center UGA Population based on 2.59 people per residential service connection.
Note * Clark Public Utilities Population Projections in this table includes the projected 2020 population of 91352 and escalated at a rate of 1.26% as describ3d in the approved 2016 GMA growth rate

Figure 2-1 | Clark County Adopted GMA Population Projections to 2060 and CPU Population Equivalent for ERUs



2.7 Projected Additional Needs

Agreements with the Cities of Battle Ground and Ridgefield allow each entity to purchase water from Clark Public Utilities. In addition, the Ilani Casino is constructing a large hotel which is expected to have a large demand totaling 300,000 gallons per day (gpd) maximum. The City of Ridgefield is expected to increase demand to 0.5 mgd over the planning period. The City of Battle Ground is expected to increase ADD from 0.5 mgd in 2022 to 0.8 mgd in 2042. The City of Ridgefield and Ilani combined are expected to increase ADD from 0 mgd in 2022 to 0.8 mgd in 2042.

2.7.1 Projected Unaccounted for Water

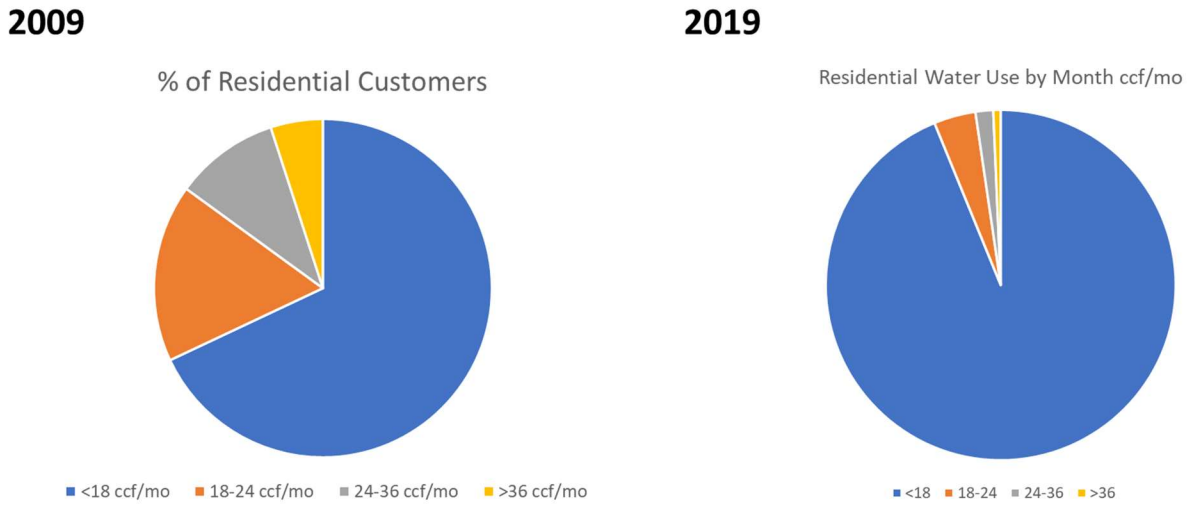
As discussed above, non-revenue water was determined by comparing annual source production with annual water sales. It has been assumed that the proportion of unaccounted for water will be 9 percent of total water production during both the 10 and 20-year planning periods.

2.7.2 Water Rates and Rate Impacts on Water Demand

The water rates were last modified since the last water system plan to incorporate tiered rates. **Figure 2-2** shows the percentage of residential customers who used more than 18 ccf per month in 2009 and 2019. In 2009 more than 32 percent of the residential customers used more than 1800 cubic feet per month in 2009

and in 2019, that percentage had reduced to 6 percent. Or stated another way, the percentage of customers using less than 1800 cubic feet per month increased from 68 percent to 94 percent from 2009 to 2019.

Figure 2-2 | Percentage of Large Residential Water Users, 2009 and 2019



2.8 Water Demand Projections

Projected water demands are based on the population projections discussed above and incorporate a percentage of distribution leakage of 9 percent for the 10- and 20-year planning period. Figure 2-3 shows ADD and peak day demand projections in mgd. These demands incorporate the projected additional use by the Cities of Battle Ground, Ridgefield, and Ilani Casino.

Over the next 20 years, the peak demand could be as high as 42 mgd for Clark Public Utilities water system.

Figure 2-4 shows a 50-year average and peak day demand projections. 50-year peak day demand projections show that as much as 53 mgd over the 20-year planning period and as much as 66 mgd over the next 50 years may be required for future supply.

Figure 2-3 | Clark Public Utilities 20-Year Demand Projections, mgd

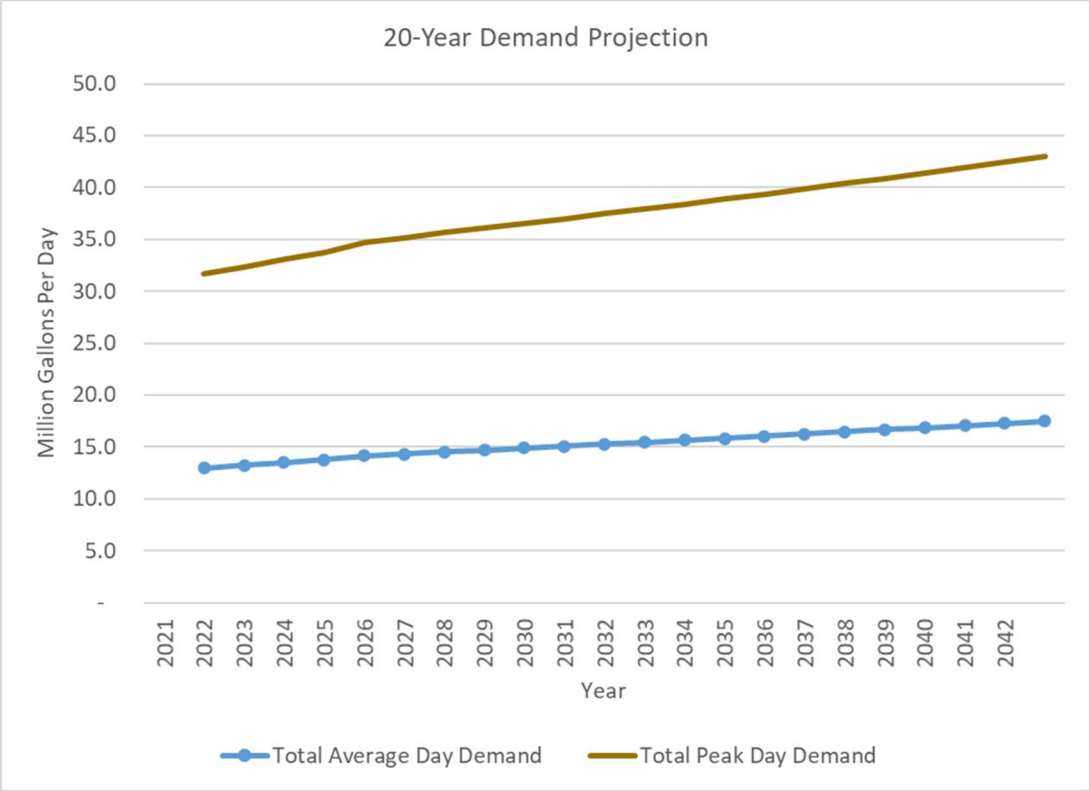
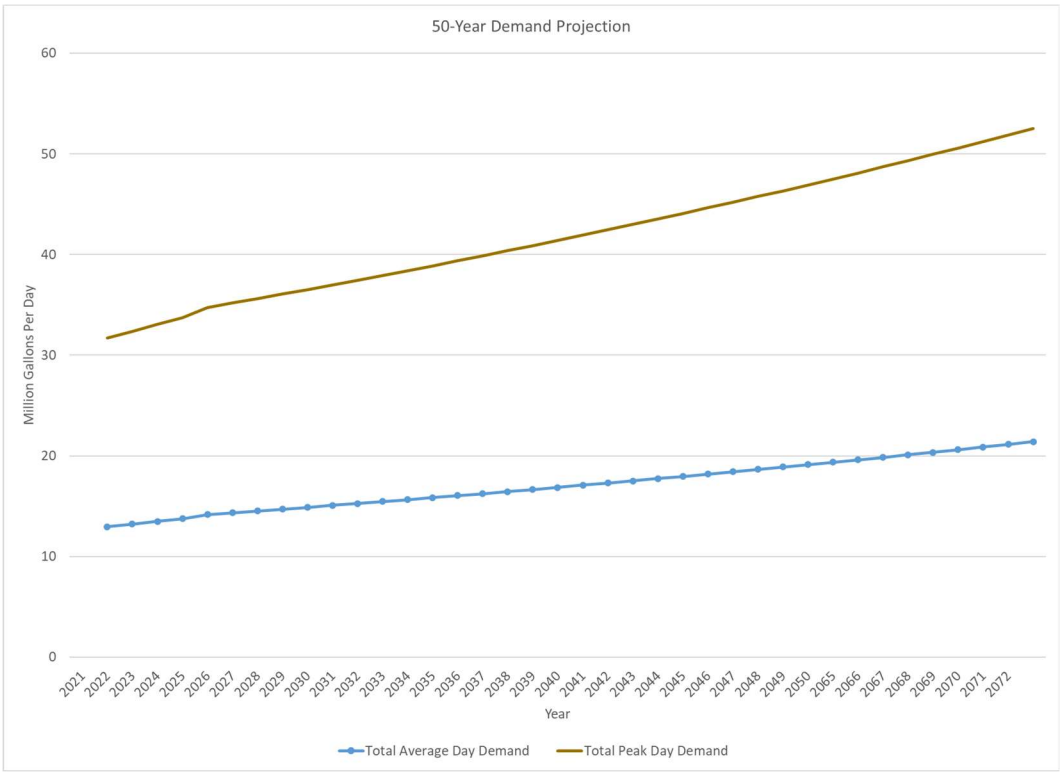


Figure 2-4 | 50 Year Demand Projections, mgd



CHAPTER 3

System Analysis

This section includes:

- The system design standards used by Clark Public Utilities in evaluating the system,
- a water quality analysis of the systems sources of supply, and
- a condition assessment of the existing facilities.

3.1 System Design Standards

This subsection details the criteria used to establish optimum levels of service and standards of construction for improvements needed in Clark Public Utilities water system. Standardized design and performance criteria are essential for the efficient construction and operation of water utilities. Establishing minimum criteria levels enhances a uniform and cost-effective utility service.

The Clark County Water System Minimum Standards and Specifications fulfill the requirements of the 2020 Water System Design Manual developed by the Washington State DOH.

System design standards included in this subsection are data for water demands, storage demands, service pressures and reliability analysis, as summarized in **Table 3-1**.

Table 3-1 | System Design Standards Summary

System Attribute	Evaluation Criterion	Value
Water Supply	Supply Capacity	MDD
	Emergency Power	At least two independent sources if adequate standby storage is not available
Storage	Total Storage Capacity	Sum of dead, equalization, fire, operational, and standby
	Dead Storage	Storage that is unavailable for use or that can provide only substandard flows and pressures below 20 psi
	Equalization Storage	= (PHD – maximum supply capacity)*150 min
	Fire Suppression Storage	Largest fire flow in a zone for duration of that flow
	Operational Storage	Pump supply capacity (in gpm) * 2.5 minutes
	Standby Storage	Number of days selected to meet water system determined standard for reliability (between 1 to 3 days depending on zone) or 200 gal/ERU minimum

System Attribute	Evaluation Criterion	Value
Pump Stations	Minimum No. of Pumps	2
	Firm capacity when pumping to storage	ADD
	Total capacity	MDD
	Capacity with largest "routinely used" pump out of service when pumping to system (no storage)	MDD plus fire flow
	Firm capacity when pumping to system (no storage)	PHD
	Emergency Power	At least two independent sources adequate to serve ADD plus largest fire flow (where standby and fire suppression storage are not adequate/available)
Service Pressure	Minimum during MDD plus fire flow	20 psi
	Minimum during PHD	30 psi
	Standard Range	40-80 psi
	Maximum	80 psi preferred
Distribution Piping	Maximum Velocity during ADD or MDD	5 ft/s
	Maximum Velocity during PHD	10 ft/s
	Maximum Velocity during Fire Flow	10 ft/s
	Minimum Future Pipe Diameter	8-inch
Fire Suppression	Available Fire Flow Requirements	Residential: 500 gpm for 30 min Commercial/Industrial/Multi-Family: 1,500 gpm for 2 hours

3.1.1 Water Demands

The water demands subsection includes a summary of ADD, maximum daily demand (MDD), peak hourly demand (PHD), fire protection demands.

Average Daily Demand (ADD): Table 3-1 summarizes the ADD, MDD, and PHD for Clark Public Utilities. In the past three years, ADD ranged from 11.8 to 12.5 mgd. The design criteria selected for the water system plan for ADD is 228 gallons per ERU which is the average of the three-year period from 2018 through 2020 with additional 5 percent conservation. The ADD in 2032 is estimated to be 13.9 mgd and 15.8 mgd in 2042.

To provide a reasonable basis for estimating average water demand CPU evaluated the customer water-meter records for 2015 through 2019 and production record from 2012 through 2020. Meters are read bi-monthly so only the annual total consumption was evaluated. The total water demand is equal to the consumption plus water uses that are not monitored: distribution system flushing, fire protection, unauthorized (unmetered) use and leaks. The Water Utility typically experiences distribution system leakage averaging less than 10 percent of total production. These water losses have been estimated as being equal to 9 percent of total production matching the Water Use Efficiency Goal.

Maximum Daily Demand (MDD): MDD was estimated by reviewing historical production for the past 10 years as shown in Table 2-3. Peaking factors ranged from 1.8 to 2.7 which are higher than those recommended in the Design Manual of 1.35. Since the utility has a long history of recording peak day production in excess of the recommended factor, we calculated MDD using the highest peaking factor of 2.7 to make sure the utility could meet its level of service goals in the future.

Peak Hourly Demand (PHD): The PHD was calculated as:

$$PHD = (ERU_{MDD}/1440)*[(C)(N) +F] +18$$

Where PHD is the peak hour demand

C is the coefficient based on ERUs (1.6 for Clark Public Utilities)

N is the Number of ERUs at maximum day

F is the factor based on ERUs (225 for Clark Public Utilities)

ERU_{MDD} is the maximum day demand per ERU (617 gal/day for Clark PUD)

Fire Protection Demands: The source of fire flow performance standards originate chiefly from national, state, and county criteria. The Washington State Survey and Rating Bureau grade each municipal fire protection agency. To accomplish this objective, the Bureau uses a national Grading Schedule to evaluate various aspects of the fire and water departments. The rating schedule also lists criteria relating fire flow and flow duration at that rate. Flow duration serves as the guide for sizing storage reservoirs. Clark County's fire flow requirements are located in **Appendix G**.

Used in conjunction with the Grading Schedule is the Guide for Determination of Required Fire Flow published by the Insurance Service Office (ISO). Local fire officials utilize the ISO standards to establish the largest flow requirements for an area based on "highest risk" facilities.

The minimum and maximum range of 500 to 12,000 gpm is based on considerations, such as the type of building construction, floor area, building height, building use, availability of automatic sprinkler systems, etc. Once this maximum flow is determined, storage, which must be reserved for fire protection, can be identified.

State criteria for minimum regulatory fire flow criteria were promulgated by DOH under Chapter 248-57 WAC. The standards are lower than the survey and Rating Bureau and ISO criteria and apply in service areas where system expansion occurs.

Table 3-2 | Clark Public Utilities Water Demand Projections

Year	Metered	Service	Leakage	System	Design Criteria (mgd)			Design Criteria (gpm)		
	Services	ERUs	ERUs	ERUs	ADD	MDD	PHD	ADD	MDD	PHD
2020	35,876	46,156	3,244	49,401	12.5	28.4	48.9	8,646	19,722	33,973
2022	36,890	47,632	3,662	51,294	11.8	32.0	50.8	8,215	22,222	35,271
2032	43,406	55,822	5,024	60,846	13.9	37.6	60.2	9,653	26,112	41,817
2042	49,195	63,268	5,694	68,962	15.8	42.6	68.2	10,941	29,596	47,380

Notes:
ADD: 228 gpd/ERU (Source: 2018 to 2020 average with conservation)
MDD: 617 gpd/ERU (2019 Actual)
PHD: 1.6 times MDD +243 gpm (2020 DOH Design Manual)
Distribution Leakage (DL): 9% of total production (WUE Goal 9%)

Table 3-2 lists the ADD and MDD Demands for the system with the additional demands projected for the Cities of Battle Ground and Ridgefield and for the Ilani Casino.

Table 3-3 | ADD and MDD with Additional Demands

Year	ADD from Battle Ground	ADD from Ridgefield and Ilani	MDD from Battle Ground	MDD from Ridgefield and Ilani	Design Criteria (mgd)			Design Criteria (gpm)		
	mgd	mgd	mgd	mgd	ADD	MDD	PHD	ADD	MDD	PHD
2020	0.4	0.0	3.0	0.0	12.9	31.6	0.2	8,938	21,944	114
2022	0.5	0.1	3.1	0.3	12.9	36.4	0.2	8,934	25,262	115
2032	0.6	0.6	3.5	1.5	15.1	41.7	0.2	10,487	28,960	115
2042	0.6	0.6	4.0	1.8	17.0	47.2	0.2	11,774	32,790	116

In addition, the 20-Year Comprehensive Growth Management Plan for Clark County identified general service provision levels for public water systems providing fire protection. The minimum standards include those shown on **Table 3-3**.

Table 3-4 lists the minimum County fire flow requirements based on the Clark County Code Ordinance 2021-07-13 passed July 20, 2021 (see **Appendix G**).

Table 3-4 | Clark County Fire Flow Requirements

Land Use Zones	Type IA and IB	Type IIA and IIB	Type IVA and IVB	Type IIIA and IIIB	Type VA and 1B	Fire Flow Requirements (gpm)	
	Square footage ot Building					Min. Flow gpm	Duration
Residential (within Fire District)						500	120 min
Residential (Outside of Fire District Boundary)						625	120 min
Buildings	0-16000	0-8000	0-6000	0-4000	0-2000	1,000	120 min
	16001-19300	8001-10299	6001-7100	4001-4900	2001-2900	1,250	120 min
	19301-22700	10200-12700	7101-8200	4901-5900	2901-3600	1,500	120 min

Fire-flows used for water system analysis are consistent with those used in the county land use plan and the coordinated water system plan. Fire-flows used in the Clark Public Utilities Water System Plan are summarized in **Table 3-5**.

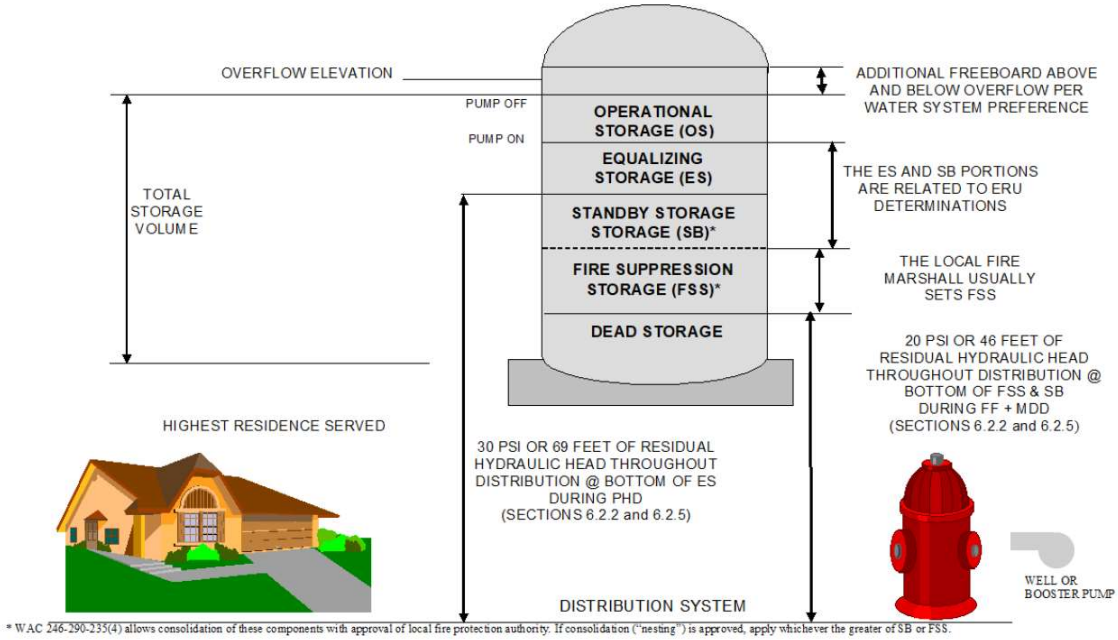
Table 3-5 | Minimum Fire-flows used for Clark Public Utilities Water System Plan

Type	Instantaneous Flow	Duration
Residential in Fire District Boundaries	500 gpm	30 minutes
Residential outside of Fire District Boundaries	625 gpm	30 minutes
Commercial and Industrial, Depending on Zoning	1,000 or 1,500	120 minutes

3.1.2 Storage Requirements

Storage was evaluated for each pressure zone. Storage components are shown in **Figure 3-1**.

Figure 3-1 | Storage Components from Washington DOH Water System Design Manual.



Storage requirements were calculated for the following components:

1. Operational Storage
2. Equalizing Storage
3. Standby Storage
4. Fire Suppression Storage
5. Dead Storage.

- Operational storage (OS) is that which provides for efficient operation of the water sources and reservoirs for a water system. Operational Storage was calculated as the pump supply to each pressure zone in gpm multiple by 2.5 minutes.
- Equalizing storage (ES) volume, which is required to supplement production from water sources during high demand periods, was calculated as
  - ES.= (PHD-Q_s)(150 min)
  - Where:
    - PHD is the peak hour demand in each pressure zone.
    - Qs is the Total Source Capacity in each pressure zone
- Fire Suppression storage (FSS) is calculated as the highest required fire flow multiplied by the longest required duration based on zoning in each pressure zone.

- Standby storage (SB) is that which provides a margin of system reliability during emergency conditions and is sized according to the following formula:

$$SB = (N)(SB_i)(T_d)$$

Where:

SB_i = locally adopted standby volume in gpd per ERU (For Clark Public Utilities this is equal to the annual average demand in gal/day per ERU);

N= Number of ERUs;

T_d = The number of days selected to meet the reliability standard (2 days for most pressure zones for Clark Public Utilities).

- Dead storage includes the volume "lost" from mud stops in the bottom of reservoirs or in the lower sections of standpipes. The effective storage volume consists of only the water at a sufficient elevation to meet minimum system pressure requirements (see *Minimum Service Pressure*).

Table 3-6 shows storage requirements for each pressure zone in the system. Table 3-7 shows the deficit for each pressure zone after the storage requirements have been assigned to the pressure zone that has existing storage or to the pressure zone that supplies water to the zone. Table 3-7 also shows which zone the storage requirement is assigned to. .

Table 3-6 | Storage Analysis for Clark Public Utilities Water System

PRESSURE ZONE	Meters	ERUs	ADD	MDD	PHD	Wells	Booster or PRV Supply	OS	ES	No Days	SB (Days* ADD)	Fire Flow	Dur.	FSS	Minimum Required
ROW LABELS			gpm	gpm	gpm	gpm	gpm	gal	Gal	Stand by		gpm	Min	gal	gal
147TH ST	9	11	2	5	12		74	185	-	2	5,749	500	120	60,000	64,616
15TH AVE	16	20	4	8	22		480	1200	-	2	10,220	500	120	60,000	69,077
244TH CT	8	10	2	4	11			0	1,649	2	5,110	500	120	60,000	65,587
82ND AVE	28	34	6	14	38		380	950	-	2	17,885	500	120	60,000	74,734
ALPINE HTS	50	62	11	25	69		200	500	-	3	47,906	500	120	60,000	97,422
ALVA	36	44	8	18	49		400	1000	-	2	22,995	500	120	60,000	78,722
ARMSTRONG	363	447	81	185	499		1050	2625	-	2	231,863	1,000	120	120,000	301,326
BERRY	43	53	10	22	59		530	1325	-	2	27,466	500	120	60,000	82,493
BIG EAST	85	105	19	43	117		200	500	-	2	54,293	500	120	60,000	102,345
BLACKHAWK	109	134	24	55	150		300	750	-	2	69,623	500	120	60,000	114,410
BONANZA	34	42	8	17	47		520	1300	-	2	21,717	500	120	60,000	78,038
BOOSTER #149	14	17	3	7	19		50	125	-	2	8,942	500	120	60,000	67,017
BOOSTER #6 (PFEIFFER)	115	142	26	59	158		200	500	-	2	73,455	500	120	60,000	117,113
BOOSTER 109 PRV	24	30	5	12	33			0	4,946	2	15,330	500	120	60,000	76,761
COLE WITTER	68	84	15	35	93			0	14,015	2	43,434	500	120	60,000	107,490
DOVE CREEK	54	66	12	27	74	680		1700	-	2	34,492	500	120	60,000	88,284
DUBLIN	182	224	40	93	250		400	1000	-	2	116,251	500	120	60,000	150,597
ECHO RIDGE	22	27	5	11	30		50	125	-	2	14,052	500	120	60,000	70,955
EDGETREE CONDOS	28	34	6	14	38		60	150	-	2	17,885	500	120	60,000	73,934
FINN HILL	24	30	5	12	33		50	125	-	2	15,330	500	120	60,000	71,940
GABLE AVE	119	146	26	61	164		380	950	-	2	76,010	500	120	60,000	119,533
GRIFFELS	2,456	3,023	545	1,250	3,375	690	3140	9575	-	2	1,568,747	1,500	120	180,000	1,398,640
HAZEL DELL	24,888	30,630	5,520	12,665	34,196	17955		44887.5	2,436,121	1	7,948,488	1,500	120	180,000	8,787,067
HEISSON BOOSTER	7	9	2	4	10		20	50	-	2	4,471	1,000	120	120,000	123,496
HOCKINSON	3,167	3,898	702	1,612	4,351	1440	2313	9382.5	89,763	2	2,022,891	1,500	120	180,000	1,838,228

PRESSURE ZONE	Meters	ERUs	ADD	MDD	PHD	Wells	Booster or PRV Supply	OS	ES	No Days	SB (Days* ADD)	Fire Flow	Dur.	FSS	Minimum Required
ROW LABELS			gpm	gpm	gpm	gpm	gpm	gal	Gal	Stand by		gpm	Min	gal	gal
HOCKINSON HIGHLANDS	14	17	3	7	19		50	125	-	2	8,942	500	120	60,000	67,017
KELLY	40	49	9	20	55		380	950	-	2	25,550	500	120	60,000	80,642
LA CENTER	760	935	169	387	1,044	200	2500	6750	-	2	485,443	1,500	120	180,000	560,891
LOCKWOOD	104	128	23	53	143		400	1000	-	2	66,429	500	120	60,000	112,198
LOWER EARLY DAWN	15	18	3	8	21		170	425	-	2	9,581	500	120	60,000	67,809
LOWER TAYLOR VALLEY	1	1	0	1	1		20	50	-	2	639	500	120	60,000	60,542
LUDLUM	246	303	55	125	338		240	600	14,700	2	157,130	1,000	120	120,000	256,404
MEADOW GLADE	3,375	4,154	749	1,717	4,637	12530		31325	-	2	2,155,749	1,500	120	180,000	1,872,804
MEADOW GLADE BOOSTER	42	52	9	21	58		100	250	-	2	26,827	500	120	60,000	80,926
METTLER MANOR	22	27	5	11	30		100	250	-	2	14,052	500	120	60,000	71,080
NORDEEN	80	98	18	41	110		480	1200	-	2	51,099	500	120	60,000	100,583
OSMAN	83	102	18	42	114		100	250	2,106	2	53,015	500	120	60,000	103,216
RAWSON	117	144	26	60	161		1450	3625	-	2	74,733	500	120	60,000	121,223
RAWSON ROAD UPPER	17	21	4	9	23		131	327.5	-	2	10,859	500	120	60,000	68,696
RIVERBEND	11	14	2	6	15		200	500	-	2	7,026	500	120	60,000	65,915
SKYLINE	7	9	2	4	10		50	125	-	2	4,471	500	120	60,000	63,571
SOUTHVIEW TERRACE	35	43	8	18	48		100	250	-	2	22,356	500	120	60,000	77,480
SPRING HILL	39	48	9	20	54		460	1150	-	2	24,911	500	120	60,000	80,349
SUMMER HILLS	90	111	20	46	124		300	750	-	2	57,487	1,000	120	120,000	165,056
SUMMER HILLS 1	34	42	8	17	47		300	750	-	2	21,717	500	120	60,000	77,488
SUMMER HILLS 2	8	10	2	4	11		300	750	-	2	5,110	500	120	60,000	64,688
TAYLOR VALLEY	70	86	16	36	96		380	950	-	2	44,712	500	120	60,000	95,410
TITTLE	673	828	149	342	925		1300	3250	-	2	429,872	1,000	120	120,000	454,561
TITTLE BOOSTER	137	169	30	70	188		300	750	-	2	87,507	500	120	60,000	128,194

PRESSURE ZONE	Meters	ERUs	ADD	MDD	PHD	Wells	Booster or PRV Supply	OS	ES	No Days	SB (Days* ADD)	Fire Flow	Dur.	FSS	Minimum Required
ROW LABELS			gpm	gpm	gpm	gpm	gpm	gal	Gal	Stand by		gpm	Min	gal	gal
UPPER BIG EAST	10	12	2	5	14		750	1875	-	2	6,387	500	120	60,000	66,798
UPPER LA CENTER	815	1,003	181	415	1,120		750	1875	55,470	2	520,574	1,500	120	180,000	638,561
UPPER VALLEY VIEW	150	185	33	76	206		780	1950	-	2	95,811	1,000	120	120,000	195,794
VERNERSBERG	27	33	6	14	37		242	605	-	2	17,246	500	120	60,000	73,897
VISTA PRV	73	90	16	37	100			0	15,045	2	46,628	500	120	60,000	110,982
(BLANK)															
GRAND TOTAL	**39,044**	**48,052**	**8,659**	**19,869**	**53,646**	**33,495**			**2,633,815**					**4,320,000**	**20,202,602**

Note:
Operational Storage Calculation includes new 2,000,000-gallon tank constructed in 2022 at Lakeshore.

Table 3-7 | Storage Deficits After Assignment of Storage

Pressure Zone Row Labels	Total Required in 2022 gal	Total Required in 2032	Total Required in 2042 gal	Current Excess of (Deficit)	2032 Deficit after assignment Gal	2042 Deficit After Assignment	Assign Storage to
147TH ST	64,616	75,092	85,108	(64,616)			Griffels
15TH AVE	69,077	80,276	90,984	(69,077)			La Center
244TH CT	65,587	76,221	86,388	(65,587)			Big East
82ND AVE	74,734	86,851	98,436	(74,734)			Griffels
Alpine Hts	97,422	113,217	128,319	162,578	72,905	47,949	
ALVA	78,722	91,486	103,689	(78,722)			Armstrong
ARMSTRONG	301,326	350,181	396,891	568,674	33,260	(78,352)	
BERRY	82,493	95,868	108,656	(82,493)			Armstrong
Big East	102,345	118,938	134,803	27,655	(228,052)	(275,813)	
BLACKHAWK	114,410	132,959	150,694	(114,410)			Griffels
BONANZA	78,038	90,690	102,787	(78,038)			Rawson
BOOSTER #149	67,017	77,883	88,271	(67,017)			Big East
BOOSTER #6 (Pfeiffer)	117,113	136,101	154,256	(117,113)			Hazel Dell
BOOSTER 109 PRV	76,761	89,207	101,106	(76,761)			Meadowglade
COLE WITTER	107,490	124,918	141,581	(107,490)			Griffels
DOVE CREEK	88,284	102,597	116,283	(88,284)			Griffels
DUBLIN	150,597	175,013	198,358	(150,597)			Griffels
ECHO RIDGE	70,955	82,459	93,459	(70,955)			Rawson
EDGETREE CONDOS	73,934	85,921	97,382	(73,934)			Hazel Dell
Finn Hill	71,940	83,604	94,756	(71,940)			Big East
GABLE AVE	119,533	138,912	157,442	(119,533)			Griffels
GRIFFELS	1,398,640	1,625,402	1,842,214	1,421,360	(238,797)	(646,809)	
HAZEL DELL	8,787,067	10,211,722	11,573,860	902,933	(1,955,117)	(3,508,454)	
Heisson Booster	123,496	143,519	162,662	(123,496)			Griffels
HOCKINSON	1,838,228	2,136,262	2,421,217	171,772	(126,262)	(411,217)	

Pressure Zone Row Labels	Total Required in 2022 gal	Total Required in 2032	Total Required in 2042 gal	Current Excess of (Deficit)	2032 Deficit after assignment Gal	2042 Deficit After Assignment	Assign Storage to
HOCKINSON HIGHLANDS	67,017	77,883	88,271	(67,017)			Summer Hill
KELLY	80,642	93,716	106,217	329,358	316,284	303,783	
LA CENTER	560,891	651,828	738,775	979,109	807,896	710,241	
LOCKWOOD	112,198	130,389	147,782	(112,198)			LaCenter
LOWER EARLY DAWN	67,809	78,803	89,315	(67,809)			Griffels
LOWER TAYLOR VALLEY	60,542	70,358	79,743	(60,542)			Griffels
LUDLUM	256,404	297,974	337,721	(256,404)			Hazel Dell
MEADOW GLADE	1,872,804	2,176,444	2,466,759	1,707,196	1,137,698	811,920	
Meadow Glade Booster	80,926	94,047	106,592	(80,926)			Meadowglade
METTLER MANOR	71,080	82,605	93,623	(71,080)			Meadowglade
NORDEEN	100,583	116,891	132,483	(100,583)			Griffels
OSMAN	103,216	119,951	135,951	(103,216)			Armstrong
RAWSON	121,223	140,877	159,668	198,777	(73,861)	(126,398)	
RAWSON ROAD UPPER	68,696	79,834	90,483	(68,696)			Rawson
RIVERBEND	65,915	76,602	86,820	(65,915)			Griffels
SKYLINE	63,571	73,878	83,732	(63,571)			Alpine Heights
SOUTHVIEW TERRACE	77,480	90,042	102,053	(77,480)			Hazel Dell
SPRING HILL	80,349	93,376	105,832	(80,349)			Armstrong
SUMMER HILLS	165,056	191,817	217,403	194,944	(74,927)	(132,941)	
SUMMER HILLS 1	77,488	90,051	102,063	(77,488)			Summer Hills
SUMMER HILLS 2	64,688	75,176	85,204	(64,688)			Summer Hills
TAYLOR VALLEY	95,410	110,879	125,669	(95,410)			Griffels
TITTLE	454,561	528,260	598,724	805,439	453,786	346,246	
TITTLE BOOSTER	128,194	148,978	168,850	(128,194)			Tittle
UPPER BIG EAST	66,798	77,628	87,983	(66,798)			Big East
UPPER LA CENTER	638,561	742,092	841,079	(113,561)			LaCenter

Pressure Zone Row Labels	Total Required in 2022 gal	Total Required in 2032	Total Required in 2042 gal	Current Excess of (Deficit)	2032 Deficit after assignment Gal	2042 Deficit After Assignment	Assign Storage to
UPPER VALLEY VIEW	195,794	227,538	257,889	(126,794)	(158,538)	(188,889)	
VERNERSBERG	73,897	85,878	97,333	(73,897)			Armstrong
VISTA PRV	110,982	128,976	146,180	(110,982)			Tittle
(BLANK)				-			
Grand Total	**20,202,602**		**26,609,800**	**3,641,398**			

3.1.3 Minimum Service Pressure

The desired range of pressure for residential services is 35 to 80 psi with 45 to 65 psi being optimal. Distribution level PRVs should be provided where practical for areas with more than ten services experiencing pressures in excess of 80 psi. Individual service PRVs are required by the building code when pressures may exceed 80 psi. Specific service pressure requirements include the following:

1. A minimum of 30 psi at all services during PHD with equalizing storage depleted.
2. A minimum of 20 psi at all services during fire flow conditions at with fire protection storage volume depleted.
3. For emergency operations (standby storage) the recommended design goal is 20 psi at all water services.

3.1.4 Minimum Pipe Sizes

In accordance with Clark Public Utilities construction standards, the minimum main size shall be 8 inches in diameter. Mains less than 8 inches in diameter, but no smaller than 4 inches in diameter, may be constructed, subject to approval by CPU's engineer, in fully platted cul-de-sacs not more than 400 feet or a 6-inch diameter looped main of not more than 1,200 feet between 8-inch or larger mains.

In general, where the area is zoned for high density residential, the minimum pipe size should be 8-inch; commercial and industrial area distribution systems should be sized to meet the fire flow requirements. Water utility staff may reduce the minimum pipe size requirements only when a hydraulic and demand analysis indicates a smaller size will meet future needs. A larger size may also be required if fire protection requirements dictate.

3.1.5 Pump Sizing

Pump sizing is based on maximum capacity requirements for each pressure zone or for a well capacity. Firm capacity is calculated with the largest pump out of service and a maximum operation of 20 hours per day.

3.1.6 Valve and Hydrant Spacing

By County ordinance 15.12.507.5.1, Hydrant spacing in residential areas (R-3 zoning) require a maximum hydrant spacing of 700 feet. Spacing in commercial areas is determined on a case-by-case basis and whether or not sprinklers or standpipes are present. In most areas, Clark Public Utilities strives to provide hydrant spacing of 300 feet. Ultimately, the Fire Marshal and the fire districts control hydrant spacing, not Clark Public Utilities. Clark Public Utilities require the installation of hydrants as directed by the fire authority. Additional hydrants are installed as needed to support water distribution operations.

Valving should be installed at all intersections with at least three valves at each location. Auxiliary valves should be installed on each hydrant branch. Design and Construction Standards are attached as Appendix F, thereby allowing the water utility to proceed with distribution projects without having to submit project reports to DOH.

3.2 Water Quality Analysis

The water quality analysis section includes a summary of water sampling results, water treatment results, and impacts of existing and future drinking water regulations.

Drinking water is required to meet the quality standards set forth by the Federal Safe Drinking Water Act and additional requirements as set by the State of Washington. The number of regulated contaminants and the monitoring requirements have increased significantly since the 1986 SDWA amendments. Future implementation of the SDWA will bring additional contaminants under regulation as their potential health effects are evaluated and appropriate standards prepared.

3.2.1 Water Sampling Results

Water sampling is conducted for Clark Public Utilities water system in a number of areas:

- Source water monitoring
- Treated water monitoring
- Distribution monitoring
- At-the-tap monitoring

Source water monitoring: Source water monitoring includes required sampling for all of Clark Public Utilities groundwater supplies. Each well is routinely tested. The monitoring schedule is included in Appendix H.

Clark Public Utilities is in compliance with all water quality testing requirements for its supply sources. Monitoring is conducted within three, three-year compliance cycles (9 years total). Source water monitoring will be needed for all of the source water supplies, for all parameters at some point. Each source has its own schedule included in the Appendix.

Source water sampling did not identify any exceedances within the last 9 years, according to the DOH Sentry system as of April 4, 2022. The system had one total coliform positive sample in 2017. The sample results also exceeded iron and manganese secondary MCL concentrations in Paradise Point wells prior to installing treatment.

Treated water monitoring: Clark Public Utilities treats water in two ways. First, all of its water sources are treated to provide a residual disinfectant to the water supply. Chlorine is used to provide the residual disinfection in the distribution system. Clark Public Utilities personnel monitor the chlorine residual level after chlorine addition at each of the wells at least weekly. Chlorine residual levels in the distribution system are checked daily and reports sent in to the state every month. Chlorine residual levels are also checked during routine and repeat bacteriological sampling. Many of the wells have been equipped with on-site sodium hypochlorite facilities, which generate chlorine solution from salt and low voltage electricity. The water utility plans to continue its use of on-site sodium hypochlorite generation equipment in new facilities.

The second way water is treated by Clark Public Utilities is by removing elevated levels of iron and manganese from a few of its wells. The water utility currently has iron and manganese removal facilities at nine of its wells. The treatment equipment used adsorbs iron and manganese onto manganese dioxide in the media. The chlorine that is used to provide a residual disinfectant also regenerates the media and maintains the adsorption capacity. Iron and manganese have secondary maximum contaminant levels (SMCLs) of 0.3 mg/L and 0.05 mg/L respectively. SMCLs are established because of aesthetic concerns, not health effects. Water utility personnel monitor the iron and manganese removal facilities on a weekly basis. Monthly testing for iron and manganese prior to the first customer is required. Chlorine residual monitoring at the iron and manganese removal facilities also help to check if the media is being properly regenerated.

3.2.2 Regulatory Changes

Appendix I includes a description of the current regulatory requirements for drinking water quality. There are several changes that may affect the District in the future.

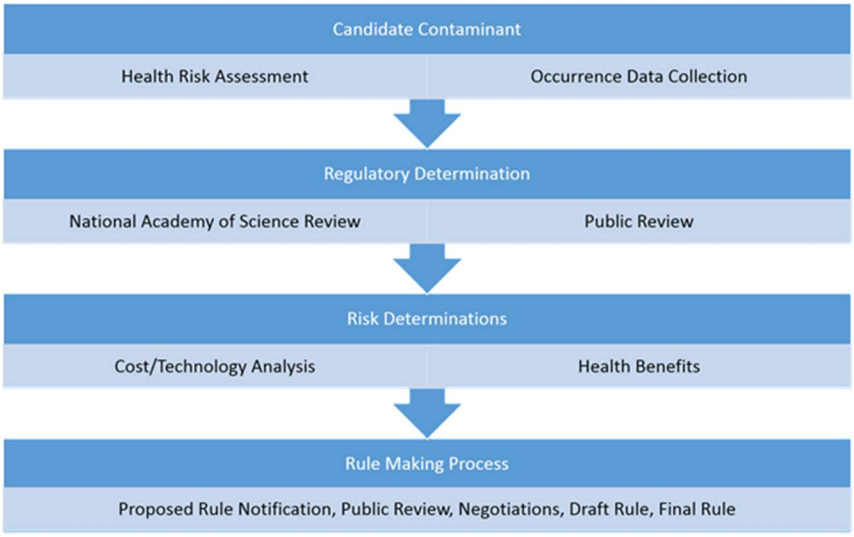
The USEPA regulates drinking water quality through standards developed under the Safe Drinking Water Act. In the United States, the Safe Drinking Water Act provides an overall regulatory framework for assuring the safety of drinking water. The Environmental Protection Agency is responsible for the development of national drinking water regulations and the implementation of these regulations.

As it was last amended in 1996, the SDWA established a scientific, risk-based process for identifying, assessing, and managing health risks from contaminants in drinking water. Since 1975, EPA has developed 18 major drinking water regulations addressing 91 different contaminants.

In 2010 EPA announced a new Drinking Water Strategy that will regulate groups of contaminants and utilize several other principles to increase coordination and collaboration among EPA and states as well as among federal statutes.

The regulatory process has multiple steps and takes several years to complete. The overall process is depicted in Figure 3-2. Because this process is well defined, we have a pretty good idea of what to expect for future regulations.

Figure 3-2 | Overview of Regulatory Process



3.3 Recent Regulatory Changes

Lead and Copper Rule (LCR): In January 2021, the EPA's revised Lead and Copper Rule (LCRR) was revised with the aim to better protect children and communities from the risks of lead exposure by better protecting children at schools and childcare facilities, getting the lead out of our nation's drinking water, and empowering communities through information. Improvements under the new rule include:

- Using science-based testing protocols to find more sources of lead in drinking water.
- Establishing a trigger level to jumpstart mitigation earlier and in more communities.

- Driving more and complete lead service line replacements.
- For the first time, requiring testing in schools and childcare facilities.
- Requiring water systems to identify and make public the locations of lead service lines

All community and non-transient non-community (NTNC) water systems must develop an initial inventory of service lines that meets the LCRR requirements, including service line materials classification and information sources, for both the public and private portions of every service line, and submit the lead service line inventory to the state by October 16, 2024. The LCRR inventory requirement directs water systems to undergo a record review of information pertaining to service lines, both water system-owned and customer-owned portions.

Perfluorinated Compounds (PFAS): EPA established a health advisory for drinking water of 70 parts per trillion (ppt) for PFOS and PFOA, two commonly found Perfluorinated compounds (PFAS). When both compounds are found in the water the combined health advisory is also 70 ppt. The Washington State Board of Health (Board) adopted rule changes to chapter 246-290 WAC, Group A Public Water Supplies and chapter 246-390 WAC, Drinking Water Laboratory Certification and Data Reporting. The newly adopted rules became effective on January 1, 2022.

The rule establishes the administrative processes for setting drinking water quality standards as state action levels (SAL) and state maximum contaminant levels (MCLs). The rule establishes SALs for five PFAS contaminants: perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), and perfluorobutane sulfonic acid (PFBS). The rule requires Group A community and nontransient noncommunity public water systems to test for PFAS. For those Group A water systems that have detections of PFAS, but do not exceed the SAL, the rule requires additional ongoing monitoring, with the frequency of monitoring based upon the detected level in comparison to the SAL. It also establishes reporting, recordkeeping, and consumer confidence report requirements. For those Group A water systems that exceed the SAL, the rule requires follow-up actions such as monitoring, public notification, additional recordkeeping, and reporting requirements. SALs for regulated PFAS compounds are shown in Table 3-8.

Table 3-8 | Perfluorinated Compounds (PFAS) State Action Levels

PFAS Compound	State Action Level (SAL), parts per trillion (ppt)
perfluorooctanoic acid (PFOA)	10
perfluorooctane sulfonic acid (PFOS)	15
perfluorohexane sulfonic acid (PFHxS)	65
perfluorononanoic acid (PFNA),	9
perfluorobutane sulfonic acid (PFBS).	345

3.4 Potential Regulatory Changes

EPA is moving forward with regulation of contaminant groups. EPA announced in February 2011 that carcinogenic VOCs would be the first group to be regulated as part of its new drinking water strategy to regulate contaminants as groups instead of individually. Another likely candidate for a rule proposal will be nitrosamines, but EPA is awaiting the final data from UCMR 2 before moving forward with regulation of the group nitrosamines.

3.5 Near-Term Regulatory Changes (within 3-5 Years)

Fluoride: On January 7, 2011, the U.S. Department of Health and Human Services (HHS) issued a news release with a draft recommendation for optimized community water fluoridation. HHS proposed to change the optimized fluoride concentration from a range of 0.7 to 1.2 mg/L to a single numerical value of 0.7 mg/L. Also on January 7, 2011, the EPA released two health-related documents for a potential future revision of the fluoride MCL: a dose-response study on non-cancer effects and an exposure and relative source contribution study. These scientific assessments will also guide EPA in making a determination of whether to lower the maximum amount of fluoride allowed in drinking water, which is set to prevent adverse health effects. EPA MCL for fluoride of 4 mg/L remains unchanged.

EPA's schedule for potentially revising the fluoride MCL is not clear at this time, but after the decision is made that the MCL should be revised it typically takes three to four years to propose a new standard and finalize the regulation.

Storage tanks: EPA has been under some pressure to "do something" on storage tanks since the 2008 Salmonella outbreak in Alamosa, Colo. EPA held a public meeting in October 2014 to hear different stakeholder's perspectives on tank inspection and cleaning (79 FR 52647). EPA is currently evaluating data and information to determine whether a regulation, guidance, or something else is needed on storage tanks.

Legionella: The EPA issued guidance on treatment options for Legionella in premise plumbing systems in September 2016 (EPA 810-R-16-001). Some water systems that serve large facilities, as well as state primacy agencies, have had to contend with Legionella outbreaks over the past few years. Consequently, some facilities have installed secondary disinfection systems for water quality issues within their premise plumbing. By adding their own secondary disinfection systems, these facilities now become public water systems and face all of the monitoring and operator certification requirements. This document does not set a new regulatory standard for Legionella, rather it simply provides guidance to facility managers who wish to install secondary systems to mitigate Legionella in their buildings to make science-based decisions.

Cyanotoxins: Cyanotoxins have received higher priority in the regulatory arena, given the water quality problems in Toledo, Ohio, in August 2014. In 2015 EPA issued a public health advisory for several Cyanotoxins with separate levels for adults and infants/toddlers. Implementation of the health advisories varies from State to State. This advisory issuance may have the effect of bypassing the long regulatory process if states require issuance of do-not-drink or do-not-use orders when cyanotoxins are found above the advisory levels. States are beginning to implement their own regulations for cyanotoxins ahead of the Federal government.

Chlorinated Volatile Organic Chemicals (cVOCs): In February 2011 EPA announced that cVOCs would be the first contaminant group to be regulated as part of the agency's new Drinking Water Strategy, which would regulate groups of contaminants rather than individual contaminants. EPA indicated that the group rule would contain as many as 16 compounds, including eight currently regulated cVOCs and up to eight from the Contaminant Candidate List. EPA is considering a potentially complicated "risk cup" approach for cVOCs. This "risk cup" approach would be based on the relative risk of each cVOC and the mixture of cVOCs in each water would result in variable standards for each cVOC between systems.

For this first group, EPA is considering eight currently regulated VOCs as well as eight VOCs from CCL 3 summarized in Table 3-9.

The EPA has not given exact details of how the carcinogenic VOC regulation would be implemented. One potential regulatory option might be to lower both of the MCLs for trichloroethylene (TCE) and tetrachloroethylene (PCE). Some associated risk reduction could be assumed for the eight carcinogenic CCL 3 VOCs that are also removed to some degree by the lower TCE and PCE MCLs. EPA has already assessed the potential effects of lowering the TCE and PCE MCLs from 5 mg/L to 2.5, 1.0, and 0.5 mg/L.

Table 3-9 | VOCs Considered for Group Contaminant Monitoring

Currently Regulated VOCs		VOCs from CCL 3	
Benzene	Dichloromethane	Aniline	Nitrobenzene
Carbon tetrachloride	Tetrachloroethylene (PCE)	Benzyl chloride	Oxirane methyl
1,2-dichloroethane	Trichloroethylene (TCE)	1,3-butadiene	1,2,3-trichloropropane
1,2-dichloropropane	Vinyl chloride	1,1-dichloroethane	Urethane

Strontium: On October 20, 2014, EPA published the Preliminary Third Regulatory Determinations (79 FR 62716). EPA made one positive preliminary determination for strontium. It is expected to be finalized by the end of 2015. Strontium has some significant health effects issues that need to be resolved before the Agency moves forward with a proposed and/or final strontium regulation. If the Agency continues to move forward with a strontium, then EPA has to propose the strontium regulation 24 months the final determination, and then publish the final regulation 18 months after the proposal maybe in 2019.

3.6 Longer Term Regulatory Changes (5-10 years)

The Environmental Protection Agency (EPA) issued the Draft Fourth Contaminant Candidate List (CCL4) on February 2, 2015 (80 FR 6076). The Draft CCL4 listed 100 chemicals or groups and 12 microbial contaminants, including manganese. EPA made a negative regulatory determination for manganese in 2003 (68 FR 42898) but added it to the Draft CCL4 due to new health effects data that showed some potential neurological effects. The Draft CCL4 list is shown in Table 1. Usually only 1 or two compounds on a CCL would get a regulatory determination to create a standard. Based on health effects research completed to date, leading candidates for regulatory determinations are:

Arsenic: EPA has updated the health assessments for arsenic but has continued to revise them after brief public review periods. The arsenic re-assessment initially showed the cancer rates were significantly higher than those used in the 1991 Arsenic Rule. There is no current schedule for the finalization of the health risk assessment.

Radon: The EPA proposed regulations on November 2, 1999, to reduce the public health risks from radon. The public comment period was open until February 4, 2000. A final rule was expected in 2011 but has yet to be proposed. The proposed standards would apply to community water systems that regularly serve 25 or more people and that use groundwater or mixed groundwater and surface water sources. The risk of radon from air is greater than the risk from water. Therefore, the EPA is encouraging states to develop enhanced programs to address health risks from radon in indoor air through multimedia mitigation (MMM) programs. If a state adopts a MMM program, individual water systems must reduce radon levels in drinking water to 4,000 picocuries per liter (pCi/L). If a state does not adopt, or create its own MMM program, systems would be required to reduce radon in drinking water to 300 pCi/L, or to develop individual local MMM programs and reduce levels in drinking water to 4,000 pCi/L.

Nitrate: While EPA has not made a formal announcement, it appears that in acknowledgment of an ongoing nutrient problem it may be considering a reduction of the current nitrate MCL of 10 mg/L as nitrogen.

Nitrosamines: Another potential contaminant group is nitrogenous DBPs, such as N-nitrosodimethylamine (NDMA) and other nitrosamines. NDMA is an emerging drinking water contaminant that is of interest to the environmental community because of its miscibility with water, as well as its carcinogenicity and toxicity. NDMA is also an unintended byproduct of the chlorination of wastewater and drinking water at treatment plants that use chloramines for disinfection.

Although NDMA is listed as a priority pollutant by the EPA, no federal MCL has been established for drinking water. NDMA can be minimized by reducing precursors, such as organic nitrogen and the chemical compound DMA. Enhanced coagulation, GAC adsorption, and biological filtration all have demonstrated effective organic nitrogen removal. Additionally, some cationic polymers contain DMA, a known precursor to NDMA. By selecting polymers that do not contain DMA, NDMA formation from polymer addition can be avoided. NDMA can also be managed by minimizing the time between chlorine and ammonia addition in chloramination. NDMA can be removed after formation by very high doses of UV but managing NDMA formation in the treatment process is a more cost-effective approach. The most likely impacts of a future NDMA or nitrosamine regulation would be to utilize only DMA-free polymers.

Chromium VI: On January 12, 2011, EPA issued a news release with guidance for enhanced monitoring of hexavalent chromium, or chromium VI (Cr-VI), in addition to the currently required monitoring for total chromium. In the guidance, EPA strongly encourages utilities to conduct Cr-VI sampling at treatment plants (raw and finished) and in the distribution system but did not provide any risk context for the sampling if Cr-VI was detected or provide any risk communication guidance.

EPA said that the timeline for proceeding with a regulatory standard for Cr-VI would not begin until the peer review of EPA's Integrated Risk Information System (IRIS) assessment of the chemical is complete. The EPA continues to evaluate the Cr-VI risk assessment, with no definitive scheduling for Cr-VI rule making, so the regulatory decision would be at least 5 to 10 years away.

Compounds of Emerging Concern: In 2005, EPA began studying environmental contamination by pharmaceuticals, detergents, natural and synthetic hormones, and other chemicals. These contaminants are commonly referred to collectively as compounds of emerging concern (CECs) and are shown in **Table 3-10**.

An additional regulatory concern in the next decade will be endocrine disrupting compounds (EDCs) and microconstituents. EDCs and pharmaceutical and personal care product (PPCP) pollutants have been found in trace concentrations (usually less than 0.1 ng/L) in waters of the United States. Data on these chemicals in finished water is still sparse, but there is widening public concern about the effects of these contaminants based upon recently published analytical results from various drinking water supply sources. In addition, several organic microconstituents have been found in the effluent of wastewater treatment facilities. Reporting on these contaminants by news organizations exerts additional pressure for utilities to evaluate the treatment process and whether action is required to reduce or remove these compounds.

As of 2022, the UCMR 3 and CCL 3 are the best location for information on how EPA is starting to gather information on these compounds and the potential for regulatory action. Though a good source of information, the UCMR 3 and CCL 3 represent the start of the regulatory process and regulatory decisions are still 5 to 10 years away.

Multi-barrier treatment approaches are being utilized in the water systems that are taking a proactive approach toward the treatment of CECs, including EDCs, pharmaceuticals, detergents, natural and synthetic hormones, and other chemicals. The multi-barrier treatment approach includes riverbank

filtration (RBF), ultra-violet advanced oxidation process (UV-AOP), and granular activated carbon (GAC) adsorption.

Table 3-10 | Draft Contaminant Candidate

Pathogens	
Adenovirus	Hepatitis A virus
Caliciviruses	Legionella pneumophila
Campylobacter jejuni	Mycobacterium avium
Enterovirus	Naegleria fowleri
Escherichia coli (0157)	Salmonella enterica
Helicobacter pylori	Shigella sonnei
Chemical Contaminants	
Common name--Registry name	
1,1,1,2-Tetrachloroethane	Halon 1011 (bromochloromethane)
1,1-Dichloroethane	HCFC-22
1,2,3-Trichloropropane	Hexane
1,3-Butadiene	Hydrazine
1,4-Dioxane	Manganese
17 alpha-Estradiol	Mestranol
1-Butanol	Methamidophos
2-Methoxyethanol	Methanol
2-Propen-1-ol	Methyl bromide (Bromomethane)
3-Hydroxycarbofuran	Methyl tertiary butyl ether (MTBE)
4,4'-Methylenedianiline	Metolachlor
Acephate	Metolachlor ethanesulfonic acid (ESA)
Acetaldehyde	Metolachlor oxanilic acid (OA)
Acetamide	Molinate
Acetochlor	Molybdenum
Acetochlor ethanesulfonic acid (ESA	Nitrobenzene
Acetochlor oxanilic acid (OA)	Nitroglycerin
Acrolein	N-Methyl-2-pyrrolidone
Alachlor ethanesulfonic acid (ESA)	N-nitrosodiethylamine (NDEA)
Alachlor oxanilic acid (OA)	N-nitrosodimethylamine (NDMA)
Alpha-Hexachlorocyclohexane	N-nitroso-di-n-propylamine (NDPA)
Aniline	N-Nitrosodiphenylamine
Bensulide	N-nitrosopyrrolidine (NPYR)
Benzyl chloride	Nonylphenol
Butylated hydroxyanisole	Norethindrone (19-Norethisterone)
Captan	n-Propylbenzene
Chlorate	o-Toluidine
Chloromethane (Methyl chloride)	Oxirane, methyl-
Clethodim	Oxydemeton-methyl
Cobalt	Oxyfluorfen

Pathogens	
Cumene hydroperoxide	Perfluorooctane sulfonic acid (PFOS)
Cyanotoxins	Perfluorooctanoic acid (PFOA)
Dicrotophos	Permethrin
Dimethipin	Profenofos
Disulfoton	Quinoline
Diuron	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)
Equilenin	sec-Butylbenzene
Equilin	Tebuconazole
Erythromycin	Tebufenozide.
Estradiol (17-beta estradiol)	Tellurium
Estriol	Thiodicarb
Estrone	Thiophanate-methyl
Ethinyl Estradiol (17-alpha Ethinyl Estradiol)	Toluene diisocyanate
Ethoprop	Tribufos
Ethylene glycol	Triethylamine
Ethylene oxide	Triphenyltin hydroxide (TPTH)
Ethylene thiourea	Urethane
Fenamiphos	Vanadium
Formaldehyde	Vinclozolin
Germanium	Ziram

3.7 System Description and Analysis/Condition and Capacity of Existing Facilities

This section includes an analysis of the overall condition of water facilities in the system. **Table 3-11** summarizes the capacity analysis for the water system using the ERU Capacity Summary worksheet format from the DOH Water System Design manual. The evaluation shows that the equalizing storage available is 5,670,213 which was calculated as 2,633,815 using the PHD *150 minutes plus the excess useable storage in the system (23,609,800-gal useable storage – 20,202,602 gal required), as shown on **Table 3-12**.

Table 3-11 | Clark Public Utilities ERU Capacity Summary (Avg of 2018-2020)

Service Classifications	Total MDD, gpd	Total # Connections	ERUs
Residential	21,394,475	34,675	34,675
Commercial	3,421,265	1,268	5,545
Miscellaneous	4,352,318	762	7,054
Distribution System Leakage	2,335,345		3,785
Total	31,503,403	36,705	51,059

ADD = 228 gpd/ERU
MDD = 617 gpd/ERU

Table 3-12 | Clark Public Utilities ERU Service Capacity

Water System Component	ERU Capacity	GPD Capacity
Source (1200 min pumping per day)	77,971	48,108,000
Treatment (1200 Min operation per day)	77,971	48,108,000
Equalizing Storage (minimum Calculated) Equalizing Storage Available	55,025	5,670,213
Standby Storage	66,426	13,285,185
Transmission	77,971	48,108,000
Water Rights Qi	161,266	99,501,120
Water Rights Qa	229,777	52,389,165
Water System Service Capacity (ERUs) **Based on limiting component**		**55,025**

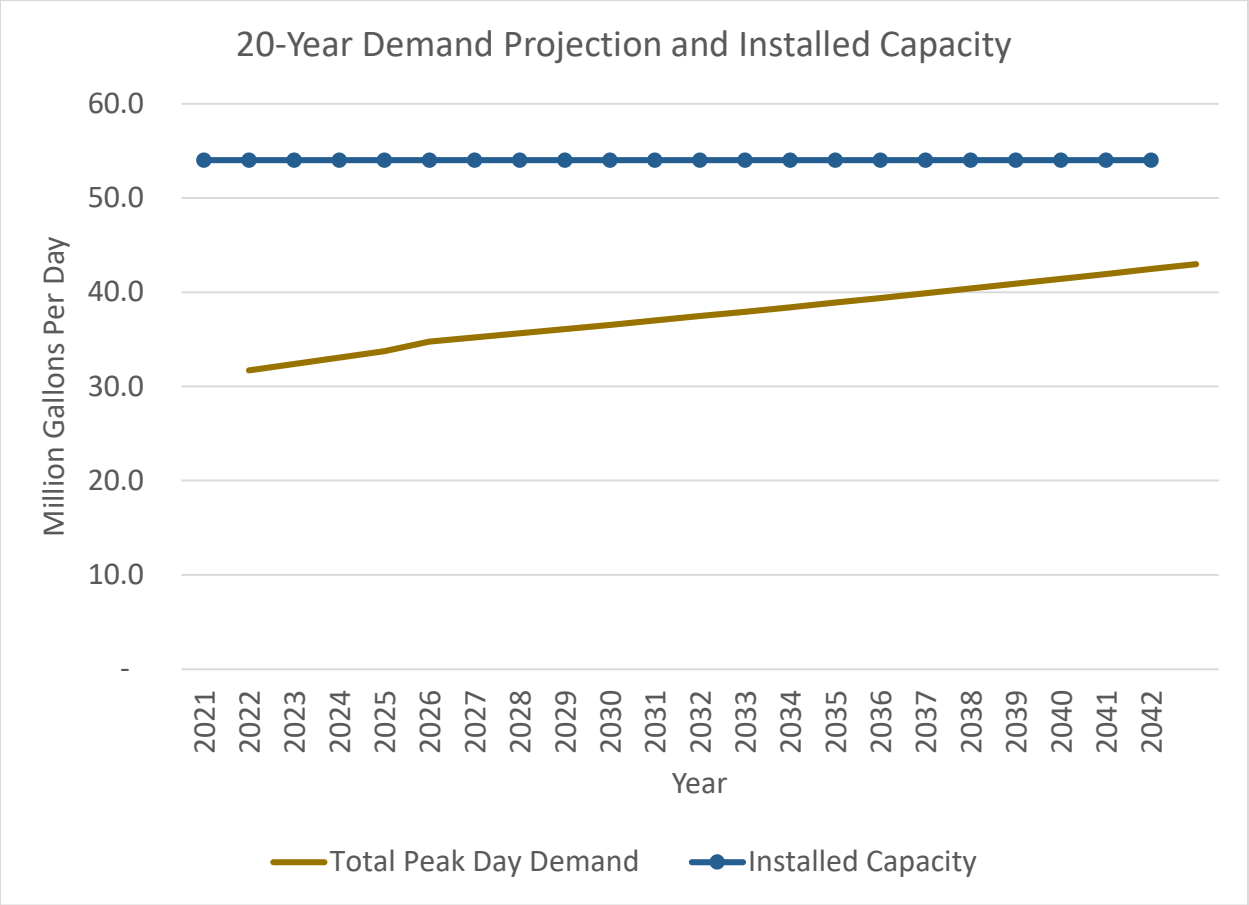
3.7.1 Water Source

Clark Public Utilities depends on groundwater for its source of supply. The wells are located throughout the service area, with its two largest sources (Carol J. Curtis Wellfield, 10 mgd and Paradise Point Wellfield, 7 mgd) located near Vancouver Lake and at the North End of the County respectively.

The capacity assessment was calculated using the installed capacity of the combined active wells, pumping for a maximum of 1,200 minutes per day divided by the MDD per ERU of 617 gpd/ERU.

As the water utility continues to grow and provide less reliance on upland wells, it will need to develop additional water supplies to meet demands. New development will largely be focused at Paradise Point Wellfield and Carol J. Curtis Wellfield. **Figure 3-3** show the installed pumping capacity vs. MDD. Potential added peak day demands from Battle Ground, Ilani Casino and from Ridgefield have been added to the graph. As can be seen from the graph it appears that sufficient pumping capacity is installed to supply the utility through the 20-year planning period, however the utility is developing more supply in lowland areas to reduce demand on the upland aquifers.

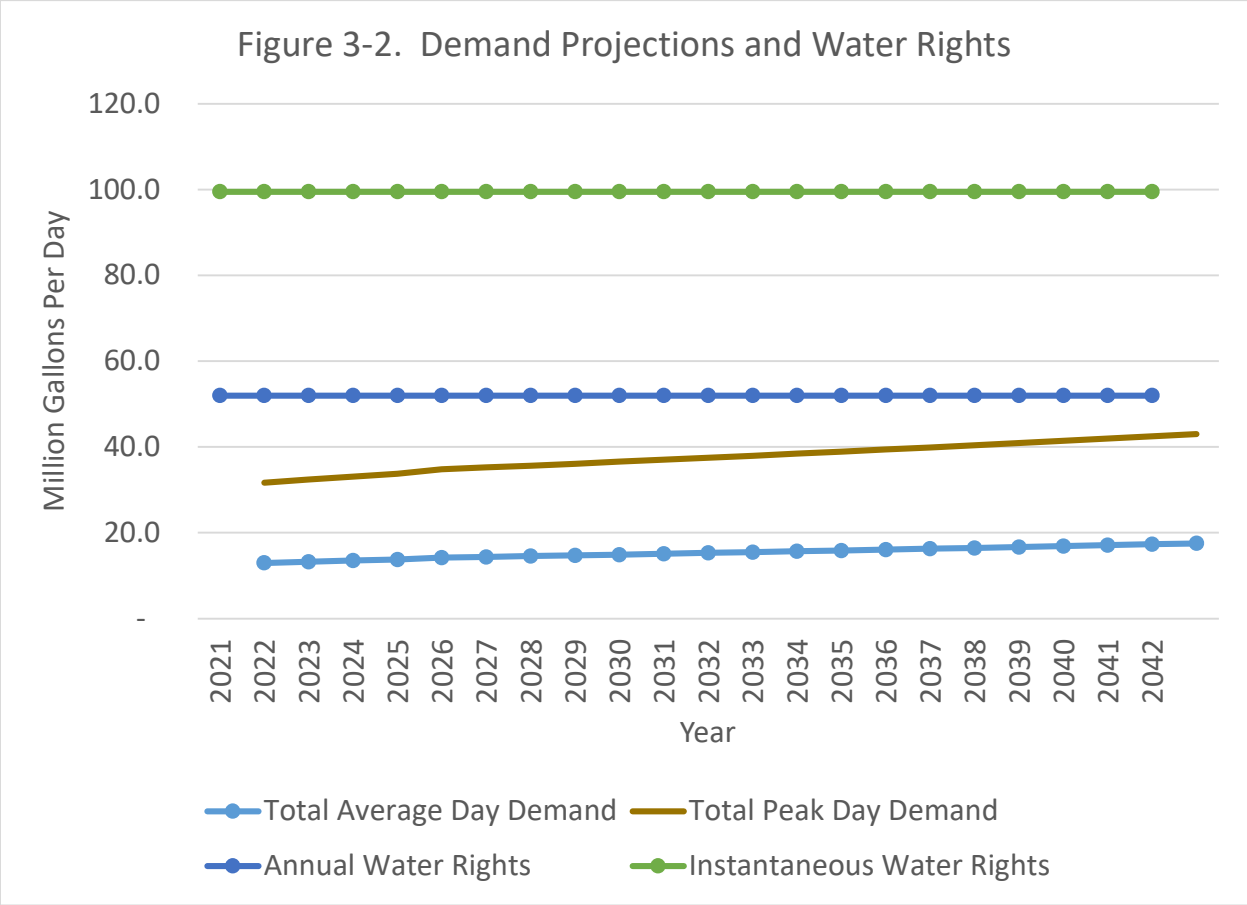
Figure 3-3 | Peak Day Demand and Installed Capacity



3.7.2 Water Rights

As shown on **Figure 3-4**, the annual average day water demand (annual amount pumped) in acre-feet provides sufficient primary water right allocation from the Department of Ecology for the next 20 years. The District has a total of 69,098 gpm (99.5 mgd) available in instantaneous water rights (Qi). Annual Water Rights total 58,687 Acre-feet per year (52 mgd). No additional primary water rights will be required for the 20-year planning period. The water rights self-assessment table is included as **Table 4-3**. The capacity analysis was completed by adding all of the primary Qi rights in gpm and multiplying by 1440 minutes per day then dividing by the MDD of 617 gpd/ERU.

Figure 3-4 | Average Day Demand and Water Rights



3.7.3 Water Treatment

Existing water treatment facilities are relatively new and have all been designed for the maximum capacity of each source. The capacity analysis was conducted by dividing the treatment capacity in gpd (assuming a 1200 minute per day operating time) and dividing the

3.7.4 Water Storage

Water storage capacity has been evaluated for the water system as shown on **Table 3-13** and follows:

- Minimum OS, ES, SB, FSS and DS were calculated for each pressure zone for the existing year (2022), for 2032 and for 2042.
- Pressure zones without storage were assigned to the pressure zone where they get water supply from that contained storage.
- The minimum required was compared to the existing useable volume (total volume less DS).
- The results show that the system has an excess of 3 MG for the existing period, but by 2032, additional storage will be needed in Griffels (240,000 gal), Hazel Dell (at least 2 MG), Hockinson (130,000 gal), Rawson (75,000 gal) and Upper La Center (160,000 gal).

- For 2042, additional storage is needed in each of the same pressure zones listed above.

Table 3-13 | Storage Requirements for 2032 and 2042

Pressure Zone	OS	ES	SB	FSS	DS	Minimum Required	Existing Volume	Existing Useable Volume	Current Excess (Deficit)	2032 Deficit after assignment	2042 Deficit After Assignment	Assign Storage to
	gal	gal	gal	gal	gal	Gal	gal	gal		gal	gal	
147TH ST	185	-	4,431	60,000		64,616			(64,616)			Griffels
15TH AVE	1200	-	7,877	60,000		69,077			(69,077)			La Center
244TH CT	0	1,649	3,938	60,000		65,587			(65,587)			Big East
82ND AVE	950	-	13,784	60,000		74,734			(74,734)			Griffels
ALPINE HTS	500	-	36,922	60,000		97,422	260,000	260,000	162,578	72,905	47,949	
ALVA	1000	-	17,722	60,000		78,722			(78,722)			Armstrong
ARMSTRONG	2625	-	178,701	120,000		301,326	870,000	830,000	568,674	33,260	(78,352)	
BERRY	1325	-	21,168	60,000		82,493			(82,493)			Armstrong
BIG EAST	500	-	41,845	60,000		102,345	130,000	120,000	27,655	(228,052)	(275,813)	
BLACKHAWK	750	-	53,660	60,000	-	114,410			(114,410)			Griffels
BONANZA	1300	-	16,738	60,000	-	78,038			(78,038)			Rawson
BOOSTER #149	125	-	6,892	60,000	-	67,017			(67,017)			Big East
BOOSTER #6 (PFEIFFER)	500	-	56,613	60,000	-	117,113			(117,113)			Hazel Dell
BOOSTER 109 PRV	0	4,946	11,815	60,000	-	76,761			(76,761)			Meadowglade
COLE WITTER	0	14,015	33,476	60,000	-	107,490			(107,490)			Griffels
DOVE CREEK	1700	-	26,584	60,000	-	88,284			(88,284)			Griffels
DUBLIN	1000	-	89,597	60,000	-	150,597			(150,597)			Griffels
ECHO RIDGE	125	-	10,830	60,000	-	70,955			(70,955)			Rawson
EDGETREE CONDOS	150	-	13,784	60,000	-	73,934			(73,934)			Hazel Dell
FINN HILL	125	-	11,815	60,000	-	71,940			(71,940)			Big East
GABLE AVE	950	-	58,583	60,000	-	119,533			(119,533)			Griffels
GRIFFELS	9575	-	1,209,065	180,000	60,000	1,398,640	2,820,000	2,760,000	1,421,360	(238,797)	(646,809)	
HAZEL DELL	44887.5	2,436,121	6,126,058	180,000	290,000	8,787,067	9,690,000	9,400,000	902,933	(1,955,117)	(3,508,454)	
HEISSON BOOSTER	50	-	3,446	120,000	-	123,496			(123,496)			Griffels
HOCKINSON	9382.5	89,763	1,559,083	180,000	60,000	1,838,228	2,010,000	1,950,000	171,772	(126,262)	(411,217)	
HOCKINSON HIGHLANDS	125	-	6,892	60,000	-	67,017			(67,017)			Summer Hill
KELLY	950	-	19,692	60,000	-	80,642	410,000	410,000	329,358	316,284	303,783	
LA CENTER	6750	-	374,141	180,000	-	560,891	1,540,000	1,540,000	979,109	807,896	710,241	
LOCKWOOD	1000	-	51,198	60,000	-	112,198			(112,198)			LaCenter
LOWER EARLY DAWN	425	-	7,384	60,000	-	67,809			(67,809)			Griffels
LOWER TAYLOR VALLEY	50	-	492	60,000	-	60,542			(60,542)			Griffels
LUDLUM	600	14,700	121,103	120,000	-	256,404			(256,404)			Hazel Dell
MEADOW GLADE	31325	-	1,661,479	180,000	-	1,872,804	3,580,000	3,580,000	1,707,196	1,137,698	811,920	
MEADOW GLADE BOOSTER	250	-	20,676	60,000	-	80,926			(80,926)			Meadowglade

Pressure Zone	OS	ES	SB	FSS	DS	Minimum Required	Existing Volume	Existing Useable Volume	Current Excess (Deficit)	2032 Deficit after assignment	2042 Deficit After Assignment	Assign Storage to
	gal	gal	gal	gal	gal	Gal	gal	gal		gal	gal	
METTLER MANOR	250	-	10,830	60,000	-	71,080			(71,080)			Meadowglade
NORDEEN	1200	-	39,383	60,000	-	100,583			(100,583)			Griffels
OSMAN	250	2,106	40,860	60,000	-	103,216			(103,216)			Armstrong
RAWSON	3625	-	57,598	60,000	-	121,223	320,000	320,000	198,777	(73,861)	(126,398)	
RAWSON ROAD UPPER	327.5	-	8,369	60,000	-	68,696			(68,696)			Rawson
RIVERBEND	500	-	5,415	60,000	-	65,915			(65,915)			Griffels
SKYLINE	125	-	3,446	60,000	-	63,571			(63,571)			Alpine Heights
SOUTHVIEW TERRACE	250	-	17,230	60,000	-	77,480			(77,480)			Hazel Dell
SPRING HILL	1150	-	19,199	60,000	-	80,349			(80,349)			Armstrong
SUMMER HILLS	750	-	44,306	120,000	120,000	165,056	360,000	240,000	194,944	(74,927)	(132,941)	
SUMMER HILLS 1	750	-	16,738	60,000	-	77,488			(77,488)			Summer Hills
SUMMER HILLS 2	750	-	3,938	60,000	-	64,688			(64,688)			Summer Hills
TAYLOR VALLEY	950	-	34,460	60,000	-	95,410			(95,410)			Griffels
TITTLE	3250	-	331,311	120,000	20,000	454,561	1,260,000	1,240,000	805,439	453,786	346,246	
TITTLE BOOSTER	750	-	67,444	60,000	-	128,194			(128,194)			Tittle
UPPER BIG EAST	1875	-	4,923	60,000	-	66,798			(66,798)			Big East
UPPER LA CENTER	1875	55,470	401,216	180,000	5,000	638,561	525,000	520,000	(113,561)			LaCenter
UPPER VALLEY VIEW	1950	-	73,844	120,000	-	195,794	69,000	69,000	(126,794)	(158,538)	(188,889)	
VERNERSBERG	605	-	13,292	60,000	-	73,897			(73,897)			Armstrong
VISTA PRV	0	15,045	35,937	60,000	-	110,982			(110,982)			Tittle
(BLANK)									-			
GRAND TOTAL	**141,563**	**2,633,815**	**13,107,225**	**4,320,000**	**555,000**	**20,202,602**	**23,844,000**	**23,239,000**	**3,641,398**	**(33,724)**	**(3,148,734)**	

3.8 Hydraulic Modeling

A technical memorandum detailing the hydraulic modeling calibration and results is provided in Appendix J.

3.8.1 Model Development

The CPU distribution system was analyzed through the use of a new hydraulic model developed for the WSP that is intended to be used in analysis of the CPU system in the future. InfoWater™ developed by Innovyze was the software used to model system operation. Static evaluations were completed for the water system plan.

Consor staff created the model by using system mapping showing all water lines, pumps stations, wells, reservoirs, and other system facilities. All pipes in the system were included in the model. An inventory of the number and length of each size and material of pipe in the model is shown in Appendix J. All wells and reservoirs are also included in the model and set up to run extended period simulations, should this level of analysis be desired in the future. Information on the size of pumps (well and booster) and reservoirs was obtained from water utility records.

Pressure zones were delineated graphically, and each junction node was assigned to the appropriate zone. There are a total of 49 zones in this model. Figure 1-2 Hydraulic Profile shows a schematic profile representation of the pressure zones. The figure shows the approximate hydraulic grade of the zones, the reservoirs and wells located in the zones, the booster pump stations associated with each zone, and the control valves that permit water to move from an upper zone to a lower zone.

Node elevations were input into the model through the use of a 3-dimensional surface model created from CPU contour mapping. Coordinates of the junction nodes were used to pick off the elevations of the junctions. An input file was created of the junction node number and the elevation. This was then imported into the model's database of junction node elevations.

Nodal demands were assigned to each node based on the number of meters and meter size in each pressure zone using the ERUs described in Chapter 2. Demands were allocated to specific meters. The projected growth was assigned zones based on current zoning and input from Clark PUD staff on where growth was likely to occur.

The model works quite well for steady state analysis. Steady state analysis is adequate for the analysis performed in this water system plan. Extended period simulations are possible with the model as it is set up at this time however, additional work on the system controls, i.e., what signals a pump to start and stop, will need to be completed before an extended period simulation will work adequately.

3.8.1.1 Model Calibration

The model was calibrated in a two-step process. The initial step involved running a simulation using ADD for the full system. The results were collated by pressure zone and the calculated hydraulic grade for each node was compared to the anticipated hydraulic grade based on the pressure zone. Using this calibration method, the placing of nodes in correct pressure zones was finalized. Open links between zones were found and closed, and the approximate static pressure of specific junction nodes was evaluated.

The second step involved a traditional fire flow calibration. Specific simulations were run and compared with field results to determine the adequacy of the model. Several calibration runs were made distributed

throughout the three largest pressure zones. Results of the simulations indicate that the model is predicting pressures within 10 percent, and typically the model pressure is lower than the field measurement.

It was felt that this level of calibration was adequate for development of a Capital Improvement Program (CIP) but that additional calibration efforts would be required if the model was to be used for water availability and fire flow for new development. In addition, significant additional modeling would be required to calibrate the model for water quality analysis.

3.8.2 Evaluation Criteria

Evaluation criteria were developed for evaluation of the facilities within the model, as shown on **Table 3-14**.

Table 3-14 | Evaluation Criteria

System Attribute	Evaluation Criterion	Value
Water Supply	Supply Capacity	MDD
	Emergency Power	At least two independent sources if adequate standby storage is not available
Storage	Total Storage Capacity	Sum of dead, equalization, fire, operational, and standby
	Dead Storage	Storage that is unavailable for use or that can provide only substandard flows and pressures below 20 psi
	Equalization Storage	(PHD-maximum supply capacity) *150 min
	Fire Suppression Storage	Largest fire flow in a zone for duration of that flow
	Operational Storage	Pump supply capacity (in gpm) times 2.5 minutes
	Standby Storage	Number of days selected to meet water system determined standard for reliability (between 1 to 3 days depending on zone) or 200 gal/ERU minimum
Pump Stations	Minimum No. of Pumps	2
	Firm capacity when pumping to storage	ADD
	Total capacity	MDD
	Capacity with largest "routinely used" pump out of service when pumping to system (no storage)	MDD plus fire flow
	Firm capacity when pumping to system (no storage)	PHD
	Emergency Power	At least two independent sources adequate to serve ADD plus largest fire flow (where standby and fire suppression storage are not adequate/available)
Service Pressure	Minimum during MDD plus fire flow	20 psi
	Minimum during PHD	30 psi
	Standard Range	40-80 psi
	Maximum	80 psi preferred[1]
Distribution Piping	Maximum Velocity during ADD or MDD	5 ft/s
	Maximum Velocity during PHD	10 ft/s
	Maximum Velocity during Fire Flow	10 ft/s
	Minimum Future Pipe Diameter	8-inch
Fire Suppression	Available Fire Flow Requirements[2]	Residential: 500 gpm for 30 min Commercial/Industrial/Multi-Family: 1,500 gpm for 2 hours

3.8.3 Model Results

Modeling was completed with the following set of activities:

The system was simulated using the existing facilities. Peak hour simulation was run with reservoirs set at the level where equalizing storage is depleted, and pump stations and wells are operating based on the automatic calls that the system would make with reservoirs at this level.

Peak day with fire flow simulation was run with reservoirs set at the level where equalizing and fire flow storage is depleted, and pump stations and wells are operating based on the automatic calls that the system would make with reservoirs at this level.

- Deficiencies were noted and solutions to the deficiencies were identified from staff recommendations and by reviewing maps of the system.
- Solutions to the deficiencies were inserted into the model and the peak hour and peak day with fire flow simulations were run to determine if the solutions were adequate.
- Additional new facilities were added to the model until there were no deficiencies in the system.

3.8.4 Year 2020 Results

Results of the year 2020, existing facilities simulations are shown on:

- **Figure 3-5** 2020 ADD Results
- **Figure 3-6** 2020 MDD Results
- **Figure 3-7** 2020 PHD Results
- **Figure 3-8** 2020 MDD + Fire Flow (FF) Results

The ADD analysis showed some areas of high pressure including within the Hockinson, Griffels Finn Hill, and Heisson pressure zone. Areas of low pressures near many of the tanks and high elevation customers were also noted.

The MDD showed a few areas in Meadow Glade that exceed velocity criteria, and high pressures in Meadow Glade when both Paradise Point pumps are operating.

The PHD analysis showed low pressures in East Hazel Dell area.

The MDD + FF analysis showed that Lockwood, Gable Ave, Taylor Valley, and Lower Taylor Valley limited by firm capacity requirement. Many deficiencies were identified in areas with small booster or prv pressure zones and in areas with small diameter piping.

3.8.5 Future Demand Results

Future demand results are shown in **Figure 3-9, Figure** 3-10**, and, Figure** 3-11. Results of the future analysis showed that with projected ADD, there were small areas of pressures below 40 psi in East Hazel Dell. For MDD, low pressures were noted in East Hazel Dell, and Upper Valley View. Velocity exceedances were seen:

- Near Well 26 and Booster 140
- Booster 101 discharge piping along NE 164th
- NE 179th and NE Deffel Road area near Well 27

For PHD, a large portion of East Hazel Dell, along with areas in Upper Valley View, near North County Tank, and NE 179th and NE Deffel Road area near Well 27 had low pressures.

3.8.6 Deficiencies and Potential Improvements

Deficiencies and potential improvements were identified through the modeling. These include:

Fire flow: Distance away from another hydrant to assume multiple hydrants was used to identify areas with deficiencies.

Pressures: Low pressures in East Hazel Dell was mitigated by making a new pressure zone with its own storage and booster pump station. Source, storage, and booster improvements were used to mitigate other low-pressure areas.

Velocity Exceedance: Areas identified with velocity exceedances were mitigated with larger pipes.

New Supply: New supplies were included for Well 36 and additional supplies from Paradise Point and Carol J. Curtis Wellfield.

Transmission: Transmission improvements were modeled including:

- 99th Street
- 10th Ave on 179th Street
- 72nd Ave 119th to Battleground
- Connecting the Town of Yacolt to the main system was also modeled.

Pumping capacity: Pumping deficiencies were addressed by increasing pump capacity in existing pump stations and adding new facilities.

The recommended improvements for the Water System plan are shown on **Figure 3-12**, and include the following projects:

3.8.6.1 Proposed Storage Facilities

Proposed improvements include adding 9 new storage facilities, and decommission 8 tanks, as shown in **Table 3-15**.

Table 3-15 | Proposed Storage Improvements

Pressure Zone	Storage Deficiency (MG)	CIP Project
Armstrong	0.08	Decommission Upper Basket Flats Tank (0.05 MG) and replace with tank that meets deficit (0.078 MG) for a total of 0.13 MG
Big East	0.28	Construct second tank at existing tank site
Griffels	0.65	Decommission Lower Valley View tank (0.06 MG) and build new tank on Gabriel Road that meets deficit (0.65 MG) for a total of 0.71 MG
Hazel Dell	2.8 - 5.2	➢ New Lakeshore tanks (size TBD)
		➢ New pumped ground storage near NE 99th St and NE 39th St (1 MG as placeholder for now)
Hockinson	0.41	New Steel tank next to existing Steel tank (1.6 MG)
Rawson	0.13	Construct second tank at existing tank site

Pressure Zone	Storage Deficiency (MG)	CIP Project
Summer Hills	0.13	Decommission existing Elk Horn tank and build larger one that is at the same HGL as Summer Hills Tank (999')
Upper Valley View	0.19	➢ Decommission tank and connect Gable Ave to UVV pressure zone
		➢ Connect a few customers at the South of UVV to Griffels to decrease high pressures
		➢ Add 250 gpm of additional pumping supply to meet closed zone firm capacity requirements

3.8.6.2 Proposed Pump Station Improvements

The key proposed pump station improvements are shown in **Table 3-16**. Additional projects are included in the Capital Improvements chapter of the report.

Table 3-16 | Proposed Pump Station Improvements

Pressure Zone	Location	Capacity (gpm)	CIP Project
Meadow Glade	NE 10th & NE 154th	2,000	Convey flow from Hazel Dell to Meadow Glade pressure zone
	NE 142nd St & NE 72nd Ave	5,550	
Hockinson	NE 119th St at Booster 109 site	1,500	Address pumping deficiency in Hockinson
Griffels	NE 144th St	750	Replace B106 with new pumps. Capacity based on velocity in proposed 8-inch pipe coming out of BPS
Dove Creek	NE 259th St & NE 82nd Ave	500?	Convey flow from Meadow Glade and add redundancy to Dove Creek and Lockwood
Gable Ave/ Upper Valley View Combined Zone	NE 339th St & NE Gable Ave	250	Add 250 gpm of additional pumping supply to meet closed zone firm capacity requirements
Kelly Booster	NE 299th St	350	Add additional capacity to serve Yacolt demand and meet closed zone firm capacity requirements
Kelly Hill Booster	NE Yacolt Mountain Rd near Kelly Hill Tank	275	Add capacity to serve Yacolt

3.8.6.3 Proposed Pipe Projects

Proposed pipe projects include a number of improvements identified to meet fire flow, velocity, small diameter and steel pipe, transmission and growth projects. Larger pipe projects include the 30-inch transmission line on 99th Street and 24-inch pipeline to supply water from Meadow Glade from Paradise Point.

3.8.6.4 Proposed Supply Projects

Proposed supply projects include the addition of Well 36, and the build out of Carol J. Curtis and Paradise Point Wellfields.

3.8.7 Additional Analysis

As stated earlier, this model works well in the steady state mode and can provide adequate analysis to develop a CIP for the water system plan. The model is anticipated to be used for developing design calculations (system curves for new pumps, for example) and for water quality analysis. In order to

complete these activities additional calibration is required. Calibration for extended period simulations will be completed during the next several years and the model will then be useful for all modeling needs.

Figure 3-5 | 2020 ADD Results

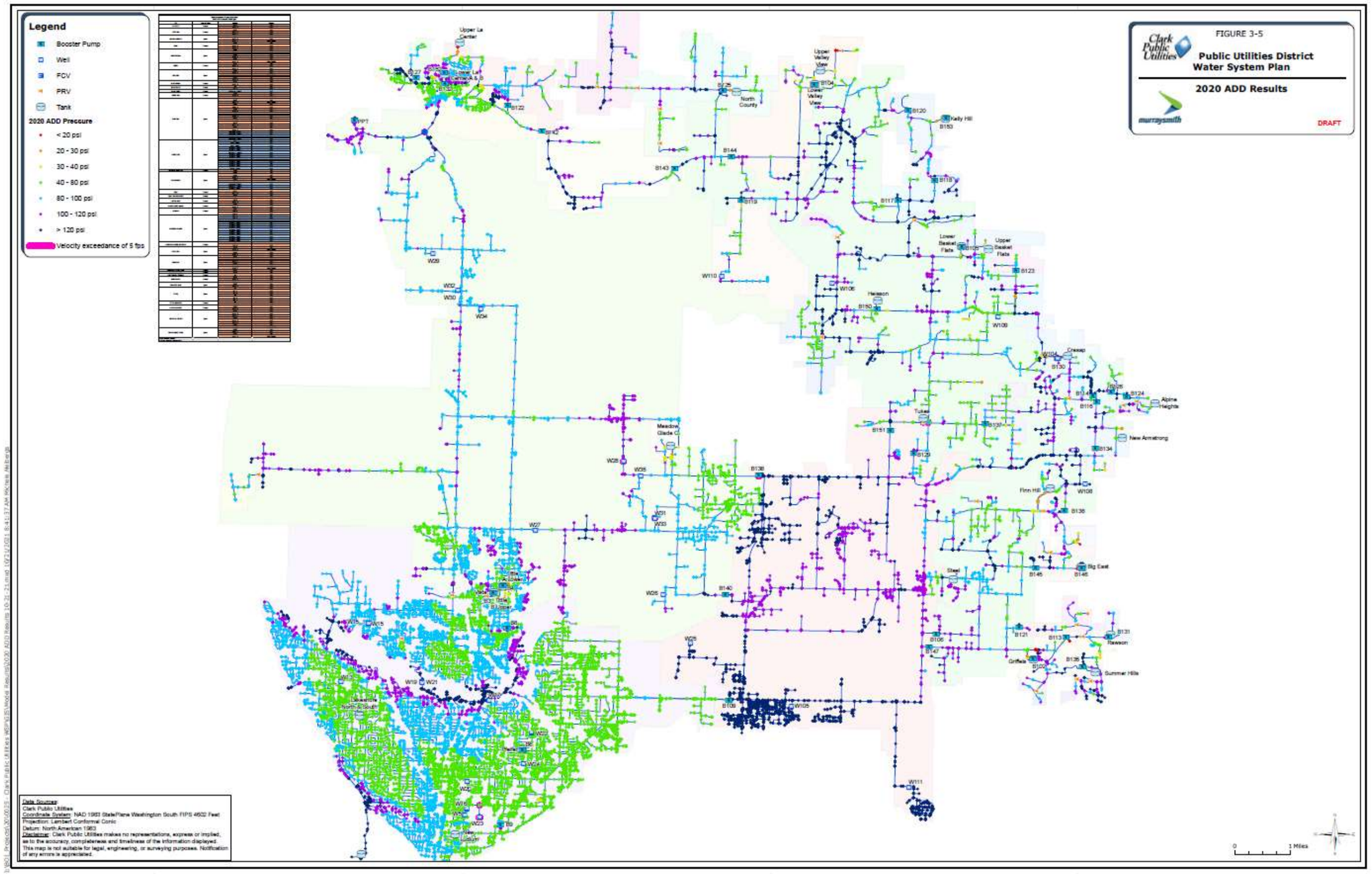


Figure 3-6 | 2020 MDD Results

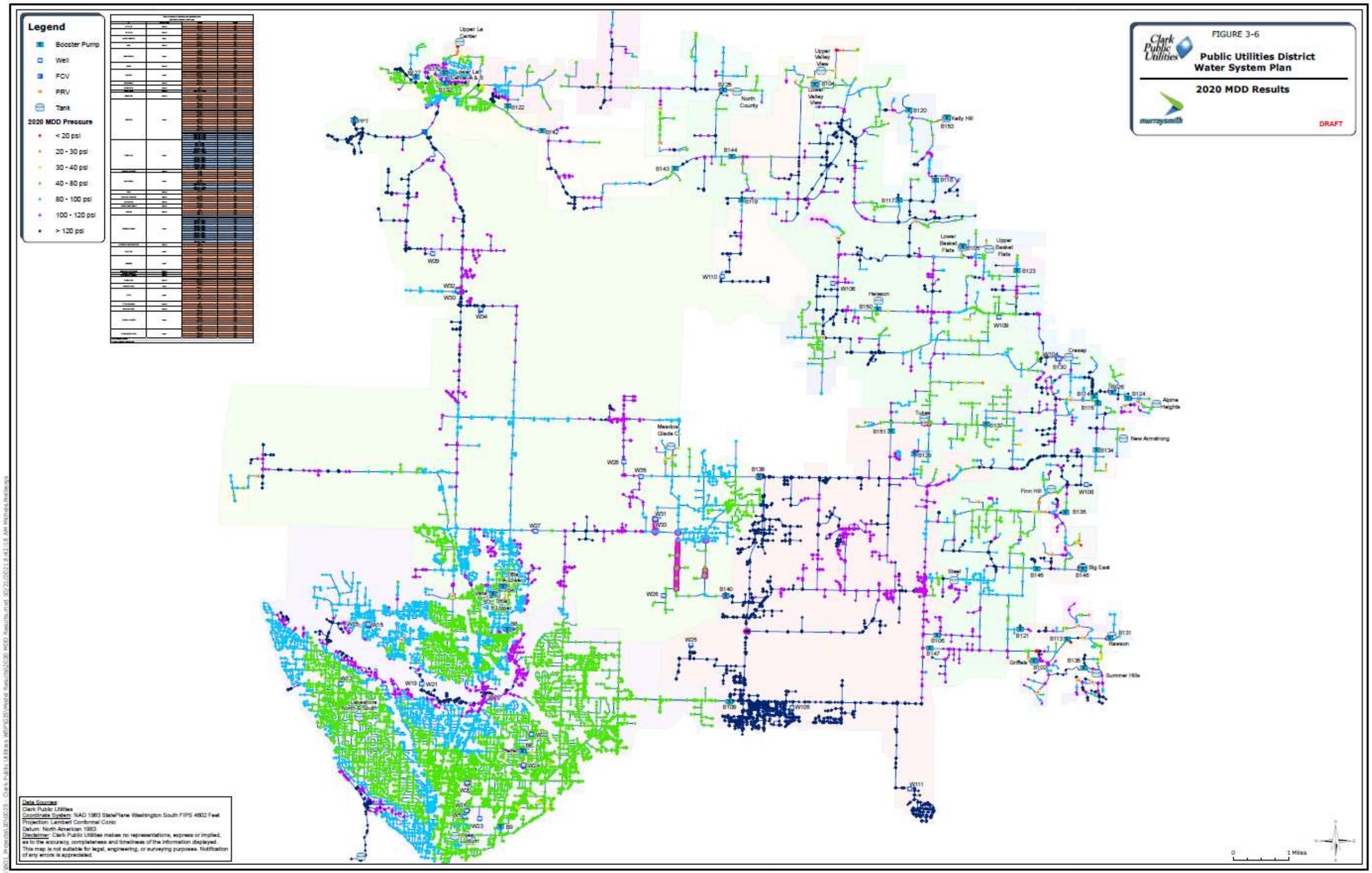


Figure 3-7 | 2020 PHD Results

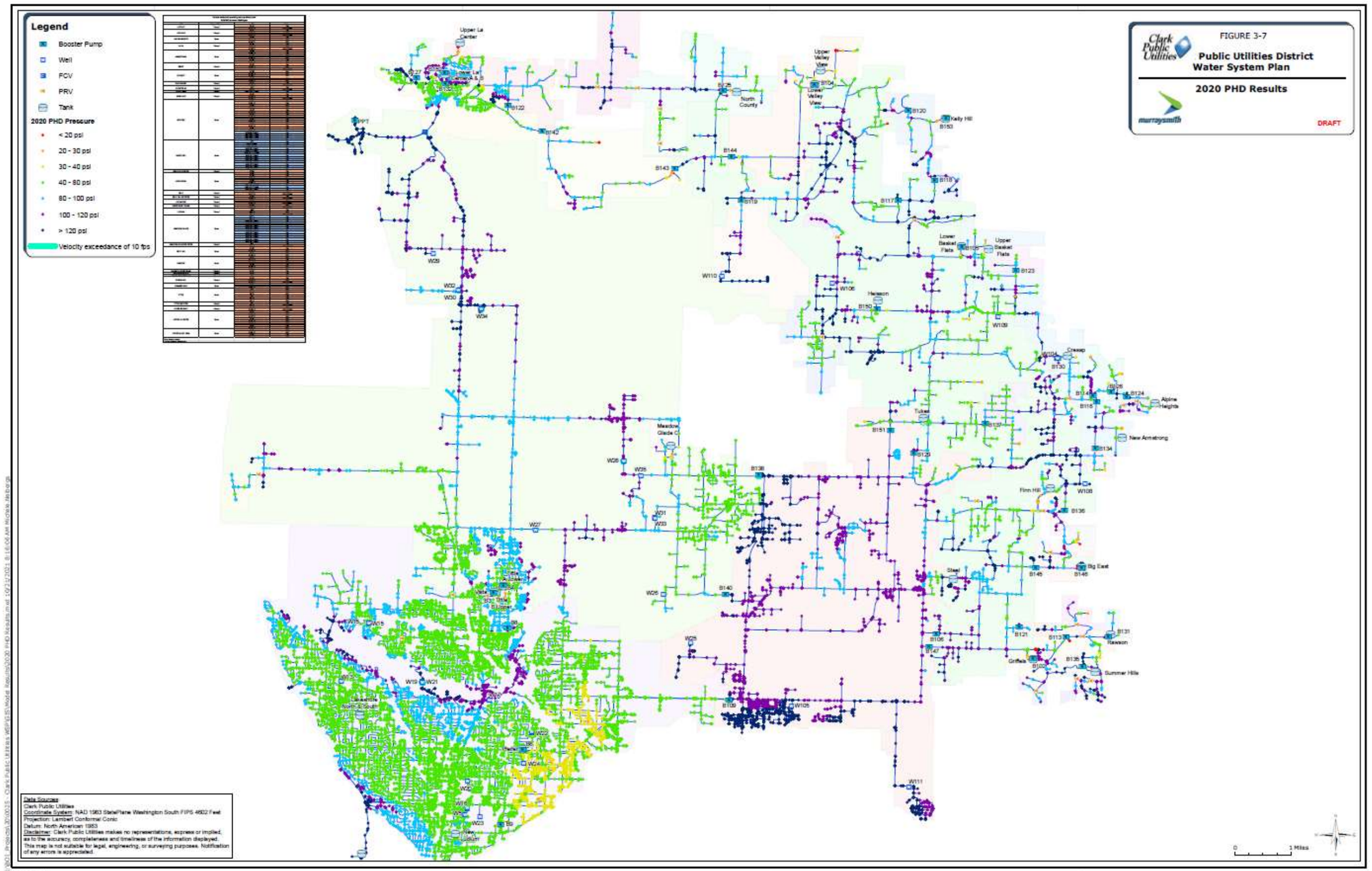


Figure 3-8 | 2020 MDD and FF Results

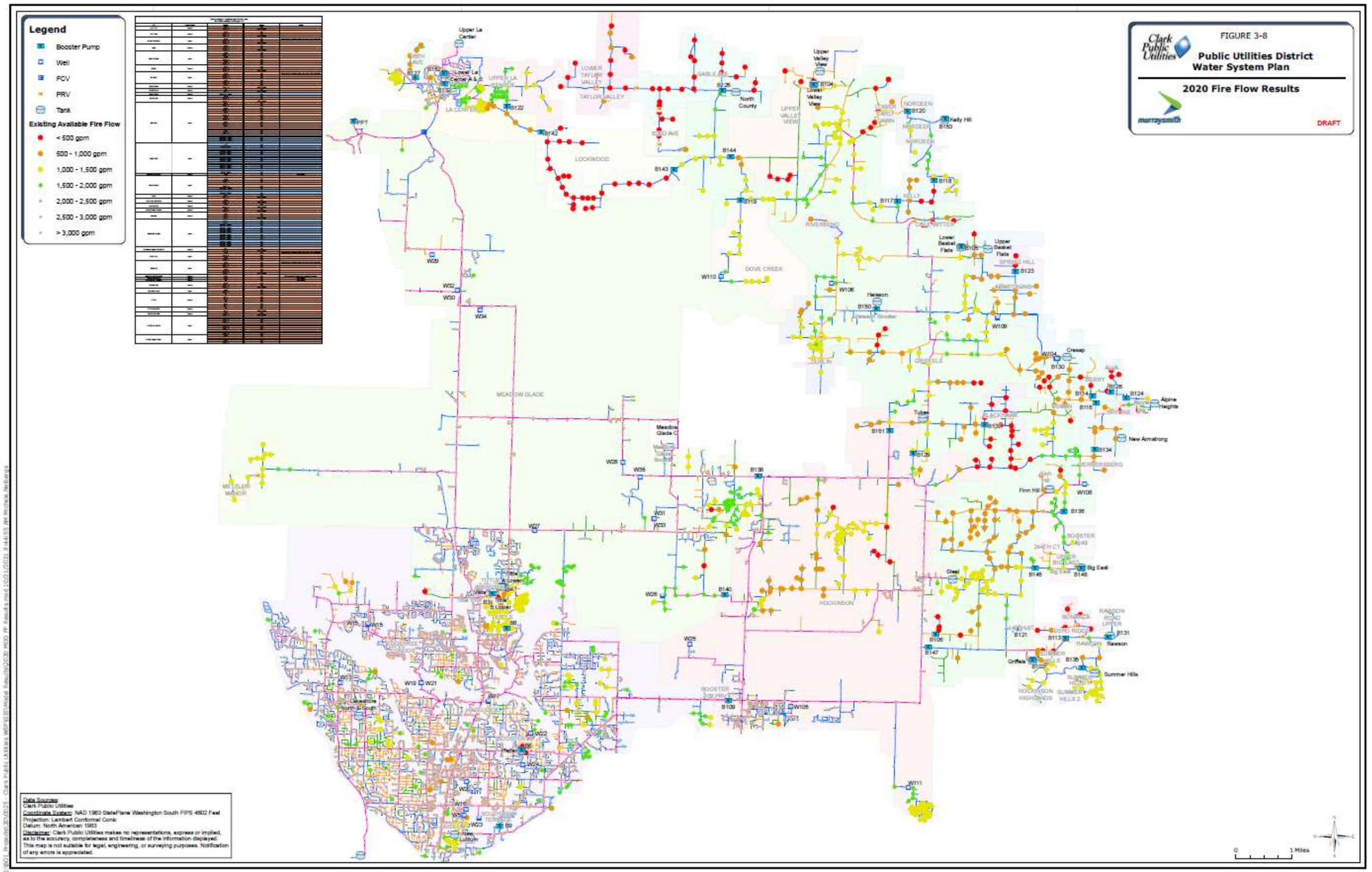


Figure 3-9 | Future ADD Results

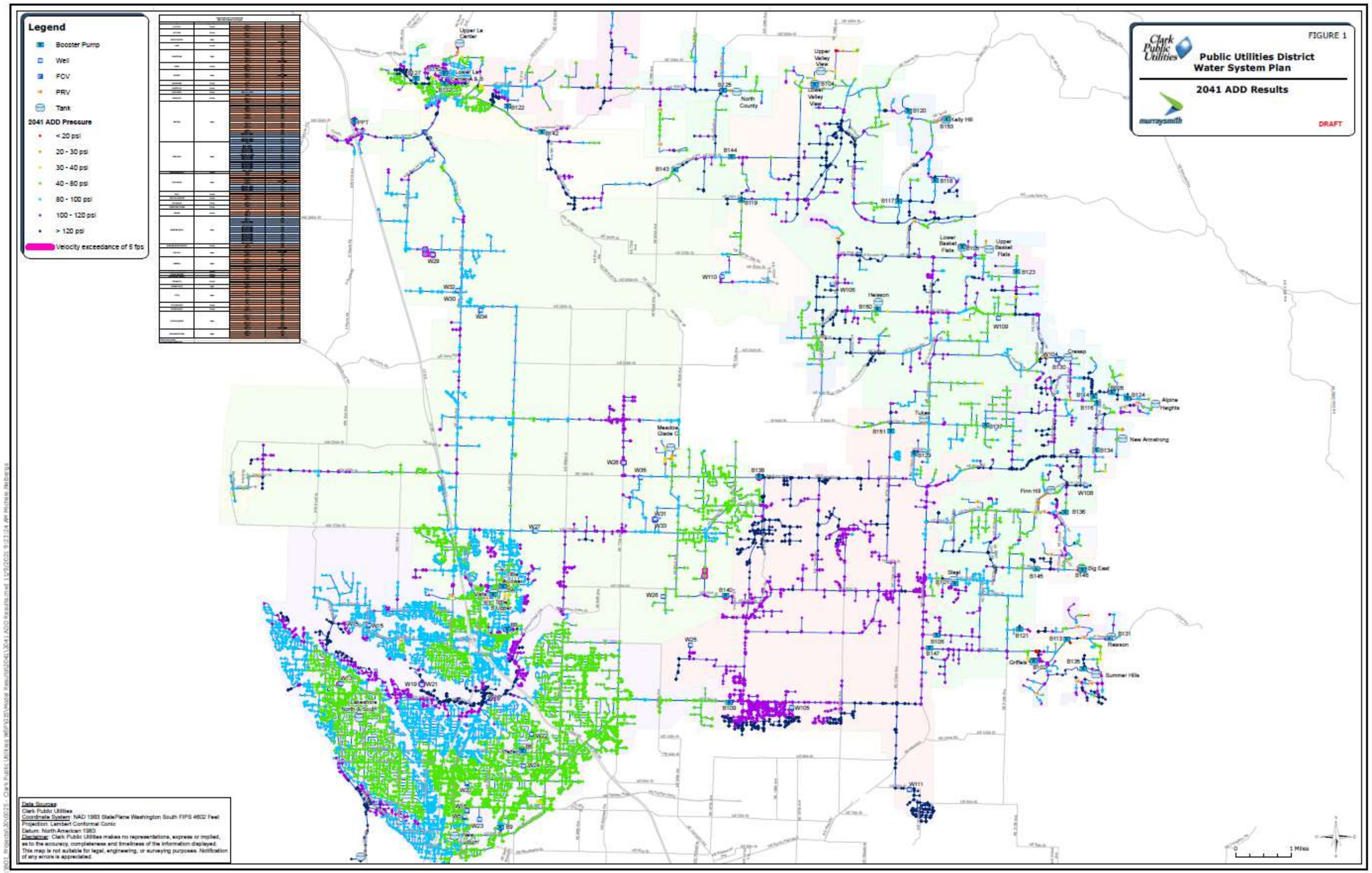


Figure 3-10 | Future MDD Results

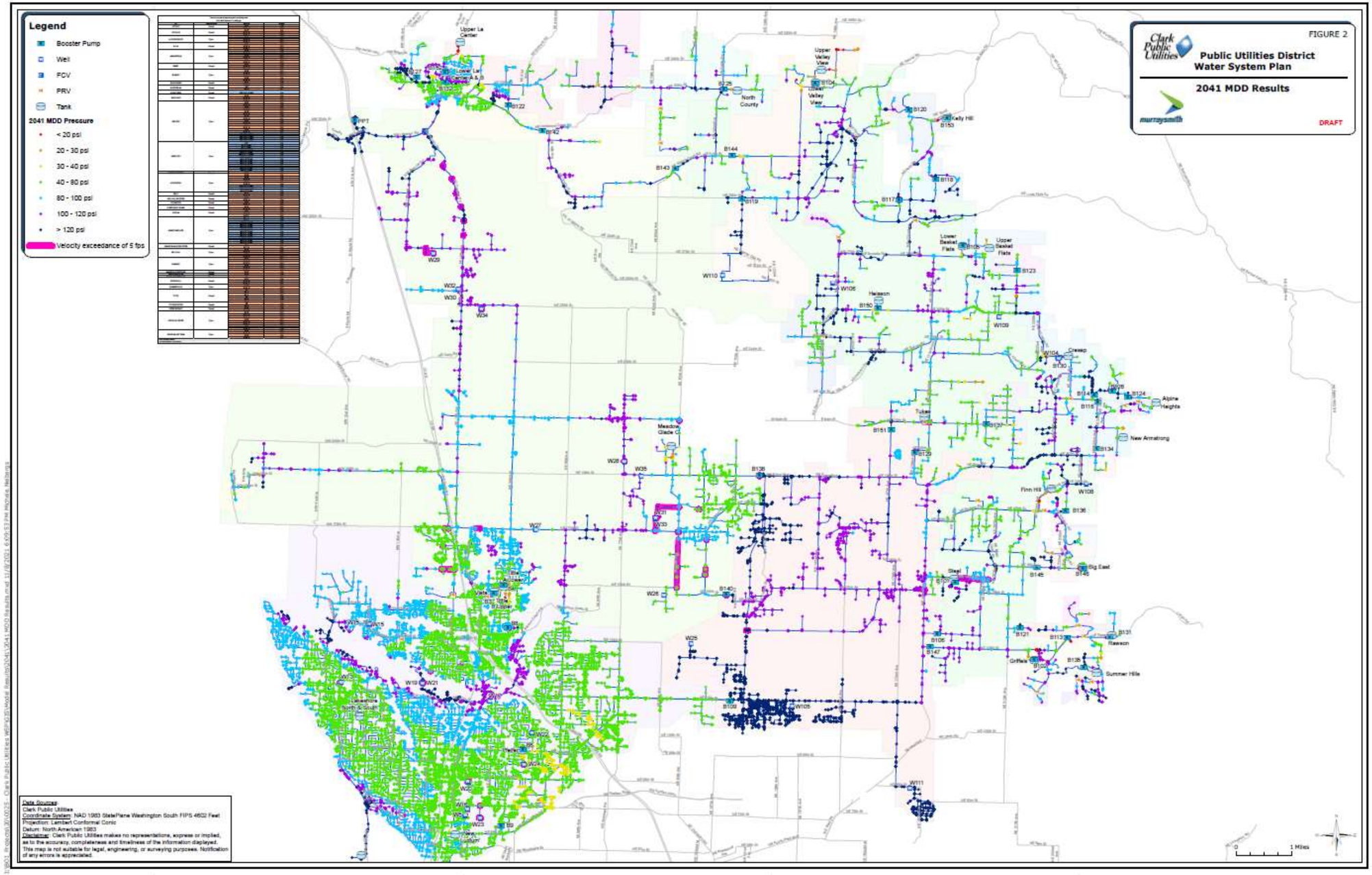


Figure 3-11 | Future PHD Results

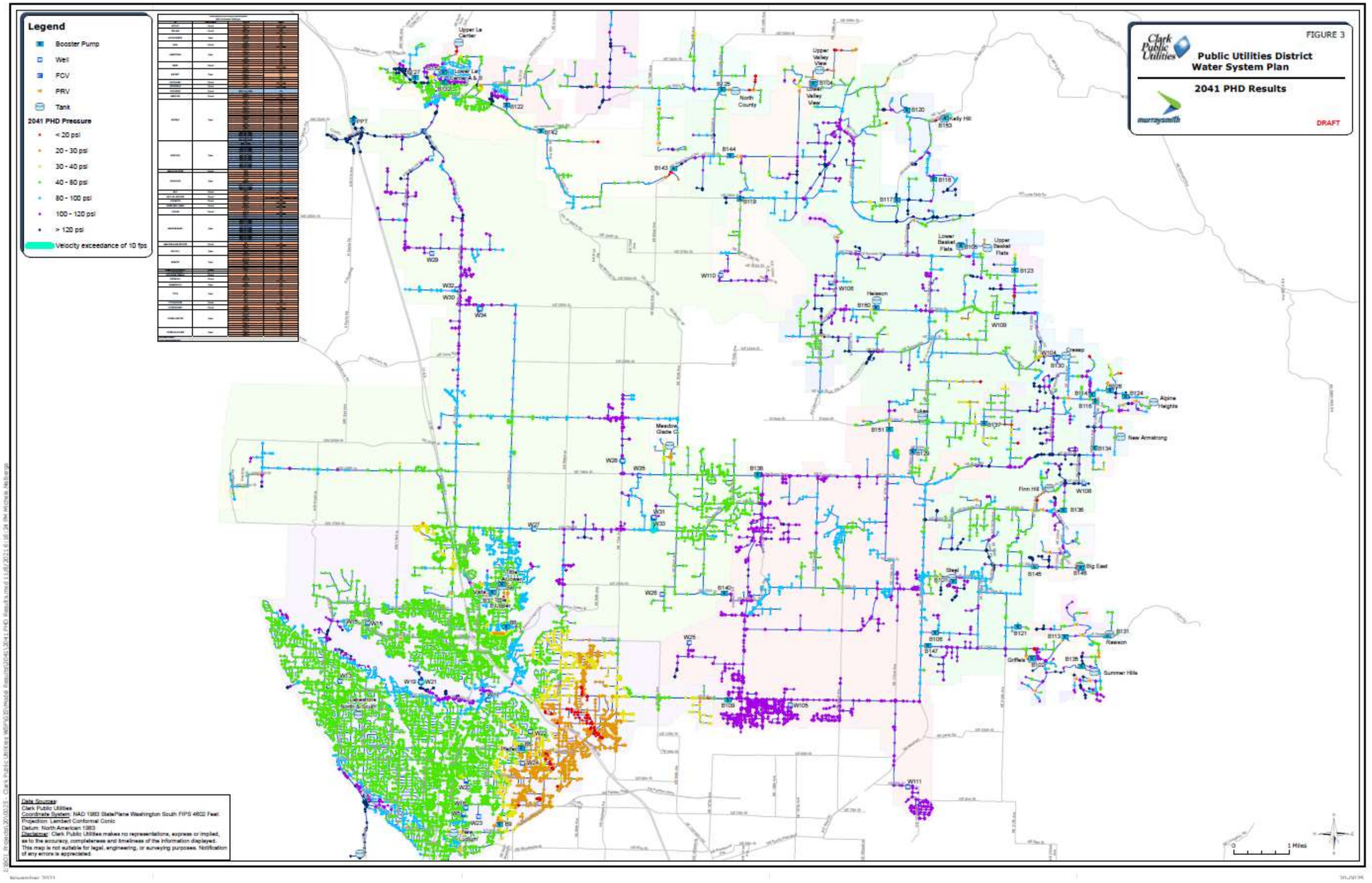
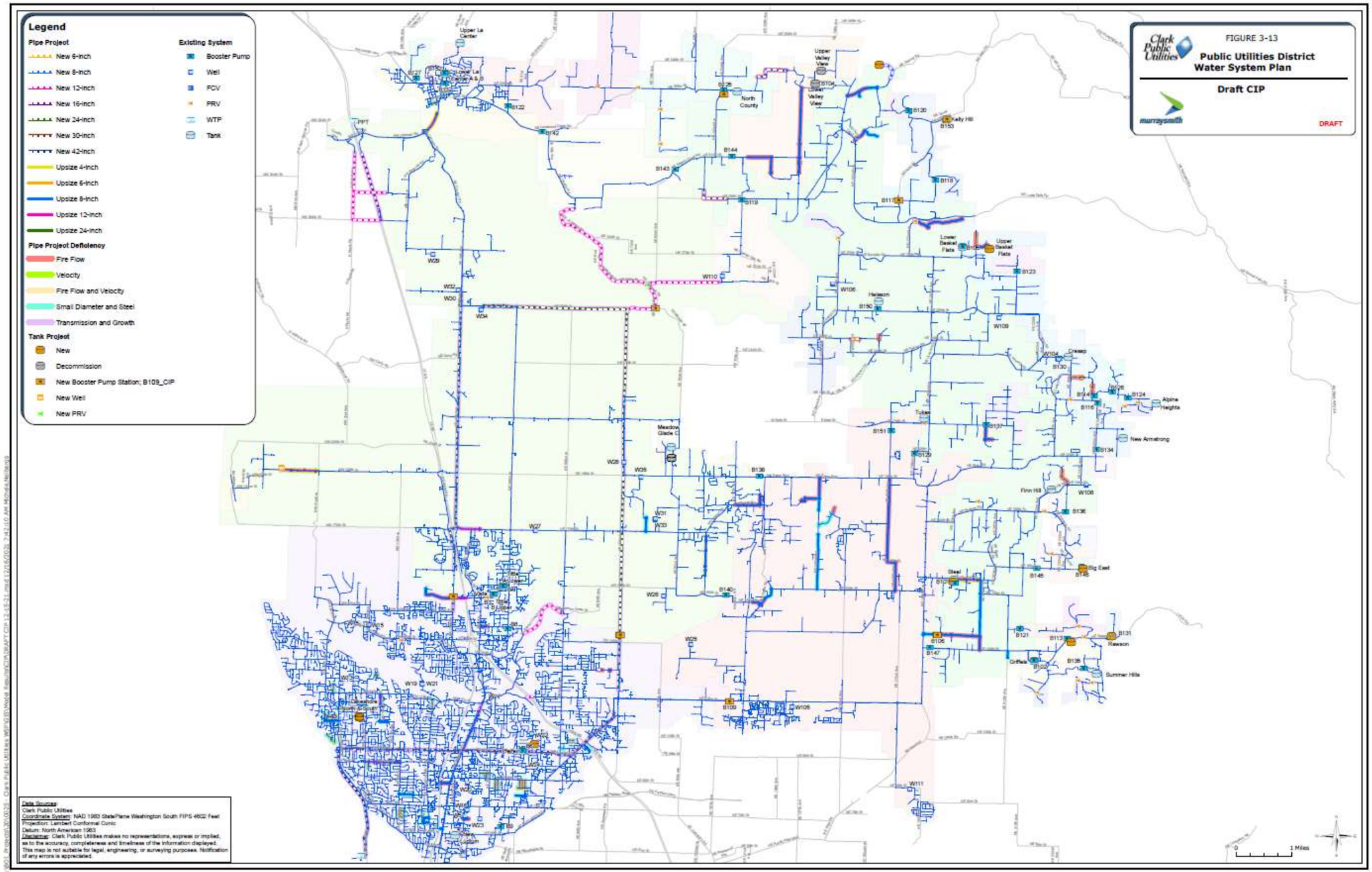


Figure 3-12 | Proposed CIP Projects



THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 4

Water Use Efficiency, Water Rights, Reliability, and Interties

4.1 Introduction

The purpose of this section is to describe the current conservation program, the current status of the water utility's water rights, a review of reliability and Interties in the water system.

4.2 Water Use Efficiency Program

This section describes the District's Water Use efficiency program, pursuant to WAC 246-290-496.

A copy of the District's Water Use Efficiency program is included in Appendix D. The program includes both demand conservation measures and supply conservation measures that comprise the districts conservation program.

The conservation program includes:

- Fully metered source water supplies
- Fully metered retail service connections
- Regular inspection, testing and repair of water system facilities
- A showerhead replacement program
- Leak abatement program
- Public education and information on landscaping and irrigation water conservation
- Public education and information on household fixture leak detection,
- Public education and information on water and energy saving devices
- Informational flyers on peak summer water use conservation
- Regional radio and television public service announcements for summer water conservation
- Public speaking to local groups and schools on conservation
- Participation in the Clark County Home and Garden Fair with public information on conservation
- Student tours of water conservation and restoration projects
- Website containing water conservation information and suggestions

Conservation goals established in the WUE include reducing water system distribution leakage to 8.5 percent or less within 10 years and reducing annual ERU water consumption by a minimum of 5 percent within 10 years.

Measures to achieve these goals include:

- Continuation of leak detection program
- Improved tracking of mainline flushing and new construction flushing

- Recording end line flushing and main/service line leaks
- Increased change-out of water meters exceeding 10 years old
- Testing and recalibrating source meters
- Work with local fire districts to document water used for training, exercises, and fire fighting
- Tracking of backwash water from treatment facilities
- Continued replacement of deteriorating water mains
- Continued leak repair
- Continued water system audits
- Help with enforcing newly adopted penalties for theft of water without appropriate meter and connection
- Continue inclined block water rate
- Provide customers information on bills about individual water use
- Targeting information to customers who are large water users

Additional future measures that may be implemented if needed, or as it becomes more cost-effective may include the use of reclaimed water, use of speaker's bureaus for water conservation, and additional paid advertising spots on radio, television, newspapers, and other media.

The water use efficiency measures in the District's WUE that apply to their customers are shown in **Table 4-1**.

Table 4-1 | Water Use Efficiency Measures Targeted to Customers

No.	Measure
1	Levy new inclined block water rate
2	Provide customers information on bills about individual water use
3	Targeting information to customers who are large water users
4	A showerhead replacement program
5	Leak abatement program
6	Public education and information on landscaping and irrigation water conservation
7	Public education and information on household fixture leak detection,
8	Public education and information on water and energy saving devices
9	Informational flyers on peak summer water use conservation
10	Regional radio and television public service announcements for summer water conservation
11	Public speaking to local groups and schools on conservation
12	Participation in the Clark County Home and Garden Fair with public information on conservation
13	Student tours of water conservation and restoration projects
14	Website containing water conservation information and suggestions

4.2.1 Source and Service Meters

The District is fully metered for all sources and all services.

4.2.2 Distribution System Leakage

Distribution System Leakage is shown in **Table 4-2** for the period from 2013 through 2020. Distribution leakage has been consistently under 10 percent in the 3-Year Running Average.

Table 4-2 | Distribution System Leakage

Year	Distribution System Leakage	3-Year Running Average
2013	6.3%	8.0%
2014	10.8%	8.5%
2015	9.5%	8.9%
2016	6.9%	9.1%
2017	8.3%	8.2%
2018	7.0%	7.4%
2019	7.7%	7.7%
2020	9.3%	8.0%

4.3 Water Rights Analysis

Water Rights: Clark Public Utilities holds forty-nine (49) certificates and permits on the water sources in its water supply system. The water rights include an annual total of 56,687.4 acre-feet of primary right and 13,130 acre-feet of supplemental right. The instantaneous withdrawal rate for all of the rights combined is 69,098 gpm (99.5 mgd). New source development is expected to be at the Carol J. Curtis Wellfield and the Paradise Point Wellfield.

Table 4-3 presents the Water Rights Self-Assessment form for Clark Public Utilities. The water rights self-assessment shows that Clark Public Utilities will not require additional primary water rights during the planning period.

THIS PAGE INTENTIONALLY LEFT BLANK

Table 4-3 Water Right Self-Assessment Form for Water System Plan

Qi is in gallons per minute (gpm) Qa is in acre-feet (af)

Water Right Permit, Certificate, or Claim # *If water right is interruptible, identify limitation in yellow section below	WFI Source # If a source has multiple water rights, list each water right on separate line	Existing Water Rights Qi= Instantaneous Flow Rate Allowed (GPM or CFS) Qa= Annual Volume Allowed (Acre-Feet/Year) This includes wholesale water sold				Current Source Production – Most Recent Calendar Year Qi = Max Instantaneous Flow Rate Withdrawn (GPM or CFS) Qa = Annual Volume Withdrawn (Acre-Feet/Year) This includes wholesale water sold				10-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold				20-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold			
		Primary Qi Maximum Rate Allowed	Non-Additive Qi Maximum Rate Allowed	Primary Qa Maximum Volume Allowed	Non-Additive Qa Maximum Volume Allowed	Total Qi Maximum Instantaneous Flow Rate Withdrawn	Current Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume Withdrawn	Current Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 10 Years	10-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 10 Years	10-Year Forecasted Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 20 Years	20-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 20 Years	20-Year Forecasted Excess or (Deficiency) Qa
1. G2-*01991CWRIS	S04 “Well #4”	400			640	400	0		640	400	0	0	640	400	0	0	640
2. G2-GWC2073(A)	S03 “Well #3”	180			290												
3. G2-GWC2073(B)	S05 “Well #5”	320			516	320		516	0	320	0	516	0	320	0	516	320
4. G2-GWC947	S05 “Well #5”		1,000	896		1320	-1320	134.03	761.97	1320	-1320	134.03	761.97	1320	-1320	134.03	761.97
5. G2-GWC4098	S07 “Well #7”	1,000			1344	990	10		1134	990	10	0	1134	990	10	0	1134
6. G2-27736	S07 “Well #7.2”	550			444	550	0		444	550	0	0	444	550	0	0	444
7. G2-27753	S51 “Well #8.2”	600		484		1100	100		1200	1100	100	0	1200	1100	100	0	1200
8. G2-GWC5921	S09 “Well #9”	200			322	800	-600		1272	800	-600	0	1272	800	-600	0	1272
9. G2-00884CWRIS	S10 “Well #10”	600		600		600	0	81.62	518.38	600	0	81.62	518.38	600	0	81.62	518.38
10. G2-00026CWRIS	S11 “Well #11”	125		67			125		67	0	125	0	67	0	125	0	67
11. G2-00885CWRIS	S12 “Well #12”	275		440			275		440	0	275	0	440	0	275	0	440
12. G2-21569CWRIS	S13 “Well #13”	100		80			100		80	0	100	0	80	0	100	0	80
13. G2-24409	S55 “Well #13.1”	750		1000		475	275	236.97	763.03	475	275	236.97	763.03	475	275	236.97	763.03
14. G2-24408CWRIS	S15 “Well #15”	750		1000		740	10	197.62	802.38	740	10	197.62	802.38	740	10	197.62	802.38
15. G2-GWC3422	S21 “Well #16”	650		144	869	650	0	393.95	646.05	650	0	393.95	646.05	650	0	393.95	646.05
16. G2-25933CWRIS	S17 “Well #17”	800			968	800	0		968	800	0	0	968	800	0	0	968
17. G2-26130CWRIS	S48 “Well # “18.1”	1,000		968			1000		968	0	1000	0	968	0	1000	0	968
18. G2-26224CWRIS	S20 “Well #19”	1,000		968		960	40		968	960	40	0	968	960	40	0	968
19. G2-27270	S22 “Well #20”	700		645		760	-60	171.83	473.17	760	-60	171.83	473.17	760	-60	171.83	473.17
20. G2-27953	S49 “Well #21”	1,300		1048		1100	200	529.14	518.86	1100	200	529.14	518.86	1100	200	529.14	518.86
21. G2-27715	S24 “Well #22”	500		403		440	60	155.93	247.07	440	60	155.93	247.07	440	60	155.93	247.07
22. G2-27980	S25 “Well #23”	1,500		4	1206	1500	0	301.4	908.6	1500	0	301.4	908.6	1500	0	301.4	908.6
23. G2-27979	S26 “Well #24”	520			444	550	-30	137.48	306.52	550	-30	137.48	306.52	550	-30	137.48	306.52
24. G2-28350	S27 “Well #25”	350			376	350	0	247.76	128.24	350	0	247.76	128.24	350	0	247.76	128.24
25. G2-24160	S43 “Well #26”	428		120		428	0	50.84	69.16	428	0	50.84	69.16	428	0	50.84	69.16
26. G2-28689	S28 “Well #27”	270			290	270	0	185.59	104.41	270	0	185.59	104.41	270	0	185.59	104.41
27. G2-26942CWRIS	S41 “Well #28”	530			365	530	0	42.94	332.06	530	0	42.94	332.06	530	0	42.94	332.06
28. G2-28630	S29 “Well #29”	500			403	550	-50	261.46	141.54	550	-50	261.46	141.54	550	-50	261.46	141.54
29. G2-28956	S30 “Well #30”	700			565	1000	-300	797.03	-232.03	1000	-300	797.03	-232.03	1000	-300	797.03	-232.03
30. G2-28397	S31 “Well #31”	1,200			1382	1200	0	1150.89	231.11	1200	0	1150.89	231.11	1200	0	1150.89	231.11
31. G2-29976	S53 “Well #32”	1,200		1075.5		1206	-6	741.11	358.89	1206	-6	741.11	358.89	1206	-6	741.11	358.89
32. G2-29575	S50 “Well #33”	1,200			1290	1200	0	774.3	515.7	1200	0	774.3	515.7	1200	0	774.3	515.7

33. G2-29956	S52 “Well #34”	1,200		700		1200	0	12.1	687.9	1200	0	12.1	687.9	1200	0	12.1	687.9
34. G2-29477(B)	S56 “Well #35”	625		1000		800	200	285.46	984.54	800	200	285.46	984.54	800	200	285.46	984.54
35. G2-30644	“Well #36”	1,100		900			1100		900	0	1100	0	900	0	1100	0	900
36. G2-00549CWRIS	S33 “Well #104”	600		352	96	350	250	168.89	279.11	350	250	168.89	279.11	350	250	168.89	279.11
37. G2-23887CWRIS	S34 “Well #105”	400		448		400	0	440.74	7.26	400	0	440.74	7.26	400	0	440.74	7.26
38. G2-24906	S35 “Well #106”	240		484		240	0	222.64	261.36	240	0	222.64	261.36	240	0	222.64	261.36
39. G2-GWC7189	“Well #107”	60		96			60		96	0	60	0	96	0	60	0	96
40. G2-27152	S36 “Well #108”	150		121		150	0	31.04	89.96	150	0	31.04	89.96	150	0	31.04	89.96
41. G2-27557	S37 “Well #109”	300		80.9		300	0	1.06	79.84	300	0	1.06	79.84	300	0	1.06	79.84
42. G2-27985	S57 “Well 110.1”	400			307	400	0	78	229	400	0	78	229	400	0	78	229
43. G2-29293	S63 “Well #111”	222		103		280	0	93.71	102.29	280	0	93.71	102.29	280	0	93.71	102.29
44. G2-26785	LaCenter #1, #2, #3	200		146	78	168	32		224	168	32	0	224	168	32	0	224
45. G2-27075CWRIS	S42 “MG #5”	250		375		250	0		375	250	0	0	375	250	0	0	375
46. G2-27172CWRIS	S39 “MG #2”	190			152	98	92		152	98	92	0	152	98	92	0	152
47. G2-28719	S47 “LaCenter #4”	110			90	110	0		90	110	0	0	90	110	0	0	90
48. G2-29981	CJC SouthLake PAA	25,000		20,000			25000		20000	25000	0	3217.72	16782.28	25000	0	5975.9	14024.1
49. G2-30381	CJC Southlake SGA	7,000		9,900		7300	-300	5189.29	4710.71	7300	-300	5189.29	4710.71	7300	-300	5189.29	4710.71
50. G2-30482	PPWF	10,000		11,200			10000		11200	10000	0	2700	8500	10000	0	3000	8200
51. G2-29821	S51 “Well #8.2”	150		412													
52. G2-GWC2284@1	S56 “Well #35”	375			270												
53. G2-GWC5515	S09 “Well #9”	600		906	54												
54. G2-23988	S03 “Well #3”	40		32													
55. G2-22419C	S03 “Well #3”	120		97													
56. G2-24272CWRIS	Well #3	150		240													
57. G2-26682CWRIS	W405 and W407	300		182													
58. G2-GWC3982	S08 “Well #8.2”	450		304													
59. G2-GWC2595	S05 “Well #5”	1000			896												
60. G2-30313	South Lake SGA “SL-1, SL-2, SL-3”																
61. CG2-22154	S32 “Well #103” S63 “Well #11”	58		93													
	TOTALS =	71,488		58,033		35,275	36,923	13,382.88	44,982.32	70,155.00	2,043.00	19,300.60	39,064.60	70,155.00	2,043.00	22,358.78	36,006.42
		A		B		C	A-C	D	B-D	E	A-E	F	B-F	G	A-G	H	B-H

PENDING WATER RIGHT APPLICATIONS: Identify any water right applications that have been submitted to Ecology.

Application Number	New or Change Application?	Date Submitted	Quantities Requested			
			Primary Qi	Non-Additive Qi	Primary Qa	Non-Additive Qa
G2-29986			1,200 gpm		1,000 af	
G2-29987			1,200 gpm		1,000 af	

INTERTIES: Systems receiving wholesale water complete this section. Wholesaling systems must include water sold through intertie in the current and forecasted source production columns above.																
Name of Wholesaling System Providing Water	Quantities Allowed In Contract		Expiration Date of Contract	Currently Purchased Current quantity purchased through intertie				10-Year Forecasted Purchase Forecasted quantity purchased through intertie				20-Year Forecasted Purchase Forecasted quantity purchased through intertie			
	Maximum Qi Instantaneous Flow Rate	Maximum Qa Annual Volume		Maximum Qi Instantaneous Flow Rate	Current Excess or (Deficiency) Qi	Maximum Qa Annual Volume	Current Excess or (Deficiency) Qa	Maximum Qi 10-Year Forecast	Future Excess or (Deficiency) Qi	Maximum Qa 10-Year Forecast	Future Excess or (Deficiency) Qa	Maximum Qi 20-Year Forecast	Future Excess or (Deficiency) Qi	Maximum Qa 20-Year Forecast	Future Excess or (Deficiency) Qa
1															
2															
3															
TOTALS =															
Column Identifiers for Calculations:	A	B		C	=A-C	D	=B-D	E	=A-E	F	=B-F	G	=A-G	H	
	=B-H														

Satellite systems managed by CPU

Water Right	WFI Source #	Water System	Water System ID	Primary Qi	Non-Additive Qi	Primary Qa	Non-Additive Qa
G2-27655	S01 Well #1 S02 Well #2	Morning Meadows	00950E	180		12.6	
G2-GWC5929	S01 Well #1	Amboy Clark Public Utilities	046254	300		80	
G2-27558	S01 Well #1	Alpine Heights	54301A	40		14	
G2-27921	S01 Well #1 S02 Well #2	Cascade Estates	00947T	140		8.6	

Notes:

1. Note that Ecology's Water Right Tracking System (WRTS) lists 83 active water rights for Clark PUD, which is not the same count as Table 4-3. 28 water rights listed under Clark PUD are not part of their main water system and were not included in Table 4-3 for the following reasons: 2 applications, 3 sibling/child water right change applications, 8 domestic water rights for individual properties owned by the District or Public Works, 1 relinquished water right, 10 non-domestic water rights, and 4 associated with satellite systems. Table 4-3 also includes water rights that authorize Clark PUD's water system that are not named under Clark PUD (i.e. Meadow Glade, Yacolt).

THIS PAGE INTENTIONALLY LEFT BLANK

4.4 Reliability

Having multiple water sources located throughout the utility's water service area provides a great deal of reliability to the water supply. Currently, the loss of no single source of water supply within the utility's main service area would result in an inability of the utility to continue meeting level of service goals. The utility uses portably power generators to provide backup power to many of its wells, rather than install multiple generators.

The utility maintains spare parts including spare power transformers for key facilities in the water system. Other materials required for emergency repairs can be obtained quickly from local sources.

The availability of redundant components allows the water system to provide more reliable service. When one component fails or must be temporarily removed from service the water system is still able to provide at least a minimum level of service. In order to enhance the reliability of the water utility's water system the following design criteria are used:

1. Looped water mains wherever practical with sufficient isolation valves to limit extent of water outages (generally 1,000-foot intervals and at each end of limited accessibility areas);

2. Dual PRV station installations with isolation valves to allow for removal of one valve from service for maintenance, repairs, or replacement;

3. When services are dependent on pump systems there shall be at least two pumps whenever the facilities serve ten or more water services;

4. Provisions for back-up power supply are highly desirable, particularly for facilities that are dependent on pumping systems to provide service pressure. At a minimum, facilities should provide an electrical connection for a back-up power generator and manual disconnect from the main power supply; and;

5. Alarms will continue to be installed on water facilities whose operating condition is essential to ensuring water availability (i.e., low level alarms on reservoirs).

Provision of more reliable water facilities will be influenced by the level of service desired by the water system's customers and their willingness to pay rates sufficient for their installation, maintenance, and operation. The system will also make investments to improve reliability in order to minimize the cost and difficulties associated with potential system failures. Additional reliability measures, such as the availability of back-up power supplies is discussed in Chapter 6.

4.5 Interties

The location and number of interties currently within the utility's water system was provided in Chapter 1.3. In addition to the existing interties, the Utility and City of Battle Ground have an intertie along Highway 502 that would eventually allow up to 4,000 gpm of instantaneous flow from the Meadowglade reservoir to the City of Battle Ground. An additional intertie with capacity of 1,000 gpm has been identified as a need in the City of Battle Ground's Water System Plan Amendment, but a location for the intertie has not been finalized. The utility does not rely on interties to provide an emergency source of water to its customers. The capacity of the City of Ridgefield interties may be expanded in the future, depending on their water supply needs

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 5

Wellhead Protection Plan

Clark Public Utilities maintains its wellhead protection plan (WHP) for 42 active supply wells located throughout Clark County. A copy of the current draft wellhead protection plan is included in this WSP as Appendix K.

The purpose of the wellhead protection plan is to help prevent Clark Public Utilities' water-supply sources from becoming contaminated and to develop contingency and emergency response procedures in case one or more sources are lost because of contamination. The plan meets the requirements of Washington Administrative Code (WAC) 246-290.135 (4). Work for this project included:

- Characterizing the hydrogeology of Clark County, identifying aquifers that supply water to wells, and identifying aquitards that protect water supplies from near-surface contamination.
- Characterizing the quality of groundwater from the water utility's wells.
- Delineating WHP capture zones for each supply well.
- Inventorying confirmed and existing sources of contamination, particularly those that lie within the capture zones, and evaluating the risks associated with these contaminant sources.
- Developing a contingency plan to provide water supplies in case one or more wells are impacted by contamination
- Developing an emergency response plan for spills that might affect the well sources.
- Designing implementation strategies to educate the public and manage the contaminant sources in the water utility's service area.

The findings and recommendations of this work are discussed below.

5.1 Findings

Clark Public Utilities currently uses 42 active wells. Eighteen of these wells produce water from shallow aquifers, twenty produce water from a deeper aquifer system, and three produce water from bedrock aquifers. Yields from these wells range from less than 250 gpm to 2,500 gpm. The lowest yields are obtained from wells completed in bedrock aquifers.

5.1.1 Hydrogeology and Existing Water Quality

The major hydrogeologic units in the area include sediments deposited by modern rivers and by the ancient Columbia River. The primary aquifers in the region include the Recent Alluvial, Upper Troutdale, and Glacial Outwash Aquifers, which form the shallow system, and the Lower Troutdale and Sand and Gravel Aquifers (SGA), which form the deep system. Fractured bedrock aquifers also yield small quantities of water to wells. The SGA is typically overlain by the fine-grained sediments of the Lower Confining Unit and, in some areas, the Upper Confining Unit. These two aquitards limit the movement of contaminants to the SGA from the

surface and overlying aquifers. Consequently, wells completed in this unit are better protected from the threat of contamination.

Groundwater generally flows to the west-southwest in the county, discharging to features such as Salmon Creek and the East Fork of the Lewis River after traveling laterally from the upland areas, where much of the recharge occurs. The Columbia River serves as a discharge point for the deeper SGA system.

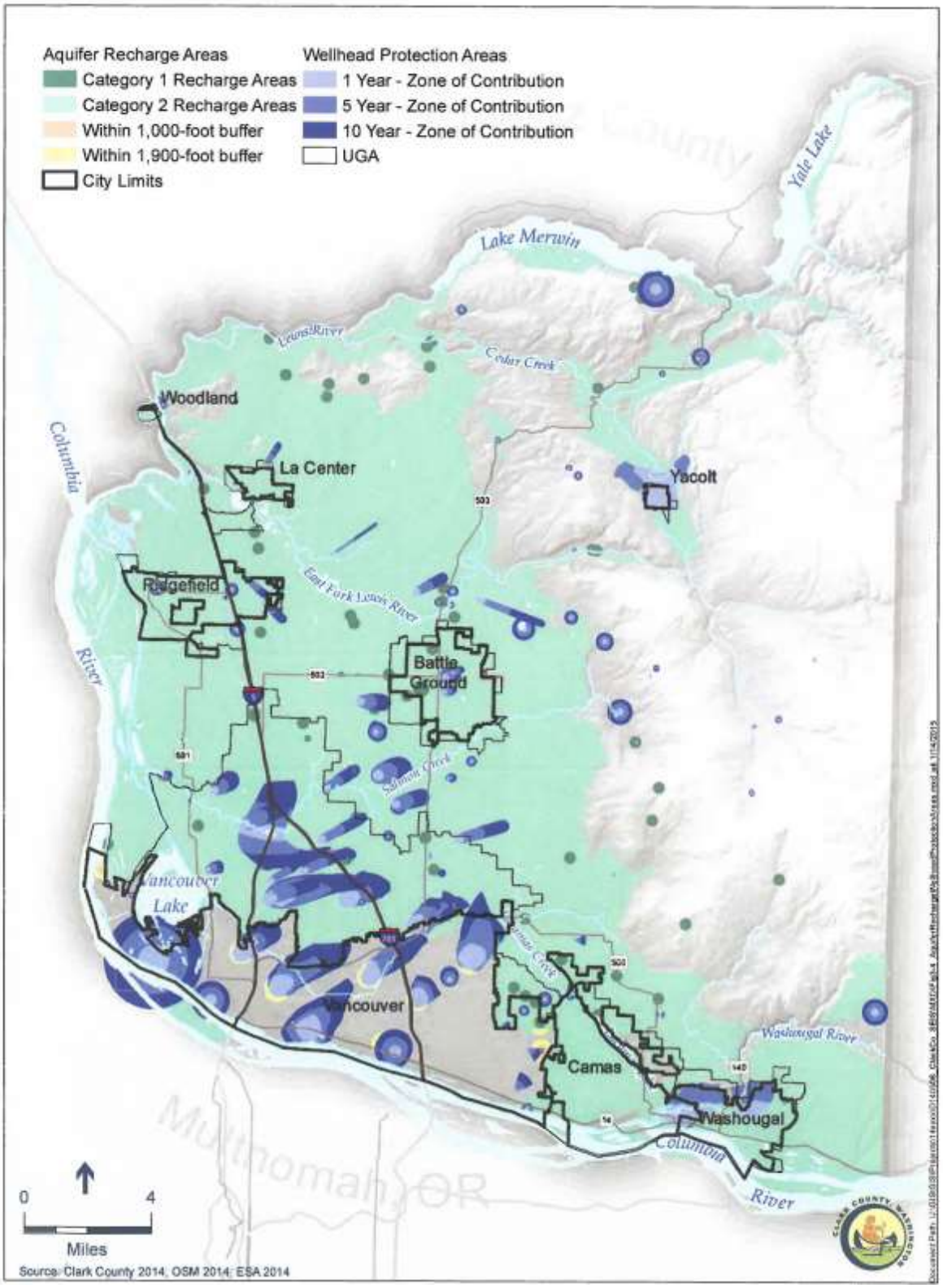
In general, the quality of groundwater from the water utility's wells is good. Prior to 1995, volatile organic compounds (VOCs) were detected at low levels in a few shallow supply wells along Salmon Creek; however, no VOCs have been detected since then. These detections may have been related to service work at one of the wells.

Iron and manganese levels are typically higher in the deeper aquifers than in the shallow aquifers. Within the Upper Troutdale and Pleistocene Alluvial Aquifers, iron and manganese levels tend to be higher in the southwest part of the County, following the direction of regional groundwater flow. The water utility currently removes iron and manganese at several supply wells (Wells 15, 21, and 110) via a pyrolusite-media treatment system.

5.1.2 Wellhead Delineations

Wellhead delineations for the water utility's supply wells were prepared using analytical modeling and hydrogeologic mapping techniques. These delineations represent the extent of the capture zone (recharge area) for each well under average pumping conditions. The capture zones for the shallow supply sources (Wells 9, 17, 18, and 19) are the most extensive and cover commercial and industrial zoned areas. All of the wellhead protection areas are included incorporated into the County's 2016 Comprehensive Plan and are included in the County's GIS system, as shown on **Figure 5-1**.

Figure 5-1 | Clark County Water Comprehensive Plan includes Clark Public Utilities Wellhead Delineations



5.1.3 Contaminant Inventory

A range of contaminant sources was inventoried using a Geographic Information Systems (GIS) approach. These sources include underground storage tanks (USTs) and many sites listed under the Resource Conservation and Recovery Act (RCRA), the State Model Toxics Control Act (MTCA), and Federal site lists.

The results of this analysis indicated many confirmed sources of contamination in the study area. Most of these are related to leaking underground storage tanks (LUSTs). In addition, many "non-leaking" USTs were identified in the study area. They comprise potential sources of contamination. Because they are ubiquitous, the USTs and LUSTs present the most significant threat to groundwater quality in the water utility's service area. Potential contaminant sites are listed for each wellhead in Appendix K.

5.1.4 Wellhead Susceptibility

The results of this analysis indicate that the following wells are most susceptible to contamination because of their shallow depth and proximity to existing and potential contaminant sources:

- Wells 9, 17, 18, and 19, which lie along the Highway 99 commercial/industrial corridor
- Wells 5, 7, and 23, lie near confirmed sources of contamination that include the Boomsnub/BOC Superfund site

5.1.5 Source-Loss Analysis

A source-loss analysis completed for the water utility's wells indicates that the Utility has the ability to manage both short and long-term losses to the system as part of the Emergency Response Planning described in Chapter 6.3.

5.2 Recommendations

The following recommendations are based on the results of work completed for WHP planning. These implementation strategies focus on public education, contaminant source management, monitoring, data management, and land use and regulatory controls. Wellhead protection can also be affected by coordination with other regional agencies and by emergency response and contingency planning, as discussed below.

5.2.1 Public Education and Technical Assistance

Strategies for public education include developing school programs and other educational materials such as the Annual Water Quality (or Consumer Confidence) Report (see Appendix L). Educational materials should also be developed for facility owners in WHPAs to convey the importance of proper waste handling and disposal. In addition, technical assistance for small businesses within designated WHPAs should be increased.

5.2.2 Contaminant Source Management

Businesses within designated WHPAs should be inventoried to assess potential contaminant sources and waste handling practices. USTs that were not identified through this study should also be inventoried, including residential home heating oil USTs. Other strategies for managing possible contaminant sources include Encouraging residents to connect to sewer systems where possible and reviewing stormwater management practices to identify areas of concern for groundwater quality. Clark Public Utilities should

request and/or encourage the cooperation of agencies such as Ecology and the Southwest Washington Health Department (SWWHD).

5.3 Monitoring and Data Management

Water-quality and other data that could assist in wellhead protection should be collected via cooperative programs with Clark County, other local purveyors such as the Cities of Battle Ground, Vancouver, and Camas and SWWHD. Existing programs should be reviewed. Data obtained through such programs should be integrated into the water utility's water-quality database.

5.3.1 Land Use and Regulatory Controls

Strategies related to land-use and regulatory controls include encouraging and supporting County ordinances related to wellhead protection and water quality, including Clark County's Critical Aquifer Recharge Areas (CARA) ordinance (Chapter 13.70) and Clark County's Water Quality ordinance (Chapter 13.26A).

5.3.2 Regional Coordination

The water utility may want to coordinate with other purveyors in the county to coordinate WHP planning activities and water supply planning and development issues such as contingency planning and expansion of interties.

5.3.3 Planning Strategies

Developing strategies for emergency response and contingency planning is essential to wellhead protection. Such strategies include notifying emergency response organizations on the location of WHPAs, establishing communication protocols with first responders, and preparing a contingency plan that covers short- and long-term responses if one or more sources are lost. In addition, the water utility should consider completing a hydraulic assessment of the distribution system to ensure that the contingency plans adequately address major losses of supply or storage capacity.

Long-term strategies should focus on developing new deep supply wells to replace existing shallow wells (Wells 9, 17, 18, and 19), which are at a high risk of contamination. Supplies from the new deep wells would be better protected from potential land-use impacts.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 6

Operations Program

6.1 Organizational Structure and Staff Responsibility

The management structure of the Clark Public Utilities water utility is headed by a board of three elected Commissioners each serving staggered six-year terms. The Board establishes policy and sets electric and water rates, along with other charges. A general manager is employed with the responsibility of day-to-day operation of both the electric and water utilities. Key personnel and position of authority are delineated in Figure 6-1. The general manager and other key water personnel's responsibilities are described below.

- Director of Water Services
- Office Supervisor
- Civil Engineers
- Water Quality Manager
- Water Operations Manager
- Construction Supervisor
- Environmental Services Supervisor

6.1.1 General Manager

The General Manager is ultimately responsible for all functions of the water and electric utilities. This position has the authority to implement both daily and long-range water utility policy in a manner most beneficial to the utility and its customers. The General Manager evaluates and selects long-range water utility planning programs for conformance with the Water utility goals, objectives, and budgetary constraints.

6.1.2 Director of Water Services

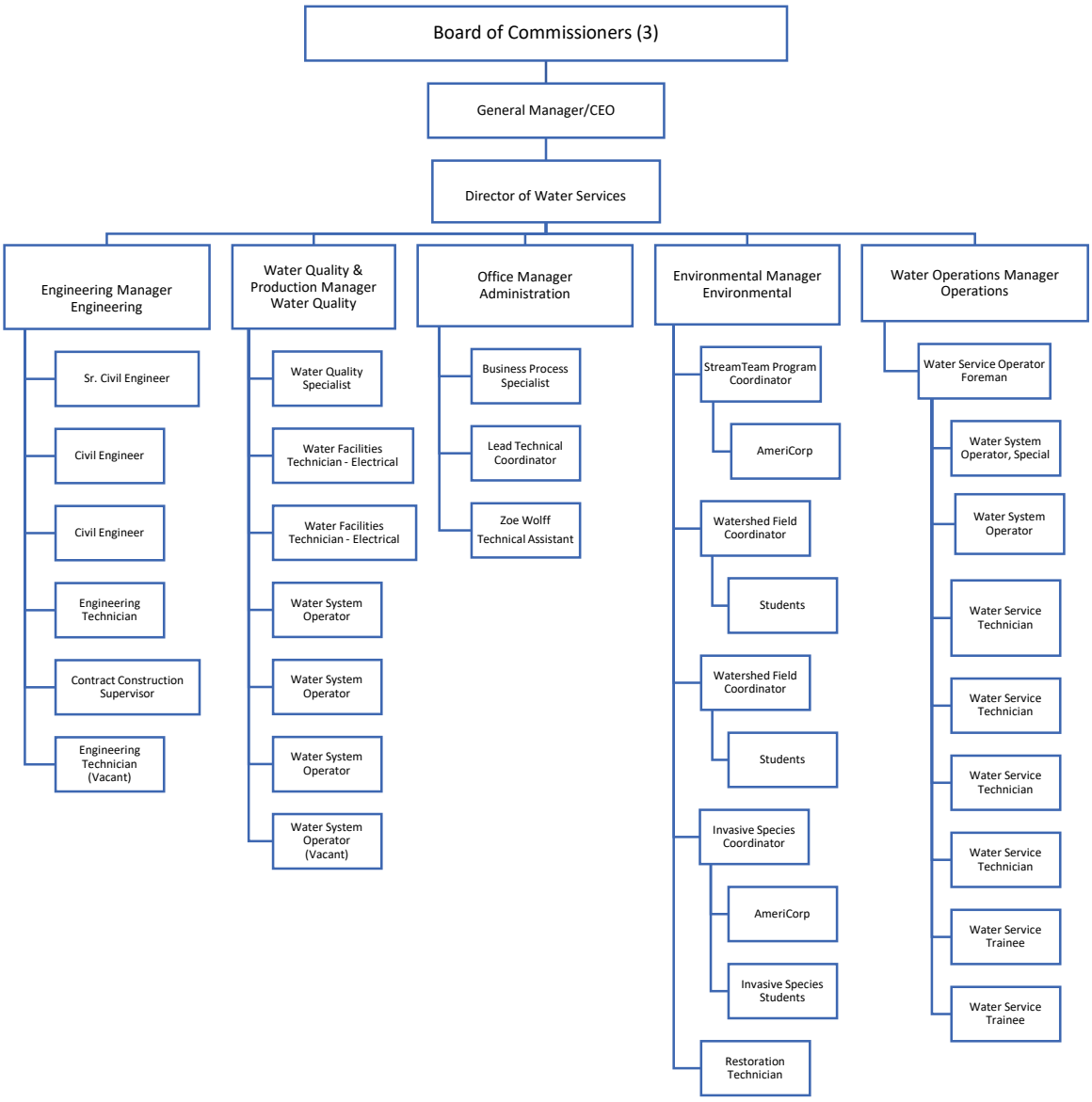
The Director is responsible to the General Manager and the elected Board of Commissioners for all matters concerning the water system. Responsibilities include developing the budget, implementing the water utility resolutions regarding water service, evaluating personnel requirements, and daily administration/management necessary for effectively operating a water system.

6.1.3 Engineering Manager

The manager of the water utilities civil engineering section oversees the Civil Engineering group. The Civil Engineers are responsible for all system design and plan and specification review. This includes all customer and utility projects. In addition, the Civil Engineers have responsibility for supervision and management of all capital projects from planning to construction.

The Civil Engineers are also responsible for handling all requests for customer service. This position is responsible for developing all engineering drawing and coordinating construction of new services. In addition, response to customer inquiries is a responsibility of this position.

Figure 6-1 | Water Services Organization Chart



6.1.4 Field Operations Manager

The Water Operations Manager is in charge of all daily field operations. This position is responsible for scheduling and dispatching all crews, equipment, and material for water utility operations. These duties include managing the water meter program, late shift duties, distribution system maintenance, crew training, and customer inquiries.

This position also has responsibility for developing and conducting a maintenance and safety training program for the utility. The construction inspection services also report to the Operations Manager.

6.1.5 Water Quality and SCADA Operations Manager

The water utility's Water Quality Manager is responsible for scheduling, monitoring, and testing the water system and all the water utility water sources. This position is also responsible for water quality sampling

and the cross-connection control program. This individual has an understanding of DOH water testing regulations and reporting requirements for the system, as well as the satellite water systems.

The Manager is in charge of monitoring all sources of supply, including the well telemetry system operation. Other duties include responsibility for all water supply development efforts.

This position is recognized by the DOH as being in responsible charge of the daily operational activities of the water system. Consequently, this position requires that the individual be certified as a Water Distribution Manager IV by DOH.

6.2 Waterworks Certification

In accordance with Chapter 246-290 WAC, Waterworks Operator Certification, all public water systems with more than 100 services are required to have a certified operator. Certified personnel are required for positions in charge of managing the water system and positions assigned to the lead responsibility for monitoring or improving water quality. The District has 18 certified operators as shown in Table 6-1. John Roth is the designated Operator in Charge of the water system.

Table 6-1 | Clark Public Utilities Operator Certifications

Name	Operator Number	Certification Level		
		Water Distribution	Water Treatment	Cross Connection
John Roth[1]	10060	WDM 4	WTPO 2	CCS
Gary St John[1, 2]	9840	WDM 4	WTPO 2	CCS
Andrew Holmes	13239	WDM 4	WTPO 2	CCS
Bailey Burk	15215	WDM 1-it		CCS
Dale Blancas	11485	WDM 2, WDS	WTPO 2	CCS
David Neibert	8358	WDM 2	WTPO 1	CCS
Dillon Leach	13040	WDM 1	WTPO 1	CCS
John Stafford	7347	WDM 4, WDS	WTPO 2	CCS
Joshua Cowperthwait	15165	WDM 2-it		CCS
Kyle McKee	13995	WDM 2	WTPO 1-it	CCS
Matthew Meier	14891	WDM 1-it		CCS
Michael Chidester	14904	WDM 1-it		CCS
Oscar Maciel	9595	WDM 2	WTPO 1	CCS

Considered "mandatory operators" by DOH
Designated CCS

The operations positions must always be filled with an appropriate certified individual to keep the system in compliance with DOH. The current requirements are to have a WDM4 and a WTPO 2. The utility must also have a Cross Connection Specialist (CCS) on staff to be in compliance with DOH.

6.3 Emergency Response Plan

DOH requirements for a Comprehensive Water System Plan specify that an Emergency Response Plan be included in the Operations Program. The Emergency Response Plan must conform to the requirements of Chapter 246-290 WAC, Emergency Measures, and to the America's Water Infrastructure Act of 2018

(AWIA) Section 2013(b). The water utility has developed an Emergency Response Plan in 2020 that provides a guide when reacting to major or catastrophic system disruptions. The development, publication, and wide distribution of standard operating procedures, emergency alert rosters, and contingency planning are essential elements of the overall Emergency Response Plan. The plan describes an organizational and communications network that has sufficient flexibility to respond to the wide range of emergency conditions. A complete copy of the Emergency Response Plan is on file for review at the Water Operations Center and is located in **Appendix M**. Actions to be taken in the event of an emergency are discussed below.

6.3.1 Introduction

The Emergency Response Plan is intended to guide water utility employees in restoring water service during a major outage.

A major emergency is an event that results in loss of water to a large service area or numerous small areas and requires the total mobilization of the water utility and outside agencies and resources to restore service. Emergencies may result from natural causes of extreme intensity, duration, and extent or from man-made events, such as civil disorder or system contamination. A summary of system components potentially impacted by various types of emergencies is shown in **Table 6-2**.

During a declared major emergency condition, all the water utility operations will be carried out through the water operations center. The functions and location of the water utility trouble centers are defined in the emergency plan. The functions and locations of the Water Command Center, Water Trouble Center, and Water Operations Center are summarized in **Table 6-3, Table** 6-4**, and Table** 6-5, respectively.

Table 6-2 | Potential Disaster Effects

Disaster Type	Wells	Storage	Transmission Network	Distribution System	Telemetry and Control Systems	Power Supply System
Earthquake	X	X	X	X	X	X
Severe Windstorm	X	X			X	X
Ice/Snow Storm (Freezing Cond.)	X	X		X	X	X
Flooding	X		X	X		X
Fire	X	X			X	X
Volcanic Eruption	X	X	X	X	X	X
Drought	X					
Contamination of Water Supply	X	X		X		
Water Main Break	X	X	X	X	X	X
Vandalism	X	X	X	X	X	X
Explosion/Bomb Blast	X	X	X	X	X	
Nuclear Warfare	X	X	X	X	X	X

6.3.2 General Policies

In the event that a major emergency exists and is declared by the General Manager or his alternate, the Director of Water Services will set up the command center and put the emergency plan into effect. For the

duration of the emergency, the command center will have overall control of the water utility and related water utility resources.

6.3.2.1 Major Emergency During Working Hours

All water utility staff will report and attend to their assigned trouble centers. Water utility crews will be dispatched through the Water Operations Center.

6.3.2.2 Major Emergency During Non-Working Hours

All water utility staff will report and attend to their assigned trouble centers. Water utility crews will report to work only upon notification. The notification can occur by phone, person, or media broadcasts.

Table 6-3 | Emergency Water Director Duties

PERSON IN CHARGE – Director of Water Utility REPORTS TO – General Manager	
1.	RESPONSIBILITIES A. Overall control of water utility resources. B. Assess damage to water system. C. Set priorities for restoration of water service. D. Coordinate efforts to restore water service. E. Make arrangements for mutual aid. F. Provide emergency status updates to general manager and communication center. G. Contact DOH Engineer if emergency may cause, or threatens to cause, water loss or unplanned pressure loss events or threatens public health (Chapter 246-290 WAC). DOH number is (360) 664-0768 or after-hours number is 877-481-4901. H. Contact Southwest Washington Health District (360) 397-8428 I. Advises local fire districts of emergency if water flow for firefighting is impaired.
2.	SUPERVISES People in charge of water utility emergency centers.
3.	DIRECT CONTACTS A. General Manager B. Major Emergency Centers
4	LOCATION Water utility Operations Center - 8600 NE 117th Street Alternate Location Clark Public Utilities Electric Center - 1200 Fort Vancouver Way

Table 6-4 | Emergency Water Office Duties

PERSON IN CHARGE – Office Supervisor REPORTS TO – Director of Water Services	
1.	RESPONSIBILITIES A. Receives and logs service outage calls. B. Ensures reported outages are on service restoration priority. C. Transmits information from office records to field crews as required. D. Provides message service to field crews and their families.
2.	STAFF SUPPORT Engineering Personnel
3.	DIRECT CONTACTS Other emergency personnel, as required.
4.	LOCATION Water Utility Operations Center - 8600 NE 117th Street Alternate Location Clark Public Utilities Electric Center - 1200 Fort Vancouver Way

Table 6-5 | Emergency Operations Duties

PERSON IN CHARGE - Water Quality Manager REPORTS TO - Director of Water Utility	
1.	RESPONSIBILTIES A. In charge of emergency operations. B. Aids Director in setting restoration priorities. C. Dispatches crews to restore service in established priority. D. Advises Water Command Center of progress in restoration of water service. E. Monitors telemetry and control system in water operations center.
2.	STAFF SUPPORT Civil Engineer. Water Operations Manager. A. Makes field inspections of damage to water utility facilities and reports condition to Water Command Center. B. Ensures crews have necessary materials and equipment to restore service. C. Coordinates material purchases with purchasing center and equipment service requirements with fleet center.
3.	SUPERVISES Water utility Field Crews
4.	DIRECT CONTACTS A. Office Supervisor. B. Director of Water Services. C. Purchasing Center. D. Fleet Center.
5.	LOCATION Water utility Operations Center - 8600 NE 117th Street Alternate Location Clark Public Utilities Electric Center - 1200 Fort Vancouver Way

6.3.2.3 Sequence of Events During Non-Working Hours

- Dispatch notified of water outage and area.
- Dispatch notifies crew person on call list.

- Crew person investigates and determines severity and extent of outage.
- Crew person notifies staff person on call if situation warrants.
- Water Operations Manager notifies Director of Water services of emergency. Decision is made on declaration of emergency. If Director cannot be reached, Manager may declare an emergency for the water utility.
- Emergency stations are manned. Director or Water Operations Manager notifies dispatch and risk manager.

6.3.3 General Field Response

The initial reaction by the water utility personnel to an emergency should be to take prompt action to remove any immediate threat to public health or safety. Next, the Water Operations Manager should be contacted, and a crew dispatched to isolate the problem or damaged facility. Meanwhile, the damage should be assessed, and a determination made as to the materials and resources necessary for correction. It is essential that the water utility's repair supplies inventory status report and list of material suppliers be kept up-to-date and readily accessible to avoid unnecessary delay in restoration of service. Throughout the emergency, radio contact should be maintained between work crews, the Water Operations Manager, and other key participants to enhance coordination of the corrective effort. It is important that the General Manager and Director of Water Services are kept apprised of the emergency to permit proper public notification.

6.3.4 Emergency Response Procedures

A series of potential disasters and other emergency conditions that may impact the water utility's system, are presented herein. Actions to be taken in the event of each emergency are discussed below. Emergency restoration priorities are summarized in Table 6-6.

6.3.4.1 Emergency: Earthquake

6.3.4.1.1 Description

A major earthquake, with a magnitude of 5.0 or greater on the Richter scale, and an intensity of 9 or greater on the Modified Mercalli scale, could disrupt the source, transmission, pumping, storage, distribution, and telemetry components of the water system. In addition, power failures and interruption to conventional communication systems may occur.

6.3.4.1.2 Response

Water personnel should anticipate critical water use needs for firefighting or medical facilities resulting from an earthquake. Since they are hidden from view and at least as susceptible to ground movement as aboveground structures, pipelines, wells, and other buried facilities require closer attention in the event of an earthquake. The system should be checked thoroughly for any unexplained drop in line pressure, reduction in flow rate, pump failure, leakage, or other signs of damage.

6.3.4.2 Emergency: Power Failure/Outage

6.3.4.2.1 Description

Short- and long-term interruptions in the power supply can occur for a variety of reasons, which can affect the water system and may or may not be associated with other emergencies. In addition, power outages may be localized to one or more blocks or may affect the entire region. Facilities most affected by this type of emergency include source and booster pumping, telemetry equipment, and communication systems.

Table 6-6 | Emergency Restoration Priorities

One-half of the water utility's well capacity, together with storage capacity of the reservoirs at operating pressure levels, will provide the minimum essential water requirement for approximately four days. Therefore, wells will be restored insofar as practicable, in the following order:		
1.	HAZEL DELL WATER SYSTEM A. Well Nos. #30 & 32 B. Well No. 5[1] C. Well No. 23 D. Well Nos. 31 and 33 E. Booster No. 138 F. Well No. 21 G. Booster No. 109 (under construction) H. Well No. 27	I. Booster No. 105 J. Well No. 108 K. Booster No. 101 L. Booster No. 114 M. Booster Nos. 117 & 118 N. Booster No. 134 O. Booster No. 102 P. Booster No. 113 Q. Booster Nos. 114, 124, & 126
2.	MEADOWGLADE WATER SYSTEM A. Paradise Point WTP B. Paradise Point Wellfield	
3.	HOCKINSON WATER SYSTEM A. Well No. 105[1] B. Well No. 106[1] C. Well No. 104[1] D. Well No. 109 E. 144th St. Booster F. Bonanza Booster G. Alpine Heights H. Lang Brothers	
4.	EMERGENCY SERVICES AND PRIORITY RESTORATION OF CUSTOMER SERVICES A. Transmission mains from wells to reservoirs. B. Life support system patients, such as kidney dialysis patients. C. Major fire mains (i.e., Highway 99). D. Sewage pumping plants. E. Individual services.	
5.	IDENTIFIED LIFE SUPPORT SYSTEMS A list of patients in Clark Public Utilities' service area who currently have dialysis machines or respirators in their homes need to be developed. In case of emergency situations, they should be instructed to call 911.	

Note:
1. Emergency generator outlet installed.

6.3.4.2.2 Response

In addition to their field response, water personnel should immediately contact the electric utility to determine the nature, extent, and expected duration of the power outage. The water utility should also contact the City of Vancouver and investigate the possibility of opening the intertie at NE 47th Avenue and NE 78 Street. Refer to Table 6-7 for power outage priorities and emergency generator equipment.

Table 6-7 | Emergency Power Outage Priority Procedures

Use same priority procedures listed on **Table 6-6 Restoration Priorities**	
HAZEL DELL WATER SYSTEM Proceed with arrangement for auxiliary power to the following Hazel Dell installations.	
A. Well Nos. 30 & 32	200 HP & 250 HP
B. Well No. 5[1]	150 HP
C. Well No. 23	200 HP
D. Well Nos. 31 & 33	250 HP EA
E. Booster No. 138	3 pumps @ 40 HP EA
F. Well No. 21	200 HP
G. Booster No. 109 (under const.)	-
H. Well No. 27	40 HP
I. Booster No. 25	2 pumps @ 15 HP EA
J. Well No. 108	25 HP
K. Booster No. 101	2 pumps @ 50 HP EA
L. Booster No. 144	2 pumps @ 15 HP EA
M. Booster Nos. 117 & 118	3 pumps @ 40 HP EA & 1 @ 7.5 HP; 2 pumps @ 40 HP EA
N. Booster No. 134	2 pumps @ 30 HP EA
O. Booster No. 102	2 pumps @ 75 HP EA
P. Booster No. 113	1 pump @ 20 HP & 2 pumps @ 30 HP EA
Q. Booster Nos. 114, 124, & 126	1 pump @ 7.5 HP, 1 pump @ 25 HP, 1 pump @ 15 HP; 1 pump @ 7.5 HP, 2 pumps @ 15 HP EA; 1 pump @ 20 HP and 2 pumps @ 7.5 HP EA
Meadowglade Water System	
A. Paradise Point WTP	2- 300 HP
B. Paradise Point Wellfield	2 – 250 HP
HOCKINSON WATER SYSTEM Auxiliary power may also be required at the following Hockinson installations.	
A. Well No. 103	10 HP
B. Well No. 104[1]	40 HP
C. Well No. 105[1]	60 HP
D. Well No. 106[1]	50 HP
E. Well No. 102	5 HP
F. B.P. No. 103	10 HP
G. B.P. No. 104	5 HP
H. B.P. No. 105	5 HP
I. B.P. No. 106	10 HP
CLARK PUBLIC UTILITIES – Auxiliary Generators	
A. 180 KW	
B. 50 KW	
C. 50 KW	
OTHER EQUIPMENT In addition to CPU's own auxiliary generators, the following firms have generators as noted:	
A. Hanson Drilling	one 15 KW; one 30 KW
B. Mather & Sons	one 15 KW
C. Halton Tractor, Portland	up to 930 KW
D. E.C. Distributing, Portland	up to 75 KW
E. United Rental	up to 125 KW
In addition to generators, Hanson Drilling also has available a right-angle drive discharge head and portable diesel engine that could be installed on some of the smaller wells or at the Wilson Hill Booster Pump.	

EMERGENCY GENERATOR START UP PROCEDURE Before leaving yard:
A. Unhook battery charger electric cord. B. Turn battery charger on/off switch to off. C. Check oil level. D. Check fuel level.
Notes: Hand-Off-Auto (HOA) switch on pump electric panel is in pumphouse. Man/Aux Switch inside pumphouse. Switches all power from PUD to generator or vice versa.
PROCEDURE AT WELL SITE
A. Turn HOA switch to off. B. Pump Man/Aux switch to off. C. Plug in power cord and lock in position. D. Remove right front door panel. E. Open back door. F. Set and lock hand throttle to approximately one-half throttle. G. Switch engine control switch to manual; engine will start and automatically shut off starter. H. Run at one-half throttle until engine is warmed up. I. Adjust throttle to obtain 60 Hz on meter. J. Switch Man/Aux switch to Aux. K. Start pump by switching HOA switch to hand.
PROCEDURE AFTER USING
A. Fill fuel tank (diesel). B. Check oil. C. Turn battery charger on/off switch to on. D. Plug in battery charger.

Notes:

1. Denotes emergency generator outlet installed.
   1 HP requires approximately 1 kilowatt.

6.3.4.3 Emergency: Water Transmission Main Damage

6.3.4.3.1 Description

Rupture or leakage in the transmission lines from wells could be a result of earthquake, pressure surge, vandalism, bomb blast, construction, soil scour, corrosion, or material failure. A system-wide major break would drain connected storage facilities and present a flood and erosion threat to nearby areas. It is unlikely that the entire system would be affected.

6.3.4.3.2 Response

Such an event requires prompt action by the water utility personnel to isolate the damaged section and, thus, minimize the disruption of service for the rest of the system. If transmission paths from wells are shut down, the affected wells should be turned off manually, and a red tag placed on the telemetry system. The size and nature of the rupture must be evaluated promptly to ensure that adequate repair materials, excavation equipment, dewatering facilities, and trained personnel are deployed immediately. A field response should also address the need to re-route traffic and warn businesses and residences possibly affected by the break. Floods may result in transmission main ruptures at crossings of Salmon Creek. All creek crossings should be checked if system damage is suspected. Ruptured crossings may be secured until flooding subsides and working conditions are safe.

Setting hydrant meters at nearby hydrants can provide emergency water supplies to affected areas. For prolonged outages, arrangements may be made to haul water by tankers to impacted areas. Proceed with restoration of service in accordance with the following service restoration priorities.

6.3.4.4 Emergency: Reservoir Structural Damage

6.3.4.4.1 Description

Reservoirs are designed to withstand earthquakes that can be expected within this seismic zone. Severe earthquakes may result in plate buckling and minor leaks in the tanks.

6.3.4.4.2 Response

Each reservoir should be checked for signs of damage. If any damage is evident, the water level in the reservoir should be drawn down below the level of damage. The tank should be taken out of service until it can be inspected and repaired. The annual reservoir inspection report should be completed and turned into the Water Operations Center.

6.3.4.5 Emergency: Contamination of Source of Supply

6.3.4.5.1 Description

Sources of contamination may occur in the aquifer or wells and can be the result of either man-made or natural occurrences. A partial list of possible contamination to sources includes septic tank drainfield effluent, urban storm runoff, overland drainage flow, pesticide leachate, landfill leachate, petroleum storage leakage, chemical or petroleum spills, animal wastes, vandalism, volcanic fallout, undesirable aquatic organisms, and seawater intrusion.

6.3.4.5.2 Response

Initial response should be to isolate the contaminated facilities from the rest of the system. Other appropriate measures will be determined according to the type, location, nature, and entry path of the contaminant. In addition to their field response, the water utility personnel should ensure that appropriate health authorities are contacted. They need to determine, if possible, the extent of contamination in the system and prepare an appropriate public information program.

6.3.4.6 Emergency: High Water Demand

6.3.4.6.1 Description

Pumps and reservoirs are not keeping up with water demand. The water levels in all reservoirs and wells are declining.

6.3.4.6.2 Response

During periods of high-water demand, the Water Operations Center may be staffed continuously until all reservoirs are refilled.

- Hazel Dell Areas – Log well pumping rates hourly. Compare with current pumping rates at half hour intervals. If there is a sharp decline in the pumping rate (gpm) on any well, take the well out of service and investigate for early closure of reservoir altitude valves.

- Hockinson/Lewis River Area – Log reservoir levels at one half hour intervals.

6.3.4.7 Confirmed Coliform Contamination Event

6.3.4.7.1 Description

Confirmation of E. Coli or Fecal Coliform contamination is detected in the distribution system or at a point of entry.

6.3.4.7.2 Response

- Contact DOH immediately for guidance on System Assessment and Public Notification requirements.

6.4 Routine and Preventive Maintenance

Good preventative maintenance is both cost-effective and a deterrent to emergency conditions. By following a set schedule of maintenance activities, the water utility can ensure efficient and reliable system operation, extend the life of equipment, and provide an early warning of mechanical breakdown. The water utility follows a schedule of monitoring and maintaining the facilities throughout the distribution system. Records of maintenance activities should be kept on separate forms for wells, reservoirs, valves, hydrants, pumps, meters, and cross connection control devices.

Preventative maintenance also requires adequate security to prevent or discourage unauthorized use, theft, or vandalism of facilities. All major equipment should be securely locked while unattended. This includes all control valves, sources, booster facilities, and storage reservoirs. Security is important to protect system integrity and to minimize liability to the water utility due to intruder/injury cases. The major facilities should also be included in routine law enforcement agency security patrols.

6.5 Water Quality Sampling and Violation Response Procedures

The water quality standards of the federal Safe Drinking Water Act (SDWA) became effective in the State of Washington in June 1977. In 1986, the federal government amended the SDWA. The SDWA was amended again in 1996. The implementation and enforcement of water quality regulations is the responsibility of DOH.

6.5.1 Present Monitoring Requirements

The rules and regulations of the DOH regarding Public Water Supplies, Chapter 246-290 WAC, set specific water quality monitoring requirements for testing water quality from the sources utilized for public supply.

Monitoring requirements have been established for bacteriological, inorganic chemical, volatile and synthetic organic, lead and copper and radionuclide parameters based on the source of water supply and the size of the water system. These parameters are utilized because of their potential impact on human health when present in the water in concentrations exceeding the allowable maximum contaminant level (MCL). Water Quality sampling procedures are outlined in Table 6-8.

Table 6-8 | Water Quality Sampling Procedures

1. Bacteriological Samples	Clark Public Utilities takes routine monthly distribution samples along with investigative samples for newly constructed water mains. Samples should be taken from interior faucets, if possible, which were identified according to a written coliform monitoring plan and base routine monitoring upon the plan. Clark Public Utilities' Coliform

	Monitoring Plan, which has been approved by DOH, is located in **Appendix N**. DOH guideline titled Preparation of a Coliform Monitoring Plan is available to assist in preparing this plan. If present, strainers and washers should be removed from faucet taps before taking the samples. Spray the tap with a sodium hypochlorite solution. The sample tap should be flushed several minutes then turned off and flamed to sterilize the tap. The faucet will then be turned on and flushed for several minutes again before taking the sample. Samples are collected in 100 ml bottles, as furnished by the testing lab. These bottles have been sterilized and sealed and care must be taken that neither the underside of the cap nor the top edge of the bottle is touched. Do not rinse out the sample bottle. The lab sample form should be filled out by the person taking the sample and sent with the sample to the testing lab within 12 to 24 hours. Instructions for taking samples are on the back of the form. Clark Public Utilities should ensure the person taking the sample fills out the form completely and indicates the source of water and type of sample being submitted. Sample sites for the monitoring program should be plotted on a map of the system to ensure that sampling efforts are not overly concentrated in any one area.
2. Inorganic Chemical Samples	Samples should be taken at the source, before treatment, in two one-quart containers per source, which are available from certified laboratories. Samples shall be taken while the source pumps are in operation. Sampling forms should be filled out by the person taking the sample and sent with the sample to the testing lab.
3. Disinfection By-Products	The water utility is required to collect total trihalomethane and Haloacetic acid samples for every treated point of entry and at distribution sites included in the disinfection by products monitoring plan.
4. Lead and Copper Sampling	One round of lead and copper sampling is required every three years. Clark Public Utilities does not exceed the action level and is optimized for corrosion control treatment. The last round was conducted in 2000. Samples are required from selected homes that have been identified as having indoor plumbing that might leach lead or copper in the water. Samples are "first draw" samples taken in the morning.
5. Synthetic and Volatile Organic Chemicals	Volatile organic chemical sampling is required once every 3 years for all wells. Clark Public Utilities has a waiver requiring synthetic organic chemical samples once every nine years. That waiver is up in 2001 and should be renewed. Clark Public Utilities will need to test for synthetic organic chemicals once at all wells in 2001 to receive the 9-year waiver.
6. Radionuclide Samples	Gross Alpha radionuclide samples are required once every 4 years from each well.
7. PFAS	The Utility must collect PFAS samples for compounds with a State Action Level at the entry points to the distribution system and have them analyzed by EPA Method 537.1 or 533 by a lab accredited for these analytes in Washington State between 2023 and 2025. State Action Levels have been established for PFOA, PFOS, PFNA, PFHxS and PFBS.

6.5.2 Reporting and Public Notification

The water utility is required to provide periodic reports to DOH, which summarize the results of water quality testing. If any MCLs are exceeded, both DOH and the public must be notified in accordance with procedures specified in WAC 246-290-310, WAC 246-290-320, and WAC 246-290-495.

Table 6-9 summarizes the reporting, check sampling, and public notification requirements for the water utility. **Table 6-9** specifies the procedures under which public notification can be carried out. Required public notification language can be found at www.epa.gov/safewater/pn.html.

Although each public notification should be developed with the assistance and concurrence of the DOH District Engineer, this example illustrates important categories of information to be included. At a minimum the notification should state the sampling criteria, identify when the violation occurred, identify what corrective measures have been taken, and inform the customers what, if any, precautionary steps should be taken. In all cases the DOH Regional Engineer should also be consulted before issuing public notices.

6.5.3 Record Keeping

The water utility is also responsible for maintaining certain records for specified periods. These requirements are listed in Table 6-10.

6.5.4 Customer Complaints

Clark PUD takes a systematic approach to handle customer complaints concerning the water system. Staff members familiar with system and operating conditions handle all relevant calls. A record is be kept of all customer complaints and includes follow-up work undertaken to correct the problem. See Table 6-11 for an example of a customer complaint record.

Table 6-9 | Reporting, Check Sampling, Public Notification Requirement for Water Quality Monitoring Program

COLIFORM MONITORING	If coliform bacteria are present in any routine sample that has not been invalidated, the water utility must collect repeat samples at the following locations:
Main CPU System 3 Repeat Samples	➢ Site of previous sample with a coliform presence ➢ Within five active services upstream of site of sample with a coliform presence ➢ Within five active services downstream of site of sample with a coliform presence For the main CPU system, a nonacute MCL violation occurs if 5 percent or more of the coliform samples in a month are positive. If a repeat sample is positive DOH needs to be contacted and additional repeat samples are needed. For the satellite systems, more than one positive sample constitutes a MCL violation. Satellite systems under a 1,000 population are required to take one routine sample a month. Satellite systems greater than a 1,000 population require two routine samples or more a month. For satellite systems greater than a 1,000 population repeat sampling is the same as the main CPU system. For satellite systems under a 1,000 population 4 repeat samples are required for a positive routine sample.
Satellite System (<1,000 population) repeat sampling 4 samples	➢ Site of previous sample with a coliform presence ➢ Within five active services upstream of site of sample with a coliform presence ➢ Within five active services downstream of site of sample with a coliform presence ➢ At any other service or from a location most susceptible to contamination (well, reservoir, etc.). For all satellite systems, 5 routine monthly samples are required the month after one or more samples were positive for coliform bacteria. An acute MCL violation occurs when a water system exceeds the MCL for Fecal Coliform or E. Coli. For all water systems this means at least one positive routine sample and at least one positive repeat sample, with one of the samples being positive for fecal coliform or E. Coli. If any sample is positive for fecal coliform or E. Coli DOH must be notified by the end of the business day that the water system is notified. If an acute coliform MCL violation occurs the following steps need to be taken. ➢ Notify DOH immediately at (360) 664-0768 during work hours or (877) 481-4901 at all other times.

	➢ Notify system users within 24 hours using mandatory health effects language. A boil water advisory will be required. The notification will go out through television and radio stations. ➢ Determine possible causes for violation and correct the situation as soon as possible. A non-acute coliform MCL violation occurs when a water system exceeds the MCL for total coliform. For the CPU main system this means more than 5 percent of the samples in a month are positive for total coliform bacteria. For satellite systems this means more than one sample is positive for total coliform bacteria. If a non-acute coliform MCL violation occurs the following steps need to be taken. ➢ Notify DOH by the end of the next business day after determining violation occurred ➢ Notify system users through public notification methods approved by DOH. This includes through the newspaper within 14 days and by hand delivery or mail notification within 30 days. ➢ Determine possible causes for violation and correct the situation as soon as possible.
NITRATE SAMPLING	If an annual nitrate sample result is 5 mg/l or greater, quarterly sampling at that site will be required for at least one year. Sampling can be reduced to annually by the state if four consecutive quarterly samples are reliably below the MCL of 10 mg/l. If a nitrate sample exceeds the MCL of 10 mg/L a confirmation sample needs to be taken within 24 hours. Compliance with the MCL will be based on the average of the two results. If the MCL is exceeded the following steps need to be taken: ➢ Notify DOH within 48 hours. ➢ Provide public notification within 72 hours by area radio and television stations. ➢ Come up with a plan to either treat the contaminated water or discontinue use of the source. ➢ Provide public notification through newspapers within 14 days and mailings within 45 days if violation continues.
INORGANIC CHEMICALS OTHER THAN NITRATE	If any routine sampling result exceeds the MCL a confirmation sample needs to be taken as soon as possible but not to exceed two weeks. Compliance will be based on the average of the routine and confirmation sample results. If an MCL is exceeded contact DOH within 48 hours and provide public notification through newspapers within 14 days and/or mailings within 45 days. DOH will provide guidance on what additional sampling will be needed.
RADIONUCLIDES	If a gross alpha sample is greater than 5 pCi/L notify DOH and conduct follow-up sampling as requested by DOH. An MCL exceedance will require public notification.
SYNTHETIC ORGANIC CHEMICALS (SOC'S)	If any routine sample posts a detection of an SOC quarterly sampling for that chemical will be required for that source. If one or more of related contaminants are detected (aldicarb, aldicarb sulfone, aldicarb sulfoxide, heptachlor, heptachlor epoxide) quarterly sampling will be required for all related contaminants for that source. Sampling may be reduced to annually by the state if quarterly samples show the SOC to be reliably and consistently below the MCL. Systems with three annual samples of no detections can apply to the state for a waiver. If a routine sample exceeds an MCL for a SOC, a confirmation sample will be required. If the average of the routine and confirmation sample exceeds the MCL, the system is in violation. Public notification is required, and you need to contact DOH within 48 hours of confirmation sample results. Public notification is required through newspapers within 14 days and/or mailings within 45 days. DOH will provide guidance on what additional sampling is needed.
TRIHALOMETHANES	When the Maximum Trihalomethane Potential (MTTP) is equal to or greater than 0.10 mg/L system will promptly collect a confirmation sample. If the confirmation sample is

	equal to or greater than 0.10 mg/L the system will notify DOH and provide follow-up action, including public notification, and additional monitoring as required.
VOLATILE ORGANIC CHEMICALS (VOC'S)	If any routine sample posts a detection of an SOC quarterly sampling for that chemical will be required for that source. If one or more of the two carbon organic chemicals are detected (trichloroethylene, tetrachloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, and 1,1-dichloroethylene) vinyl chloride sampling will be required for that source. Sampling may be reduced to annually by the state if quarterly samples show the SOC to be reliably and consistently below the MCL. Systems with three annual samples of no detections can apply to the state for a waiver. If a routine sample exceeds an MCL for a SOC, a confirmation sample will be required. If the average of the routine and confirmation sample exceeds the MCL, the system is in violation. Public notification is required, and you need to contact DOH within 48 hours of confirmation sample results. Public notification is required through newspapers within 14 days and/or mailings within 45 days. DOH will provide guidance on what additional sampling is needed.
LEAD AND COPPER	Water systems that exceed the lead action level (AL) must deliver the USEPA-approved public education program to its customers within 60 days of determination. This program informs the public about the health impacts of lead and how to reduce exposure to lead from water, such as tap flushing and checking for lead solder in new plumbing. Additionally, systems exceeding the lead AL must include mandatory alert language on all water bills within 60 days. In addition, CPU shall offer to sample the water of any customer who requests it. CPU is not required to pay for the collection or the analysis of the sample. The general public notification requirements of the SDWA also apply to the Lead and Copper Rule. Tier 1 notification is required for violations of treatment techniques and failure to comply with deadlines. Tier 2 notification is triggered by failure to comply with testing and monitoring requirements. Violations of reporting requirements and exceedances of the copper AL do not require public notification. In all cases, contact DOH upon identification of any problems and initiate corrective action.
SECONDARY CONTAMINANT (IRON AND MANGANESE) MONITORING	CPU currently has three treatment systems for iron and manganese. Monthly testing is required for iron and manganese is required at each source treated after treatment but before the water enters the distribution system. If iron and/or manganese levels exceed the secondary MCL four months or more out of the year DOH needs to be notified and follow-up action may be needed.
CHLORINATION	CPU chlorinates the water to provide disinfection and leave a chlorine residual in the water. CPU is required to monitor the chlorine residual in the system on a daily basis and provide monthly reports to DOH. A measurable chlorine residual should be present in all parts of the distribution system.

Note:
DOH, S.W. Drinking Water Operations, Regional Engineer or Water Quality Specialist, PO Box 47823, Olympia, WA 98504-7823; (360) 664-0768. The after-hours emergency number is (877) 481-4901.

Table 6-10 | Retention of Records of Operations and Analysis

Bacteriological Analysis	5 Years
Chemical Analysis	For as long as the system is in operation.
Records of Action Taken to Correct MCL Violations	3 Years after Last Violation
Sanitary Survey Data	10 Years after Completion
Records Regarding a Variance or Exemption	10 Years Following Expiration of Variance or Exemption
Records Concerning Public Notification	3 Years after Date of Notification
Chlorine Residual	3 Years (copies sent to DOH monthly)
Source Meter Readings (daily)	10 Years

Project Reports, Construction Records and Drawings, Inspection Reports and Approvals	For life of facility.

Table 6-11 | Example Customer Complaints and Follow-Up Action List

Date: _____

Time: _____

Received By: _____

Complainant's Name and Phone No.: _____

Complainant's Address: _____

Nature of Complaint: _____

Water Quality ☐ Water Pressure ☐ Leak ☐ Service Problem ☐ Other ☐

Description: _____

_____

_____

_____

Follow-Up Action: _____

_____

_____

_____

6.6 Cross-Connection Control Program

As stipulated by Chapter 246-290 WAC, all cross-connections between the water utility's system and a non-potable supply are prohibited. It is the purveyor's responsibility to prevent contamination of the public water system from cross-connections. An effective program requires coordination among the purveyor, the customer, building inspector, and the health department. Basic to an effective program are local ordinances and trained personnel to enforce and monitor the elimination or protection from cross-connections. A copy of the written cross connection control program is included as Appendix O. The water utility's cross-connection control program was updated in October 2023.

Categories of cross-connections requiring backflow prevention assemblies are defined by state law. Backflow prevention assembly models approved by DOH must be used on all cross-connections. Backflow prevention devices should be inspected and tested annually. The water utility currently has fifteen people on-staff who are certified as a Cross Connection Control Specialist I (CCSI) and one person as a Cross Connection Control Specialist II (CCSII).

The utility has an inventory of all backflow prevention assemblies throughout the system that is kept and updated. An individual file exists for each assembly. It shows its location, owner, manufacturer, model number, and result of the most recent test. The inventory and file system are kept up-to-date and the cross-connection control assemblies inspected and maintained on an annual basis. The utility has a computer database program which helps with the management of the cross-connection control program.

CHAPTER 7

Capital Improvement Plan

Recommended capital improvements for the Clark Public Utilities water system include improvements to the following:

- Distribution storage facilities and booster pumping stations,
- Source of supply and treatment facilities,
- Meters and meter installations,
- Distribution piping and appurtenances.

Projects in the capital improvement plan were identified by each of the categories shown above. A summary of the 20-year capital improvement plan is shown in **Table 7-1**. The locations of the 10-and 20-year CIP projects are shown on **Figure 7-1**.

The capital improvement plan provides for improvements to Clark Public Utilities' water system over a 20-year planning horizon. Projects are needed for source of supply, distribution, storage, pumping and resource management. **Table 7-1** identifies a summary of projects by type. **Appendix P** includes identification of individual capital improvement projects in the 6-year planning horizon, their timing and estimated costs in 2010 dollars, and the type of project. Individual projects have not been identified in the 7–20-year planning horizon. Future growth and the pressure zone hydraulic analysis will help identify needs for the 7–20-year time period.

7.1 Environmental Review

SEPA and documents for the water system plan are provided in **Appendix Q**.

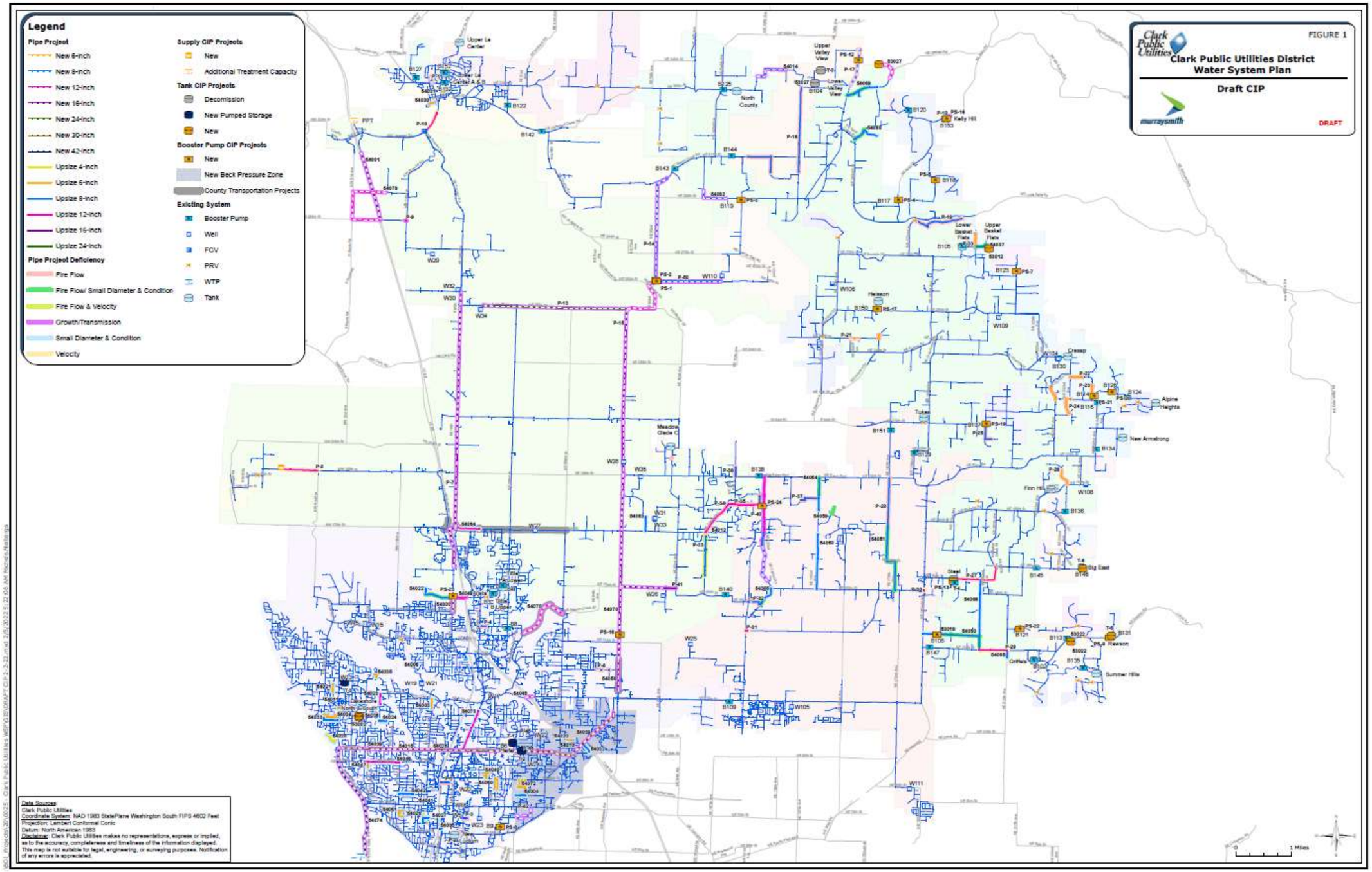
Table 7-1 | Capital Improvement Plan Summary 2010 - 2030

Year	Storage & Boosters	Mains	Source	Meters	Total
2022	$165,000	$83,000	$1,545,000	$1,001	$1,794,001
2023	420,000	10,445,000	713,000	1,100	11,579,100
2024	480,000	718,000	1,275,000	7,129	2,480,129
2025	1,728,000	3,089,000	615,000	24,342	5,456,342
2026	660,000	7,828,000		53,736	8,541,736
2027	615,000	7,828,000		90,868	8,533,868
2028	345,000	1,235,000	5,550,000	149,300	7,279,300
2029	968,000	1,077,000		462,168	2,507,168
2030	1,313,000	2,314,000		744,891	4,371,891
2031	1,448,000	9,738,000		843,267	12,029,267
2032	13,125,000	3,571,000	1,800,000	1,024,170	19,520,170
2033	3,000,000	3,210,000		1,658,802	7,868,802
2034	245,000	3,574,000		1,700,963	5,519,963
2035	525,000	7,973,000		1,730,210	10,228,210

Year	Storage & Boosters	Mains	Source	Meters	Total
2036	113,000	895,000	1,800,000	1,743,906	4,551,906
2037	1,408,000	1,261,000		1,747,973	4,416,973
2038	470,000	1,293,000		1,730,944	3,493,944
2039	525,000	5,669,000		1,366,674	7,560,674
2040	113,000	8,141,000	1,800,000	1,042,335	11,096,335
2041		1,940,000		972,826	2,912,826
2042		3,256,000		799,078	4,055,078

Note:
All costs and cost estimates for capital projects include Design, contingency and overhead costs.

Figure 7-1


Legend
Pipe Project
New 6-inch
New 8-inch
New 12-inch
New 16-inch
New 24-inch
New 30-inch
New 42-inch
Upsize 4-inch
Upsize 6-inch
Upsize 8-inch
Upsize 12-inch
Upsize 16-inch
Upsize 24-inch
Pipe Project Deficiency
Fire Flow
Fire Flow/ Small Diameter & Condition
Fire Flow & Velocity
Growth/Transmission
Small Diameter & Condition
Velocity
Supply CIP Projects
New
Additional Treatment Capacity
Tank CIP Projects
Decomission
New Pumped Storage
New
Booster Pump CIP Projects
New
New Beck Pressure Zone
County Transportation Projects
Existing System
Booster Pump
Well
FCV
PRV
WTP
Tank
Clark Public Utilities
FIGURE 1
Clark Public Utilities District
Water System Plan
Draft CIP
murraysmith
DRAFT
Data Sources
Clark Public Utilities
Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Disclaimer: Clark Public Utilities makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.
0
1 Miles

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 8

Financing Strategy

8.1 Introduction

The primary objective of the financing strategy for the project is to fund growth-related improvements through growth-related revenues. A discussion of internal and external funding alternatives is provided below, followed by the recommended financial strategy.

8.2 Discussion of Funding Alternatives

The capital funding alternatives for the water utility include State and Federal grant/loan programs and municipal bonds financed through rate revenue and replacement projects through rates and bonds. Internal sources of funding available for capital projects include a combination of general facility charges and monthly user rates.

8.2.1 Internal Funding Sources

Internal funding sources include system development charges and water monthly user charges.

8.2.1.1 System Development Charges

This source of funding is a one-time charge, paid at the time a user makes a connection to the water system. It is frequently called a general facility charge, a connection charge, or a system development charge. In essence, the system development charge is for the right to use capacity in the major facilities of the system. Municipalities charge this fee as a way for a new property to pay an equitable share in the cost of existing as well as new facilities. The basis of the charge may be upon the historical value of the existing facilities, the replacement value of existing facilities, the projected new facilities required to meet projected growth, or combinations thereof.

For Clark Public Utilities, system development charges are calculated based on capital requirements for the entire system. Some new main extensions are financed through developer contributions.

8.2.1.2 Monthly User Charges

Monthly user charges for municipal utilities are generally structured to satisfy revenue requirements related to operating and maintenance expenses, taxes, debt service obligations from bond sales, and those capital construction items funded directly from rates. These revenue requirements are distributed to different classes of customers using cost of service techniques to develop equitable monthly rates.

The level of these rates is impacted by several important items, including the level of exterior grant funding, debt service requirements related to bond sales and other loan issuances, and additional debt service coverage required in the bond covenants to insure satisfactory maintenance of existing facilities. Debt service coverage frequently consists of 25 to 50 percent of the total debt service. This extra debt service coverage must be collected annually from rates but can be completely expended each year in the performance of routine system maintenance and repairs.

8.3 External Funding Sources

External Funding sources include grant and loan programs administered by the State and Federal Government as well as bonds issued by water utilities.

8.3.1 Grants and Loans

There are several grant and loan programs available to water utilities as shown on Table 8-1.

8.3.2 Municipal Bonds

Municipal Bonds are a common means of financing long-term capital improvements. As with conventional loans, a municipality agrees to repay the lender the face value of the municipal bond plus interest. Because municipal bonds are currently exempt from the federal income taxes, these bonds are generally issued at lower interest rates than bonds issued by private institutions. Debt service is based on the annual principal and interest payments needed in order to retire the bond. The type of bond determines the method of debt service repayment. The type of municipal bonds generally utilized for projects of this nature include the following:

8.3.3 General Obligation (GO) Bond

GO Bonds represent a pledge of the full faith and credit of a municipal entity. The entity indicates by this GO bond that all of its financial resources are available for repayment of the debt. In general, the private investor regards this type of bond with the most respect for it offers the greatest insurance that the loan will be repaid. The strength of the bond is determined by the past debt payment experience, existing debt burden, and the general activity of the municipal bond market at the time of its issue.

The limits of a utility's GO bonding capability are established in RCW 39.36. These regulations specify that no more than 7.5 percent of the City's property tax base can be utilized for the sale of GO bonds. One-third of this value is allocated to public works projects, one-third for parks and recreation projects, and one-third for general purpose bonding. Voter approval is required prior to the issuance of GO bonds. An exception is the water utility's ability to issue GO bonds equal to 0.75 percent of the tax base at the discretion of the legislative authority.

GO bonds are generally supported by liens against all real property within the community. Annual tax assessments are used to repay the bonds. These bonds are generally used to finance projects, which improve service to all customers. It is also possible to repay GO bonds from revenues related to services provided by the utility. These funds are collected in a fashion similar to that explained below for revenue bonds.

8.3.4 Revenue Bonds

Revenue bonds are issued under the concept that revenues from system charges should pay debt rather than placing the burden on the general taxpayer. Bond payments are generally made from revenues such as monthly user charges and special fees, which are generated by the project being financed. No taxes are levied or pledged as a backup. Revenue bonds normally require the utility to provide further security in the form of a "debt service reserve," which is usually equal to one-year requirement of principal and interest.

Revenue bonds do not require voter approval. Normally, there are no legal limitations on the amount of revenue bonds to be issued, but the accumulated issuance of excessive amounts may be unattractive to

bond buyers because they may represent high investment risks. In addition, extensive use of revenue bonds may result in user charges, which are unacceptably high to system customers.

These bonds are generally issued at a somewhat higher interest rate than are GO bonds. They generally include financial covenants ensuring that proper operation and maintenance of the utility is accomplished through the collection of additional debt service coverage funds within the rate structure that are used for these activities.

The rate impact analysis evaluated a revenue bond sale for funding between 25 and 100 percent of the capital facility needs at a rate of 10.25 percent for 20 years. A minimum debt service coverage ratio of at least 1.3 was maintained throughout the analysis.

8.3.5 LUD Bonds

When a project involves water system improvements for adjacent properties, such as water lines extending in front of residential-type development, funding is often accomplished through formation of a LUD. A LUD bond is actually issued as a revenue bond. It can be paid back from assessment against the properties benefited, or the water utility may elect to use monthly user rates and revenues of the system to also pay the bonds.

The principle of charges for improvement district bonds is that the charge against the property must equal the benefit. There are very strict procedures under state law for establishing LUDs and for the collection of the bond funds.

.

Table 8-1 | External Funding: Water Utility Grant and Loan Programs

PLANNING Programs	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
CDBG Community Development Block Grant – General Purpose Grant Fund – Planning-Only Activities	• Comprehensive plans • Non-routine infrastructure plans • Feasibility studies • Community action plans • Low-income housing assessments	Projects must principally benefit low- to moderate income people in non-entitlement cities and counties. • Cities or towns with fewer than 50,000 people • Counties with fewer than 200,000 people	Grant • Up to $30,000 for a single jurisdiction.	2021 CDBG General Purpose application materials are due June 2, 2021. Grant awards early September. **Contact:** Jon Galow 509-847-5021 jon.galow@commerce.wa.gov Visit www.commerce.wa.gov/cdbg and click on the General Purpose grant menu for information and forms.
SOURCE WATER PROTECTION GRANT PROGRAM	Source water protection studies (watershed, hydrogeologic, feasibility studies). Eligible activities can lead to reducing the risk of contamination of a system's drinking water sources(s), or they can evaluate or build resiliency for a public water supply. They must contribute to better protecting one or more public water supply sources.	Non-profit Group A water systems. Local governments proposing a regional project. Project must be reasonably expected to provide long-term benefit to drinking water quality or quantity.	Grants • Funding is dependent upon project needs, but typically does not exceed $30,000.	Applications accepted anytime; grants awarded on a funds available basis. **Contact:** Corina Hayes Source Water Protection Program Manager 360-236-3114 corina.hayes@doh.wa.gov http://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/SourceWaterProtection.aspx Grant guidelines https://www.doh.wa.gov/Portals/1/Documents/ Pubs/331-552.pdf
RD PRE-DEVELOPMENT PLANNING GRANTS (PPG) U.S. Dept. of Agriculture Rural Development – Rural Utilities Service – Water and Waste Disposal Direct Loans and Grants	Water and/or sewer planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Low-income, small communities and systems serving areas under 10,000 population.	Planning grant to assist in paying costs associated with developing a complete application for RD funding for a proposed project. Maximum $30,000 grant. Requires minimum 25% match.	Applications accepted year-round, on a fund-available basis. **Contact:** Janice Roderick 360-704-7739 janice.roderick@usda.gov http://www.rd.usda.gov/wa

RD 'SEARCH' GRANTS: SPECIAL EVALUATION ASSISTANCE FOR RURAL COMMUNITIES U.S. Dept. of Agriculture Rural Development – Rural Utilities Service – Water and Waste Disposal Direct Loans and Grants	Water and/or sewer planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Low-income, small communities and systems serving areas under 2,500 population.	Maximum $30,000 grant. No match required.	Applications accepted year-round, on a fund-available basis. **Contact:** Janice Roderick 360-704-7739 janice.roderick@usda.gov http://www.rd.usda.gov/wa
CERB PLANNING AND FEASIBILITY GRANTS Community Economic Revitalization Board – Project-Specific Planning Program	Project-specific feasibility and pre-development studies that advance community economic development goals for industrial sector business development.	Eligible statewide • Counties, cities, towns, port districts, special districts. • Federally recognized tribes • Municipal corporations, quasi-municipal corporations w/ economic development purposes.	Grant • Up to $50,000 per application. • Requires 25% (of total project cost) matching funds.	Applications accepted year-round. The Board meets six times a year. **Contact:** Janea Delk 360-725-3151 janea.delk@commerce.wa.gov
RCAC Rural Community Assistance Corporation Feasibility and Pre-Development Loans	Water, wastewater, stormwater, and solid waste planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 or less if proposed permanent financing is through USDA Rural Development.	• Typically up to $50,000 for feasibility loan. • Typically up to $350,000 for pre-development loan. • Typically up to a 1-year term. • 5% interest rate. • 1% loan fee.	Applications accepted anytime. **Contact**: Michael Archer 406-593-0065 marcher@rcac.org Applications available online at http://www.rcac.org/lending/environmentalhttp://www.rcac.org/lending/environmental-loans/loans/
DWSRF Drinking Water State Revolving Fund Preconstruction Loans	Preparation of planning documents, engineering reports, construction documents, permits, cultural reports, environmental reports.	Group A (private and publicly owned) community and not-for-profit non-community water systems, but not federal or state-owned systems.	• $500,000 maximum per jurisdiction • 0% annual interest rate • 2% loan origination fee • 2-year time of performance • 10-year repayment period	On-line applications accepted year-round until funding exhausted. Approximately $3 million available to award each year. **Contact:** Corina Hayes 360-236-3114 Corina.hayes@doh.wa.gov For information and forms visit: http://www.doh.wa.gov/DWSRF

Economic Development Administration (EDA) United States Department of Commerce **EDA Public Works Program:** Planning, Feasibility Studies, Preliminary Engineering Reports, Environmental Consultation for distressed and disaster communities.	Drinking water infrastructure; including pre-distribution conveyance, withdrawal/harvest (i.e., well extraction), storage facilities, treatment, and distribution. Wastewater infrastructure; including conveyance, treatment facilities, discharge infrastructure and water recycling.	Municipalities, counties, cities, towns, states, not-for-profit organizations, ports, tribal nations.	Grants: • EDA investment share up to $1M. • Cost sharing required from applicant **up to** 50% of total project cost. • Grants w/ cost sharing: ○ 50%/50% to 80%/20% ○ Up to 100% for Tribal Nations	**Information:** EDA.gov **Contact:** Laura Ives 206-200-1951 lives@eda.gov **Apply at:** grants.gov
PRECONSTRUCTION ONLY Programs	**Eligible Projects**	**Eligible Applicants**	**Funding Available**	**How To Apply**
PWB PRE-CON Public Works Board Pre-Construction Program	Low-interest loans to fund pre-construction activities that prepare a specific project for construction. Water, sanitary sewer, stormwater, roads, streets, bridges, solid waste, and recycling facilities.	Counties, cities, special purpose districts, and quasi-municipal organizations that meet certain requirements. School districts and port districts are not eligible.	• Approximately $10 million available for preconstruction • Maximum loan amount $1 million per jurisdiction per biennium. • 5-year loan term. • Interest rates vary. • Pre-construction work must be completed within 2 years.	Check the Public Works Board website periodically at http://www.pwb.wa.gov to obtain the latest information on program details or to contact Public Works Board staff. **Contact:** Connie Rivera 360-704-9535 connie.rivera@commerce.wa.gov
RCAC Rural Community Assistance Corporation Feasibility and Pre-Development Loans	Water, wastewater, stormwater, or solid waste planning; environmental work; and other work to assist in developing an application for infrastructure improvements.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 or less if proposed permanent financing is through USDA Rural Development.	• Typically up to $50,000 for feasibility loan. • Typically up to $350,000 for pre-development loan. • Typically a 1-year term. • 5% interest rate. • 1% loan fee.	Applications accepted anytime. **Contact**: Michael Archer 406-593-0065 marcher@rcac.org Applications available online at http://www.rcac.org/lending/environmentalhttp://www.rcac.org/lending/environmental-loans/loans/
Economic Development Administration (EDA) United States Department of Commerce **EDA Public Works Program:** Design and/or Construction for distressed and disaster communities.	Drinking water infrastructure; including pre-distribution conveyance, withdrawal/harvest (i.e., well extraction), storage facilities, treatment, and distribution. Wastewater infrastructure; including conveyance, treatment facilities, discharge infrastructure and water recycling.	Municipalities, counties, cities, towns, states, not-for-profit organizations, ports, tribal nations.	Grants: • EDA investment share up to $10M. • Cost sharing required from applicant up to 50% of total project cost. • Grants w/ cost sharing: ○ 50%/50% to 80%/20% ○ Up to 100% for Tribal Nations	**Information:** EDA.gov **Contact:** Laura Ives 206-200-1951 lives@eda.gov **Apply at:** grants.gov

CONSTRUCTION AND DESIGN/CONSTRUCTION Programs	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
CDBG-GP Community Development Block Grant General Purpose Grants	• Final design and construction of wastewater, drinking water, side connections, stormwater, streets, and community facility projects. • Infrastructure in support of economic development or affordable housing. • Planning activities	Projects must principally benefit low- to moderate-income people in non-entitlement cities and counties. • Cities or towns with fewer than 50,000 people • Counties with fewer than 200,000 people	Maximum grant amounts: • $900,000 for construction and acquisition projects. • $500,000 for local housing rehabilitation programs. • $250,000 for local microenterprise assistance programs. • $30,000 for planning-only activities.	2021 CDBG General Purpose application materials are due June 2, 2021. Grant awards early September. **Contact:** Jacquie Andresen 360-688-0822 Jacquie.andresen@commerce.wa.gov Visit www.commerce.wa.gov/cdbg and click on the General Purpose Grants menu for information and forms.
DWSRF Drinking Water State Revolving Fund Construction Loan Program	Drinking water system infrastructure projects aimed at increasing public health protection. There is a limited amount of principal forgiveness for communities with high affordability index numbers and water system restructuring/ consolidation projects.	Group A (private and publicly owned) community and not-for-profit non-community water systems, but not federal or state-owned systems. Tribal systems are eligible provided the project is not receiving other national set-aside funding for the project.	Loan • 1.0% loan fee (water systems receiving subsidy are not subject to loan fees). • $5 million maximum per jurisdiction. • 1.25 – 1.75% interest rate. • Loan repayment period: 20 years or life of the project, whichever is less. • No local match required. • $50 million expected to be available this cycle.	Online applications available and accepted October 1 through November 30, 2021. NOTE: The timeframe for applications may be modified to coincide with infrastructure stimulus funding. Check the DWSRF webpage for updates. **Contact:** Corina Hayes 360-236-3114 Corina.hayes@doh.wa.gov For information and forms visit: http://www.doh.wa.gov/DWSRF
RD U.S. Dept. of Agriculture Rural Development - Rural Utilities Service Water and Waste Disposal Direct Loans and Grants	Pre-construction and construction associated with building, repairing, or improving drinking water, wastewater, solid waste, and stormwater facilities.	• Cities, towns, and other public bodies, tribes and private non-profit corporations serving rural areas with populations under 10,000.	Loans; Grants in some cases • Interest rates change quarterly; contact staff for latest interest rates. • Up to 40-year loan term. • No pre-payment penalty.	Applications accepted year-round on a fund-available basis. **Contact:** Janice Roderick 360-704-7739 janice.roderick@usda.gov http://www.rd.usda.gov/wa

CERB Community Economic Revitalization Board Construction Program	Public facility projects required by private sector expansion and job creation. Projects must support significant job creation or significant private investment in the state. • Bridges, roads and railroad spurs, domestic and industrial water, sanitary and storm sewers. • Electricity, natural gas and telecommunications • General purpose industrial buildings, port facilities. • Acquisition, construction, repair, reconstruction, replacement, rehabilitation	• Counties, cities, towns, port districts, special districts • Federally recognized tribes • Municipal and Quasi municipal corporations with economic development purposes.	Loans; grants in unique cases • Projects without a committed private partner allowed for in rural areas. • $3 million maximum per project, per policy. • Interest rates: 1-3% Based on Debt Service Coverage Ratio (DSCR), Distressed County, and length of loan term. • 20-year maximum loan term • Match for committed private partners: 20% (of total project cost). • Match for prospective partners: 50% (of total project cost). • Applicants must demonstrate gap in public project funding and need for CERB assistance. • CERB is authority for funding approvals.	Applications accepted year-round. The Board meets six times a year. **Contact:** Janea Delk 360-725-3151 janea.delk@commerce.wa.gov
RCAC Rural Community Assistance Corporation Intermediate Term Loan	Water, wastewater, solid waste, and stormwater facilities that primarily serve low-income rural communities.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less.	• For smaller capital needs, normally not to exceed $100,000. • Typically up to a 20-year term • 5% interest rate • 1% – 1.125% loan fee	Applications accepted anytime. **Contact**: Michael Archer 406-593-0065 marcher@rcac.org Applications available online at http://www.rcac.org/lending/environmental-loans/
RURAL WATER REVOLVING LOAN FUND	Short-term costs incurred for replacement equipment, small scale extension of services, or other small capital projects that are not a part of regular operations and maintenance for drinking water and wastewater projects.	Public entities, including municipalities, counties, special purpose districts, Native American Tribes, and corporations not operated for profit, including cooperatives, with up to 10,000 population and rural areas with no population limits.	• Loan amounts may not exceed $100,000 or 75% of the total project cost, whichever is less. Applicants will be given credit for documented project costs prior to receiving the RLF loan. • Interest rates at the lower of the poverty or market interest rate as published by USDA RD RUS, with a minimum of 3% at the time of closing. • Maximum repayment period is 10 • years. Additional ranking points for a shorter repayment period. The repayment period cannot	Applications accepted anytime. **Contact**: Tracey Hunter Evergreen Rural Water of WA 360-462-9287 thunter@erwow.org Download application online: http://nrwa.org/initiatives/revolving-loan-fund/

			exceed the useful life of the facilities or financed item.	
Economic Development Administration (EDA) United States Department of Commerce **EDA Public Works Program:** Design and/or Construction for distressed and disaster communities.	Drinking water infrastructure; including pre-distribution conveyance, withdrawal/ harvest (i.e., well extraction), storage facilities, treatment, and distribution. Wastewater infrastructure; including conveyance, treatment facilities, discharge infrastructure and water recycling.	Municipalities, counties, cities, towns, states, not-for-profit organizations, ports, tribal nations.	Grants: • EDA investment share up to $10M. • Cost sharing required from applicant up to 50% of total project cost. • Grants w/ cost sharing: ○ 50%/50% to 80%/20% ○ Up to 100% for Tribal Nations	**Information:** EDA.gov **Contact:** Laura Ives 206-200-1951 lives@eda.gov **Apply at:** grants.gov
Energy Retrofits for Public Buildings Program: Energy Efficiency Grant *(Formerly Energy Efficiency & Solar)* Washington State Department of Commerce	Retrofit projects that reduce energy consumption (electricity, gas, water, etc.) and operational costs on existing facilities and related projects owned by an eligible applicant. Projects must utilize devices that do not require fossil fuels whenever possible.	• Washington State public entities, such as local agencies, public higher education institutions, school districts, federally recognized tribal governments, and state agencies. • Some percentage of funds are reserved for projects in small towns or cities with populations of 5,000 or less. • Priority will be given to applicants who have not received funding previously, and to school districts demonstrating positive heal outcomes for reductions of PCBs.	2021: Funds available to be determined. • Maximum grant: $500,000 • Minimum match requirements will apply. • Other State funds cannot be used as match. Application schedule to be determined.	**Contact:** Kristen Kalbrener 360-515-8112 EEandS@commerce.wa.gov Visit https://www.commerce.wa.gov/growing-thehttps://www.commerce.wa.gov/growing-the-economy/energy/energy-efficiency-and-solar-grants/economy/energy/energy-efficiency-and-solar-grants/ for more information.
Energy Retrofits for Public Buildings: Solar Grants *(Formerly Energy Efficiency & Solar)* Washington State Department of Commerce	Purchase and installation of grid-tied solar photovoltaic (electric) arrays net metered with existing facilities owned by public entities. Additional points for 'Made in Washington' components.	• Washington State public entities, such as local agencies, public higher education institutions, school districts, federally recognized tribal governments, and state agencies. • Minimum payback period of 50 years. Priority will be given to applicants who have not received funding previously.	2021: $3,465,810 • Maximum amount per awardee: $350,000 • Minimum match requirements will apply. • Application scheduled to open in June 2021.	**Contact:** Jill Eikenhorst 360-522-0000 EEandS@commerce.wa.gov Visit https://www.commerce.wa.gov/growing-thehttps://www.commerce.wa.gov/growing-the-economy/energy/energy-efficiency-and-solar-grants/economy/energy/energy-efficiency-and-solar-grants/ for more information.

EMERGENCY Programs	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
RD – ECWAG U.S. Dept. of Agriculture Rural Development Emergency Community Water Assistance Grants	Domestic water projects needing emergency repairs due to an incident such as: a drought; earthquake; flood; chemical spill; fire; etc. A significant decline in quantity or quality of potable water supply that was caused by an emergency.	Public bodies, tribes and private non-profit corporations serving rural areas with populations under 10,000.	Grant; pending availability of funds • $150,000 limit for incident related emergency repairs to an existing water system. • $500,000 limit to alleviate a significant decline in potable water supply caused by an emergency.	Applications accepted year-round on a fund-available basis. **Contact:** Janice Roderick 360-704-7739 janice.roderick@usda.gov http://www.rd.usda.gov/wa
DWSRF DOH – Drinking Water State Revolving Fund Emergency Loan Program	Will financially assist eligible communities experiencing the loss of critical drinking water services or facilities due to an emergency.	• Publicly or privately owned (not for-profit) Group A community water systems with a population of fewer than 10,000. • Transient or non-transient noncommunity public water systems owned by a non-profit organization. Non-profit noncommunity water systems must submit tax-exempt documentation. • Tribal systems are eligible provided the project is not receiving other national set aside funding for the project.	Loan • Interest rate: 0%, no subsidy available • Loan fee: 1.5% • Loan term: 10 years • $500,000 maximum award per jurisdiction. • Time of performance: 2 years from contract execution to project completion date. • Repayment commencing first October after contract execution.	To be considered for an emergency loan, an applicant must submit a completed emergency application package to the department. **Contacts:** DOH Regional Engineers or Corina Hayes 360-236-3114 Corina.hayes@doh.wa.gov For information and forms visit: http://www.doh.wa.gov/DWSRF
PWB Public Works Board Emergency Loan Program: Repair, replace, rehabilitate, or reconstruct eligible systems to current standards for existing users.	A public works project made necessary by a natural disaster, or an immediate and emergent threat to the public health and safety due to unforeseen or unavoidable circumstances. Demonstrate financial need through inadequate local budget resources.	Counties, cities, special purpose districts, and quasi-municipal organizations. No school districts, port districts, or tribes per statute. Water, sanitary sewer, storm water, roads, streets, bridges, solid waste, and recycling facilities.	• Approximately $5 million for emergency loan funding. • Maximum loan amount $1 million per jurisdiction per biennium. • 20-year loan term or life of the improvement, whichever is less. • Interest rates vary. Application cycle is open until appropriated funds are exhausted.	Check the Public Works Board website periodically at: http://www.pwb.wa.gov to obtain the latest information on program details or to contact Public Works Board staff. **Contact:** Connie Rivera 360-704-9535 connie.rivera@commerce.wa.gov
HAZARD MITIGATION GRANT PROGRAM FEMA/WA Emergency Management Division	Disaster risk-reduction projects and planning after a disaster declaration in the state.	Any state, tribe, county, or local jurisdiction (incl., special purpose districts) that has a current FEMA approved hazard mitigation plan.	Varies depending on the level of disaster, but projects only need to compete at the state level. Local jurisdiction cost-share: 12.5%	Applications will be opened after a disaster declaration. Contact: Tim Cook State Hazard Mitigation Officer 253-512-7072 Tim.cook@mil.wa.gov
PUBLIC ASSISTANCE PROGRAM FEMA/WA Emergency Management Division	Construction, repair to, and restoration of publicly owned facilities damaged during a disaster. Debris-removal, life-	State, tribes, counties, and local jurisdictions directly affected by the disaster.	Varies depending on the level of disaster and total damage caused.	Applications are opened after disaster declaration. **Contact:** Gary Urbas

	saving measures, and restoration of public infrastructure.			Public Assistance Project Manager 253-512-7402 Gary.urbas@mil.wa.gov
RURAL WATER REVOLVING LOAN FUND Disaster area emergency loans	Contact staff for more information on emergency loans.	Public entities, including municipalities, counties, special purpose districts, Native American Tribes, and corporations not operated for profit, including cooperatives, with up to 10,000 population and rural areas with no population limits.	90-day, no interest, disaster area emergency loans with immediate turn-around. Download application online: http://nrwa.org/initiatives/revolving-loan-fund/	Applications accepted anytime. **Contact:** Tracey Hunter Evergreen Rural Water of WA 360-462-9287 thunter@erwow.org

8.4 Capital Improvements Funding Plan

The District prepares a Water System Comprehensive plan every ten years as required by the DOH which includes a 10-year and 20-year capital improvement plan. The last Comprehensive Plan was last completed in February 2011; the development of a new comprehensive plan is underway and is expected to be complete by the end of 2021. In addition, the District evaluates its capital requirements and adopts a new Capital Improvement Plan every year. The capital program described in this report reflects the most recent capital plan being considered by the District.

An ongoing upgrade of water distribution and source of supply facilities is currently underway. By using money from prior bond issues, loans from the State's Public Works Trust Fund and the Drinking Water State Revolving Fund (DWSRF), the District has undergone a program to replace aging and undersized water lines. The District also operates an extensive groundwater protection program to protect water supply.

As shown in Table 8-2, the projections for capital improvements provide for repair, replacements, upgrades, and improvements to the Water System to assure a continual distribution and supply of water. The plan includes expansion of the Carol J. Curtis Wellfield and the Paradise Point Regional Water Supply System, where water rights permits have been obtained. Once construction of facilities is completed, the expansion will double the current wells water supply, allowing for sustained growth within the District's service area. Construction is expected to span more than 40 years, and to provide a total supply capacity of 94.4 mgd when completed. The District has applied for DWSRF loans in the past to pay for a portion of the cost of the Paradise Point Wellfield but has made projections assuming no DWSRF funding will be used.

The annual capital improvement program is between $8.0 million and $12.9 million per year. The District has projected that its capital improvement program for additions, repairs and replacements for the Water System for the five-year period 2021 to 2025 will be approximately $53.9 million. These projections are based on the District's current capital plan. Funding sources for these capital improvements include the proceeds of the 2021 Bonds. The plan is based upon a forecast of capital requirements. Should the capital requirements change, the plan funding requirements will be adjusted accordingly.

The District has been installing Automated Meter Reading (AMR) for all obsolete replacements and new services since 2009. The AMR water meters leveraged the District's existing investment in the AMR system used to read electric meters and are capable of transitioning to Advanced Metering Infrastructure (AMI) should the District choose to do so. In 2017, the Commission authorized an expenditure of $1,500,000 to accelerate the installation of AMR water meters by 6,000 new meters. The Commission authorized an additional $1,500,000 for 6,000 meters in 2018. These expenditures were made using cash surpluses. The Commission allocated $4,000,000 in surplus funds from 2019 and 2020 towards completing the conversion to AMR. Future meter expenditures allow for replacement of AMR meters or a switch to AMI meters.

Table 8-2 | CPU Water System Capital Improvement Program Budget 2023-2032

Capital Improvement Type	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Storage & Boosters	420,000	480,000	1,728,000	660,000	615,000	345,000	968,000	1,313,000	1,448,000	13,125,000
Mains	10,445,000	718,000	3,089,000	7,828,000	7,828,000	1,235,000	1,077,000	2,314,000	9,738,000	3,571,000
Source	713,000	1,275,000	615,000			5,550,000				1,800,000
Meters	1,100	7,129	24,342	53,736	90,868	149,300	462,168	744,891	843,267	1,024,170
Total	11,579,100	2,480,129	5,456,342	8,541,736	8,533,868	7,279,300	2,507,168	4,371,891	12,029,267	19,520,170

8.5 Financial Viability

The objective of financial viability assessments is to ensure the ability of the water utility to meet short-term emergency needs and provide long-term reliable water system finances. The evaluation is also useful for larger utilities and consists of a set of four simple rules:

1. Operating Budget: Do the annual revenues exceed the annual expenses?
2. Operating Cash Reserve: Is there a cash reserve equal to at least 3 months of annual operation and maintenance costs?
3. Capital Cash Reserve: Are there sufficient funds to provide immediate financing of the costs associated with unforeseen costs?
4. Affordability: Is the average water bill less than 1.5 percent of the median household income?

Each of these rules has been briefly considered for this water system with discussion of the important elements and implications.

8.5.1 Operating Budget

The operating budget analysis requires identification of the true costs of running the utility. These include the normal operation and maintenance costs but also the long-term replacement costs of existing system components. The revenues should include cash flow sufficient to cover depreciation of existing facilities to provide for long-term replacement. The loss of extra capacity, as a result of new connections, must also be considered. If system development fees are used for system replacement or operation rather than facility expansion, then the utility will be vulnerable when the capacity for additional connections has been utilized and no funds have been reserved for expansion. The water revenues and annual budget need to be reviewed annually to ensure that adequate water rates are being assessed. This is increased by the new testing requirements resulting from the Safe Drinking Water Act and additional legislation regarding the Endangered Species Act (ESA). As the system grows, the efficiency of operations will increase due to economies of scale and the presence of many fixed operating costs independent of the total water production. The actual revenues year-to-year are significantly impacted by the weather during the irrigation season.

8.5.2 Operating Cash Reserve

The purpose of the operating cash reserve is to provide resources during periods of the year when there may be unforeseen expenses. The utility also maintains sufficient cash reserves to provide for the seasonal

variation in revenues due to increased irrigation activity during a few months of the year. This level is sufficient to meet these criteria. As annual maintenance and operation costs increase, the operating cash reserves will also need to increase.

8.5.3 Capital Cash Reserve

The capital cash reserve is intended to provide funds for emergency repairs and fund capital project costs. The capital cash reserve should be a fund(s) dedicated to funding capital related costs and consist of either cash deposits or available credit.

8.5.4 Median Household Income Index (MHII)

The last financial viability criterion is the affordability of water charges for utility customers. This is more of a guideline than a rule and indicates the importance of evaluating the level of service that can be provided. The current standards used by Environmental Protection Agency (EPA) and the Washington State Department of Ecology (WDOE) recommend that the monthly average water bills be less than 1.5 percent of the median household income for the service area.

The current average annual water bill is approximately $26.00. The median household income (from https://www.census.gov/quickfacts/clarkcountywashington, accessed 4/12/2012)) in 2021 was $76,253 in Clark County. The average water rates were only 0.53 percent of the 2002 median household income. The water rates are well within the affordability criteria.

8.6 Rates and Charges

Rates for water service are established by resolution of the Commission. Under the terms of the Resolution and the resolutions authorizing the issuance of the Outstanding Bonds, the District is required to establish, maintain, and collect rates or charges for water and other commodities sold, furnished or supplied by the District that are fair, non-discriminatory and adequate to provide Net Water Revenues sufficient for payment of the principal and interest on the 2021 Bonds, the Outstanding Bonds and any Future Parity Bonds. The District also is required when establishing rates to maintain and collect rates and charges for the use of the services and facilities and all commodities sold, furnished or supplied by the Water System so that the Net Water Revenues for each calendar year, together with Assessment Income, will equal at least the sum of: (1) 1.00 times the Average Annual Debt Service of that portion of all Bonds then Outstanding that are Assessment Bonds; plus (2) 1.25 times the Average Annual Debt Service of such portion of all 2021 Bonds then Outstanding that are not Assessment Bonds, as further described in the Official Statement under the heading “SECURITY AND SOURCES OF PAYMENT FOR THE 2021 BONDS - Rate Covenants.” At this time the District has no Assessment Income or known plans to levy any Assessments, nor does it have any Assessment Bonds or plans to issue Assessment Bonds.

The District has maintained rates and charges to provide for payment of Operating Expenses, repairs and debt service expenses (including compliance with the debt service coverage covenant) and has provided a sufficient operating margin to fund a portion of planned capital additions to the Water System.

For the purposes of imposing water rates and charges, the District maintains three broad categories of customers: residential, commercial and miscellaneous. Miscellaneous customers include public authorities, multifamily and other customers.

On February 1, 2012, the Commission instituted new tiered water rates designed to encourage conservation by Water System customers. The base monthly charge for a residential meter is $9 and

increases for commercial and institutional customers are based on the meter size. Water consumption for residential use up to 1,800 cubic feet in a month is charged at the rate of $1.85 per 100 cubic feet (748 gallons). Use of between 1,801 and 3,600 cubic feet in a month is charged at the rate of $2.40 per 100 cubic feet. Water consumption above 3,600 cubic feet in a month is charged at $2.95 per 100 cubic feet. Note that while the block rates apply to non-residential customers also, the usage thresholds for each block vary depending on the meter size of the customer. Water charges are billed monthly or bi–monthly depending on the type of customer and the service area in which the customer resides.

In addition to the rates for water service, the District charges each new water connection for installation as well as a System Development Charge (SDC) based on the customer's meter size. Installation fees include $2,200 for service up to 1-inch. Meter set fees range, based on meter size, from $355 to $3,760 per meter. SDCs range, based on meter size, from $2,900 to $475,130 for the largest installations. The installation fees and SDC rates were last approved by the Commission in 2012. The meter set fees were last updated in 2015 to reflect the change in meters to Automatic Meter Reading

8.7 Customers and Sales

During the five-year period 2016 through 2020, the average number of water customers served by the District increased from 33,248 to 37,350. This represents an average annual growth rate of 3.0 percent per year. Customer accounts are projected to increase 2.6 percent in 2021 and 1.8 percent per year in 2022 through 2025.

Between 2016 and 2020 total water sales by the District increased from 487,273,000 cubic feet to 565,094,000 cubic feet. Over the same five-year period average water use per customer varied. In the residential class average annual use was lowest in 2019 at 11,371 cubic feet per customer and highest in 2018 at 12,373 cubic feet per customer. Average water use in 2021 is projected to be 11,575 cubic feet per residential customer. For the forecast period 2022 through 2025 we are assuming that average annual water use is 11,575 cubic feet per residential customer. Since the number of connections in the Water System has continued to grow and are projected to grow in the future, water sales are projected to grow. Total water sales are projected to increase by increase by 1.8 percent annually in 2022 through 2025.

8.8 Historic and Projected Revenues and Expenses

As shown in Table 8-4, the Water System's revenue from water sales has increased from approximately $16.1 million in 2018 to approximately $18.9 million in 2022. The Water System received 78 percent of its operating revenue from the sale of water in 2022. Historically the factors influencing increases in operating revenues have been customer growth and rate increases, with decreases in water sales leading to decreases in operating revenues. Projected revenues from retail rates shown in Table 8-5 reflect the District's current rates. The District does not anticipate the need for a rate increase during the forecast period.

The historical and projected number of customers and water sales are shown in Table 8-4. Historical and projected revenues for each of the District's customer classes are shown in Table 8-5.

The historical and projected operating results for the Water System for the fiscal years 2016 through 2025 are shown in Table 8-5. Future revenues are based on the projected revenues at current rates shown in Table 8-3. Revenues from the sale of water are projected to increase from $19.4 million in 2024 to $21.9 in 2034.

Other revenues increased from $4.8 million in 2018 to $5.0 million in 2020. Other revenues include meter fees, SDC revenues and other miscellaneous revenues. Other revenues shown in Table 8-4 reflect forecasted revenues for 2024 through 2034. The other revenue forecast is based on the district's projections and is projected to increase by 1.2 percent annually after a decrease in 2021.

Additional revenue is obtained through interest earnings and miscellaneous fees. Operating costs, excluding depreciation, increased from $8.9 million in 2018 to $10.3 million in 2020. This represents an annual average increase of 5.3 percent per year. Operation and maintenance (O&M) expenses are projected to increase at an average rate of 2.5 percent between 2024 and 2034. Taxes are estimated based on annual revenues.

Table 8-3 | CPU Historical and Projected Customers and Deliveries

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Number of Customers																	
Residential	33,908	34,846	35,271	36,704	37,461	37,933	38,411	38,895	39,385	39,881	40,384	40,893	41,408	41,930	42,458	42,993	43,535
Commercial	1,222	1,256	1,327	1,381	1,409	1,427	1,445	1,463	1,481	1,500	1,519	1,538	1,557	1,577	1,597	1,617	1,637
Miscellaneous	746	788	752	783	799	809	819	830	840	851	861	872	883	894	906	917	929
Total	35,876	36,890	37,350	38,867	39,669	40,169	40,675	41,187	41,706	42,232	42,764	43,303	43,848	44,401	44,960	45,527	46,101
% Change		2.80%	1.20%	4.10%	2.10%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%
Cubic Feet Delivered																	
Residential (x1000)	412,919	390,893	416,535	455,123	479,526	485,568	491,686	497,881	504,155	510,507	516,939	523,453	530,048	536,727	543,490	550,338	557,272
Commercial (x1000)	67,174	66,246	61,319	67,000	70,592	71,481	72,382	73,294	74,218	75,153	76,100	77,059	78,030	79,013	80,008	81,016	82,037
Miscellaneous (x1000)	84,273	76,365	87,240	95,322	100,433	101,698	102,980	104,277	105,591	106,922	108,269	109,633	111,014	112,413	113,830	115,264	116,716
Total (x1000)	564,366	533,504	565,094	617,444	650,551	658,748	667,048	675,453	683,964	692,582	701,308	710,145	719,092	728,153	737,328	746,618	756,025
Cubic Feet Delivered Per Customer																	
Residential (x1000)	12.2	11.2	11.8	12.4	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Commercial (x1000)	55	52.7	46.2	48.5	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1
Miscellaneous (x1000)	113	96.9	116	121.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7	125.7
Total (x1000)	15.7	14.5	15.1	15.9	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4
% Change		-8.10%	4.60%	5.00%	3.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 8-4 | Water System Historical and Projected Water Sales and Revenues

.

Revenues from Sale of Water (x$1000)																	
Year	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Residential	11,952	11,478	12,148	13,017	14,098	14,276	14,456	14,638	14,822	15,009	15,198	15,390	15,583	15,780	15,979	16,180	16,384
Commercial	1,899	1,860	1,759	1,896	2,019	2,044	2,070	2,096	2,123	2,149	2,176	2,204	2,232	2,260	2,288	2,317	2,346
Other	2,296	2,082	2,401	2,583	2,762	2,797	2,832	2,868	2,904	2,940	2,977	3,015	3,053	3,091	3,130	3,170	3,210
Total Sales Revenue	16,147	15,420	16,308	17,496	18,879	19,117	19,358	19,602	19,849	20,099	20,352	20,608	20,868	21,131	21,397	21,667	21,940

Revenues for 2018 through 2022 are from the Utilities Audited Financial Reports and Annual Reports.

Table 8-5 | Historical and Projected Operating Results

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Operating Revenues																	
Water Sales	16,147	15,420	16,308	17,496	18,879	19,117	19,358	19,602	19,849	20,099	20,352	20,608	20,868	21,131	21,397	21,667	21,940
Other Revenue	4819	4010	4683	4,966	3,423	3,466	3,570	3,677	3,788	3,901	4,018	4,139	4,263	4,391	4,523	4,658	4,798
Total Operating Revenue	20,966	19,430	20,991	22,462	22,302	22,583	22,928	23,279	23,636	24,000	24,370	24,747	25,131	25,522	25,920	26,325	26,738
Operating Expenses	8945	9204	9727	10296	10298	10,539	10,855	11,181	11,516	11,862	12,218	12,584	12,962	13,350	13,751	14,164	14,588
Non-Operating Revenue	751	641	279	532	50	51	51	52	53	53	54	55	55	56	57	57	58
Balance Available for Debt Service	12,772	10,867	11,543	12,698	12,054	12,095	12,124	12,150	12,172	12,191	12,206	12,218	12,225	12,227	12,225	12,219	12,207
Total Debt Service	8724	8806	9002	8414	9434	9563	10198	10019	10019	10019	10019	10019	10019	10019	10019	10019	10019
Operating Result	4,048	2,061	2,541	4,284	2,620	2,532	1,926	2,131	2,153	2,172	2,187	2,199	2,206	2,208	2,206	2,200	2,188

Operating revenues are expected to increase with additional customer growth. Operating expenses are projected to increase at 3% per year. No Rate increases are included in the projections..

8.9 Comparison of Retail Water Rates

The District's present rates for water service are competitive with other utilities in the Pacific Northwest. A comparison of monthly water rates for various municipalities within the Pacific Northwest is provided in Table 8-6.

Table 8-6 | Monthly Residential Water Retail Bill Comparison as of April 2021

Utility	Monthly Bill
Clark Public Utilities	$31.20
Selected Northwest Public Utility Districts and Municipalities	
City of Battle Ground, WA	$37.42
City of Camas, WA	$38.79
City of Ridgefield, WA	$41.78
City of Vancouver, WA	$45.27
City of Washougal, WA	$70.18
Kitsap County PUD, WA	$45.47
City of Longview, WA	$53.88
City of Portland, OR	$84.03
City of Salem, OR	$43.16
Snohomish County PUD, WA	$65.22
City of Seattle, WA	$83.25 off peak/ $94.22 peak
City of Tacoma, WA	$62.48 off peak/ $66.27 peak
Average (excluding the District)	$56.32

Note:
Based on monthly consumption of 1,200 cubic feet and a 3/4" meter.

THIS PAGE INTENTIONALLY LEFT BLANK