Deschutes Valley Water District

Water Master Plan 2023-2043

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Executive Summary

Master Plan Purpose

The purpose of this Water Master Plan (WMP) is to perform an analysis of the Deschutes Valley Water District's (DVWD) water system and:

- Document existing water system service area, facilities and operation
- Estimate future water requirements including potential water system expansion areas
- Identify deficiencies and recommend water facility improvements that correct deficiencies and provide for growth
- Update the District's capital improvement program (CIP)
- Evaluate the District's existing operation and maintenance (O&M) program
- Evaluate the District's financial status

This Plan contains five chapters, followed by appendices that provide supporting documentation for the information presented in the report. The chapters of the Plan are organized as follows: Chapter 1 – Existing Systems describes the history and existing facilities and operations. Chapter 2 – Water Demand Analysis evaluates existing water use and future water use and assess future growth areas. Chapter 3 – Service Standards and Planning Criteria analyzes the District's facilities and levels of service requirements and presents regulatory requirements. Chapter 4 – Engineering Analysis presents the engineering analysis performed and the hydraulic model results. Chapter 5 – Engineering Solutions discusses the engineering solutions and a capital improvement plan to discuss the solutions along with the District's financial analysis.

Master Plan Objectives

The planning and analysis efforts presented in this WMP are intended to provide the District with the information needed to inform long-term water infrastructure decisions. This plan complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, and Division 61.

Sections Summary

1. Existing System

This plan presents the history of DVWD detailing how it has grown to serve over 13,000 people in the District. Important to this growth was the purchase of Opal Springs in 1958.

The Opal Springs aquifer is the sole source of supply of domestic water for the DVWD. Three artesian wells drilled by the District in order to increase flow capture from Opal Springs have expanded the capacity of existing pumps, reduced pumping costs and increased ability to capture water without the risk of external contamination.

The quality of water from Opal Springs is excellent. There have been no volatile or synthetic compounds detected by water testing and healthy amounts of inorganic compounds and minerals are found in the water.

14 water storage facilities are used by the District with a total capacity of 16.17 million gallons (MG). Due to the high quality of the water the tanks require less maintenance than would typically be expected for similar storage facilities.

The District's water distribution system is comprised of 355 miles of pipes, 10 high service pumps, 12 booster pumps, 14 Tanks, 2,752 system isolation valves, 9 control valves, and 509 hydrants.

The District's 13 pressure zones are detailed in the plan and shown in Figure 1-3.

To operate the system, water is pumped out of the canyon in the vicinity of Opal Springs to the main tank reservoir site where the water is then distributed to customers within the 130-square-mile area served by the District. System wide resiliency has been introduced to the system by installing a water driven turbine 400 horsepower (HP) pump and a hydro powered mechanical pump that do not rely on electricity, making it possible to continue operations in cases of power outages. In cases where the system relies solely on water stored in reservoirs, the District would be able to supply water to customers for 4-8 days based on conservation measures implemented.

The City of Madras is the only whole sale water customer the District has. There are 3 system interconnects with the City of Madras. The sale of water and interconnections are established under a "Water Sale Agreement" found in Appendix D.

2. Water Demand Analysis

Current District water use is summarized using figures and tables to exhibit current water production, daily flow and tank levels, and water usage by customer category.

Population projection estimates that customers served through the horizon of this plan will be 16,045. This will result in a 22% increase of Average Daily Demand (ADD) to 4.68 million gallons per day (MGD). This projection is used to determine future water use and perform a hydraulic analysis of the water system to identify the system's performance under future demand conditions.

Regulatory requirements including a Service Line Inventory in the Lead and Copper Rule Revisions, Environmental Protection Agency (EPA) Groundwater Rule, Reduction of Lead in Drinking Water Act, America's Water Infrastructure Act and several other procedures are in place and factor into the maintenance and operation of the system.

3. Service Standards and Planning Criteria

The 20 year planning horizon in this WMP is the timeframe during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. Typical design life for several components of the water system are discussed and then summarized in Table 3-1.

Each community that the District serves has different fire flow standards determined on a case by case basis. The District attempts to meet minimum fire flow conditions of 1000 gallons per minute (gpm) for residential structures and 3000 gpm for commercial or high hazard structures. The normal operating pressure range for the District is 40 to 150 pounds per square inch (psi).

Congress passed the original Title XIV of the Public Health Service Act, commonly known as the Safe Drinking Water Act, in 1974, and amended it in 1986 and 1996. The Safe Drinking Water Act (SDWA) and the 1986 and 1996 amendments are federal water quality regulations affecting all public water purveyors. In Oregon, water treatment and distribution regulations under the SDWA are promulgated by the United States EPA (USEPA) administered by the Oregon Health Authority (OHA).

In addition to OHA, the Oregon Water Resource Department (OWRD) regulates the use of surface and groundwater in the State of Oregon. Over the years as greater demand is placed on limited water resources, OWRD has been exercising greater control over this water use.

4. Engineering Analysis

A water model was used to perform a hydraulic analysis of the distribution system. The model was calibrated and has been determined to be a good representation of the actual system conditions and can represent the system under future demand conditions. The Hydraulic Model analyzed two main criteria, pipeline water velocity, and minimum and maximum pressure under existing and future demand conditions.

A hydraulic model of the existing system was run under the ADD and maximum day demand (MDD) conditions. A few locations indicated the velocity of the pipe is greater than the design criteria of 5 feet per second (fps). When the MDD plus Fire Flow (FF) conditions were analyzed an overall trend of higher velocities in the core of the distribution system near the Metolius tanks was identified. When the existing system was analyzed under peak hour demand (PHD) conditions the same deficiencies were identified previously discussed.

The model was then run under future demand conditions. The deficiencies exhibited in the existing systems analysis were exacerbated under future demand conditions. The future ADD and MDD conditions are very similar to the conditions exhibited during the existing systems analysis. The overall system under future MDD plus FF conditions performed well with the exception of some localized high flows. During analysis of the future PHD conditions, a few areas of low pressure were identified in the Plain's area of the distribution system.

5. Engineering Solutions

A CIP was developed to address deficiencies identified in the engineering analysis. Four, five year phases of the CIP were developed with each phase containing 4-5 projects with a total 20 year capital improvement cost of $16.5 million.

The District does not anticipate growth outside of the existing service boundary. Rather, growth will occur within the existing framework of the Distribution System and infill into areas which are zoned

for commercial or residential development. The Districts backbone system or grid is sufficiently sized to allow for infill into areas that would need more localized distribution network to allow for individual service connections.

The District's cash flow relies upon two main sources of revenue; water sales and power sales. The Hydro revenue, through power sales, has been subsidizing the water distribution system capital expenses since construction in 1985.

A new power sales agreement in January of 2020 has reduced the overall available hydro revenue and the District will be required to consider moderate rate increases and explore funding options to finance future capital improvement projects.

Current water rates

Base Rate (includes usage up to 700 cubic ft.)	$22
Excess Rate (Each additional 100 cubic ft.)	$1.43

The long term financial outlook of the District will be evaluated every 2 years during a detailed budget cycle and adjustments will need to be made for the any circumstances that have changed.

1. Existing System

History

DVWD was formed in 1919 from a private water system, Jefferson Water Company. This private company could not achieve a profitable return, so they chartered the District known today under Oregon Revised Statutes (ORS), Chapter 264. The signatures on the original charter are a "who's who" of the pioneers of the Culver and Metolius area.

The original service area included the District of Culver, the District of Metolius, and the surrounding agricultural areas from South of Juniper Butte to the North end of Metolius. The Opal Springs aquifer has been the sole source of domestic water since the inception of the District. However, Opal Springs was privately owned until it was purchased by the District in 1958.

The distribution of water throughout the rural area was not feasible in the 1920's because of the sparse population. Instead, the District installed a wooden mainline to a standpipe in the District of Culver. There, residents from outlying areas could fill tanks to transport home. A single 3" pipeline also served the District of Metolius and its outlying areas.

With the formation and completion of the North Unit Irrigation project, the Culver/Metolius/Madras areas were broken into 80 to 160 acre parcels and a massive influx of farmers began in the mid 1940's. This sudden population growth required the District to install many new mainlines to distribute domestic water to many of the newly formed farms. During this same period, the area North of Madras (called The Plains) formed a water district to accomplish the same tasks in that area.

In 1948, the Plains Water District and Deschutes Valley Water District merged to form the approximate District boundaries known today. The conveyance of water over such a great distance (23.6 miles), presented many problems which required long District Board meetings to solve. The District has been fortunate to have faithful and responsible Board members over the years. For many years, the District strived and strained within its budget at times, to deliver water to each service with undersized and leaky mainlines.

The most important milestone in District history was the purchase of Opal Springs in 1958. Previously, the purchase of water and the poor condition of the pumps at Opal Springs had kept the District poor and without water at times. The purchase, modifications, new pump house and discharge lines began a cycle that has been repeated over and over. The process includes installing pumping capacity, discharge lines, storage, and then distribution lines. By the time a cycle is finished, new and improved

facilities are required and the cycle begins anew. Historically, whenever possible, new construction is done by District crews.

Hydro-electricity powers the District literally and financially. In 1985, the District's hydro-electric plant was completed near Opal Springs. Since then, revenues from that plant have subsidized the water district’s operations and capital improvement programs.

Due in large part to this hydro-electric revenue, the District has not had to issue new bonds, water rates have been fairly constant with minimal rate increases, and new service hook-up fees have remain some of the lowest in the area.

The current District service area is shown on Figure 1-1. The service area boundaries extend from Juniper Butte on the South to Agency Plains and Gateway, west of Warm Springs, on the North. The communities of Culver, Madras and Metolius are within the service area and are supplied with water by the District. The District water conveyance distance between the Southwest and Northeast service area boundaries is roughly 23 miles.

The District's boundaries encompass a broad area for a relatively small water community. The District currently supplies 4,800 active services. Based on U.S. Census Bureau 2022, the persons per household statistics for Jefferson County is 2.74. Estimated population served by the District is 13,152 based on persons per household multiplied by active services.

Figure 1-1
District Service Area

N

Gateway

Warm Springs

Gateway Tank

Sagebrush Creek

Agency Plains

NE Fern Ln

Dry Hollow

Dry Hollow

NW Fir Ln

NW Highway 26

Plains Tank

Madras City-County Airport

Lake Simtustus

City of Madras Interconnects

Madras

Little Agency Plains

2587 ft

Prison Tank

Prison Pump

Round Butte Tanks 16 & 17

Crooked River National Grassland

Round Butte Booster

Metolius

Canadian Bench

Metolius Tanks 8, 10 & 11

The Cove Palisades State Park

SW Culver Hwy

Culver

Opal Springs

Juniper Booster

The Peninsula

Jericho Booster

Juniper Butte

KOA Tank

Juniper Butte Tank

Haystack Butte

Wells #1, #2, #3

Green Drive Pump

LaSalle Tanks 2, 4, 6 & 7

Legend

- Production Well
- Storage Basin
- Pump Station
- Pumps

Mains

- 6" & Smaller
- 8" & Larger
- District Boundary

0 0.5 1 2 Miles

Water Rights Status

There are three instream water rights on the Crooked River that begin upstream of the District's points of diversion and appropriation and extend downstream past these points to Lake Billy Chinook.

A summary of pertinent information relative to these water rights is below.

Certificate 81584

Instream transfer of an irrigation right.
Maximum rate #1: 0.431 cubic feet per second (cfs) within Reach #1; 1904/1910 priority date.
Maximum rate #2: 1.296 cfs within Reach #2, being 0.865 cfs, 1898 priority date and 0.431 cfs, 1904/1910 priority date.
Total maximum rate (Reach #1 & #2): 1.727 cfs.
Total volume transferred instream: 416.4 acre-feet.
Period of Use: May 23 through October 31.

Certificate 83650

Instream transfer of an irrigation right.
Maximum rate #1: 0.206 cfs within Reach #1, 1903 priority date;
Maximum rate #2: 0.093 cfs within Reach #2, 1903 priority date. Total maximum rate (Reach #1 & #2): 0.299 cfs.
Total volume transferred instream: 66.84 acre-feet.
Period of Use: May 21 through October 31.

Certificate 80966

Instream transfer of water right from conservation project CW24. Maximum rate: 0.54 cfs, September 18, 1968 priority.
Total volume transferred instream: 149.2 acre-feet.
Period of use: May 1 through September 16.
River reach: From North Unit Irrigation District point of diversion on the Crooked River to Lake Billy Chinook.

The three instream water rights protect a total combined flow rate of 2.566 cfs and a total combined volume of 632.44 acre-feet in the Crooked River beginning upstream of the District's points of diversion at Opal Springs and points of appropriation near Opal Springs, extending to Lake Billy Chinook. The priority dates for Certificate 81584 and 83650 are senior to all of the District's water right certificates and permits. Certificate 80966 (1968) is senior to the District's Permit 36515 (quasi-

municipal, 1971), Certificate 83733 (inchoate) (quasi-municipal, 1971), Certificate 65840 (power, 1977), and Permit 47591 (power, 1982).

Although the instream transfers have some seniority over District certificates and permits, the instream certificates contain Findings of Fact that state they will not result in injury to other water rights.

A tabular list of all the District's water rights is found in Appendix A.

To reiterate; the source of water for the District is Opal Springs or ground water which feeds Opal Springs. Neither the spring nor the ground water source for the spring are part of a critical ground water designated by the Oregon Water Resources Department (OWRD). In addition, Opal Springs or the ground water which feeds Opal Springs is not listed in Oregon's Water Quality Assessment Database - 2022 Draft Report.

Water from the spring and the ground water not captured by DVWD, does flow into the Crooked River at about River Mile 7. The Crooked River, however, is not the source of water for DVWD. Ground water use is restricted administratively only by provision of mitigation water prior to appropriation of ground water under permit G-16548. There is nothing that is anticipated that would affect the Districts ability to fully exercise its ground water and surface water rights in the foreseeable future for reasons including those above relative to substantial interference.

Three wells (No.s 1, 2 and 3) supply the District with water in conjunction with lower Opal Springs. The wells are located on the east side of the Crooked River at distances ranging from approximately 300 to 1300 feet South of the lower Opal Springs (Figure 1-2). District water rights allow appropriation of ground water from wells between June 15 and August 31 at a maximum rate and annual volume of 16.7 cfs and 2,312 acre-feet, respectively for permit G-16548 and at a maximum rate of 10.38 cfs under T-9720 for a total of 27.08 cfs. These ground water rights are subject to mitigation under OAR Chapter 690 Division 505. All District water rights are summarized in Appendix A.

Figure 1-2

District Water Source

DESCHUTES VALLEY WATER DISTRICT

OPAL SPRINGS PROJECT AREA

Water Supply

The Opal Springs aquifer is the sole source of supply of domestic water for the DVWD. The District is also the sole supplier of domestic water to the City of Madras. The artesian spring and three artesian wells are located 5 miles Southwest of Culver at the bottom of the 850 foot deep Crooked River canyon, less than 150 feet from the river.

Opal Springs flows approximately 108,000 gpm at 53.8 degrees Fahrenheit with no seasonal variation. There has been no detectable change in flow, temperature, or pH since the spring was first tested in 1925.

Beginning in 1997, the District drilled three production wells all within 1500 ft. of Opal Springs. These wells were the result of an investigation into how to increase flow capture from Opal Springs. Even though there is a considerable amount of water surfacing from the Opal Springs vicinity, the sheet wall containment system capturing water for the pump house was proving marginal at peak pumping demand. Numerous alternatives were investigated and weighed by the District Board. An initial 12" test well was drilled 500 ft. and produced static artesian pressure of 48 psi and a free flow of over 4000 gpm. Since then, two more 16" wells were drilled with comparable artesian pressures and free flows of 5,360 gpm and 4,000 gpm.

The three artesian wells have been an advantage to the District. The existing pumps have an expanded capacity due to the inlet pressure going from 3 psi to about 43 psi (depending on how many pumps are running). Pumping costs out of the canyon were reduced by about 10%. Another benefit was the increased ability to capture water without risk from external contamination. The OWRD has determined that the water from the three artesian wells and water from and Opal Springs comes from the same aquifer. This has been determined geologically, from water quality testing comparisons, and flow test results.

Drinking Water Quality

The quality of water from the Opal Springs Aquifer is outstanding. This is especially evident when the Crooked River is flowing at spring run-off. Opal Springs flows into the muddy river as a clear bluish streak. The contrast makes a strong visual impact.

No volatile organic or synthetic compounds (herbicides or pesticides) have been detected by water testing. Various healthful inorganic compounds or minerals are found in the water. Excessive amounts of these minerals could be harmful, but they are far below the maximum allowable

concentrations. The spring has yet to show radiation from WW II nuclear testing, placing the age of the water from Opal Springs at a minimum of 70 years. During the Deschutes Basin Groundwater Study, the USGS had some water age analysis done. According to "USGS Report 97-197", the water could be as old as 1000 to 4000 years old. Despite the age of the water from the Opal Springs aquifer an analysis for waterborne particulates shows conclusively that Opal Springs is a ground water source not influenced by surface water.

Currently, there is no filtration or treatment of the District's water. There are two bottling plants in Culver bottling water from Opal Springs. The taste, clarity, and purity of the water makes it a popular bottled product.

Water Storage

The District has fourteen (14) water storage facilities throughout the distribution system with a total capacity of 16.17 MG. Tank sizes range from 4 MG to .1 MG. The main tank site has 4 tanks with a total capacity of 8.5 MG. The main tank site is at the Southern portion of the district on SW LaSalle Lane and provides the main storage and hydraulic head for the rest of the system. The newest tank in the system was built at this site in 2013. At 4 MG it is also the largest storage facility in the distribution system.

The second main storage site for the District is what the District refers to as the Metolius site and is located on the East side of Hwy 97 and Eureka. Total gallonage for the Metolius site is 5.5 MG. All tanks in the system with the exception of the Round Butte tanks are welded steel. The two Round Butte tanks are glass fused bolted steel tanks.

Due to the high quality of water the tanks require less maintenance than would typically be expected for similar storage facilities. Tanks are cleaned and inspected on a rotating 10-year schedule. There is very little sediment when tanks are drained and cleaned.

Table 1-1 lists the District's storage facilities and corresponding attributes.

DVWD Domestic Water Storage Facilities					
Tank Number #	**Location**	**Capacity (MG)**	**Year Installed**	**Diameter**	**Height**
2	LaSalle (Main Tank Site)	1	1954	66	40
4	LaSalle (Main Tank Site)	1	1970	66	40

6	LaSalle (Main Tank Site)	2.5	1982	104	40
7	LaSalle (Main Tank Site)	4	2013	130	40
8	Metolius (Hwy 97)	1	1964	66	40
10	Metolius (Hwy 97)	1.5	1982	80	40
11	Metolius (Hwy 97)	3	2007	113	40
14	Plains Tank	1	1987	66	40
24	Prison Tank	0.5	2006	60	24
17	Round Butte	0.11	1993	30	20
16	Round Butte	0.11	2012	30	20
19	Juniper Butte	0.15	1995	32	24
20	KOA Tank	0.2	2000	36	32
22	Gateway Tank	0.1	1995	32	16
	Total Storage Capacity	**16.17**			

Table 1-1: District Storage Facilities

Water Distribution

The Districts water distribution system is comprised of 355 miles of pipes, 10 high service pumps, 12 booster pumps, 14 Tanks, 2,752 system isolation valves, 9 control valves, and 509 hydrants. The system starts at the source at the bottom of the canyon on the crooked river near river mile 7. Water is pumped up over 900 ft to the top of the rim and 4 main tanks. The remainder of the system, by in large, is gravity fed from the main tank site as water travels North.

The District is over 100 years old. The system has continuously been expanded and upgraded since the beginning, however since the 60s there have been major capital improvement projects which has increased the size and scope of the District. Tables 1-2 through 1-4 detail the characteristics of the District's pipe including size and material distribution and vintage. The District was an early adopter of PVC pipe and has standardized c900 PVC pipe. The District also has utilized steel for major transmission mains or for areas of high pressure.

Pipe Diameter (inches)	Length (ft)	Length (miles)
3" and Smaller	562751	106.6
4	400301	75.8
5	1495	0.3
6	351031	66.5
8	164172	31.1
10	71156	13.5
12	43306	8.2
14	73549	13.9
16	1127	0.2
20	144818	27.4
24	63472	12.0
30	786	0.1
Total	**1877966**	**355.7**

Table 1-2: Pipe Diameter Distribution

Pipe Material	Length (ft)	Length (miles)
Galvanized	79363	15.0
Plastic/PVC	1200459	227.4
Steel	598144	113.3
Total	**1877966**	**355.7**

Table 1-3: Pipe Material Distribution

Vintage	Length (ft)	Length (mi)	Percent
No Date	512918	97.1	27.3%
1920	9630	1.8	0.5%
1930	1111	0.2	0.1%
1940	27723	5.3	1.5%
1950	50732	9.6	2.7%
1960	207266	39.3	11.0%
1970	146661	27.8	7.8%
1980	201906	38.2	10.7%
1990	355495	67.3	18.9%
2000	266399	50.5	14.2%
2010	70693	13.4	3.8%
2020	27675	5.2	1.5%
Total	**1878209**	**355.7**	**100.0%**

Table 1-4: Pipe Vintage

Pressure Zones

The District has fourteen (14) Pressure zones. Areas where a pump provides increased pressure to an area include Main Tanks, Juniper Tank, Round Butte Tank, Prison Tank, KOA Tank, Green Drive and Hilltop neighborhood. The other areas are regulated by pressure reducing valves (PRVs) to limit pressure of the water being supplied to specific areas. These pressure regulated areas are Metolius Tank, Plaines Tank, The Pines, Treasure Hills, Yarro, Cedar Hills and Gateway. Additionally the District suggests customers install PRVs at their own service as well. Pressure zones and hydraulic profile of the Districts system is shown in Figure 1-3.

Figure 1-3

Hydraulic Profile

EXISTING SYSTEM HYDRAULIC SCHEMATIC

DESCHUTES VALLEY WATER DISTRICT

ELEVATION IN FEET

DISTANCE IN MILES FROM MAIN TANKS

3200
3000
2800
2600
2400
2200
2000
1800

0
5
10
15
20
25

LEGEND

- RESERVOIRS
- DISTRIBUTION LINES
- PRESSURE CONTROL VALVES
- BOOSTER PUMPS

JUNIPER TANK
EL. 3158'

GREEN DR BOOSTER

MAIN TANKS
EL. 2910'

KOA TANK
EL. 2964'

ROUND BUTTE TANKS
EL. 3079'

METOLIUS TANKS
EL. 2740'

PRISON TANK
EL. 2742'
3 Miles East of Madras
Fed by 8" Main

JERICHO BOOSTER

CULVER

METOLIUS

MADRAS INDUST. PARK

PLAINS TANK
EL. 2590'

AGENCY PLAINS

CITY TANK
EL. 2430'

N. CITY TIE-IN

MADRAS

DOGWOOD & CLARK DR.

GATEWAY TANK
EL. 2180'

GATEWAY
EL. 1800'

WELLS
#1 #2 #3

OPAL SPRINGS
EL. 1977'

6"
4"
14",20",24"
12", 20" & 24"
10",20"& 20"
8"
12"
20"
10"
CITY 10"

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System Operations and Maintenance

Water is pumped out of the canyon to four Main Reservoir tanks located on top of the canyon rim, West of Culver, Oregon. Water is pumped out of the canyon through one of three pipes exiting the canyon in one of the 12-inch, 20-inch or 24-inch diameter steel pipelines. The 4 Main Reservoirs are approximately 825 feet above the pump facilities. Water is distributed from the reservoirs to customers within the 130-square-mile area served by the District.

In 2021 the District installed a water turbine driven 400 HP pump capable of delivering the District's average winter day demand. This pump does not rely on electricity and can operate even in the case of a prolonged power outage. The District operated from November 2021 to March 2022 without turning on an electric powered pump to deliver water to the distribution system. This addition to the Districts supply pumping capacity creates resiliency in similar power outage situations.

On March 30, 2020 a severe storm event with 60-100 miles per hour (mph) winds hit the Culver area. The winds uprooted trees and downed power lines, cutting electricity to some 10,000 customers in Jefferson County and beyond including the District. Power to the District's supply pumps was interrupted and the District could no longer pump water to the distribution system.

DVWD in conjunction with the cities of Madras, Culver, and Metolius asked all customers to stop all outdoor watering for the next 24-48 hours. The water that was held in the distribution system reservoirs at the time of the power outage was sufficient to support customer ADD for up to five days. Power was restored to the pumps in two days and the District resumed normal pumping operations.

Storage capacity for the District is 16.17 MG. If the District is unable to pump water and the system relies solely on water stored in the reservoirs then the District would be able to supply water to customers for four (4) days based on ADD consumption and up to eight (8) days if conservation measures are implemented such as no outdoor watering.

Water is continually pumped from the lower Opal Springs 24-hours a day. The original pump house contains six pumps. Three pumps are rated at 150 HP, two at 500 HP, and one at 400 HP. A seventh 400 HP pump is located in the turbine house on the west side of the Crooked River. By monitoring the level of the Main Reservoirs, one or any combination of these pumps is manually operated to meet demands of the water being used.

The 'new' pump house provides the capacity for eight 500 HP pumps; however, the District presently uses only two 500 HP pumps and one 400 HP pump. The redundancy of the three pump houses and their transformers provides more reliability to District customers. If one fails, the District has a backup system.

Building	Pump #	Capacity (gpm)	HP	KW Actual (Running)	Gallons per KW	Year
	Pump 1	500	150	130	3.846	1960s
	Pump 2	500	150	127	3.937	1960s
Old PH	Pump 3	500	150	130	3.846	1960s
	Pump 4	1800	500	369	4.878	1990
	Pump 5	1558	400	341	4.569	1974
	Pump 6	1800	500	375	4.800	1986
Turbine Room	Pump 7	1500	400	320	4.688	2021
	Pump 8	1805	500	381	4.738	2002
New PH	Pump 9	1805	500	381	4.738	2002
	Pump 10	1150		244	4.713	2018

Table 1-5: Pump Efficiency

The District has analyzed optimal pumping conditions out of the canyon. It looks at the different pumping combinations and the limitations of the 3 pipes out of the canyon to determine the best combination of pumps for the different pumping capacities. The maximum capacity of the pumping facilities with the largest pump out of service is 11,200 gpm or 16 MGD. During the winter demand

conditions one 400 HP pump is sufficient to meet demands. Typical summer demand requires a combination of pumps. Typical operation turns on pump 4 first, then pump 10. If more water is required pump 10 is turned off and pump 8 or 9 is turned on and pump 10 is added as demand requires. During peak summer demand pumps 5, 7, 8, 9 have been in operation. Pumps 1, 2, and 3 are typically not operated on a regular basis. They are only operated occasionally to exercise the pump.

Detailed pump information can be found in Appendix B.

The District has a leak detection program and measures in place to reduce system leakage to under 10%. The District uses the AWWA free water audit software to quantify system leakage and identify where improvements can be made to lower water loss within the distribution system. The District's past 4 years of water loss calculations can be found in Table 1-6.

The current AWWA water loss work sheet can be found in Appendix C.

Year	Production (MG)	Metered Consumption (MG)	Unmetered Authorized Usage (MG)	System Leakage %
2018	1291.59	1169.92	3.89	10.04%
2019	1173.49	1070.22	4.52	9.65%
2020	1402.38	1259.48	3.89	9.91%
2021	1641.33	1493.05	4.52	8.76%

Table 1-6: Quantification of system leakage

System Interconnects

The City of Madras is the only interconnection the District has with another public water system. Water is supplied from the District to the City through three interconnections; therefore, future plans of the District include water demand for the City of Madras.

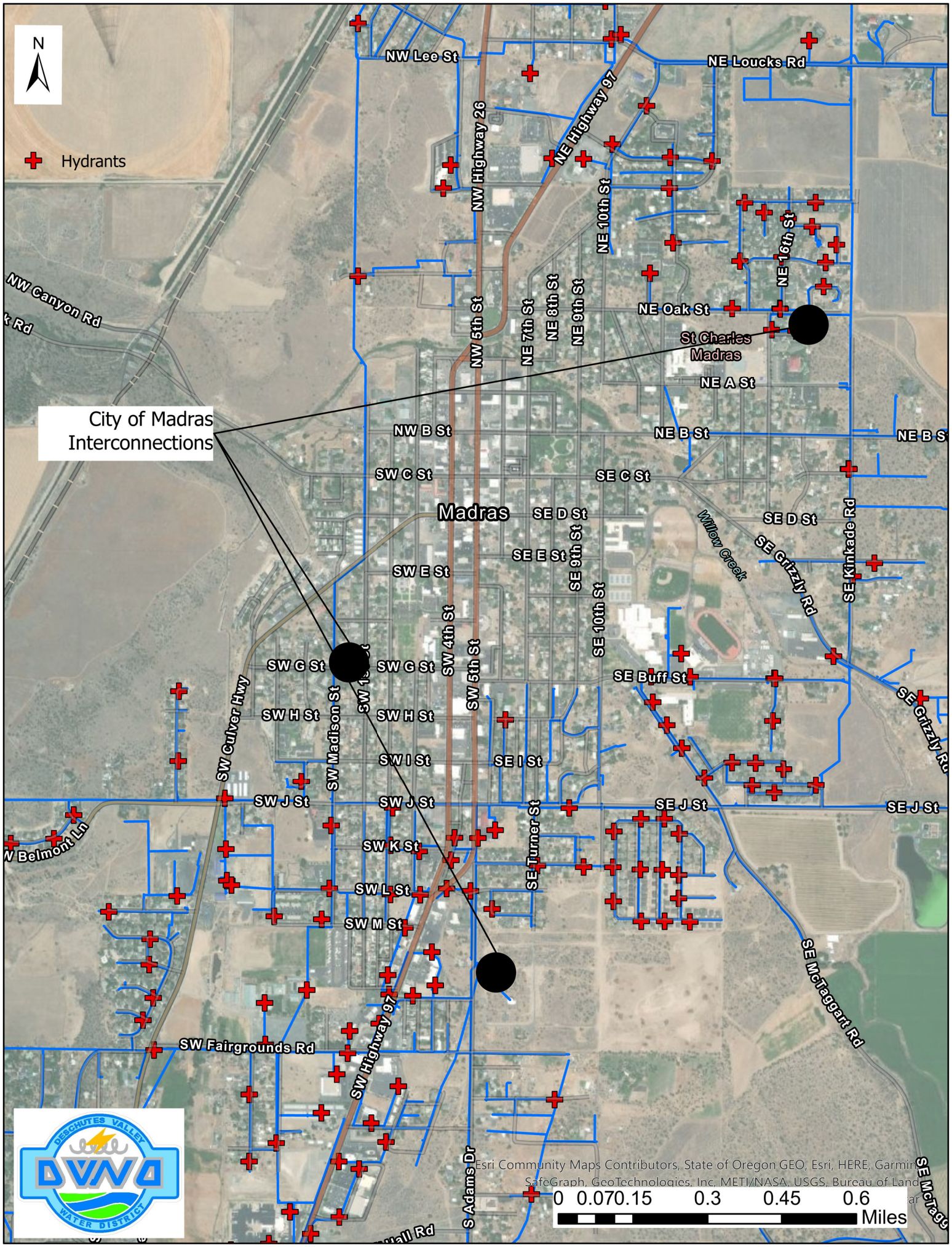
The South interconnection is located at South Adams Drive and Bard Lane. This is the primary interconnection supplying up to approximately 1,000 gpm during summer periods. The North interconnection is located at Kinkade and 'A' Street, supplying approximately 400 to 500 gpm during summer periods. The third interconnection is sited at Lincoln and 'I' Street and is used primarily for fire backup flows. Two interconnections are through 6-inch meters and the connection at Kinkade

and ‘A’ Street is an 8” meter. Each interconnection has a 2 inch bypass connection. The interconnection locations are shown on Figure 1-4.

The interconnections are established under a "Water Sale Agreement" (Agreement) between the District and the City of Madras. The Agreement is renewable on a three-year cycle and provides for basis of payment by the City, metering by the District, interconnection maintenance by the District and continuity of service (considering potential curtailment, interruption or reduction in deliveries). A copy of the current agreement is included in Appendix D.

Figure 1-4

Interconnection locations


N
Hydrants
City of Madras Interconnections
St Charles Madras
Madras
NW Lee St
NE Loucks Rd
NW Highway 26
NE Highway 97
NE 10th St
NE 16th St
NW Canyon Rd
NW 5th St
NE 7th St
NE 8th St
NE 9th St
NE Oak St
NE A St
NW B St
NE B St
SW C St
SE C St
SE D St
Willow Creek
SE Grizzly Rd
SE Kinkade Rd
SE E St
SE 9th St
SE 10th St
SW E St
SW 4th St
SW 5th St
SW G St
SE Buff St
SW Culver Hwy
SW Madison St
SW H St
SW I St
SE I St
SW J St
SE J St
SE Turner St
SW Belmont Ln
SW K St
SW L St
SW M St
SE McTaggart Rd
SW Fairgrounds Rd
SW Highway 97
S Adams Dr
Esri Community Maps Contributors, State of Oregon GEO, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land
0 0.07 0.15 0.3 0.45 0.6
Miles

2. Water Demand Analysis

Existing Water Use

Current District water use is summarized below. The water records are for the calendar year starting January 2022 through December 2022 as summarized in Table 2-1.

2022 Month	Water Production (MG)
Jan	50.71
Feb	46.92
Mar	53.87
Apr	73.37
May	117.35
Jun	141.11
Jul	229.80
Aug	235.57
Sep	180.15
Oct	100.04
Nov	49.37
Dec	49.64
Total	**1,327.88**

Table 2-1: 2022 Water Production

System demand conditions for years 2020-2022 are summarized in Table 2-2. The years 2020 and 2022 are more representative of current demand conditions for the District. With the Governors official Drought Declaration for Jefferson County in June 2021 the District elected to provide supplemental water to North Unit Irrigation District (NUID). The supplemental irrigation water was provided for two (2) months in June and July and resulted in over 200 MG being delivered to NUID. The District will not be providing additional supplemental water in the future. The average max day peaking factor for years 2020 through 2022 is 2.70. Figures 2-1 and 2-2 represent District daily pumping and daily tank levels for 2020 and 2021.

System Demand Conditions	2020 MGD	2021 MGD	2022 MGD
Average Annual Demand (AAD)	3.84	4.50	3.64
Average Daily Winter Demand (Nov - Feb)	2.00	2.00	1.65
Maximum Day Demand (MDD)	9.13	12.65	10.64
Average Monthly Demand (AMD)	116.87	136.78	110.66
Maximum Monthly Demand (MMD)	222.83	300.45	235.57

Seasonal Demand (April - Sept)	992.96	1244.76	977.35
Max Day Peaking Factor	2.38	2.81	2.92

Table 2-2: System Demand Conditions

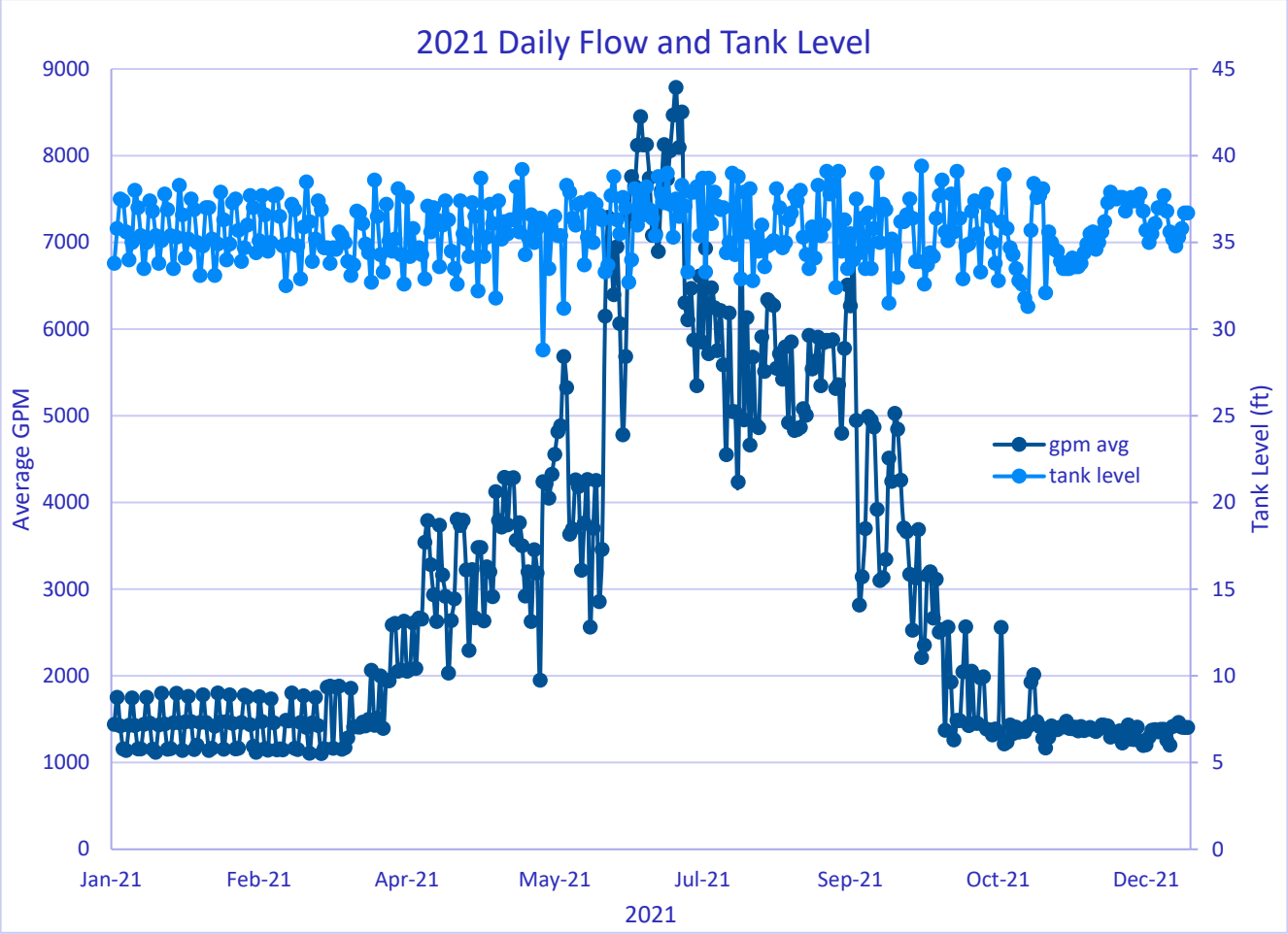


Figure 2-1: 2021 Daily Flow and Tank Level

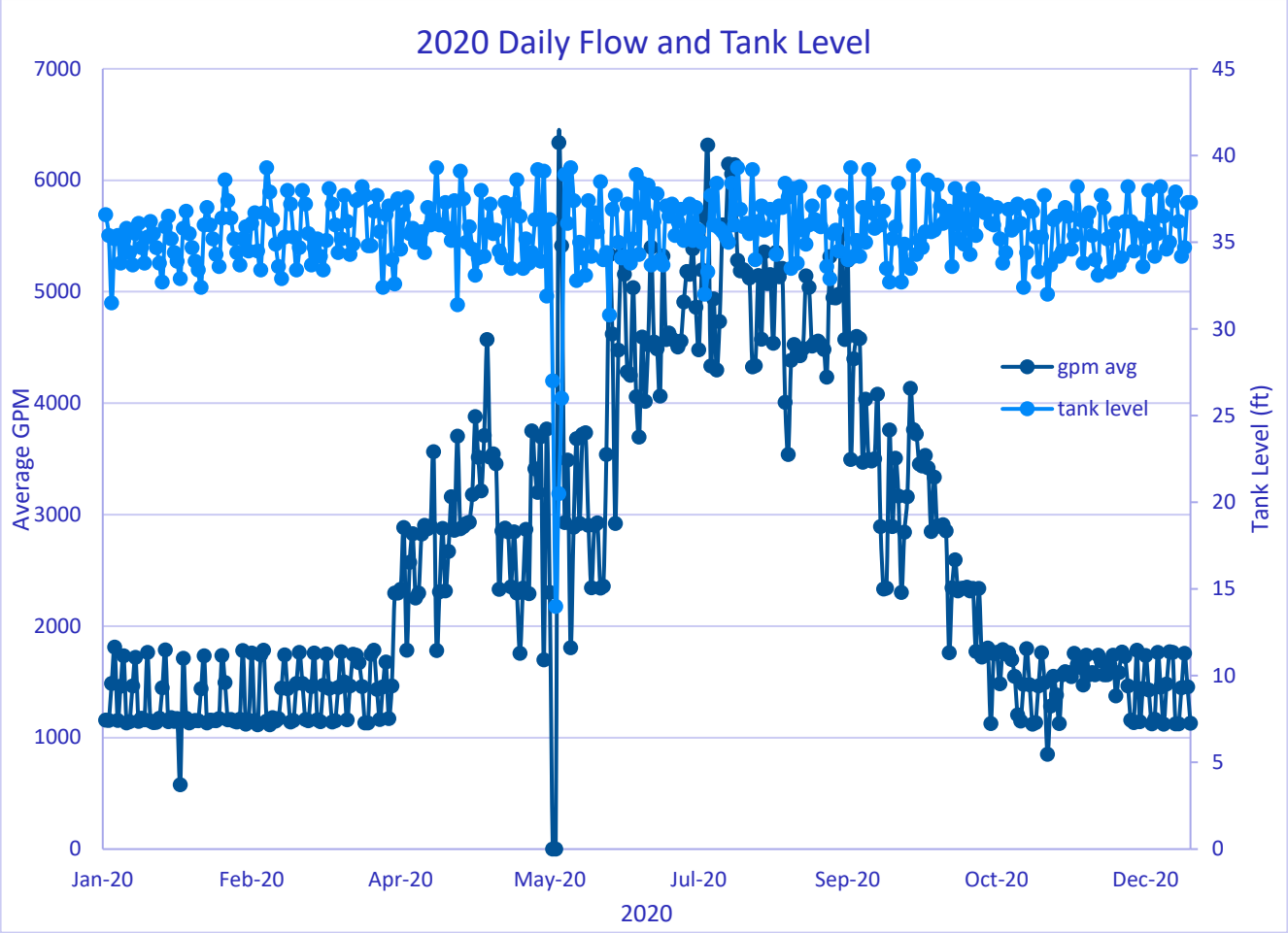


Figure 2-2: 2020 Daily Flow and Tank Level

Figure 2-3 illustrates the District's customer base by category and average daily usage for each category in 2020. The master meter category includes sales for resale customers specifically related to mobile home parks. Hydrant use is very small percentage of the overall use but it has been separated as a category in order to track usage that includes construction or bulk water delivery.

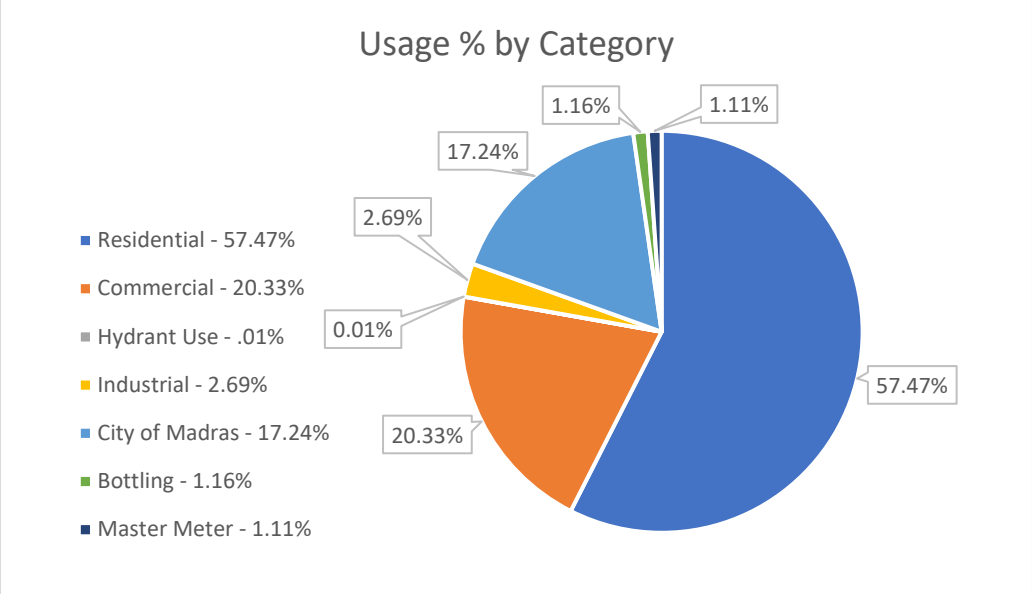


Figure 2-3: Water Usage by Customer Category

Table 2-3 shows the District's customer category and the average daily usage for each.

Category	MG Adjusted	Average Usage MGD
Residential	806.00	2.21
Commercial	285.04	0.78
Hydrant Use	0.14	0.00
Industrial	37.74	0.10
City of Madras	241.71	0.66
Bottling	16.20	0.04
Master Meter	15.54	0.04
Total	1402.38	3.84

Table 2-3: Average Daily Water Use for Each Customer Category

Future Water Use

The WMP is intended to serve a 20-year period. Population growth projections are used in determining water use estimates which are in turn used to perform hydraulic analysis of the water system to determine water system performance under future demand conditions. A capital improvement plan is developed to address any anticipated deficiencies or improvements needed. The basis for population projections used in this Master Plan is taken from the Portland State

University Population Research Center Coordinated Population Forecast for Jefferson County 2022 through 2072 as well as the United States Census Bureau July 1, 2021 statistics. Additional information can be found in Appendix E.

The following table represents population forecasts for the County and specified urban growth boundaries within the County.

Total Population						
Area / Year	**2022**	**2025**	**2030**	**2035**	**2040**	**2045**
Jefferson County	25,068	25,589	26,481	27,377	28,338	29,432
Culver	1,664	1,716	1,818	1,915	2,005	2,091
Madras	9,069	9,575	10,316	11,047	11,763	12,471
Metolius	1,050	1,095	1,184	1,273	1,364	1,457
Outside UGB Area	13,284	13,203	13,163	13,141	13,207	13,412

Table 2-4: Proposed Population Forecasts prepared by: Population Research Center, Portland State University, June 30, 2022.

Based on the above population projections, over the next twenty years, Jefferson County will see an overall year to year average annual population growth rate of .75%. The Urban Growth Boundaries may see slightly higher growth rates of .88% in Madras to 1.29% in Metolius, however the overall growth of the County is lower. For the purposes of the Master Plan, DVWD will use a year over year population growth rate of .8% to estimate water use for the 20 year Master Plan Horizon. Currently, the District serves an estimated population of 13,152. To estimate the population served by the District, the number of connections (4,800) is multiplied by the 2022 Census average population per household (2.74 persons/household). This is a conservative estimate in that not all the connections are domestic households, however the vast majority (92%) of the District's connections are residential.

A breakdown of the Districts customer classifications is as follows:

Customer Classification	Number	Percent
Residential	4390	91.46%
Commercial	301	6.27%
Industrial	95	1.98%
City of Madras Meters	5	0.10%
Bottling	4	0.08%
Master Meter (Mobile Home Park)	3	0.06%
Hydrant Meter	2	0.04%
Grand Total	**4800**	**100%**

Table 2-5: District Customer Classifications

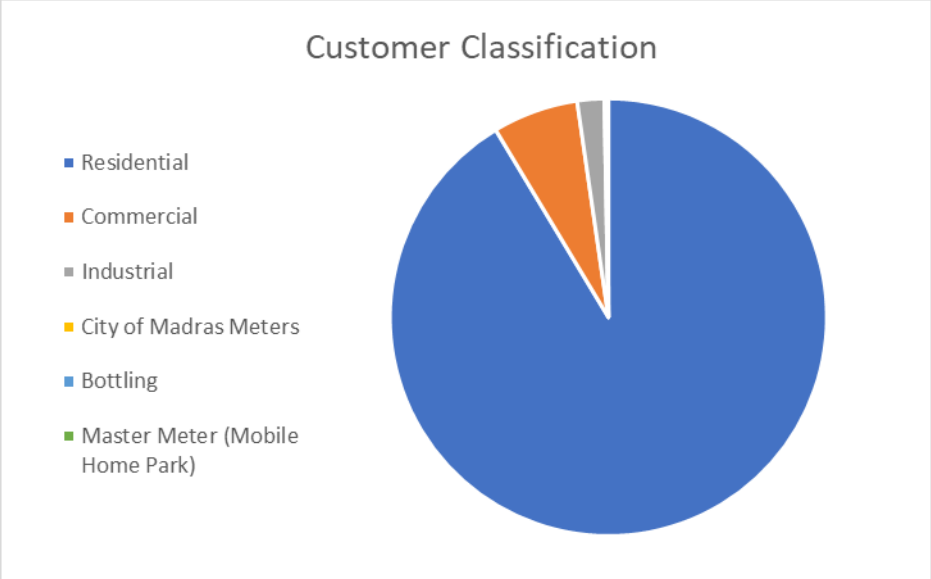


Figure 2-4: Customer Classification

Several commercial customers are commercial farms. DVWD policy prohibits the District from providing water for agricultural use, however the policy does allow for some commercial farms to use DVWD water for processing, greenhouse or chemical spraying.

Using the population growth model of .8% annual growth or a 22% overall growth rate it can be extrapolated that customers served will be an estimated population of 16,045 and approximately 5,856 connections. ADD would increase by 22% to 4.68 MGD. Using an ADD to MDD peaking factor

of 2.7 the MDD would be 12.65 MGD. A peaking factor of 5 is used to estimate PHD for existing and future system analysis.

Peaking Factors	
Average Annual Demand (AAD)	1
Maximum Day Demand (MDD)	2.7
Peak Hour Demand (PHD)	5

Table 2-7: Peaking Factors

Future Demand Conditions	2022 MGD	2043 MGD
Average Annual Demand (AAD)	3.64	4.44
Maximum Day Demand (MDD)	10.64	12.98
Peak Hour Demand (PHD)	18.2	22.2

Table 2-8: Existing and Future Demand Conditions

Future Growth Areas

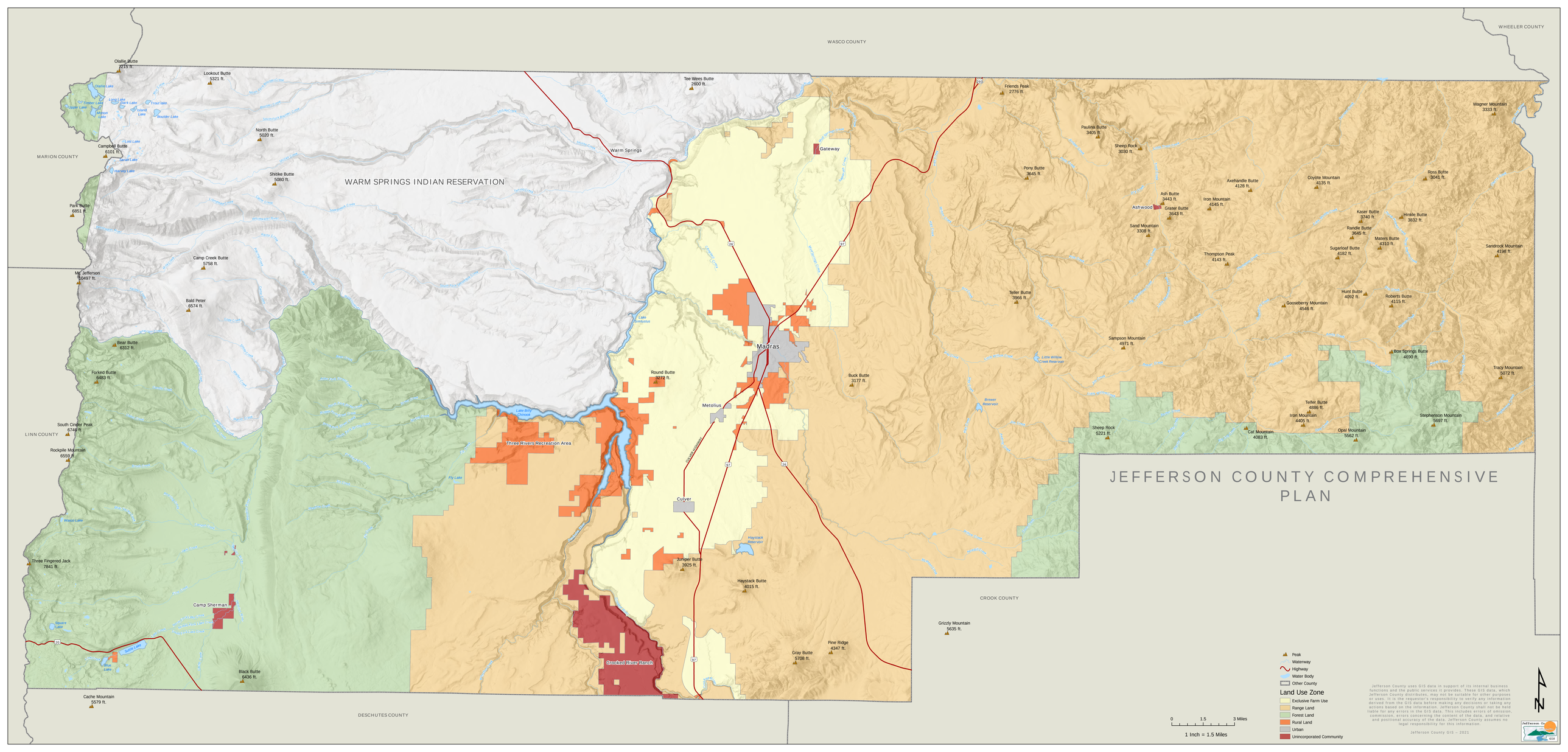
The District's service area boundaries encompass a large section of the populated area of Jefferson County including the towns of Culver, Metolius and Madras. It is not anticipated that there will be significant growth outside of the existing service area boundary, but rather there will be more infilling of the areas that are already serviced by the District. Table 2-9 lists a number of anticipated developments within the District's service area and are mostly in the incorporated areas of Metolius, Culver and Madras. The areas of growth outside of the incorporated cities are mainly contiguous to the urban growth boundary areas of the city of Madras. A few of the potential areas of growth in Jefferson County are shown in The Jefferson County Comprehensive Plan figure 2-6.

Envisioned Projects	Equivalent Connections
Summer Place Mobile Home Park (Boro)	59
Rock Cress	10
Park Place	44
Sun Ridge (Upper)	149
Sun Ridge (phase 1)	31
Sun Ridge (phase 2)	28
Sun Ridge (phase 3)	5
Sunrise (South of Treasure Hill)	141
Sagebrooke Estates	186
Rock Cress	10
Juniper Crossing (West of Loves)	154

Pinaar Subdivision (Metolius)	52
Madras RV Park	60
Ickler Property (Culver)	160
Bill Hoffman Subdivision	52
Dream Catcher (North of Sunnyside dr.)	23
SW Belmont Ln (Townhomes)	35
Yarrow Master Plan	300
Total Possible New Connections	**1499**
Existing Connections	**4800**
% increase	**31%**

Table 2-9: Envisioned Projects and Equivalent Connections

Figure 2-5
Map of Jefferson County Comprehensive Plan


JEFFERSON COUNTY COMPREHENSIVE PLAN
WASCO COUNTY
WHEELER COUNTY
MARION COUNTY
LINN COUNTY
CROOK COUNTY
DESCHUTES COUNTY
WARM SPRINGS INDIAN RESERVATION
Madras
Metolius
Culver
Gateway
Warm Springs
Ashwood
Three Rivers Recreation Area
Crooked River Ranch
Camp Sherman
Olallie Butte 7215 ft.
Lookout Butte 5321 ft.
Tee Wees Butte 2600 ft.
Friends Peak 2776 ft.
Wagner Mountain 3333 ft.
Paulina Butte 3405 ft.
Sheep Rock 3030 ft.
Pony Butte 3645 ft.
Axehandle Butte 4128 ft.
Coyote Mountain 4135 ft.
Ross Butte 3041 ft.
Ash Butte 3443 ft.
Iron Mountain 4145 ft.
Grater Butte 3643 ft.
Kaser Butte 3740 ft.
Hinkle Butte 3832 ft.
Sand Mountain 3308 ft.
Ramdle Butte 3645 ft.
Maters Butte 4310 ft.
Sugarloaf Butte 4182 ft.
Thompson Peak 4143 ft.
Sandrock Mountain 4198 ft.
Teller Butte 3966 ft.
Hunt Butte 4092 ft.
Roberts Butte 4115 ft.
Gooseberry Mountain 4546 ft.
Sampson Mountain 4971 ft.
Box Springs Butte 4690 ft.
Tracy Mountain 5072 ft.
Teller Butte 4386 ft.
Iron Mountain 4405 ft.
Stepherson Mountain 5697 ft.
Sheep Rock 5221 ft.
Cat Mountain 4083 ft.
Opal Mountain 5562 ft.
Grizzly Mountain 5635 ft.
Pine Ridge 4347 ft.
Gray Butte 5708 ft.
Haystack Butte 4015 ft.
Juniper Butte 3925 ft.
Round Butte 3272 ft.
Buck Butte 3177 ft.
Shitike Butte 5080 ft.
North Butte 5020 ft.
Campbell Butte 6101 ft.
Park Butte 6851 ft.
Camp Creek Butte 5758 ft.
Mc Jefferson 10497 ft.
Bald Peter 6574 ft.
Bear Butte 6312 ft.
Forked Butte 6483 ft.
South Cinder Peak 6746 ft.
Rockpile Mountain 6559 ft.
Three Fingered Jack 7841 ft.
Black Butte 6436 ft.
Cache Mountain 5579 ft.
Square Lake
Suttle Lake
Blue Lakes
Wizard Falls Fish Hatchery
Lake Billy Chinook
Lake Simtustus
Little Willow Creek Reservoir
Brewer Reservoir
Haystack Reservoir
Fly Lake
Wasco Lake
Olallie Lake
Timber Lake
Upper Lake
Long Lake
Dark Lake
Trout lake
Island Lake
Boulder Lake
Lost Lake
Sarah Lake
Harvey Lake
Peak
Waterway
Highway
Water Body
Other County
Land Use Zone
Exclusive Farm Use
Range Land
Forest Land
Rural Land
Urban
Unincorporated Community
0
1.5
3 Miles
1 Inch = 1.5 Miles
N
Jefferson County uses GIS data in support of its internal business functions and the public services it provides. These GIS data, which Jefferson County distributes, may not be suitable for other purposes or uses. It is the requestor's responsibility to verify any information derived from the GIS data before making any decisions or taking any actions based on the information. Jefferson County shall not be held liable for any errors in the GIS data. This includes errors of omission, commission, errors concerning the content of the data, and relative and positional accuracy of the data. Jefferson County assumes no legal responsibility for this information.
Jefferson County GIS – 2021

3. Service Standards and Planning Criteria

Design Life of Improvements

The design life of a water system component is generally referred to its service life. The selection of a design life is an estimate based on several factors including type and intensity of use, type, and quality of materials used in construction, and quality of workmanship during installation. Estimated service life and actual service life will vary based on these factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements. The planning period for this Water System Master Plan is 20 years, ending in 2043. The planning period is the timeframe during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land-use considerations. The typical design life for system components are discussed below.

Pumping Equipment and Structures

Major structures and buildings have a service life of 75 years. Pump equipment is anticipated to have a service life of 30 years. The District has 10 pumps with ages ranging from 2 to 60 years old.

Water Distribution Piping

Water distribution piping has a service life of at least 50 years, but PVC and ductile iron piping can have a service life up to 100 years. Steel pipes can exhibit corrosion and leakage within 30 years. The District has many records indicating the age of pipe within the distribution system; however about 25% of the pipe does not have a vintage. Pipe in general is holding up well, however, the service life for distribution piping used for asset management life cycle will be 80 years. The District has a number of small (2 inch and smaller) galvanized pipes. There has been a concentrated focus on replacing these galvanized service mains because these pipes have exhibited the greatest propensity for corrosion and leakage.

Connections to the City of Madras

The District provides water to the City of Madras, which is an independently operated water system, through three tie-ins. Based on the City of Madras' water master plan dated March 2014, these connections are proficient to provide for their needs through their planning horizon.

Wells

The District currently operates three wells. These wells are artesian and do not have any pumps. The life expectancy of these wells will be 50 years before rehabilitation. Because of the high water quality and low sediment these wells will not need to be redeveloped for an extended period.

Water Storage

The District's water storage reservoir age ranges from 70-10 years old. Because of water quality and frequent maintenance a service life of 100 years will be expected for the District's storage facilities. Due to the high quality of water the tanks require less maintenance than would typically be expected for similar storage facilities. Tanks are cleaned and inspected on a rotating 10-year schedule. There is very little sediment when tanks are drained and cleaned.

Storage reservoirs within the distribution system provide at least five important services:

1. Provide a reservoir supply of water to draw upon during short term peak system consumption.
2. Allow parts of the system to be shut down for repairs or maintenance.
3. Assist keeping the system pressures reasonably constant throughout the system.
4. Provide a reserve supply of water to meet fire demands.
5. Add to system reliability and operational flexibility.

Total storage capacity must include reserve storage for equalization, emergency, and fire suppression.

- Equalization storage should typically be set at 25% of the MDD to balance the difference between peak hourly demand and the supply capacity so these variations in demand are not imposed on pumping operations.
- Emergency storage is required to protect against a total loss of water supply, which would occur with a broken transmission line, equipment breakdown, or natural disaster. At a minimum, the emergency storage volume should be equal to 75% of the MDD assuming water use is restricted during times of emergencies.
- Fire reserve storage is needed to supply fire flows throughout the water system to fight major fires. The fire reserve storage is based on the maximum flow and duration of flow to suppress a major fire. The guidelines published in the "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO) are typically used to determine the required fire flow and fire reserve storage. Generally, fire flows of 1,000 to 1,500 gpm are sufficient for one to two dwelling units not exceeding two stories in heights. Commercial, industrial, and institutional buildings require higher flows. Determination of these flows is unique to each building under consideration and involves detailed surveys of construction (type and area), occupancy (combustibility), exposure (construction type, distance, length/height of wall), and communications (opening).

A community with a rating of a 1 is considered elite and a 10 is essentially not protected effectively. The fire district was re-rated by ISO in 2017. The fire district has lowered the district's fire protection ratings from a 5/8B to a 3 for any property within 5 road miles of Jefferson County Fire Department's

(JCFD) 2 fire stations. This was achieved with commitment by volunteers and a partnership with the JCFD.

There are three main pressure zones within the District. This master plan will analyze the capacity of the distribution system based on fire flow requirements at the location of the structure with the highest fire flow requirements in two of the zones (main tank zone and Metolius tank zone). The structure with the highest fire flow requirements in the pressure zone controlled by the main tank site is Brightwood cooperation in Culver. The structure with the highest fire flow requirement in the Metolius pressure zone is the Madras High School. A second site in the Metolius pressure zone that was analyzed is Brightwood cooperation located next to Highway 97 and Cherry Ln. In the pressure zone controlled by the Plain's tank reservoir there are no large commercial buildings that require commercial fire flows. All of these buildings will be analyzed based on 3000 gpm for 2 hours.

Existing Required Storage Capacity

The 2022 MDD as previously defined is 3.64 MGD.

Equalization storage (MDD*0.25) = .91 MGD

Emergency storage (MDD*0.75) = 2.73 MGD

Fire storage (4,250gpm*60min/hr*4 hours) = 1,020,000 gallons

TOTAL: 8.3 MGD

Projected Required Storage Capacity

The 2043 MDD as previously defined is 4.44 MGD

Equalization storage (MDD*0.25) = 1.11 MGD

Emergency storage (MDD*0.75) = 3.33 MGD

Fire storage (4,250gpm*60min/hr*4 hours) = 1,020,000 gallons

TOTAL: 9.9 MGD

Presently the District has a total capacity of 16.17 MGD and can sustain the existing and anticipated future storage requirements. For the purposes of the District's water system, there is adequate storage for the next twenty years.

Distribution System

The distribution system is to be sized for fire flows and water demand based on the 20 year population projection. All pipelines should be large enough to sustain a minimum residual pressure of 20 psi under fire flow conditions and or 40 psi during normal usage (District standards). Velocity in distribution lines shall be less than 5 feet per second during peak hour usage for residential areas. Distribution lines in commercial areas and transmission mains shall have velocities under 7.5 feet per second for peak hourly flows under fire flow conditions. Minimum pressure should be 20psi at all times even under fire flow conditions.

Minimum main size should be 6" for residential and 12" for commercial areas. Many of the District's existing water lines are 2" and 4" diameter. As water mains are replaced over time, these should be upgraded to a minimum 6" diameter.

Distribution laterals mains should be looped where possible.

Fire Flows

The District is using 1000 gallons for single family residential fire flow requirement and 3000 gallons for school, industrial and multifamily buildings. Multiple fires will place a greater demand on the distribution system. A public water system must continue to serve its domestic, commercial, and institutional customers during a fire event. The ISO recommends the fire system be able to operate with the remainder of the potable water system operating at the MDD.

The biggest stress on a water distribution system occurs during a fire flow event. The system is typically designed around these conditions. The District serves several municipalities and several different communities serviced by the Jefferson County Fire District. Each community has different fire flow standards. The District, while not obligated to any of these municipalities for maintaining specific standards, attempts to meet minimum fire flow conditions of 1000 gallons for residential and 3000 gallons for commercial areas. Fire flow requirements are typically determined on a case by case basis and ISO on a case-by-case basis. Specific fire flow requirements are based on the size of building (in square feet) and type of construction (wood frame, metal, masonry, installation of sprinklers, etc.). For purposes of analysis the District used 3000 gpm for 2 hours for fire flow capacity.

Pressure

The District's pressure range under normal operating conditions is 40 to 150 psi. However, due to ground elevations in some pressure zones, some customers receive service pressures outside this range. The Oregon Plumbing Specialty Code recommends pressure of no more than 80 psi. The District recommends PRVs at each metered connection. During a fire flow event or emergency, the minimum service pressure is 20 psi as required by OHA, Drinking Water Program regulations.

To provide water within the normal operating pressure range, the District has separate pressure zones. To do this, systems are divided into pressure zones. Pressure zones are typically served by one or more reservoirs with the same overflow elevation. The ground elevation band is limited by the pressure available from the HGL within each level. The HGL in each pressure zone is set by the water level in the reservoirs or settings of PRVs serving the level. Areas of the system can also be hydraulically connected to another pressure zone by a PRV or pump station.

Level of Service Summary

Item	Value	Notes/Comments
Fire flows for single-family residential areas	1000 gpm for 2 hours	
Fire flows for schools, commercial, industrial and multi-family buildings	3000 gpm for 3 hours	Specific fire flow requirements are based on the size of building (in square feet) and type of construction (wood frame, metal, masonry, installation of sprinklers, etc.).
Minimum pressure during fire flows	20 psi	
Residential piping: sizes and looping	6"main minimum	Washington and Ten States Standards require a minimum of 6-inch diameter for mains
Transmission mains: sizing	Limit velocities to 5.0 fps for peak day demands, but consider higher as discussed	This criteria can be evaluated on a case by case basis, based on allowable head loss, and allow velocities up to 8-10 fps.
Operating pressures	40-150 psi	The current operating pressure range is high compared to typical standards. However, the District recommends PRVs at each metered connection.
Valve exercising	Exercise all valves at least once every 4 years.	

	Consider more frequent exercising for older/larger/critical valves	
Main Flushing	Flush dead end and problem area mains once every 2 years	
Water Age	7 days	

Table 3-1: Level of Service Summary

Regulatory Conditions

Several regulatory requirements have been enacted and factor into maintenance and operations of the system.

Congress passed the original Title XIV of the Public Health Service Act, commonly known as The Safe Drinking Water Act (SDWA), in 1974, and amended it in 1986 and 1996. The SDWA and the 1986 and 1996 amendments are federal water quality regulations affecting all public water purveyors. Regulations under the SDWA are promulgated by the USEPA and administered by the Oregon Health Division (OHA). The OHA, Drinking Water Program is the primary regulating authority for public drinking water systems. The requirements of the Federal Safe Drinking Water Act and amendments are implemented by Oregon under the Oregon Drinking Water Quality Act of 1981 (ORS 448 as amended). The State of Oregon, through OHA, has exercised primary responsibility for the administration of the drinking water programs in the State, and arrangement called Primacy. The Oregon Drinking Water Quality Act is regulated by the administrative rules outlined under OAR 333-61, Public Drinking Water Systems. In practice, the Oregon Drinking Water Standards match the national standards established under the Safe Drinking Water Act. OHA, under the Primacy Agreement with the USEPA, has up to two years to adopt each federal rule after it is finalized.

OAR 333-61 outlines the responsibilities of the water suppliers, maximum contaminant levels and treatment requirements, sampling reporting and public notice requirements, operation and maintenance requirements, and cross connection/backflow standards. It also contains the minimum construction standards and plan review requirements for construction of new public water systems and to major additions or modifications to existing public water systems (OAR 333-61-050 & 060).

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure the water delivered to water users does not exceed maximum contaminant levels, to assure

that water system facilities are free of public health hazards, and to assure that water system operation and maintenance are performed as required by these rules. This includes the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies and sampling points prescribed by OAR 333-061-0036;
- Take immediate corrective action when the results of the analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040;
- Continue to report as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels have not been exceeded;
- Notify all customers of the system, as well as the general public in the service area, when the maximum contaminant levels have been exceeded;
- Notify all customers served by the system when the reporting requirements are not being met, when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance;
- Maintain monitoring and operating records and make these records available for review when the system is inspected;
- Maintain a pressure of at least 20 pounds per square inch (psi) at all service connections at all times;
- Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken;
- Conduct an active program for systematically identifying and controlling cross connections;
- Submit, to the Department, plans prepared by a professional engineer registered in the State of Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from the requirement;
- Assure the water system is in compliance with OAR 333-061-0205 relating to certification of water system operators;

Following is a brief description of other rules that factors into District operations, maintenance, and overall system planning.

Service Line Inventory requirements in the Lead and Copper Rule Revisions (LCRR)

The Lead and Copper Rule applies to all community (CWS) and non-transient (NTNC) public water systems. EPA adopted revisions to the Lead and Copper Rule in 2021 that include a requirement for public water systems to conduct inventories of service lines and to identify service line material type. The intent of the service line inventory requirement is to identify those service lines made of lead so that they can be scheduled for removal and replacement.

Public water systems must conduct an inventory of all service lines, on both the water system side and the homeowner side of the meter, and to submit the results to OHA–Drinking Water Services (DWS) by October 16, 2024.

EPA Groundwater Rule

The groundwater source monitoring as required under the EPA Groundwater Rule, applies to all public water systems that use groundwater sources or purchase groundwater. The purpose of the rule is to protect the public from fecal-related bacterial and viral pathogens in public groundwater systems. E. coli is used as the indicator of fecal contamination.

If a groundwater source (well or spring) is found to be fecally contaminated, the public water supplier must take corrective action to assure that their consumers are adequately protected.

Reduction of Lead in Drinking Water Act

The Reduction of Lead in Drinking Water Act amends the Safe Drinking Water Act regarding the use and introduction into commerce of lead pipes, plumbing fittings or fixtures, solder and flux. The law is effective January 4, 2014.

America’s Water Infrastructure Act (AWIA)

Effective October 23, 2018, America's Water Infrastructure Act (AWIA) Section 2013 required communities serving more than 3,300 people to develop or update a risk assessments and Emergency Response Plan (ERP). The District submitted the ERP and the risk and resilience assessment in 2021. The risk and resilience assessment of the system included: risk from criminal acts and natural hazards; resilience of the system components and associated appurtenances; monitoring practices of the system; financial infrastructure of the system; chemical storage, use, and handling; and operation and maintenance of the system. The ERP should incorporate: physical and cyber security; plans and procedures in case of an event that threatens the water supply; options to limit the effect of such an event; and ways to detect these events. These should be updated yearly, or as needed.

The Stage 2 Disinfection Byproducts Rule does not apply to the District because the District does not currently add a primary or residual disinfectant to the water.

Consumer Confidence Report

On August 19, 1998, the USEPA published the final rule requiring every community water system to prepare and provide customers an annual consumer confidence report (CCR). This rule was mandated by the 1996 amendments to the Safe Drinking Water Act and became effective as of September 18, 1998. A CCR is a report card for customers on the quality of water delivered by the water system.

Community water systems must prepare an annual consumer confidence report on source water and the levels of contaminants found in drinking water. The report must be mailed to all customers; however the Governor may allow a system serving fewer than 10,000 people to publish the report in a local newspaper rather than mailing it. Governors may allow systems serving fewer than 500 to notify customers that a report is available.

The District has had 3 positive coliform events in the last 4 years. These positive coliform events all occurred in the same area of the District. In 2 events positive coliform samples were traced back to tank 2 at the District's main tank site on LaSalle Lane. Upgrades to the LaSalle Lane tank site are planned in the next 20 year horizon and are discussed in the Engineering Solutions.

The 2022 Water Quality Report is referenced in Appendix F.

4. Engineering Analysis

Hydraulic Water Model

A water model was used to perform hydraulic analysis of the distribution system. The model was developed using GIS data and importing the data into EPANet2.2 software. The model was developed and then calibrated to determine if real conditions could be replicated using the modeling software. When calibrated the model is a good representation of the actual system conditions and can reasonably represent the system under theoretical (future) conditions.

The Hydraulic Model was used to analyze two main criteria, pipeline water velocity and minimum and maximum pressure under existing and future demand conditions. Another parameter that can be measured with a hydraulic simulation, but which was not analyzed in this study, is water age. Water age can be used as a surrogate for water quality. The District does not chlorinate water within the distribution system and chlorine residual, or disinfection byproducts is not a concern. However, the longer water stays in a system the more susceptible it is to degradation or can be influenced by other factors including temperature and microbial growth. The next iteration of the model will incorporate the parameters necessary to run extended period simulation (EPS), and evaluate water age.

Existing System Analysis

The existing system was analyzed by running different conditions in the hydraulic model. Four conditions were analyzed, average day demand, maximum day demand, maximum day demand plus fire flow and peak hour demand. Please refer back to Table 2-8 for existing demand conditions. Maximum day demand plus fire flow conditions were analyzed at three locations, Brightwood Corporation in Culver, Madras High School (MHS) and the Brightwood Corporation located on Highway 97 and Cherry Lane on the North end of Madras. See Figure 4-1 for a map of these locations.

Detailed hydraulic analysis results and model output are found in Appendix G.

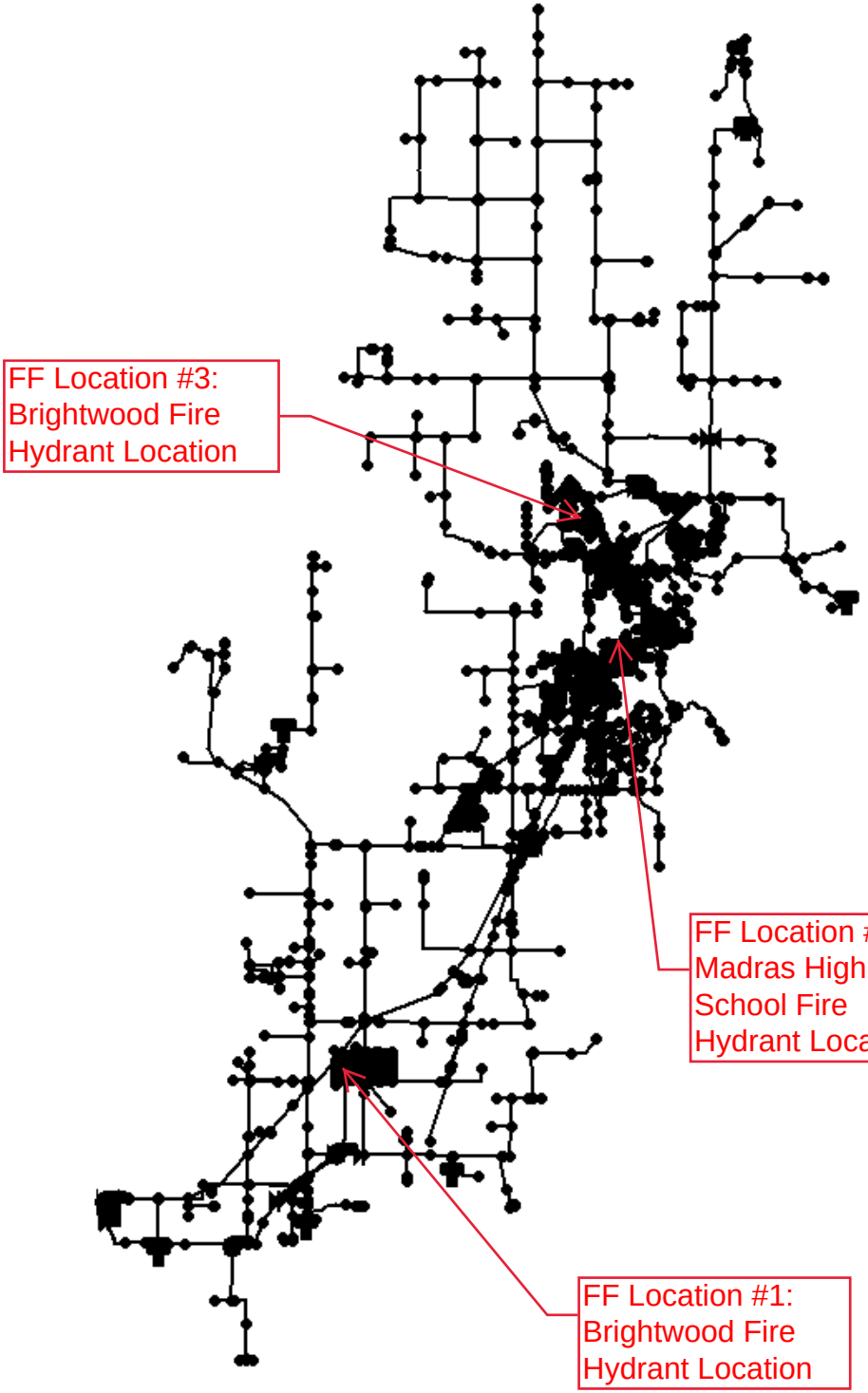
Average Day Demand and Maximum Day Demand Conditions

The existing system ADD and MDD conditions are reported together because in both scenarios the model reports the same results. After running ADD and MDD scenarios, a few system deficiencies were identified. The hydraulic model indicated that velocities in a select few pipes are greater than the design standard of 5 fps. Velocities in these pipes range from 5 to 7.5 fps.

The first section of higher velocity pipe is located on the East side of Metolius along Butte Avenue. The existing 6 inch PVC pipe acts as a transmission corridor to help get water from the South area of

Figure 4-1

Map of fire flow locations


FF Location #3:
Brightwood Fire
Hydrant Location
FF Location #2:
Madras High
School Fire
Hydrant Location
FF Location #1:
Brightwood Fire
Hydrant Location

the system to the North area of the system. This is a general assessment of the distribution system that there is a narrowing of the system in the Metolius area and water is conveyed from the South to the North areas of the system through several transmission mains. There is also some lower pressure conditions on Juniper Butte and along LaSalle Avenue which don't meet the design operating pressure of 40 psi, but are still above the minimum 20 psi required.

Maximum Day Demand plus Fire Flow Conditions

There were three different MDD plus FF scenarios that were evaluated. These scenarios revealed a few additional areas where velocity exceeded the design criteria of 5 fps however, are below the acceptable limits of 5 fps. These pipes include J Street with velocity varying from 5.1 to 7.4 fps. The 6 inch line between Bear Dr and SW Culver Highway on Fairgrounds road is 5.4 fps. The 6 inch in Metolius ranges from 5.1 to 5.8 fps. These velocities are not excessive and don't require immediate improvements, however they show the overall trend of higher velocities in the core of the transmission main of the system near the Metolius tanks.

Fire flow 1 – Brightwood in Culver
There are some localized pipe lines with high velocities in the vicinity of the fire flow simulation upwards of 8 fps due to main sizing. The District is able to maintain residual pressure of 20 psi due to the higher background system pressure.

Fire flow 2 – MHS
There are some localized pipe lines with high velocities in the vicinity of the fire flow simulation upwards of 15 fps due to main sizing. The District is able to maintain residual pressure of 20 psi due to the higher background system pressure.

Fire flow 3 – Brightwood in North Madras
This scenario resulted in the least amount of impact to the system due to the large transmission mains feeding the area. The system still experiences some higher flows of around 5 to 6 fps through the main corridor at the Metolius tanks area.

Peak Hour Demand Conditions

Under existing PHD conditions the system does not show any conditions that would cause any concern. There are some higher velocities in pipes identified in the ADD and MDD scenarios and these conditions are mitigated through future improvements discussed in chapter 5.

Future System Analysis

The same criteria that was used to analyze the existing system were used to evaluate and analyze the future system conditions. The model was updated to reflect future demands and demand distribution. Demands were updated in the system and new demand nodes were added to the system to represent areas of potential growth.

Detailed hydraulic analysis results and model output are found in Appendix H.

Future Average Day Demand Conditions

The system performs according to design criteria with the exception of the section around Metolius as noted in the existing system analysis. A 6 inch pipe located on the East side of Metolius along Butte Avenue experiences higher velocity under these system conditions. The existing 6 inch PVC pipe acts as a transmission corridor to help get water from the South area of the system to the North area of the system. This is a general assessment of the distribution system that there is a narrowing of the system in the Metolius area and water is conveyed from the South to the North areas of the system through several transmission mains. There is also some lower pressure conditions on Juniper Butte and along LaSalle Avenue which don't meet the design operating pressure of 40 psi, but are still above the minimum 20 psi required.

Future Maximum Day Demand Conditions

Future MDD conditions are the same as the ADD conditions with the addition of the model indicating higher velocities in water being conveyed on the 14 inch main on 'J' Street with velocities being in the range of 5.5 fps. In addition, the velocities of the water in the pipes on the East side of Metolius tended higher in the range of 6.5 to 7 fps.

The deficiencies identified under the future MDD conditions are consistent with deficiencies identified in the future ADD conditions with the exception of higher velocities on 'J' Street and on the East side of Metolius.

Future Maximum Day Demand plus Fire Flow Conditions

Future MDD plus FF conditions revealed additional potential system deficiencies as discussed below. Similar results existed in the future scenarios as in the existing systems scenarios pertaining to localized high velocities. In addition to those issues identified in the existing system additional issues were identified as follows.

Fire flow 1 – Brightwood in Culver

There are higher velocities in the transmission corridor of Dover Lane and along the 20 inch main from Dover to Grizzly. Also higher velocities in the 10 inch pipe along Adams Drive and the 6 inch pipe along Old Culver Highway.

Fire flow 2 - MHS

In addition to the deficiencies identified in the existing system analysis, the future MDD plus FF conditions identified a section of the distribution system that experienced lower pressures below the 20 psi minimum pressure criteria. This area is a small section of the distribution system near Cherry Lane, below the Plains tank.

Fire Flow 3 – Brightwood in the North Madras

Similar deficiencies were identified in this scenario as in the other MDD plus FF scenarios already discussed. This scenario identifies higher flows in the transmission mains surrounding the Metolius corridor and low pressures exhibited in the Cherry Lane area below the Plain's tank as described in the fire flow 2 scenario.

Future Peak Hour Demand Conditions

The future PHD conditions identified higher velocities in the transmission mains around the main Metolius corridor as previously discussed. In addition to the high velocities two areas of low pressure

were highlighted in the Plain's area of the distribution system along NW Dogwood Lane and NW Hickory Lane. Mitigating these low pressure scenarios is discussed in the Engineering Solutions Capital Improvement Plan.

Impacts

Future demand conditions under all scenarios analyzed do not cause any impacts on water supply or availability. Sufficient water supply is available to meet existing and future demands on the system.

The future analysis will change if the trends of water use shift. The Average Daily Winter Demand (Nov-Feb) is approximately 2 MGD versus a typical MDD over the summer of 10 MGD. This winter to summer peaking factor of 5 shows a significant trend of the outdoor water use. A potential exists that future water use will change based on the cost of water. As water costs begin to rise customers will modify their water use, specifically outdoor water use, and adopt more water conscience landscaping.

5. Engineering Solutions

Findings from Analysis

Several solutions were modeled to alleviate deficiencies analyzed in the future systems analysis. One of the major deficiencies identified was the high velocities in the transmission mains as the system bottlenecks in the vicinity of the Metolius tanks. The overall solution to alleviate these deficiencies is by introducing a new 24-inch diameter transmission main from the South side of the Metolius tanks near SW Eureka Lane going North along Bear Drive and connecting back into the system at the intersection of NW Alder and NW Mill St. Introducing this transmission main relieves the congestion experienced in the distribution system around the Metolius area. It decreases velocity in the other transmission mains to align with the design criteria of 7.5 fps under FF conditions. The scenarios analyzed were modeled under the future MDD plus FF conditions. This scenario represents the system conditions under the most taxing conditions.

Other localized improvements include adding a new 8 inch distribution main along the east side of Metolius and along Belmont Lane from Bear Drive to SW Culver Highway. As the District tries to improve the flow of water from the South end of the district to the North end, adding or upsizing distribution mains will help improve the flow and pressure characteristics of the distribution system in these localized areas.

Capital Improvement Plan

Phase One

This phase includes local distribution projects that require repairs or improvements to bolster the distribution system and improve past deficiencies like multiple pipe failures. It also includes removing the last known section of leaded joint pipe from the system. Mapping and details of the improvements can be found in Appendix I.

Phase	Projects	Length (ft)	Cost
1.1	2” replacement South of Fairgrounds Rd along Culver Hwy	1500	$ 150,050
1.2	Commercial St 6"	5600	$ 560,050
1.3	Metolius 4"	1000	$ 100,000
1.4	6” from Opal to 6th St	1080	$ 108,000
1.5	Jefferson St east of highway 26 at 6" and 2" junction	1060	$ 106,050
		Total	**$ 1,024,150**

Table 5-1 Phase One Improvement Projects

- Improvement 1.1 - 2” replacement South of Fairgrounds Rd along Culver Hwy - The plan to replace the 2” line will be completed as part of an overall upgrade to the distribution system in this area. This includes some development near the Love’s truck stop on Highway 97 and SW Hall Road. This project removes the existing 2 inch from an inaccessible area. The 2” currently runs along an easement behind houses and through fields. There have also been failures on this 2” pipe that has required multiple repairs.
- Improvement 1.2 - Commercial St 6” – The Commercial Street project includes the whole area bounded by NW Commercial St on the West and NW Lee St on the South and NW Cleveland St on the North. This project will replace the undersized 2” steel pipe with 6” PVC mains which will improve the flow availability in the area as well as provide sufficient fire flow. This is also an area that has experienced multiple breaks requiring frequent repair. The total footage to be replaced is about 5000 feet.
- Improvement 1.3 - Metolius 4” – Improvement 1.3 is in the City of Metolius and replaces the current 4” main from SW Wilson Ave to Washington Ave running along 6th Street. A portion of this 4” steel pipe is the last known section of leaded joint pipe in the entire distribution system. A new section of main on 6th Street crossing Hood Ave has already been replaced in a previous project. This project requires coordination with ODOT for crossing Highway 361. The improvement is about 1000’.
- Improvement 1.4 - 6” from Opal to 6th Street – Improvement 1.4 is also in the City of Metolius and replaces a 0.75” galvanized main with a new 6” distribution main. Similar to the majority of mains in Metolius, this line runs in a dedicated utility easement alley behind the homes. The install date on this pipe dates back to 1927.
- Improvement 1.5 - Jefferson St East of Highway 26 at 6” and 2” Junction – This project includes upsizing a 2” line on NW Jefferson Street to a 6” main running east along NE Jefferson Street and South on Highway 26 before crossing the highway and connecting with an existing 10” main on NW Lee Street. This project will also remove an existing 6” main that is very shallow and not accessible. A hydrant will be removed. Very few Highway 26 crossings exist in the distribution system and this additional crossing will help bolster the flow of water between the West and the East sections of the distribution system. The next closest highway crossing is 1.5 miles to the South or 1.3 miles to the North.

Phase Two

The improvements in this phase focus on additional distribution system improvements along with some strategic upgrades that bolsters the transmission system. Mapping and details of the improvements can be found in Appendix I.

Phase	Projects	Length (ft)	Cost
2.1	Terrace Ln to South Adams 6”	5280	$ 528,000
2.2	SW Belmont Lane from Bear to SW Culver Highway	3000	$ 300,000
2.3	McKenzie 2"	2400	$ 240,000
2.4	Meadowlark 4"	4,500	$ 450,000
2.5	Columbia Dr South of Gumwood	1740	$ 174,000
		Total	**$ 1,692,000**

Table 5-2 Phase Two Improvement Projects

- Improvement 2.1 - Terrace Ln to South Adams 6” – Terrace Lane improvements focus on removing an old 6” steel pipe that was installed before development occurred and cuts across many properties which makes repairs and maintenance hard to access. Approximately 33 services are served off of this line which is not looped and has limited fire flow. The new loop will provide adequate fire flow and looped redundancy.
- Improvement 2.2 - SW Belmont Lane from Bear to SW Culver Highway – Connecting SW Bear to SW Culver Highway along Belmont Lane is important for supporting additional development in the area. Currently 3 developments are underway with potential for another development which would add approximately 200 dwelling units to this area. A new 8” line from Bear Drive will provide another connection to the area which will increase fire flow capability and redundancy to the distribution system. This improvement will require a railroad crossing and coordination with Burlington Northern. Soil conditions in this area is known to be hard rock which will require either blasting or rock cutting.
- Improvement 2.3 - McKenzie 2" – This improvement will replace a 2” galvanized pipe with a 4” PVC pipe. The existing 2” galvanized pipe currently avoids the Metolius lagoon and has required multiple repairs, making replacement necessary. The install date on this pipe dates back to 1966.
- Improvement 2.4 - Meadowlark 4" – NE Meadowlark Lane is a vintage 1968 steel pipe that requires frequent repairs and needs to be upgraded to support approximately 30 connections.

The upgrade will also provide additional fire flow and looping for added reliability and redundancy.

- Improvement 2.5 - Columbia Drive South of Gumwood – Currently Columbia drive has two 2 inch mains running parallel south of Gumwood Drive. Past practice was to do the minimum size of pipe required to meet a specific residential need and over time more and more connections were added to the service line resulting in multiple connections for undersized mains. This project will replace the two 2 inch mains with one 6 inch main and 3 fire hydrants.

Phase Three

This improvement phase will focus on the Plain's area of the distribution system. The Plain's area is the farthest northern area of the system and is a separate pressure zone controlled by the Plain's tank. Almost exclusively the Plain's area of the system serves residential homesteads for large plots and lots. The majority of the land is zoned agricultural and large scale development is not anticipated for this area. Traditionally small mains have supported residential water use, however very limited fire flow is available in the Plain's area and the small galvanized mains in some areas require more frequent repairs. The focus of this phased improvements is to replace some of the undersized and failing mains. Mapping and details of the improvements can be found in Appendix I.

Phase	Projects	Length (ft)	Cost
3.1	Juniper 2" from Boise to Adams	9187	$ 918,720
3.2	Elm 4" from Boise to Columbia	5280	$ 528,000
3.3	NW Hickory Lane and NW Deschutes Drive improvements	13200	$ 1,000,000
3.4	Dogwood West of Columbia	5280	$ 400,000
		Total	**$ 2,846,720**

Table 5-3 Phase Three Improvement Projects

- Improvement 3.1 - Juniper 2" from Boise to Adams – Replaces a 2 inch steel main from 1967 with a new 6 inch PVC main.
- Improvement 3.2 - Elm 4" from Boise to Columbia – This improvement will replace a 4 inch steel pipe dated 1960 with a new 6 inch PVC main. This improvement will require a Highway 26 crossing.
- Improvement 3.3 - NW Hickory Lane and NW Deschutes Drive improvements – Hickory lane is an old two inch PVC line from 1988. The 2 inch on Deschutes Drive is from 1966. These are undersized and deteriorating. In addition, the hydraulic model indicates pressure below the required minimum 20 psi during future MDD plus fire flow conditions. These improvements

will allow the District to provide adequate pressure in the future under high demand conditions.

- Improvement 3.4 - Dogwood West of Columbia – The 2 inch PVC pipe between Columbia Drive and Deschutes Drive is from 1968 and requires replacement. It is undersized and deteriorating. In addition, the hydraulic model indicates pressure below the required minimum 20 psi during future maximum day demand plus fire flow conditions. It will be replaced with a 6 inch pipe. The improvements bring the system pressure under maximum day demand plus fire flow conditions above the 20 psi minimum.

Phase Four

Phase four improvements will focus on the long term sustainability, storage and transmission improvements needed for continued reliability for the next 20 years and beyond. These improvements are in phase four to allow the District to raise capital for the needed improvements**.** Mapping and details of the improvements can be found in Appendix I.

Phase	Projects	Length (ft)	Cost
4.1	LaSalle Tank Rebuild	NA	$ 3,000,000
4.2	Bear Dr transmission main	33000	$ 5,000,000
4.3	Main tank site inlet/outlet separation	4500	$ 900,180
4.4	Canyon 12” upgrade	5280	$ 2,100,000
		Total	**$ 11,000,180**

Table 5-4 Phase Four Improvement Projects

- Improvement 4.1 - LaSalle Tank Rebuild – Tanks #2 was constructed in 1954 and is nearing its service life. In addition, several of the positive coliform events in the last 3 years can be traced back to Tank #2. Tank #4 was built in 1970 and is approaching its useful life span and will be demolished in conjunction with Tank #2 in order to accommodate a new 3 MG tank. Demolition and construction of the new tank is estimated to be about 1 million dollars per million gallon.
- Improvement 4.2 - Bear Dr transmission main –The engineering analysis indicates that a new transmission main is needed to help convey water from the South side of the district to the North side bypassing some of the congestion and restrictions near the Metolius area of the system. Preliminary analysis suggests that a 24 inch main from SW Eureka Lane along Bear Dr traveling North to the intersection of NW Alder and NW Mills Street would provide the

hydraulic capacity necessary so the distribution system meets all design criteria for all the future demand conditions. High level analysis suggests that the line would need to be 33,000 feet at an estimated cost of $150 per foot making this project close to $5,000,000.

- Improvement 4.3 - Main tank site inlet/outlet separation – Currently the main tank sites on SW LaSalle Lane share a common header with the other distribution mains. The main tanks provide storage and system buffering. Currently the main tanks have an air system that turns the water over and minimizes striation of the water in the water tanks. However, overall water age and temperature in the tanks can increase over time so that water in the tanks is warmer than the water being pumped from the wells. Water age in the tank is also minimized by operating the system so that the level in the tank fluctuates more. The positive coliform events over the last three years has lead the District to consider dedicated inlet and outlet lines to and from the tanks. Separating the common header would force water to flow directly through the tanks thus minimizing water age and water quality concerns. This would be accomplished by bringing a new dedicated 36 inch main from SW Kent Lane to the main tank site and utilizing the existing 20 inch and 12 inch mains as dedicated outlet pipes.
- Improvement 4.4 - Canyon 12” upgrade – Currently the District maintains 3 separate pipes that convey water out of the canyon at Opal Springs. First is a 12 inch leaded steel pipe from 1959 the second is a steel pipe from 1976 and the third is a 24 inch steel pipe from 2016. The existing pipes are well maintained. The 20 inch and 12 inch steel pipes are exposed and visible and are secured to the canyon walls. These two can be inspected visually and are in good repair, however the 12 inch steel pipe is nearing its useful lifespan. The District plans to install a fourth line from the pump house to the canyon rim to minimize the impact of the possibility of one of the existing lines being out of service for an extended period of time. This will provide additional redundancy and reliability. The final remaining existing pipe is a 24 inch welded steel pipe that is buried under the access road and comes up out of the canyon on SW LaSalle Lane. The new pipe will be 24 inch welded steel and the alignment and construction will have to be determined based on additional engineering studies. See the existing 12 inch steel main in figure 5-1.

Figure 5-1

Existing 12 inch steel main

Capital Improvement Summary

Phase	Projects	Length (ft)	Cost
1.1	2” replacement South of Fairgrounds Rd along Culver Hwy	1500	$ 150,050
1.2	Commercial St 6"	5600	$ 560,050
1.3	Metolius 4"	1000	$ 100,000
1.4	6” from Opal to 6th St	1080	$ 108,000
1.5	Jefferson St east of highway 26 at 6" and 2" junction	1060	$ 106,050
2.1	Terrace Ln to South Adams 6”	5280	$ 528,000
2.2	SW Belmont Lane from Bear to SW Culver Highway	3000	$ 300,000
2.3	McKenzie 2"	2400	$ 240,000
2.4	Meadowlark 4"	4,500	$ 450,000
2.5	Columbia Dr South of Gumwood	1740	$ 174,000
3.1	Juniper 2" from Boise to Adams	9187	$ 918,720
3.2	Elm 4" from Boise to Columbia	5280	$ 528,000
3.3	NW Hickory Lane and NW Deschutes Drive improvements	13200	$ 1,000,000
3.4	Dogwood West of Columbia	5280	$ 400,000
4.1	LaSalle Tank Rebuild	NA	$ 3,000,000
4.2	Bear Dr transmission main	33000	$ 5,000,000
4.3	Main tank site inlet/outlet separation	4500	$ 900,180
4.4	Canyon 12” upgrade	5280	$ 2,100,000
		Total	**$ 16,563,050**

Table 5-5 Summary of Improvement Projects

System Expansions

The District does not anticipate growth outside of the existing service boundary. Rather, growth will occur within the existing framework of the Distribution System and infill into areas which are zoned for commercial or residential development. The Districts backbone system or grid is sufficiently sized to allow for infill into areas that would need more localized distribution network to allow for individual service connections.

Financial Analysis

The District’s cash flow relies upon two main sources of revenue; water sales and power sales. The Hydro revenue, through power sales, has been subsidizing the water distribution system capital expenses since construction in 1985.

In 1985, the District's hydro-electric plant was completed near Opal Springs. Since then, revenues from that plant have paid annual principal and interest on two water bonds for a savings of over $4 The District's cash flow relies upon two main sources of revenue; water sales and power sales. The Hydro revenue, through power sales, has been subsidizing the water distribution system capital expenses since construction in 1985. Hydro-electric revenues have also financed approximately $16 million of the District's new construction. The District levies no taxes and has no plans to levy taxes in the future, thanks to the hydro-electric revenue.

Due in large part to this hydro-electric revenue, the District has not had to issue new bonds, water rates have been fairly constant with minimal rate increases, and new service hook-up fees have remain some of the lowest in the area.

However, effective January 2020 a new fifteen (15) year power sales agreement was implemented which has reduced hydro revenue for the next few years. The new power sales agreement will not allow the Hydro Fund to continue to cover all of the expenses and the District will rely on water sales and savings to cover these expenses. In February 2023 the District implemented a 10% water rate increase and will consider moderate water rate increases in the future.

The District has been preparing for this time by saving and making strategic capital improvements over the years. The District is in a solid financial position to make well thought out decisions regarding future expenditures and capital improvements.

The following are additional financial options that the District will pursue to fund new capital project. Grants will be favored in lieu of loans and loans will be used in lieu of reserved funds dropping below two times the District's operating expenses.

- Oregon Community Development Block Grant (OCDBG) Program
- Safe Drinking Water Revolving Loan Fund
- Oregon Special Public Works Fund
- Water/Wastewater Financing Program
- Drinking Water Protection Loan Fund
- Water and Waste Disposal Loans and Grants (RUS)
- Emergency Community Water Assistance Grants (ECWAO)
- Rural Community Assistance Corporation (RCAQ Financial Services)

- Economic Development Administration (EDA) Public Works Grant Program
- Technical Assistance and Training Grants (TAT)
- Department of Environmental Quality Clean Water State Revolving Fund (CWSRF)
- State Water Resources Department: Water Development Loan Fund
- Oregon Department of Energy Small Scale Energy Loan Program (SELP)

Rate Structure

The District currently meters water usage and employs a rate structure to assess charges to its customers. The current rate structure has been in effective since February 2023.

Current water rates	
Base Rate (includes usage up to 700 cubic ft.)	$22
Excess Rate (Each additional 100 cubic ft.)	$1.43

A 20 year cost analysis was performed. The cost analysis assumes several factors.

- Hydro Revenue. The current power sales agreement extends through 2035. A new power sales agreement will begin in 2036. It is projected that a new power sales agreement would be similar to the current power sales agreement with a 10% increase from 2036 to 2043 through the master plan study horizon.
- Water Revenue. In order to maintain a positive balance by the end of the 20 year master planning horizon, water revenue rates will need to increase at a rate of 3.5% per year.
- Investment Revenue. Investment income generated from reserve funds is a conservative 3%.
- Operating expenses increase at 2% per year or target inflation rates.
- Capital expenditures for the 4 phases are amortized over 5 years for each phase.

  Each of these factors will be evaluated every 2 years during a detailed budget cycle and adjustments will need to be made for the any circumstances that have changed.

See figure 5-2 for the 20 year cost analysis.

Figure 5-2

20 year cost analysis

Year	Hydro Revenue	Water Revenue	Investment Income	Operating Expenses	Capital Expenditures	Net	Reserve	Remaing Balance
2023	$ 622,157	$ 2,922,750	$ 503,068	$ 5,025,947		$ (977,972)	$ 20,368,830	$ 19,390,858
2024	$ 717,446	$ 3,025,046	$ 581,726	$ 5,126,466	$ 204,830	$ (1,007,078)	$ 19,390,858	$ 18,383,780
2025	$ 786,749	$ 3,130,923	$ 551,513	$ 5,228,995	$ 204,830	$ (964,640)	$ 18,383,780	$ 17,419,141
2026	$ 865,653	$ 3,240,505	$ 522,574	$ 5,333,575	$ 204,830	$ (909,673)	$ 17,419,141	$ 16,509,468
2027	$ 910,270	$ 3,353,923	$ 495,284	$ 5,440,246	$ 204,830	$ (885,599)	$ 16,509,468	$ 15,623,869
2028	$ 1,028,123	$ 3,471,310	$ 468,716	$ 5,549,051	$ 204,830	$ (785,733)	$ 15,623,869	$ 14,838,136
2029	$ 1,040,923	$ 3,592,806	$ 445,144	$ 5,660,032	$ 338,400	$ (919,560)	$ 14,838,136	$ 13,918,576
2030	$ 1,072,009	$ 3,718,554	$ 417,557	$ 5,773,233	$ 338,400	$ (903,513)	$ 13,918,576	$ 13,015,063
2031	$ 2,197,046	$ 3,848,704	$ 390,452	$ 5,888,698	$ 338,400	$ 209,104	$ 13,015,063	$ 13,224,167
2032	$ 2,528,295	$ 3,983,408	$ 396,725	$ 6,006,472	$ 338,400	$ 563,556	$ 13,224,167	$ 13,787,724
2033	$ 2,585,529	$ 4,122,828	$ 413,632	$ 6,126,601	$ 338,400	$ 656,988	$ 13,787,724	$ 14,444,711
2034	$ 2,646,513	$ 4,267,126	$ 433,341	$ 6,249,133	$ 569,344	$ 528,503	$ 14,444,711	$ 14,973,214
2035	$ 2,710,330	$ 4,416,476	$ 449,196	$ 6,374,116	$ 569,344	$ 632,543	$ 14,973,214	$ 15,605,757
2036	$ 789,190	$ 4,571,053	$ 468,173	$ 6,501,598	$ 569,344	$ (1,242,526)	$ 15,605,757	$ 14,363,231
2037	$ 865,424	$ 4,731,039	$ 430,897	$ 6,631,630	$ 569,344	$ (1,173,614)	$ 14,363,231	$ 13,189,617
2038	$ 952,218	$ 4,896,626	$ 395,689	$ 6,764,263	$ 569,344	$ (1,089,074)	$ 13,189,617	$ 12,100,543
2039	$ 1,001,297	$ 5,068,008	$ 363,016	$ 6,899,548	$ 2,200,036	$ (2,667,263)	$ 12,100,543	$ 9,433,280
2040	$ 1,130,935	$ 5,245,388	$ 282,998	$ 7,037,539	$ 2,200,036	$ (2,578,254)	$ 9,433,280	$ 6,855,026
2041	$ 1,145,015	$ 5,428,977	$ 205,651	$ 7,178,290	$ 2,200,036	$ (2,598,683)	$ 6,855,026	$ 4,256,343
2042	$ 1,179,210	$ 5,618,991	$ 127,690	$ 7,321,856	$ 2,200,036	$ (2,596,001)	$ 4,256,343	$ 1,660,342
2043	$ 2,416,751	$ 5,815,655	$ 49,810	$ 7,468,293	$ 2,200,036	$ (1,386,112)	$ 1,660,342	$ 274,230

Concluding Statement

The engineering analysis and solutions presented in this report offer a comprehensive plan for the District's system wide viability through the next 20 year planning horizon. The District's financial position is solid and plans are in place to maintain the District's financial position without overburdening the customer. Over a 20 year span, if rates were to increase by 3.5% per year, the District's base rate would be $43.78 in the year 2043. Other factors that would affect the overall financial analysis is dependent on the District's ability to receive grant funding for any projects.

Seismic risk assessment is not required as the District is located in seismic zones 5 and 6.

Appendices

Appendix A

District Water Rights

Deschutes Valley Water District - Water Rights Summary

Appl. No.	Permit No.	Certificate No.	Priority Date	Source	Use	Allowed Rate (cfs)	Actual Diversion				Authorized Completion Date	Notes *(Facility Name, Resource Issues or Problems, Etc.)*
							* Maximum Instantaneous Rate Diverted to Date (cfs)	* Maximum Annual Quantity Diverted to Date (MG)	* Average Monthly Diversion (MG)	* Average Daily Diversion (Gallons)		
S-48909	S-36515	N/A	12/29/1971	Opal Springs	Quasi Municipal	11.92	1.28[1]	87.6	.35	11,628	1-Oct-2003 Extension Application Proposes 1-Oct-2028	Certificate C-83733 for 10.38 cfs issued as a partial perfection of permit S-36515, leaving 11.92 cfs under the permit. Once this remainder is fully developed, file Claim of Beneficial Use to obtain certificate. extension Needed
S-48909	S-36515	T-9720	12/29/1971	Groundwater (Well #1, #2, #3)	Quasi Municipal	10.38	10.38	1641	116	3,842,147	1-Oct-2015	T-9720 transferred 10.38 cfs partial perfection of S-36515 to District Wells
S-32724	S-26113	C-35632	10/24/1958	Opal Springs	MUNI	2.2	2.2	150	12.5	412,000		
G-14721	G16548		4/13/1998	Groundwater (Well #1, #2, #3)	MUNI	16.7 or 2,312 ac/ft annually	1.547	77	6.41	210,000	16- Jul-2029	Max rate diversion based on mitigation – 128.4 temp credits through Deschutes River Conservancy for 214 ac/ft
S-6261	S-3903	C-7931	9/5/1918 9/5/1918	A Spring A Spring	Domestic Power	3.0 3.0**	3.0	205	17.1	563,000		**Not to exceed a Maximum rate of 3.0 cfs at any one time
S-43228	S-32674	C-46049	3/6/1967 1/25/1967	Opal Springs Crooked Rivr	Domestic Power	1.11 60.0	1.11 *	76	6.33	208,000		In Good Standing In Good Standing
S-63249[2]	S-55026		2/10/1982 6/10/1982	Crooked Rivr Crooked Rivr	Power Power	1,500 272.5	*	*	*	*	1-Oct-1986	In Good Standing
S-7852	S-5436	C-10851	4/25/1921	Crooked Rivr	Power	48.2	*	*	*	*		In Good Standing
S-23473	S-18802	C-27796	10/8/1948	Crooked Rivr	Power	21.3	*	*	*	*		In Good Standing
S-56774	S-43521	C-65840	10/20/1977	Crooked Rivr	Power	140.0	*	*	*	*		In Good Standing
R-84628			12/5/2000	Deschutes River	GW Rechrge	200.0	0	0	0	0	Not Assigned	Application Withdrawn April 2022

- The District diverts water for hydropower up to the maximum combined allowable rate without exceeding, however, flow rate fluctuates based on allowable diversion flows available.
- * Actual Diversion annual values based on 2020 water year.

1. Permit S-36515 is currently limited to 1.28cfs (out of the permitted rate of 1 l.92cfs) due to the development limitation included in the extension of time dated January 23, 2015. This is the currently authorized max. instantaneous rate allowed from Opal Springs under this permit.
2. Application S-63249/Permit S-47591 went through a permit amendment which resulted in Permit S-47591 being cancelled and replaced with Permit S-55026.

Appendix B

District's Pump Info


POMONA
TURBIN
PUMP
TRADE MARKS REGISTERED U.S. PAT. OFF.
POMONA PUMPS
SIZE 10"x MC
MODEL 6934TI
500
G.P.M. 943
1755
SERIAL NO. P2B1116
CONTRACT NO.
FAIRBANKS, MORSE & CO. CHICAGO, U.S.A.

Peerless Horse Pump Corporation

FACTORY PUMP SPECIFICATIONS AND BILL OF MATERIAL

☐ ~~Bill of Material~~ ED VAUGHN

CC: ☐ TEST FLOOR KP

DATE ENTERED	DATE PROMISED	DATE SHIPPED	MOTOR S/N	PUMP SERIAL NO.
1-22-90				T3T2-429348
CUSTOMER'S NAME	USER	CUSTOMER P.O.		
DE SCHUTES VALLEY WATER DISTR	DE SCHUTES VALLEY WATER DIST	11-29-89 LETTER		

BUILD 1 PUMPS ON THIS BILL AND 0 OTHER PUMPS ON THIS ORDER

SPEC. WRITER DR | CHECKER

PUMP DESCRIPTION		GENERAL	OPERATING CONDITIONS		TEST REQ'MTS: NONE ☐	SPECIAL INSTRUCTIONS & OPTIONS
SIZE 14M	STGS 9	SUCTION PROJ.	GPM 1400	TDH 943'	☐ NON WITNESS # ( )	COAT ALL BOWL FLANGES WITH
HOUSE NO. 7002W		DISCH. PROJ. 1 15/16" X 12"	SUCTION LIFT / SUCTION HEAD		☐ CURVE APPROVAL	PERMATEX PRIOR TO ASSEMBLY
PUMP FITTING BF	ROTATION CCW	TUBE PROJ.	PUMP RPM 1775	MTR. S.F. 1.15	☐ WITNESS # ( )	
DRIVE NO.	DRIVE POS. #	SUCTION SIZE BELL	MTR. HP 500	MTR. TYPE WP-1	TEST QUAN:	
					GUAR EFF %	
PUMP ASSEMBLED ☒ YES ☐ NO		DISCH. SIZE 10" FLG'D	IMPELLER T7FA92	DIA OR "B" DIM. 10.37" (Full)	☐ ENGINEERING TYPE #	
DRIVER MOUNTED BY FACTORY / CUSTOMER		MIN. END PLAY	SOLID OVERLOAD YES / NO	SP GRAVITY	☒ HYDRO PSI 650 / ☐ CERTIFIED	MAX USEABLE HP AT GPM
						IMPELLER REF:

SETTING PLAN: ASSEMBLY DRAWING:

QUANTITY	SYMBOL	REFERENCE BUYOUT DESCRIPTION	ORDER STATE	LINE

PAGE ___ OF ___ HC 675 B

APR-07-1995 07:45 FROM TO 15035463072 P.13

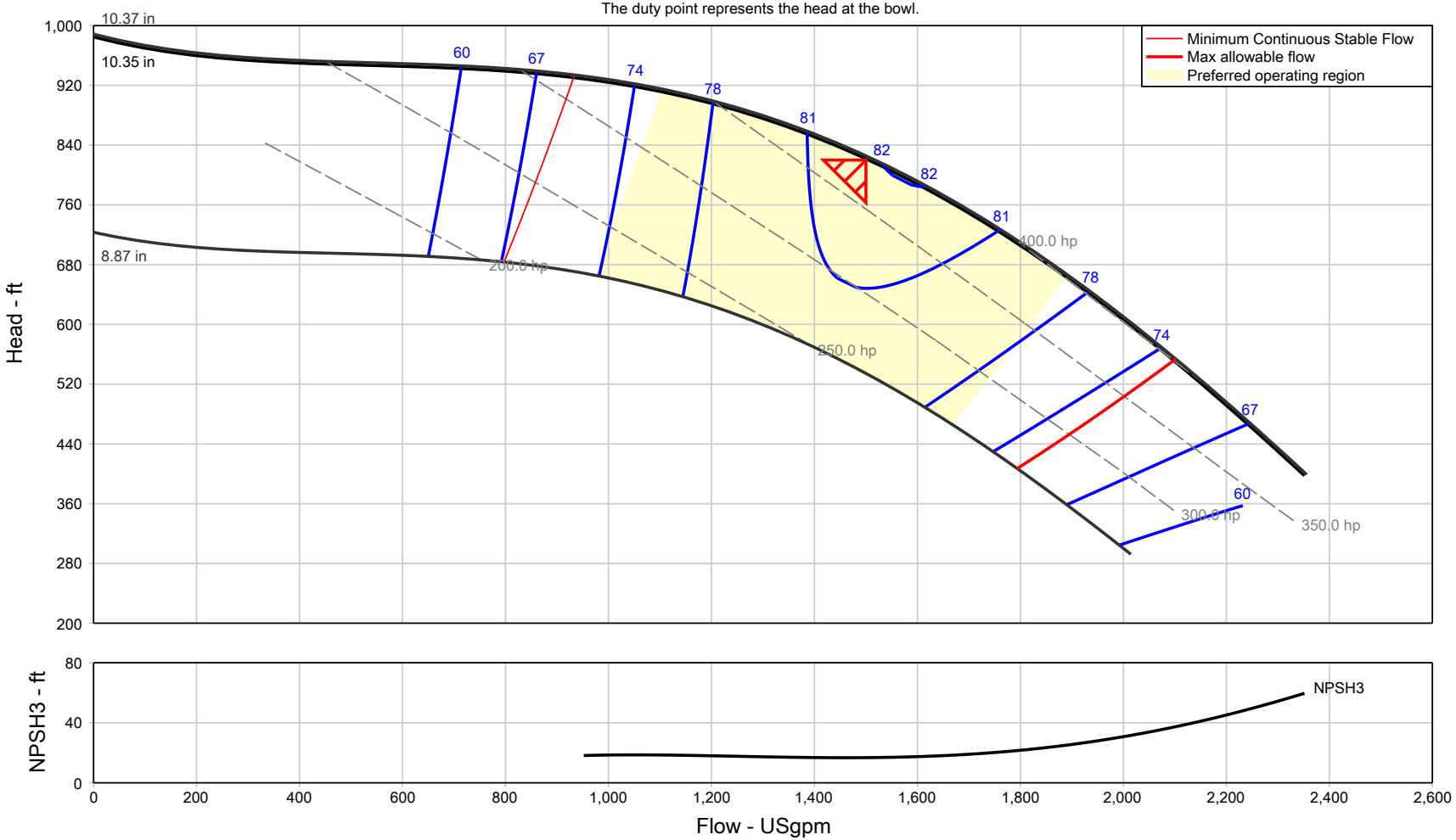
PENTAIR

Customer : DVWD
Project name :

Pump Performance Curve

Encompass 2.0 - 22.2.2

Bowl performance. Adjusted for construction and viscosity.
The duty point represents the head at the bowl.



Item number	: Default	Size	: 14M-SS	Flow, rated	: 1,500.0 USgpm
Service	:	Stages	: 8	Differential head / pressure, rated	: 820.0 ft
Quantity	: 0	Speed, rated	: 1770 rpm	NPSH required	: 16.78 ft
Quote number	:	Based on curve number	: 14_TURB_2130_1800_SS Rev 170804	Fluid density, rated / max	: 1.000 / 1.000 SG
Date last saved	: 08 Aug 2022 5:00 PM			Viscosity	: 1.00 cP
		Efficiency (bowl / pump)	: 81.88 / - %	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
		Power (bowl / pump)	: 380 / - hp		

Morse Pump Corporation

FACTORY PUMP SPECIFICATIONS AND BILL OF MATERIAL

CC: ☐ TEST FLOOR

KP#

ENTERED	DATE PROMISED	DATE SHIPPED	MOTOR S/N	PUMP SERIAL NO.
2-5-86	4-1			

OMER'S NAME: Sch[illegible]s Valley Water Dist

USER: Madras, Oregon / De Schutes Valley Water Dist

CUSTOMER P.O.: Signed Accept K3R2-017658

1 PUMPS ON THIS B111 AND 0 OTHER PUMPS ON THIS ORDER

SPEC. WRITER: Stark 9/5/86

CHECKER:

UMP DESCRIPTION		GENERAL	OPERATING CONDITIONS		TEST REQ'MTS: NONE ☒	SPECIAL INSTRUCTIONS
14M	STGS 9	SUCTION PROJ. —	GPM 1400	TDH 943'	☐ NON WITNESS R ( )	1.) For 9 Stage 14M Bowl Assem; 10" Col. 1 15/16" Shaft; 24½ x 10" x 10 x 18" T
E NO. 7000W		DISCH. PROJ. 1 15/16 x 12"	SUCTION LIFT / SUCTION HEAD		☐ CURVE APPROVAL	Head W/ HRB; 400 HP. Motor (2.) O.A.L.
FITTING 2B/F	ROTATION CCW	TUBE PROJ. —	PUMP RPM F/L 1775	MFR. S.F. 1.15	☐ WITNESS R ( )	Bot. Head To Bot. Suct Bell Lip 15'-3 5/16"
NO. 500K	DIS. POS. # —	SUCTION SIZE Bell	MTR. HP 400	MTR. TYPE ODP / WP-1	TEST QUAN:	3.) Assembly: Coat All Bowl Flanges
ASSEMBLED ☒ YES ☐ NO		DISCH. SIZE 10" THRD	IMPELLER T7FA92B	DIA. OR "D" DIM. Field 10.37"	GUAR EFF %	With Permatex Prior To Assembly
IVER MOUNTED BY CTORY - CUSTOMER		MIN. END PLAY .63"	SOLD OVERLOAD YES NO	SP GRAVITY —	☐ ENGINEERING TYPE B	4.) This Is Not A "Dry Pit" Installation
					☒ HYDRO ☐ CERTIFIED PSI 6050	REF. -

ING PLAN

SPECIAL AND VARIABLE PARTS ON THIS ORDER

QTY		MATERIAL	LEVEL CODE	PRODUCT CODE	DESCRIPTION	REFERENCE	LINE
	22 B017658	9306	F		HP - - - 400 FRAME - - 5008P	('B' STAMP SHIP DIRECT)	
					RPM - - 1800 (F/L 1775) BD - - - 24½"		
					CHAR - - 3/60/460V. OPTIONS - - W/NRR; 175% EHT; SPACE HEATERS		
					CONFIG - VHS BORE - - - 1.9375"	4546	46
					ENCL - - ODP/WP-1 KEYWAY - - ½" x ¼"	1093 chg	
					MFG. - U.S. Elec. CD = 54 21/32"		
					Pump had galv. coupl. guard - Do not paint per Dixie 11/25/86		
		11-22					

PAGE ___ OF ___

KC 675 B

Fairbanks Morse Pump
A Member of Pentair Pump Group

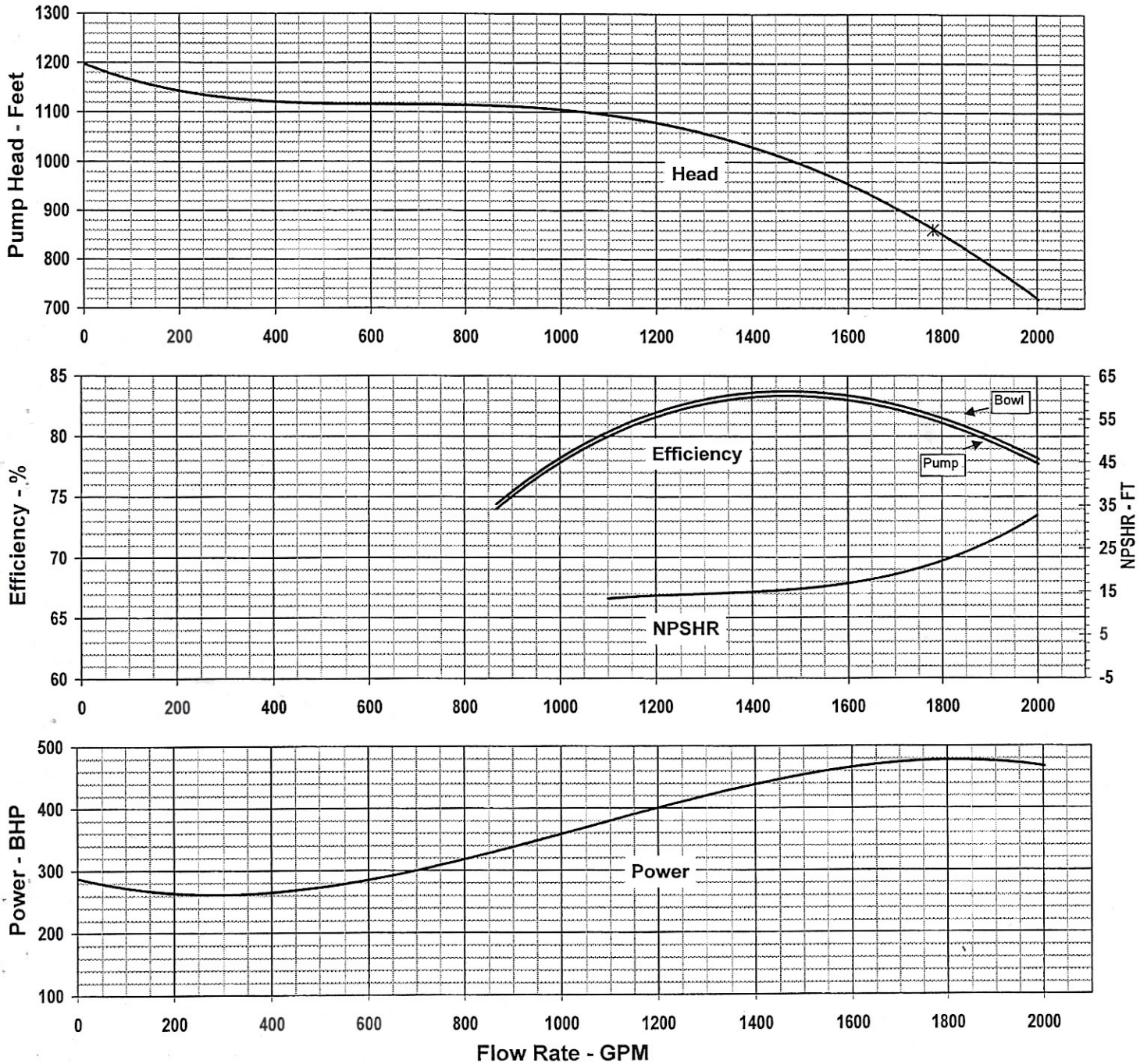
14M-7000 SUBMITTAL CURVE

CURVE NO.:	C-063287 REV.A
REV. A	TEN STAGES, 10" COLUMN
PROJECT NO.:	063287

SPEED	IMPELLER	DIAMETER	POT LENGTH
1775	T7FA92	8=10.37",2=9"	15'- 5-1/16"
SPHERE	DRIVER	DATE	BY
1"	500	6/17/02	BHW

THIS CURVE IS BASED ON THE ACTUAL TEST PERFORMANCE OF A SIMILAR PUMP(K4H1-602236& BC). ONLY THE INDICATED POINT(S) IS GUARANTEED.

GUARANTEED VALUES			
FLOW	HEAD	BOWL EFF.	BHP
1780	860		

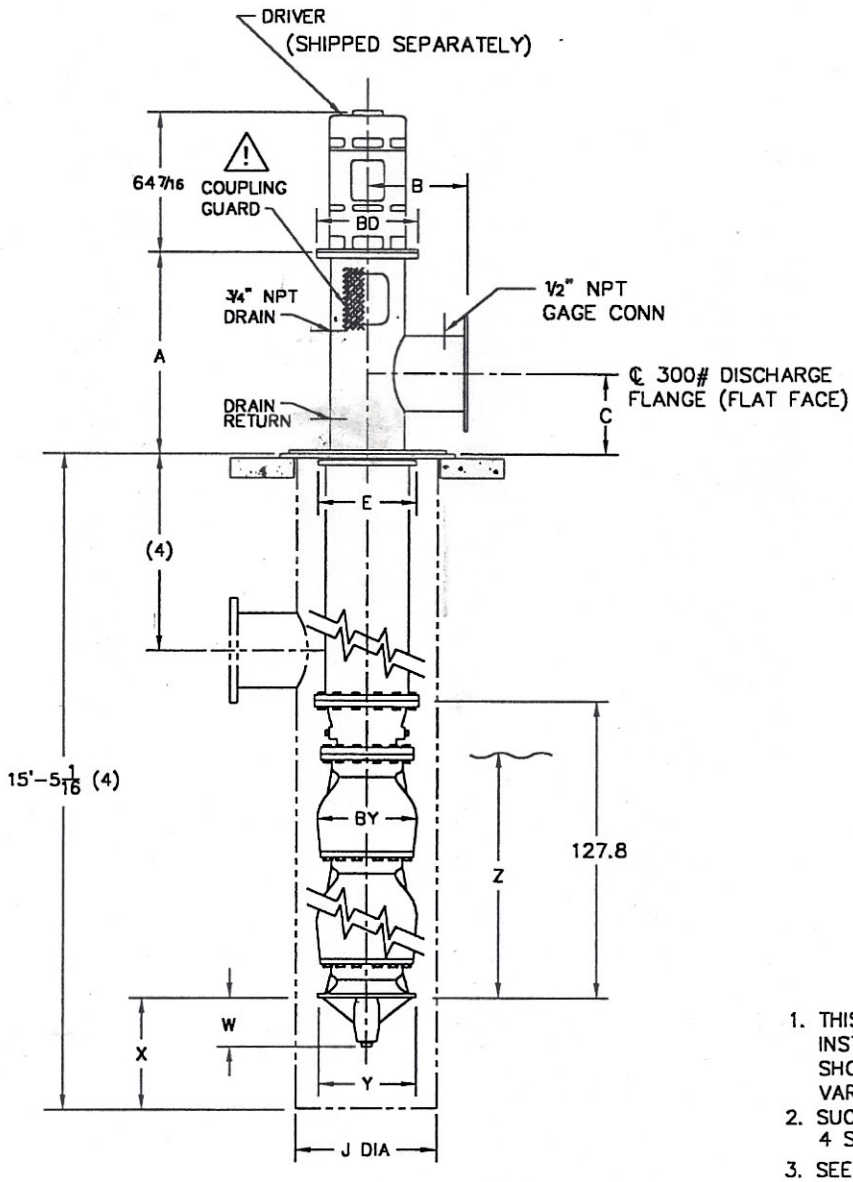


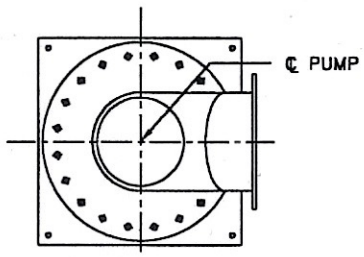
DRAWN BY	DATE	CHECKED BY	DATE	ENGINEERING APPROVAL	DATE	MARKETING APPROVAL	DATE	ECN
MSH	05/02	KB	05/02					PUMP

⚠ WARNING

DO NOT OPERATE THIS MACHINE WITHOUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUT PROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY.

DISCHARGE HEAD DIMENSIONS										
DISCH SIZE	COL SIZE	A** MTR BASE DIA (BD) 12	16½	20	24½	30½	B	C	E	"J" POT FLG
10	10	--	--	--	32	--	15	11	13¾	20





BOWL SIZE	COLUMN SIZE	W	X	Y	Z	BY
14M	10	6 7/8	12 1/8	14 3/4	36	14

1. THIS DRAWING NOT FOR CONSTRUCTION OR INSTALLATION UNLESS CERTIFIED. DIMENSIONS SHOWN ARE TYPICAL AND MAY VARY DUE TO VARIOUS TOLERANCES.
2. SUCTION POT MUST BE SUPPORTED ON ALL 4 SIDES AND GROUTED IN PLACE.
3. SEE SHEET 2 OF 2 FOR ADDITIONAL POT DIMENSIONS.
4. CUSTOMER TO VERIFY OR ADVISE LENGTH PRIOR TO OR AT RELEASE.

CUSTOMER: DESCHUTES VALLEY WATER					P.O.	
JOB NAME: DESCHUTES VALLEY WATER DISTRICT					SERVICE	
PUMP SIZE & MODEL: 14M-7000AW	STAGES: 10	GPM: 1600	TDH: 943	RPM: 1800	ROT: CCW	
MOTOR: US ELECTRIC	HP: 500	FRAME: 5009P	PHASE: 3	HERTZ: 60	VOLTS: 460	ENCL
CERTIFIED FOR	CERTIFIED BY: J. FINE			DATE: 5/02		

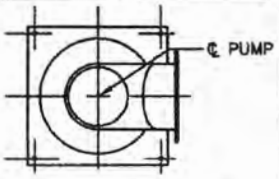
Fairbanks Morse
PENTAIR PUMP GROUP

SETTING PLAN TYPE "L" SURFACE HEAD

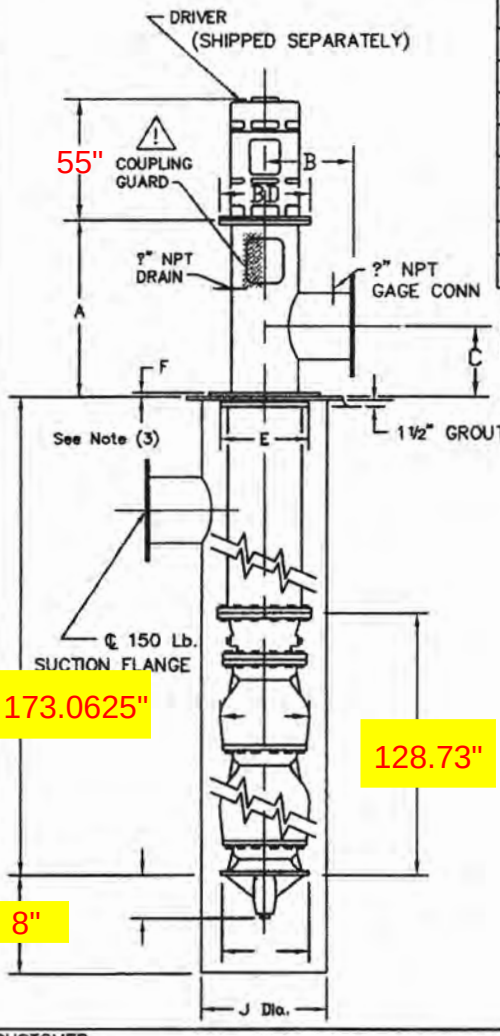
DWG. NO. SP-063287 REV 0

⚠ WARNING

DO NOT OPERATE THIS MACHINE WITHOUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUT PROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY.



PLAN VIEW OF SUCTION CAN (2)

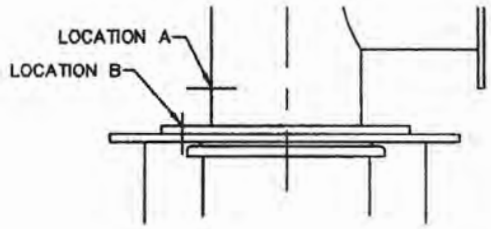


DISCHARGE HEAD DIMENSIONS

DISCH SIZE	COL SIZE	A** MTR BASE DIA (BD) 12	16?	20	24?	30?	B CONST SPD	B VAR SPD	C	S	T	E	F	"J" CAN FLANGE
4	4	28	28	--	--	--	10½	13½	7	¾	A	6⅝	1¼	12
4	4	28	28	--	--	--	11½	14½	7	¾	A	6⅝	1¼	14
6	6	30	30	--	--	--	10½	13½	8	¾	A	9	1¼	12
6	6	30	30	--	--	--	11½	14½	8	¾	A	9	1¼	14
6	6	30	30	--	--	--	12¾	16	8	¾	A	9	1¼	16
8	8	32	32	32	--	--	12¾	16	9	¾	A	11½	1¼	16
8	8	--	32	32	--	--	13½	16½	9	¾	A	11½	1½	18
8	8	--	32	32	--	--	14¾	17½	9	¾	A	11½	1½	20
10	10	--	35	35	--	--	13½	16½	11	¾	A	13¾	1½	18
10	10	--	35	35	--	--	14¾	17½	11	1	B	13¾	1½	20
10	10	--	35	35	38	--	17	20	11	1	B	13¾	1½	24
12	12	--	37	37	--	--	14¾	17½	12	1	B	16¼	1½	20
12	12	--	37	37	40	--	17	20	12	1	B	16¼	1½	24
12	12	--	37	37	40	--	20⅜	23½	12	1	B	16¼	1¾	30
14	14	--	40	40	--	--	17	20	14	1	B	17½	1½	24
14	14	--	40	40	43	--	20⅜	23½	14	1	B	17½	1¾	30
14	14	--	40	40	43	--	24	24½	14	1	B	17½	1¾	36
16	16	--	42	42	45	--	20⅜	23½	15	1	B	19½	1¾	30
16	16	--	42	42	45	50	24	24½	15	1	B	19½	1¾	36

** ADD 4½" FOR VSS DRIVER & SPACER CPLG

CAN VENT SIZE (S NPT) AND LOCATION (T)



1. THIS DRAWING NOT FOR CONSTRUCTION OR INSTALLATION UNLESS CERTIFIED. DIMENSIONS SHOWN ARE TYPICAL AND MAY VARY DUE TO VARIOUS TOLERANCES.
2. SUCTION CAN MUST BE SUPPORTED ON ALL 4 SIDES AND GROUTED IN PLACE.
3. CUSTOMER TO VERIFY OR ADVISE OVERALL LENGTH PRIOR TO OR AT RELEASE.

CUSTOMER: DVWD					P.O.	PENTAIR FAIRBANKS NIJHUIS
JOB NAME				SERVICE: Potable Water		SETTING PLAN TYPE "L" SURFACE HEAD
PUMP SIZE & MODEL: 12M-SS	STAGES: 11	GPM: 1100	TDH: 808	RPM: 1770	ROT: CCW	
MOTOR: US	HP: 300	FRAME: 447TP	PHASE: 3	HERTZ: 60	VOLTS: 460	ENCL: WP1
CERTIFIED FOR	CERTIFIED BY		DATE		DWG. NO. 7000CS001	REV 1

Pump 10

Certified Performance Curve

PENTAIR FAIRBANKS NIJHUIS

Customer:	Granich Engineered Products, Inc.			
End User:	Deschutes Valley Water Districts - Madras, OR			
Sales No.	Proj. No.	Serial No.	Rev.	Test Date
51665519	0909928	10539988	0	3/1/2018

Certified By

John C. Mamie — 3/2/2018

Product Engineer — Date

Pump Details	
Application:	AW
Series:	7100
Model:	12M
Stages:	11
Running Pos:	0.200"
Speed:	1770 RPM

Guaranteed Performance			
Flow	Head	Power	Efficiency
(GPM)	(ft)	(HP)	(%)
1100	808		
1300		300	

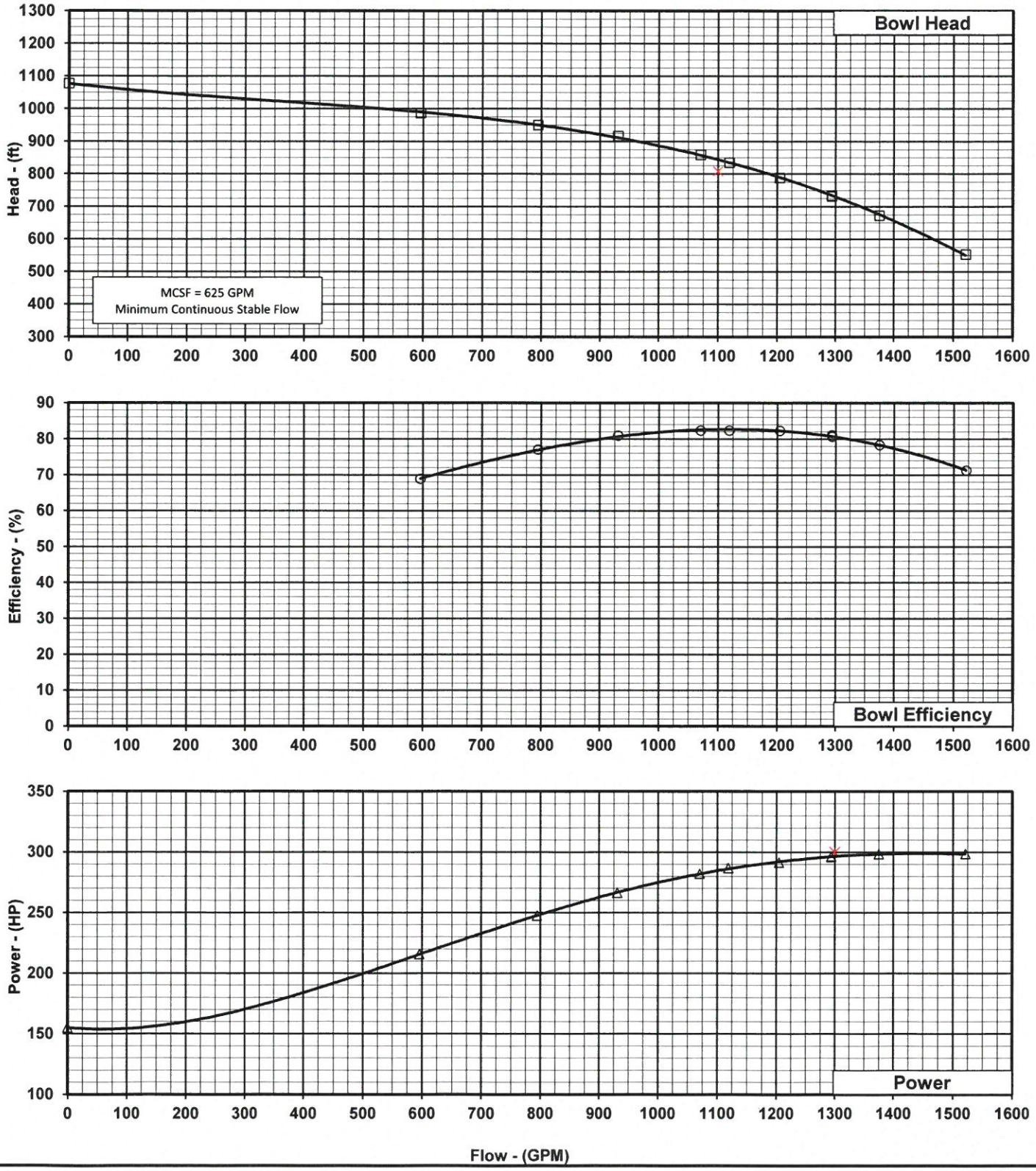
Plotted per Hydraulic Institute paragraph 14.6.6.2.2.

Impeller Details			
Symbol: T7EA92			
Diameter	Quantity	Underfile	Material
9.16"	8	0.03"	2660
8.20"	2	0.03"	2660
7.80"	1	0.03"	2660

Details of (Test) Motor Used for Test

350 HP, 1800 RPM, VHS

S/N: KKJ1023003



Appendix C

AWWA Water Audit

AWWA Free Water Audit Software v6.0

FWAS v6.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format and is not meant to take the place of a full-scale, comprehensive water audit format. Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targeting loss reduction levels. This tool contains several separate worksheets. Sheets can be accessed using the tabs at the bottom of the screen, or by clicking the TOC links below.

Table of Contents (TOC)

AWWA Web Resources for Water Loss Control

https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control

Items referenced in the Free Water Audit Software v6.0 on the web:

- Data Grading Matrix v6.0
- Example Water Audit v6.0
- Water Audit Compiler v6.0
- AWWA Reports on Performance Indicators
- M36 Manual

Enter Basic Information

Name of Utility:	Deschutes Valley Water District
Name of Contact Person:	Joel Gehrett
Email:	jgehrett@dvwd.org
Telephone | Ext.:	541.475.3849
City/Town/Municipality:	Madras
State / Province:	Oregon (OR)
Country:	
Audit Preparation Date:	
Audit Year:	2021
Audit Year Label:	2021 (Fiscal, Calendar, etc)
Audit Period Start Date:	Jan 01 2021
Audit Period End Date:	Dec 31 2021
Volume Reporting Units:	Million gallons (US)
Water System Structure:	Retail
Water Type:	Potable Water
System ID Number:	
Validator Name/ID:	
Validator Email:	
Estimated Total Population Served by Water Utility:	

Key of Input Acronyms

In order of appearance in the Worksheet

VOS	Volume from Own Sources
VOSEA	VOS Error Adjustment
WI	Water Imported
WIEA	WI Error Adjustment
WE	Water Exported
WEEA	WE Error Adjustment
BMAC	Billed Metered Authorized Consumption
BUAC	Billed Unmetered Authorized Consumption
UMAC	Unbilled Metered Authorized Consumption
UUAC	Unbilled Unmetered Authorized Consumption
SDHE	Systematic Data Handling Errors
CMI	Customer Metering Inaccuracies
UC	Unauthorized Consumption
Lm	Length of mains
Nc	Number of service connections
Lp	Average length of (private) customer service line
AOP	Average Operating Pressure
CRUC	Customer Retail Unit Charge
VPC	Variable Production Cost

Color Key User input | Calculated | Optional default

Guidance for the Worksheet

Choosing to enter unit of **percent** or **volume** (applies to VOSEA, WIEA, WEEA, CMI) choose entry option:

1.00%	percent	*or*
	volume	25.000

Choosing to enter **default** or **custom input** (applies to UUAC, SDHE, UC) choose entry option:

0.25%	default	*or*
	custom	75.000

Guidance for the Interactive Data Grading

Use acronym buttons in IDG header to navigate among inputs. Acronym Key above. White = needs answers, orange = complete, clear = not required. Example below.

VOS	VOSEA	WI	WIEA	WE	WEEA	BMAC	BUAC	UMAC	UUAC
SDHE	CMI	UC	Lm	Nc	Lp	AOP	CRUC	VPC	

After clicking an acronym button, answer all visible questions in the order they're presented, choosing best-fit answer

Grade will populate when all visible questions are complete for an input: **7**

The limiting criteria will be labeled along the right. If only 1 limiting criterion is shown, improving on that criterion will achieve a higher data grade. If multiple limiting criteria are shown, improving on *each* limiting criterion is necessary to achieve a higher data grade. A complete inventory of data grading criteria is available in the Data Grading Matrix v6.0 (see web resources)

Limiting

If you have questions or comments regarding this software please contact us at: wlc@awwa.org

AWWA Free Water Audit Software: Worksheet

FWAS v6.0

Water Audit Report for: Deschutes Valley Water District
Audit Year: 2021 | Jan 01 2021 - Dec 31 2021 | 2021

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	6	1,641.326	MG/Yr	n g 4		percent	VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr				WEEA
	WATER SUPPLIED:				1,641.326	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	7	1,493.051	MG/Yr		
BUAC	Billed Unmetered:	n	g	8	33.818	MG/Yr		
UMAC	Unbilled Metered:	n	g	n/a		MG/Yr		
UUAC	Unbilled Unmetered:	n	g	3	3.817	MG/Yr	0.25%	default

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 1,530.686 MG/Yr

WATER LOSSES 110.640 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	3.817	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	1	38.283	MG/Yr	2.50%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	3.817	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 45.918 MG/Yr

Real Losses

Real Losses: 64.722 MG/Yr

WATER LOSSES: 110.640 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 114.457 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	8	354.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	8	4,646		(active *and* inactive)
	Service connection density:				13	conn./mile main	

Are customer meters typically located at the curbstop/property line? Yes

Lp: n g 10

Average length of customer service line has been set to zero and a data grading of 10 has been applied

AOP	Average Operating Pressure:	n	g	7	150.0	psi

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	1	$25.37	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	3	$50.00	$/Million gallons		$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier III (51-70). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Customer Metering Inaccuracies (CMI)
3: Customer Retail Unit Charge (CRUC)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

go to input

Volume from Own Sources (VOS) - Data Grading Criteria

go to notes

vos	Criteria Question	Select Best-Fit Answers to All Visible Questions	
vos.0	Did the water utility supply any water from its own sources during the audit year?	Yes	
vos.1	What percent of own supply volume is metered?	>99%	

For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the finished water volume.
In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.
Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).
Secondary device can include conversion to mA, meter transmitter or similar instrumentation.
Tertiary device can include SCADA, historian or other computerized archival system.

vos.2	What is the frequency of electronic calibration?	At least semi-annually	
vos.3	What level of data transfer errors are checked as part of the electronic calibration process?	Data transfer errors are checked at secondary device(s), but no tertiary device(s) exist	
vos.4	Is the most recent electronic calibration documentation available for review?	Yes	
vos.5	What is the frequency of in-situ flow accuracy testing?	Less than annual but within last 5 years	
vos.6	Is the most recent in-situ flow accuracy testing documentation available for review?	Yes	
vos.7	What are the total volume-weighted average results of in-situ flow accuracy testing (during or closest to audit year)?	Between ±3% to ±6%	
vos.8	Have testing and calibration procedures been closely scrutinized for compliance with procedures described in the AWWA M36 and/or M33 Manual(s)?	Yes	
vos.9	Which best describes the frequency of finished water meter readings?	Once per month	Limiting
vos.10	Which best describes the frequency of data review for anomalies/errors? These can include numbers that are outside of typical patterns, and zero or 'null' values that may reflect a gap in data recording.	Once per month	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**6**	

go to input

Volume from Own Sources Error Adjustment (VOSEA) - Data Grading Criteria

go to notes

vosea	Criteria Question	Select Best-Fit Answers to All Visible Questions	
vosea.1	Are tank levels monitored automatically & recorded daily?	Yes	
vosea.2	Are daily changes of stored water volumes in distribution system tanks included in the tabulation of the daily "Volume from Own Sources" quantity?	Yes	
vosea.3	Is the annual net distribution storage change included in either the VOS input or the VOSEA input?	No	
vosea.4	Are the flow accuracy test and/or electronic calibration results included in the VOSEA input in the water audit?	Results are available but not analyzed	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**4**	

go to input

Water Imported (WI) - Data Grading Criteria

go to notes

wi	Criteria Question	Select Best-Fit Answers to All Visible Questions
wi.0	Did the water utility import any water during the audit year?	No
wi.1		

For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the water imported volume.
In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.
Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).
Secondary device can include conversion to mA, meter transmitter or similar instrumentation.
Tertiary device can include SCADA, historian or other computerized archival system.

wi.2		
wi.3		
wi.4		
wi.5		
wi.6		
wi.7		
wi.8		
wi.9		
wi.10		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Water Imported Error Adjustment (WIEA) - Data Grading Criteria

go to notes

wiea	Criteria Question	Select Best-Fit Answers to All Visible Questions
wiea.1		
wiea.2		
wiea.3		
wiea.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Water Exported (WE) - Data Grading Criteria

go to notes

we	Criteria Question	Select Best-Fit Answers to All Visible Questions
we.0	Did the water utility export any water during the audit year?	No
we.1		

For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the water exported volume.
In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.
Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).
Secondary device can include conversion to mA, meter transmitter or similar instrumentation.
Tertiary device can include SCADA, historian or other computerized archival system.

we.2		
we.3		
we.4		
we.5		
we.6		
we.7		
we.8		
we.9		
we.10		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Water Exported Error Adjustment (WEEA) - Data Grading Criteria

go to notes

weea	Criteria Question	Select Best-Fit Answers to All Visible Questions
weea.1		
weea.2		
weea.3		
weea.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Billed Metered Authorized Consumption (BMAC) - Data Grading Criteria

go to notes

bmac	Criteria Question	Select Best-Fit Answers to All Visible Questions	
bmac.0	Were any customers metered in the audit year?	Yes	
bmac.1	For billed metered accounts, what % of bills are estimated in a typical billing cycle?	5% or less	
bmac.2	How often does the utility read its customer meters? For systems with multiple read frequencies, select the reading frequency that describes the majority of your customers.	Monthly	
bmac.3	Is the BMAC volume pro-rated to represent consumption occuring exactly during the audit period?	Yes	
bmac.4	How frequently does internal review by utility staff of the BMAC volumes occur?	More frequently than annually but less than every billing cycle	
bmac.5	What level of detail is examined in the internal review of BMAC volumes?	Sum total only	Limiting
bmac.6	When was the most recent billing data review by someone who is independent of the utility billing process?	More than 5 years ago, or not sure	
bmac.7			
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**7**	

go to input

Billed Unmetered Authorized Consumption (BUAC) - Data Grading Criteria

go to notes

buac	Criteria Question	Select Best-Fit Answers to All Visible Questions	
buac.0	Was there any billed consumption on unmetered accounts in the audit year?	Yes	
buac.1	What portion of billed accounts are unmetered (% by number of accounts)?	5% or less	
buac.2	Methodology to quantify consumption for unmetered accounts?	Estimated for each unmetered customer OR derived from representative statistical samples of the system	
buac.3	How frequently is unmetered customer consumption estimated?	Bi-monthly	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**8**	

go to input

Unbilled Metered Authorized Consumption (UMAC) - Data Grading Criteria

go to notes

umac	Criteria Question	Select Best-Fit Answers to All Visible Questions
umac.0	Did the water utility have any unbilled-metered consumption in the audit year?	No
umac.1		
umac.2		
umac.3		
umac.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Unbilled Unmetered Authorized Consumption (UUAC) - Data Grading Criteria

go to notes

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT:	3

go to input

Systematic Data Handling Error (SDHE) - Data Grading Criteria

go to notes

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT:	3

go to input

Customer Metering Inaccuracies (CMI) - Data Grading Criteria

go to notes

cmi	Criteria Question	Select Best-Fit Answers to All Visible Questions	
cmi.0	Was there any metered customer usage during the audit period?	Yes	
cmi.1	Do you test meters reactively (when triggered by customer complaint or billing/consumption flag)?	No reactive testing conducted	Limiting
cmi.2	For small size customer meters, which best describes the frequency of proactive testing (effort beyond when triggered by customer complaint or billing/consumption flags)?	Recurring, within 5 years prior to audit period	
cmi.3	Which best describes what meters are included in the proactive small size customer meter testing activities?	Testing targeted to subsets of meters ie oldest meters	
cmi.4	For mid and large size customer meters, which best describes the frequency of the proactive testing program?	Recurring, within 5 years prior to audit period, but less frequently than annually	
cmi.5	Which best describes what meters are included in the proactive mid- and large customer meter testing activities?	Proactive - all large meters are on a testing schedule	
cmi.6	Which best describes how the input was derived?	No test results were used, but at least 50% of meter stock has been replaced within two years of the audit period	
cmi.7	Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology?	Yes	
cmi.8	To what extent does meter replacement occur and for which meters?	Proactive replacement informed by meter accuracy testing and study of meter performance trends	
cmi.9	Which best describes the reliability of meter installation records?	Records are kept for meter installations, and they include data on installation date, type, size, and manufacturer	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**1**	

go to input

Unauthorized Consumption (UC) - Data Grading Criteria

go to notes

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT: **3**

go to input

Length of Mains (Lm) - Data Grading Criteria

go to notes

Lm	Criteria Question	Select Best-Fit Answers to All Visible Questions	
Lm.1	How was the input derived?	Derived directly from Mains inventory (GIS, ledger, etc)	
Lm.2	Are hydrant laterals included in the input derivation?	No	Limiting
Lm.3	Which best describes how the Mains inventory (GIS, ledger, etc) is kept up to date?	Additions or subtractions are updated in the mains inventory (GIS, ledger, etc), at least annually	
Lm.4	Which best describes how the Mains inventory (GIS, ledger, etc) is field validated to confirm field conditions match the inventory?	Field validation is accomplished (i.e. in daily operations or specific validation projects)	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**8**	

go to input

Number of Service Connections (Nc) - Data Grading Criteria

go to notes

Nc	Criteria Question	Select Best-Fit Answers to All Visible Questions	
Nc.1	How was the input derived?	Extracted from Services inventory (GIS, billing system, etc)	
Nc.2	What is the count of services based on?	Non-premise based, i.e. meter count, customer count	Limiting
Nc.3	Are inactive (but still pressurized) service lines included in the input? These may be metered or unmetered.	Yes	
Nc.4	Which best describes how the inventory of service connections (GIS, billing system, etc) is kept up to date?	Additions or subtractions are updated in the service line inventory (GIS, billing system, etc), at least annually	
Nc.5	Which best describes how the inventory of service connections (GIS, billing system, etc) is field validated to confirm field conditions match the inventory?	Field validation is accomplished for the entire system (i.e. in daily operations or specific validation projects)	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**8**	

go to input

Average Length of (Private) Customer Service Line (Lp) - Data Grading Criteria

go to notes

Lp	Criteria Question	Select Best-Fit Answers to All Visible Questions
Lp.0	Are customer meters typically located at the curbstop or property line?	Yes
Lp.1		
Lp.2		
Lp.3		
Lp.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**10**

go to input

Average Operating Pressure (AOP) - Data Grading Criteria

go to notes

aop	Criteria Question	Select Best-Fit Answers to All Visible Questions	
aop.1	Which best describes checks on the boundary integrity for the system's pressure zone(s)?	Normally-closed boundary valves between zones have been confirmed within the past 3 years to be fully closed	
aop.2	Which best describes how one-time pressure readings (i.e. from hydrants) are collected?	Collected annually during routine system flushing and/or hydrant testing	
aop.3	Which best describes where continuous pressure data (via temporary data loggers or permanent telemetry) is collected?	At zone boundary conditions only (i.e. supply entry points, PRVs, booster stations)	
aop.4	Which best describes how continuous pressure data is collected?	Temporary data logger(s) deployed, but limited and not capturing seasonal variation during the year	Limiting
aop.5	How was the input derived?	Calculated from field data as a simple average	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**7**	

go to input

Customer Retail Unit Charge (CRUC) - Data Grading Criteria

go to notes

cruc	Criteria Question	Select Best-Fit Answers to All Visible Questions	
cruc.0	Was any metered consumption billed on a volumetric basis in the audit period?	Yes	
cruc.1	Which best describes the use and reliability of the current rate structure?	Customer bill calculations have not been checked to confirm the rate structure is correctly implemented	Limiting
cruc.2	Choose the option that best describes how the input was derived	Rate structure has multiple volumetric rates, but only one rate was selected for this input	
cruc.3	Is there any additional volumetric revenue the utility receives that depends on water meter readings, such as sewer?	No	
cruc.4	Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology?	No	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**1**	

go to input

Variable Production Cost (VPC) - Data Grading Criteria

go to notes

vpc	Criteria Question	Select Best-Fit Answers to All Visible Questions	
vpc.1	Choose the option that best describes how the input was derived	Only one source of water exists, which was the basis for the input derivation	
vpc.2	Choose the option that best describes which short-run marginal costs have been included in the input, using the definitions below for reference. Short-run marginal costs can include the following: - chemicals + power for treatment, typically applicable if the utility is producing/treating water - power for distribution, typically applicable if pumps exist in the distribution network - water acquisition costs, typically applicable if the utility is purchasing water or incurs any extraction costs for withdrawing from a source Some short-run marginal costs may not be applicable. The auditor should analyze the system characteristics to determine which costs are applicable for inclusion in the VPC input derivation. See also the latest AWWA M36 Manual for further guidance.	Some but not all applicable short-run marginal costs are included	Limiting
vpc.3	Choose the option that best describes which long-run marginal costs have been included in the input, using the definitions below for reference. Long-run marginal costs can include the following: - water treatment residuals management, typically applicable if solids are produced from water treatment process - accelerated wear & tear on dynamic equipment, typically applicable if pumps exist for treatment and/or distribution, or any other equipment exists that wears out as a function of use instead of time (i.e. filter media, chemical dosing pumps, uv disinfection bulbs, etc) - payouts for damage claims from main and service line breaks, typically applicable if damage claims are paid by the utility - accelerated expansion of supply capacity, typically applicable if the utility is at or nearing supply capacity, or scarecity costs in water scarce areas - full cost pricing that includes all lifecycle costs and externalities (internalized or not) Some long-run marginal costs may not be applicable. The auditor should analyze the system characteristics to determine which costs are applicable for inclusion in the VPC input derivation. See also the latest AWWA M36 Manual for further guidance.	Long-run marginal costs have been evaluated for applicability, and some but not all applicable costs are included	
vpc.4	Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology?	No	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**3**	

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

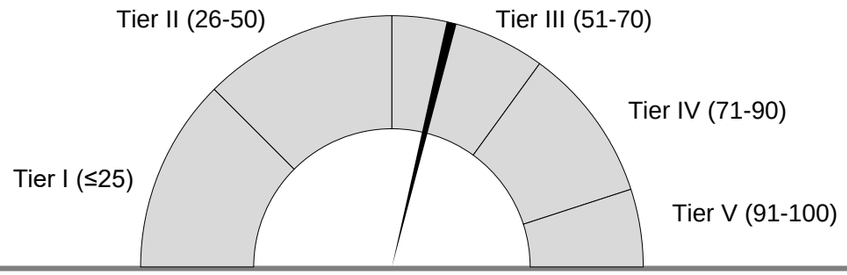
go to worksheet | go to grading | go to references

Water Audit Report for: Deschutes Valley Water District **Audit Year:** 2021 ## Jan 01 2021 - Dec 31 2021

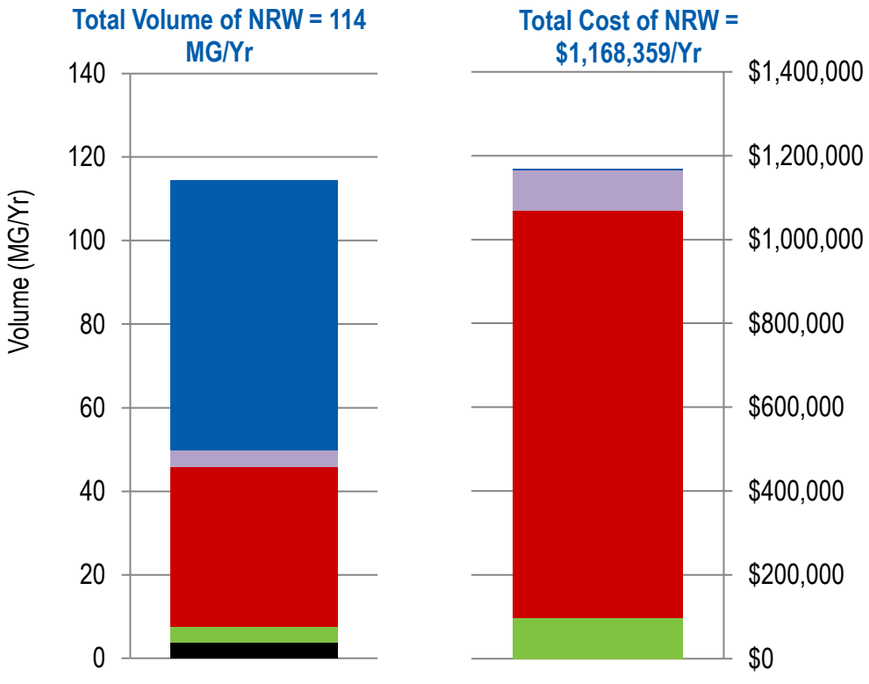
Data Validity

Data Validity Score: 57 **Data Validity Tier:** Tier III (51-70)

See Loss Control Planning for Tier Details



NRW Components Summary

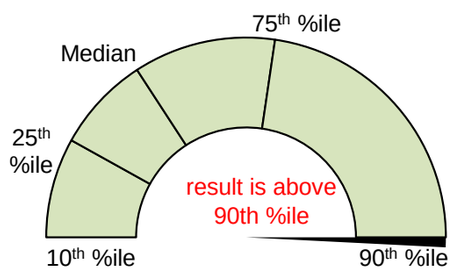


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	45.9	$1,164,932	CRUC
Real Losses	64.7	$3,236	VPC
Unbilled Authorized Cons	3.8	$191	VPC
Non-Revenue Water	114.5	$1,168,359	Blended

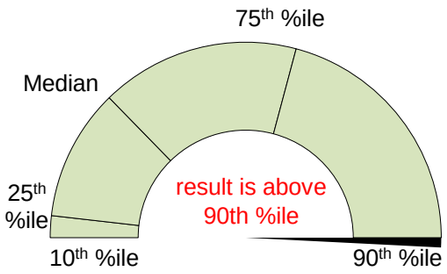
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

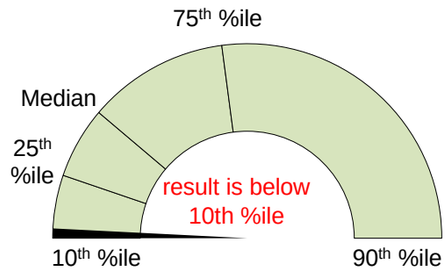
gauge %iles per validated industry ranges[2]



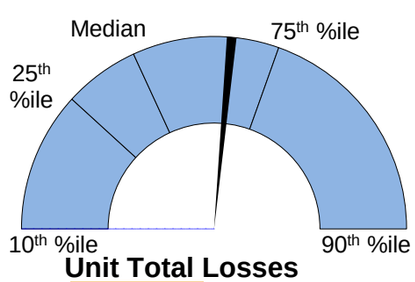
Total Loss Cost Rate
251.44 $/conn/year



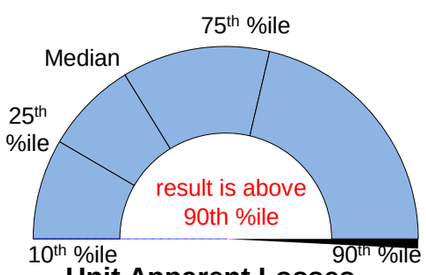
Apparent Loss Cost Rate
250.74 $/conn/year



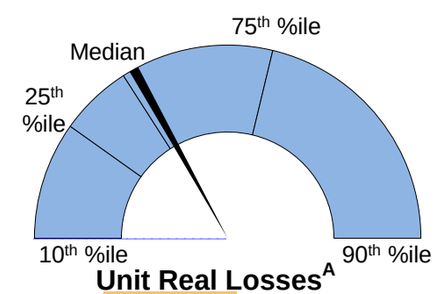
Real Loss Cost Rate
0.70 $/conn/year



Unit Total Losses
65.2 gal/conn/day

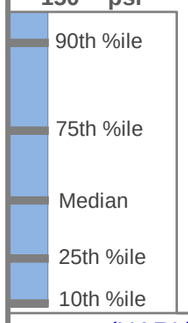


Unit Apparent Losses
27.1 gal/conn/day

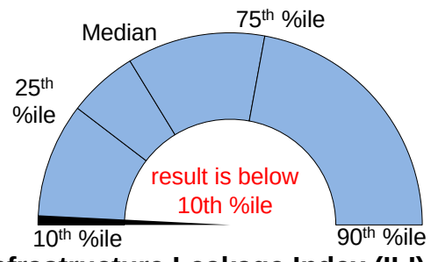


Unit Real Losses[A]
38.2 gal/conn/day

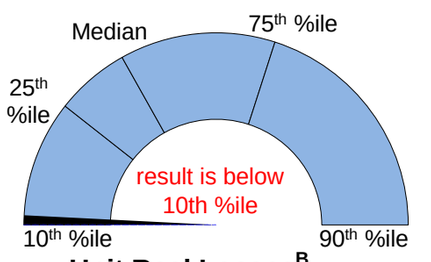
Average Operating Pressure
150 psi



AOP is above 90th %ile



Infrastructure Leakage Index (ILI)
0.5 dimensionless



Unit Real Losses[B]
500 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	143.2 MG/Yr	84.4 gal/conn/day

Guidance Information for Key Performance

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[5].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes					Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning	Tracking		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with “low” connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software
Water Balance

Water Audit Report for: Deschutes Valley Water District
Audit Year: 2021 Jan 01 2021 - Dec 31 2021
Data Validity Tier: Tier III (51-70)

FWAS v6.0

		Water Exported (WE) (corrected for known errors) *0.000*	Billed Water Exported			Revenue Water (Exported) 0.000
Volume from Own Sources (VOS) (corrected for known errors) *1,641.326*	System Input Volume *1,641.326*	Water Supplied *1,641.326*	Authorized Consumption *1,530.686*	Billed Authorized Consumption *1,526.869*	Billed Metered Consumption (BMAC) (water exported is removed) *1,493.051*	Revenue Water 1,526.869
					Billed Unmetered Consumption (BUAC) *33.818*	
				Unbilled Authorized Consumption *3.817*	Unbilled Metered Consumption (UMAC) *0.000*	Non-Revenue Water (NRW) 114.457
					Unbilled Unmetered Consumption (UUAC) *3.817*	
			Water Losses *110.640*	Apparent Losses *45.918*	Systematic Data Handling Errors (SDHE) *3.817*	
					Customer Metering Inaccuracies (CMI) *38.283*	
					Unauthorized Consumption (UC) *3.817*	
Water Imported (WI) (corrected for known errors) *0.000*				Real Losses *64.722*	Leakage on Transmission and/or Distribution Mains *Not broken down*	
					Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
					Leakage on Service Connections *Not broken down*	

AWWA Free Water Audit Software:
Determining Water Loss Standing

Water Audit Report for: Deschutes Valley Water District
Audit Year: 2021 Jan 01 2021 - Dec 31 2021
Data Validity Tier: Tier III (51-70)

Water Loss Control Planning Guide

	Water Audit Data Validity Tier (Score Range)				
Functional Focus Area	**Tier I (1-25)**	**Tier II (26-50)**	**Tier III (51-70)**	**Tier IV (71-90)**	**Tier V (91-100)**
Audit Data Collection	Launch auditing and loss control team; address supply metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations; Identify data gaps; improve supply metering	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs; Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or AMR/AMI system	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon with PIs for performance comparisons for real losses	Performance Benchmarking with PIs is meaningful in comparing real loss standing	Identify Best Practices/ Best in class; PIs are very reliable as real loss performance indicators for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Appendix D

Water Sale Agreement

WATER SALE AGREEMENT
between
DESCHUTES VALLEY WATER DISTRICT
and
CITY OF MADRAS

THIS AGREEMENT is made and entered into this 22nd day of June 2021, by and between DESCHUTES VALLEY WATER DISTRICT, hereinafter referred to as "District" and the CITY OF MADRAS, hereinafter referred to as "City".

RECITALS

WHEREAS, the District owns and operates a domestic water district under ORS Chapter 264 for the purpose of supplying domestic water;

AND WHEREAS, the City wishes to purchase domestic water from the District for the purpose of providing for the entire water needs for the City of Madras except in situations of emergency where the District is unable to provide for the entire needs of the City in which case the City will utilize it's own wells during the period of the inability of the District to provide sufficient water for the needs of the residents of the City of Madras;

AND WHEREAS, the District and the City have previously operated under a Water Sale Agreement dated May 24, 2016, which expired June 30, 2019, and was extended through June 30, 2021 and this Agreement shall replace the previous Agreement, and the previous Agreement, upon expiration, shall be null and void and have no effect;

AND WHEREAS, the District and the City are authorized pursuant to ORS 190.010 to enter into an intergovernmental contractual agreement;

AND WHEREAS, the District is authorized specifically pursuant to ORS 264.310 to contract and enter into an intergovernmental agreement to supply and sell surplus water on such terms and conditions and at such rates as the District's Board shall consider advisable;

NOW THEREFORE, the parties hereby mutually agree as follows:

TERM OF AGREEMENT: This agreement shall commence on July 1, 2021 and extend through June 30, 2024. The District shall make available to the City subject to the provisions of this agreement domestic water at the District's three points of interconnection with the City water system.

WATER RIGHTS: The City shall pay to the District according to the following rate schedule:

Effective Date	Monthly Delivery Charge	Usage Charge per Unit[1]
July 1, 2021 through June 30, 2022	$11,769.00	$0.35
July 1, 2022 through June 30, 2023	$12,004.00	$0.36
July 1, 2023 through June 30, 2024	$12,244.00	$0.37

1. *One (1) Unit is equal to 100 cubic feet of water*

METERING AND PAYMENTS: The District shall meter the amount of water delivered to the City by the District at the District's points of delivery to the City. The parties acknowledge that there are three points of delivery existing. The points of delivery are the locations where the District and City's water facilities are connected and metering by the District..

The District shall provide the City with monthly computations of metered use and the City shall make monthly payments within thirty (30) days of the City receiving the invoice. The City shall, in addition, pay the Delivery Charge each month during the term of this contract.

RENEWAL OF CONTRACT: Unless notice is given by either party to this contract in writing, no later than ninety (90) days of the expiration date of this contract, that the contract shall not be renewed, then the contract shall automatically be renewed for an additional one year period at the current rate schedule. The renewal shall be automatic and shall commence on July 1st of the succeeding period and shall expire on June 30th of the succeeding period. For each renewal period the parties reserve the right to notify the other party of their intent to terminate the contract ninety (90) days before the next contract expiration date. During any renewal contract period the District shall be able to negotiate a different monthly charge for the provision of domestic water services.

POINT OF DELIVERY AND MAINTENANCE: The parties agree that there are three points of delivery located within the City. The District is responsible for the maintenance of the valve house locations at the point of delivery. The point of delivery is where the District shall meter the water delivered to the City. The District will maintain all equipment and installation of valve house metering equipment at the point of delivery. The valve housing and equipment shall belong to the District. The District shall maintain all necessary repairs, maintenance and replacement of equipment at the point of delivery.

SUPPLY OF WATER: The District shall supply to the City all the water needs that the City shall require during the period of this agreement. The water shall be used by the City for domestic water purposes including the City's irrigation of parks and green spaces. The District shall supply water to the City pursuant to this agreement so long as available to the District a surplus supply of water existing over and above all demands of the District's domestic water users.

CONTINUITY OF SERVICE: The District may be required to curtail, interrupt or reduce deliveries of water in order to construct, install, maintain, repair, replace, remove, investigate or inspect any of the District's equipment or any part of its system. In such circumstances, the District shall use its best efforts to keep all curtailments, interruptions or reductions to a minimum. The District shall notify the City in advance when the District is required to temporarily curtail water delivery service and shall notify the City as to the period of time in which said service may be temporarily discontinued for the needs of the District to make necessary repairs, improvements or testing.

In the event that the City shall need to make repairs, construction, maintenance or inspect any of the City's domestic water delivery system, the City shall notify the District of the need for the District to shut down a supply of water to the City on a temporary basis to allow the City to construct or maintain the City's water delivery system to it's citizens. The District agrees to cease service for a period of time to allow the City to make any necessary repairs, inspection, replacement or construction. Notices shall be given by the parties to the appropriate representative of the City and District as designated from time to time by the City or District.

LIABILITY: Neither party, its directors, officers and employees, shall be liable to the other party for any loss or damage to the water system of the other caused by or arising out of an interruption of water service, whether or not such interruption of water service resulted from gross negligence, negligence, wrongful act or omission of the other party. An interruption of water service caused by the design, construction, operation, maintenance or use of one parties' water system shall not be the liability of the other party. Each party releases the other party, its directors, officers and employees from any such liability.

WARRANTIES: The District warrants to the City that the District shall supply domestic water to the City of the same quality as the domestic water being supplied to the District's domestic water users.

The District neither warrants nor guarantees the quality or quantity of the domestic water delivered to the City at or beyond the point of delivery, which is the point at which the District delivers water to the City and meters the water from the District's point of delivery at the valve houses at the point of delivery. The City shall assume all responsibility for water quality from the point of delivery by the District to the City and the City shall assume responsibility for water quality to the City's own domestic water service users. The City warrants that the water delivered by the District to the City shall be used for domestic water purposes only.

NON-DEDICATION: Nothing in this Agreement shall be construed to create any duty to, any standard of care with reference to, or any liability to any person not a party to this Agreement. No undertaking by one party to the other under any provisions of this Agreement shall constitute the dedication of that party's system of domestic water supply or any portion thereof to the other party or to the public.

COMPLETENESS OF AGREEMENT: The provisions embodied in this Agreement contain all covenants, agreements, obligations and stipulations agreed upon between the parties and on execution hereof, any and all previous and existing agreements and/or contracts entered into between the parties are hereby declared by mutual consent to be null and void.

ASSIGNMENT: No assignment of this Agreement shall be valid.

ENTIRE AGREEMENT: This Agreement contains the entire agreement between the parties and no modification of this Agreement shall be binding upon the parties unless evidence by an agreement in writing signed by the District and the City by and through their authorized representatives after the date hereof.

BREACH: A breach of contract by either party shall constitute grounds for cancellation of this Agreement by the other party. However, the party who commits the breach shall have thirty (30) days after mailing a written notice of such breach from the other party in which to correct or abate the breach and avoid cancellation. If the party committing the breach fails, refuses or neglects to correct or abate the breach within such thirty day period, then the other party, at its option, shall immediately terminate this Agreement by giving written notice of termination to the party in default. Any written notice provided for herein shall be deemed properly mailed and delivered when the same is deposited in the United States Mail, postage prepaid and properly addressed to the party to whom such notice is directed. Proper addresses of the two parties shall be as follows: Deschutes Valley Water District, 881 SW Culver Highway, Madras, Oregon 97741 and City of Madras, 125 SW "E" Street, Madras, Oregon 97741.

RATIFICATION: The signatures by the parties' agents as hereinafter contained do hereby certify that this contract has been ratified on behalf of the City of Madras by the City Council of the City of Madras and on behalf of Deschutes Valley Water District by the Board of Directors of Deschutes Valley Water District and the undersigned have authority to enter into this contract as referenced by the signing of the parties' agents.

DESCHUTES VALLEY WATER DISTRICT ("DISTRICT")

By: _____
Joel Gehrett, General Manager

ATTEST:

By: _____
~~Gary Dinkel~~, Chairman, Board of Commissioners
of Deschutes Valley Water District
Kathy Marston

CITY OF MADRAS ("CITY")

By: _____
Richard Ladeby, Mayor of the City of Madras

ATTEST:

By: _____
Lysa Vattimo, City Recorder of the City of Madras

Appendix E

Population Data

Coordinated Population Forecast

2022

Through

2072

Jefferson County

Urban Growth Boundaries (UGB) & Area Outside UGBs

Population Research Center
PORTLAND STATE UNIVERSITY

How to Read this Report

This report should be read with reference to the documents listed below, which are downloadable on the Forecast Program website (https://www.pdx.edu/population-research/population-forecasts).

- *Methods and Data for Developing Coordinated Population Forecasts:* Provides a detailed description and discussion of the forecast methods employed. This document also describes the assumptions that feed into these methods and determine the forecast output.
- *Forecast Tables:* Provides complete tables of population forecast numbers by county and all sub-areas within each county for each five-year interval of the forecast period (2022-2072).

Population Research Center (PRC) Project Staff

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Recommended Citation:

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The PRC project staff wish to acknowledge and express gratitude for support from the Forecast Advisory Committee (DLCD) and the hard work of many people who contributed to the development of these forecasts by answering questions, lending insight, providing data, or giving feedback.

Cover Photo Credit: Gary Halvorson, July 2011.
https://commons.wikimedia.org/wiki/File:Irrigation_Canal_(Jefferson_County,_Oregon_scenic_images)_(jefDB1619).jpg

Coordinated Population Forecast for Jefferson County, its Urban Growth Boundaries (UGB), and Area Outside UGBs

2022 – 2072

Prepared by

Population Research Center

College of Urban and Public Affairs

Portland State University

June 30, 2022

This project is funded by the State of Oregon through the Department of Land Conservation and Development (DLCD). The contents of this document do not necessarily reflect the views or policies of the State of Oregon.

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1. Methodology

Counties were forecast using the cohort component method. Deaths and survival rates were projected based on historical trends (2000-2020) and based on the methodology published by Clark and Sharrow 2011[1]. Mortality rates for the 85+ age group were further divided into 5-year age groups up to 100+ (i.e., 85-89, 90-94, 95-99, and 100+) using the proportion of each age group calculated from the single-year age group data in the 2010 decennial census. Age specific fertility rates were projected based on historical trends up to 2035 and held constant afterwards. The 2021 births data was not included in the projection model for two reasons: 1) the 2021 vital statistics were not finalized at the time of this report, and 2) due to uncertainties related to COVID-19 impacts on births and deaths, incorporating the 2021 births data into births and fertility rate projection may lead to errors such as underestimation. Nonetheless, the 2021 births and deaths numbers are included in Figures 3 and 4 to provide a more consistent visualization. Since the 2020 deaths data may be impacted by COVID-19, deaths were adjusted based on CDC's estimated excess deaths when forecasting future mortality rates to ensure these rates were not affected by short-term pandemic-related deaths.

Annual net migrants were calculated based on published data gathered from the IRS and the U.S. Census Bureau's American Community Survey (ACS) Public Use Microdata Sample (PUMS) and Population Estimates Program (PEP). Historical county level in-, out-, and net migration (domestic and foreign) were obtained from IRS and PEP (1991 – 2020). IRS provides domestic in- and out- while PEP provides domestic and foreign net. Age structures of gross migrants by direction (domestic in- and out- and foreign in-migration) were calculated for ACS Public Use Microdata Areas (PUMAs) which were used for migration to or from constituent counties. Future total net migrants were projected by applying an ARIMA model appropriate for each individual county.

The PRC estimate formed the baseline of the forecast for individual UGBs, with the difference in population between incorporated city and UGB boundaries estimated based on assignment of population in individual census blocks in each county into a UGB area and or city area, or balance of county. Populations in individual UGBs or in the balance of county were forecast by projections of individual components of the housing unit method of population estimation. Historical rates of population and housing unit change since 1990 were used to generate a weighted average annual rate of change. Jurisdiction-level vacancy rates and average household size were held constant from the 2020 decennial census. Population forecasts for sub-areas were then controlled by the county-level forecasts, e.g., sub-area populations were allocated using the county total (top-down approach), and the population summation of the sub-areas does not exceed the county population.

Forecast Program surveys were used to make adjustments to the baseline results for counties and UGB areas. Recent development and plans obtained from surveys were generally implemented in the first 5-10 years of the forecast, except where they indicate a change in long-run outlook. For the immediate period (2022-2030), the development rate derived from the surveys or received reports was applied before 2030. If no planned housing units were reported, recent development rate (2010-2020) or the overall county rate was used. For the later period (2030-2047), housing unit growth was based on either

[1] https://csss.uw.edu/research/working-papers/contemporary-model-life-tables-developed-countries-application-model-based

a weighted average or an extrapolation of historic trend (1990-2020). Assumptions were made for individual cities based on knowledge obtained from the general surveys, housing surveys, as well as documentations (e.g., housing needs assessment, comprehensive development plans) received from the cities.

Many uncertainties still remain in understanding the climate change impacts on migration. Thus, specific scenarios of climate change, political unrest, or other shocks were not reflected in the current forecast. The forecast program methodology is described in further detail in an accompanying report available on the Population Research Center's website.

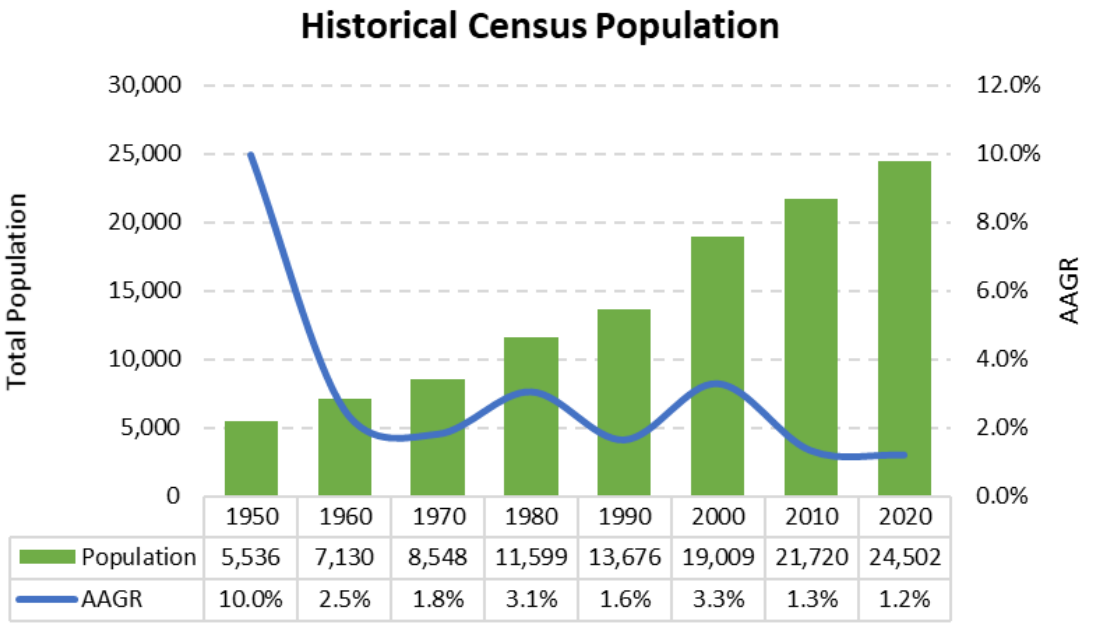
2. County Overview

According to the 2020 census, Jefferson County has a population of 24,502. Its county seat, Madras city, has 7,456 people as recorded by the 2020 census. Jefferson County's population has maintained a population AAGR of at least 1% in the last eight censuses. Most recently, the county has an AAGR of 1.2% between the 2010 and 2020 censuses. The county population is projected to continue to grow at AAGRs between 0.7% and 0.8% for the next 50 years. Madras is the county's most populated city and absorbs many people seeking lower housing prices and living expenses. Based on the general survey responses received from Madras, the city has multiple housing projects completed in the past several years and plans to add more construction projects to accommodate people moving from cities with higher housing prices, for instance, Bend and Redmond. Culver city also suggested potential growth with several housing development projects under review.

3. Historical Trend and Population Forecast

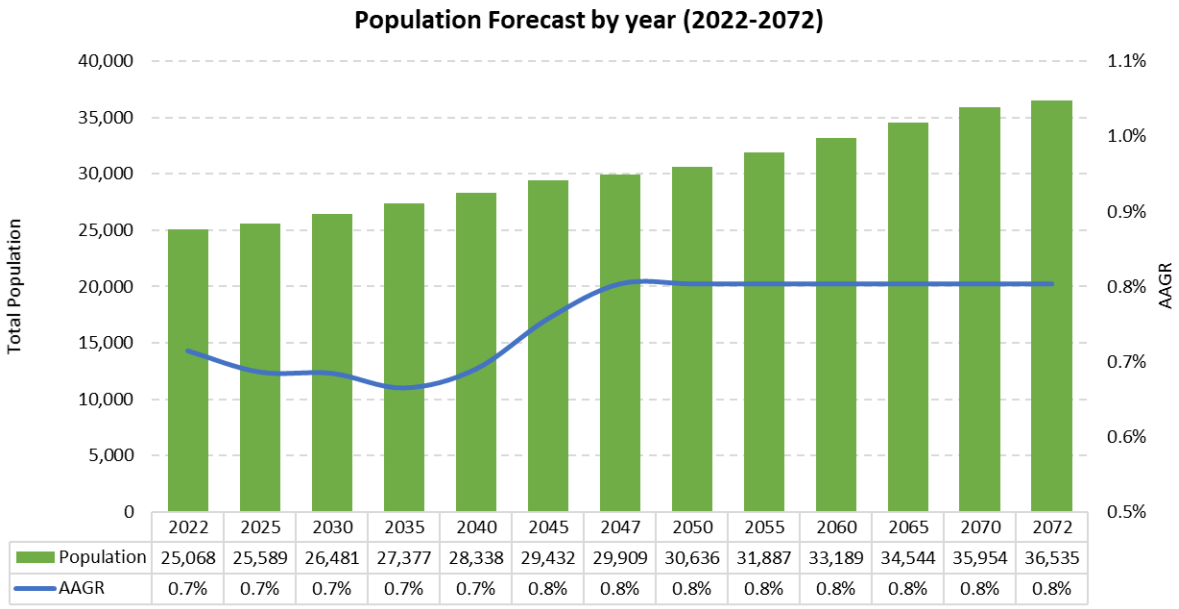
3.1 County Population

As illustrated in the Figure 1, Jefferson County experienced a peak growth in the 1950 census in which the AAGR reached 10%. Growth rate has declined since the 1950s but still remain above 1.0% in the past seven decennial censuses. Both the 1980 and 2000 censuses indicated an AAGR of over 3.0%. The 2020 census recorded a county population of 24,502, which indicates a 29% growth from the 2000 census. During the forecast period, the county population is projected to have an AAGR between 0.7% and 0.8%. The county's population is projected to have a slightly higher AAGR in the second half of the 50-year forecast time horizon, which may be associated with future shifts in age structure and changes in components such as the number of births.



Sources: US Census Bureau, 1950, 1060, 1970, 1980, 1990, 2000, 2010, and 2020 Decennial Census.

Figure 1. Historical total county population and AAGR, 1950-2020.



Sources: Forecasted by Population Research Center (PRC).

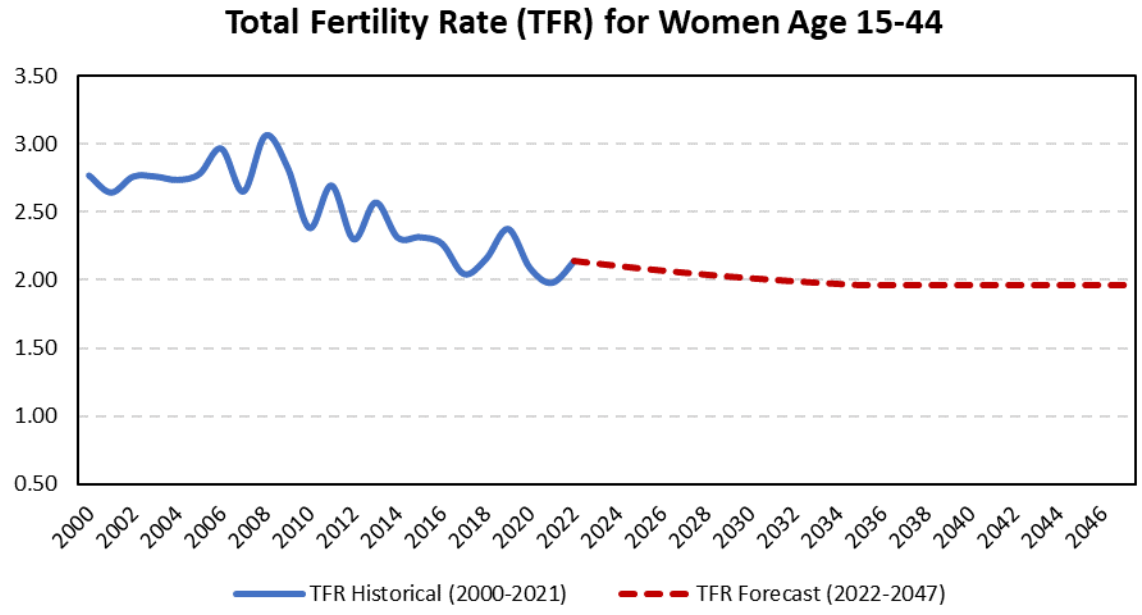
Figure 2. Forecasted total county population and AAGR, 2022-2072.

3.2 Births and Deaths

The total fertility rate (TFR) is shown in Figure 3. Jefferson County's TFR has declined from a high point of 3.1 in 2008 to 2.1 in 2020. Compared to Oregon state, which experienced a TFR drop from 1.7 to 1.4 between 2014 and 2020, Jefferson County's TFR has been higher than the state average. According to the preliminary 2021 births data, the county's TFR dropped to 2.0, but it is uncertain whether this drop is associated with COVID-19 or if it was a continuation of the historic pattern of varying TFR shown in the past 20 years. The TFR projection used data up to 2020 and was not significantly affected by any COVID-19. The county TFR is projected to be around 2.0 throughout the forecast.

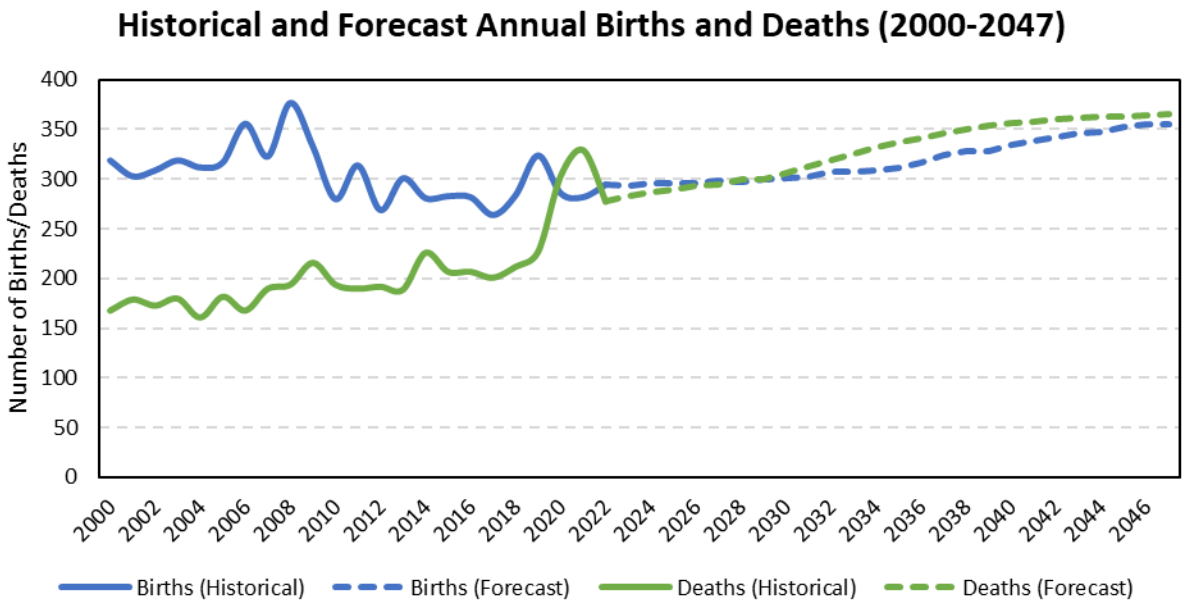
The actual number of births can follow a different trend than TFR if there are unusually high or low numbers of women of childbearing age in a given year. Figure 4 includes historical and projected births (and deaths) in the county. Annual births in the county has outnumbered annual deaths for most of the past two decades, except in 2020, which may be related to excess deaths associated with COVID-19. Annual births are projected to gradually increase over time, reaching 365 by 2047. Compared to 277 projected in 2022, this is an increase of 78 annual births.

In comparison, annual deaths are projected to grow in a pattern similar to that of births. The sudden increase in deaths shown in the 2021 OHA preliminary data may mainly be associated with excess deaths related to COVID-19. The impacts of COVID-19 was considered to be short-term in our forecast and the county annual deaths are expected to return to continue the pre-pandemic trend. Annual deaths are projected to outnumber annual births around 2030 as the older population increases. Toward the end of the first 25 years of the 50-year forecast time horizon, annual deaths appear to show signs of slower growth. These dynamics are due to aging in the population, with the aging of the large baby boom cohort accounting for most of the increases in death counts during 2020-2040.



Note: OHA's vital statistics for 2021 are preliminary at the time of this report.
Sources: Oregon Health Authority (OHA), Center for Health Statistics. Calculations and forecast by Population Research Center (PRC).

Figure 3. Historical and projected total fertility rate (TFR), 2000-2047.

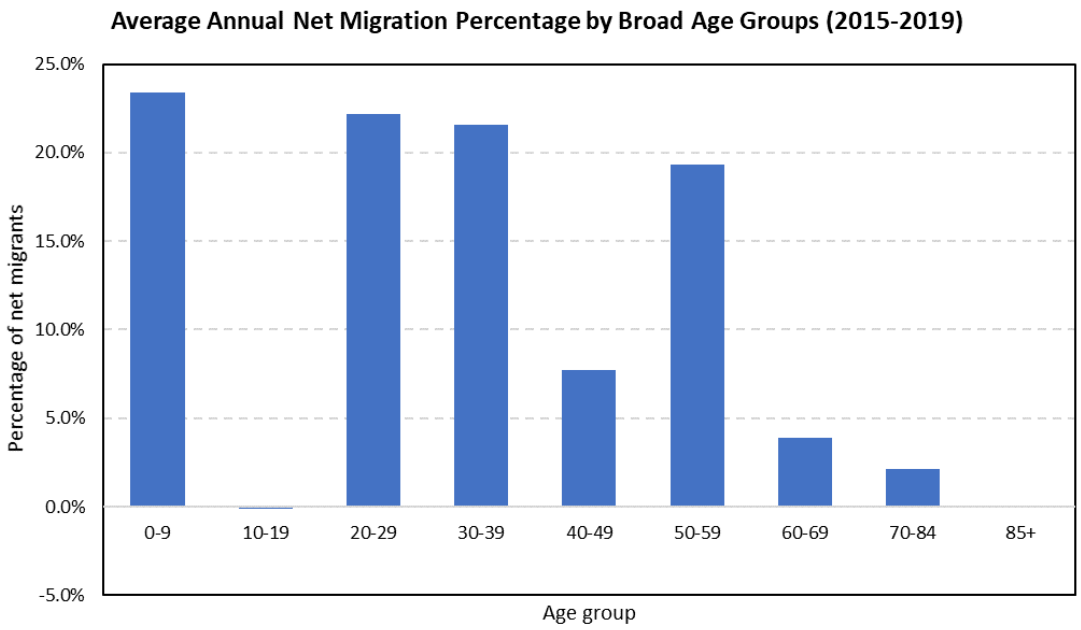


Note: OHA's vital statistics for 2021 are preliminary at the time of this report.
Sources: Oregon Health Authority (OHA), Center for Health Statistics. Calculations and forecast by Population Research Center (PRC).

Figure 4. Historical and projected annual births/deaths trend, 2000-2047.

3.3 Migration

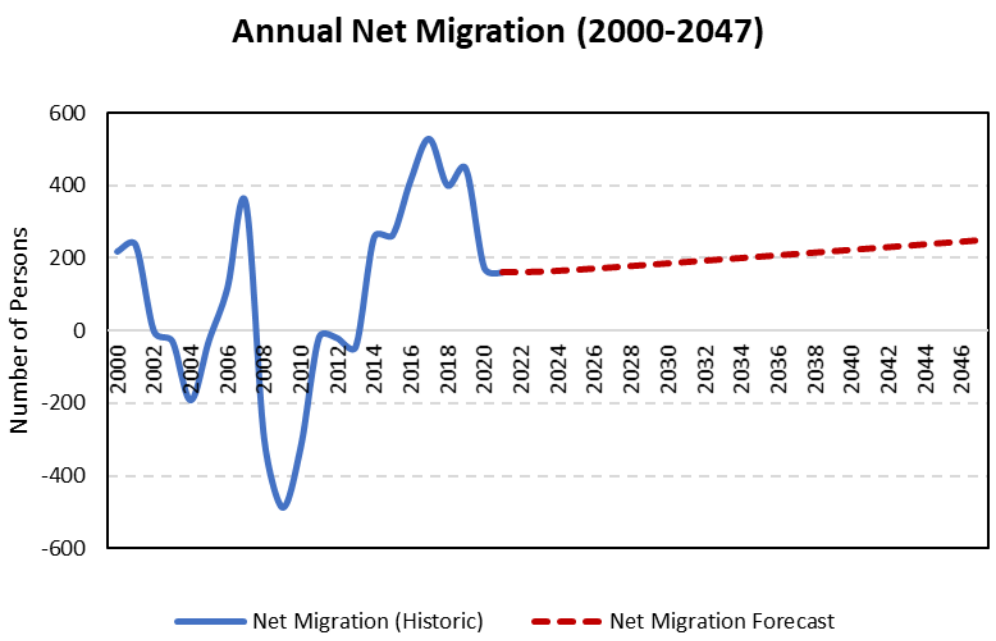
Age-specific migration was estimated based on the 2006-2010, 2011-2015, and 2015-2019 5-year ACS. The age patterns were used from the ACS but controlled to the number of total migrants by direction (in or out) and domestic (inter-state or between counties in Oregon) or foreign. The overall net migrants for each county were adjusted for consistency with annual PRC population estimates. Figure 5 illustrates the percentage each 10-year age group accounts for among total county net migration calculated based on the 2015-2019 ACS migration flow. Most age groups account for a positive share of net migration in the county, with the exception of the 10-19 and 85+ age groups. Many factors can impact the age-specific migration rates. For instance, college-age population may leave the county for education while population in the 20-39 age groups may move to the county with children. Older age groups are less likely to move in or out of the county.



Sources: American Community Survey (ACS); Internal Revenue Services (IRS); US Census Bureau Population Estimated Program (PEP); Calculated by Population Research Center (PRC).

Figure 5. Percentage of net migrations by broad age groups in Jefferson County, 2015-2019.

As shown in Figure 6, the historic annual net migration in Jefferson County varied significantly between 2000 and 2020. County-wide net migration experienced some downturns in the late 2000s and early 2010s, which may be associated with the impacts of the economic recession during that period. The county experienced the highest number of net migrations in 2017, in which the annual net migration reached over 500. Annual net migration is projected to remain in the mid-range compared to historic data and gradually increase over time.

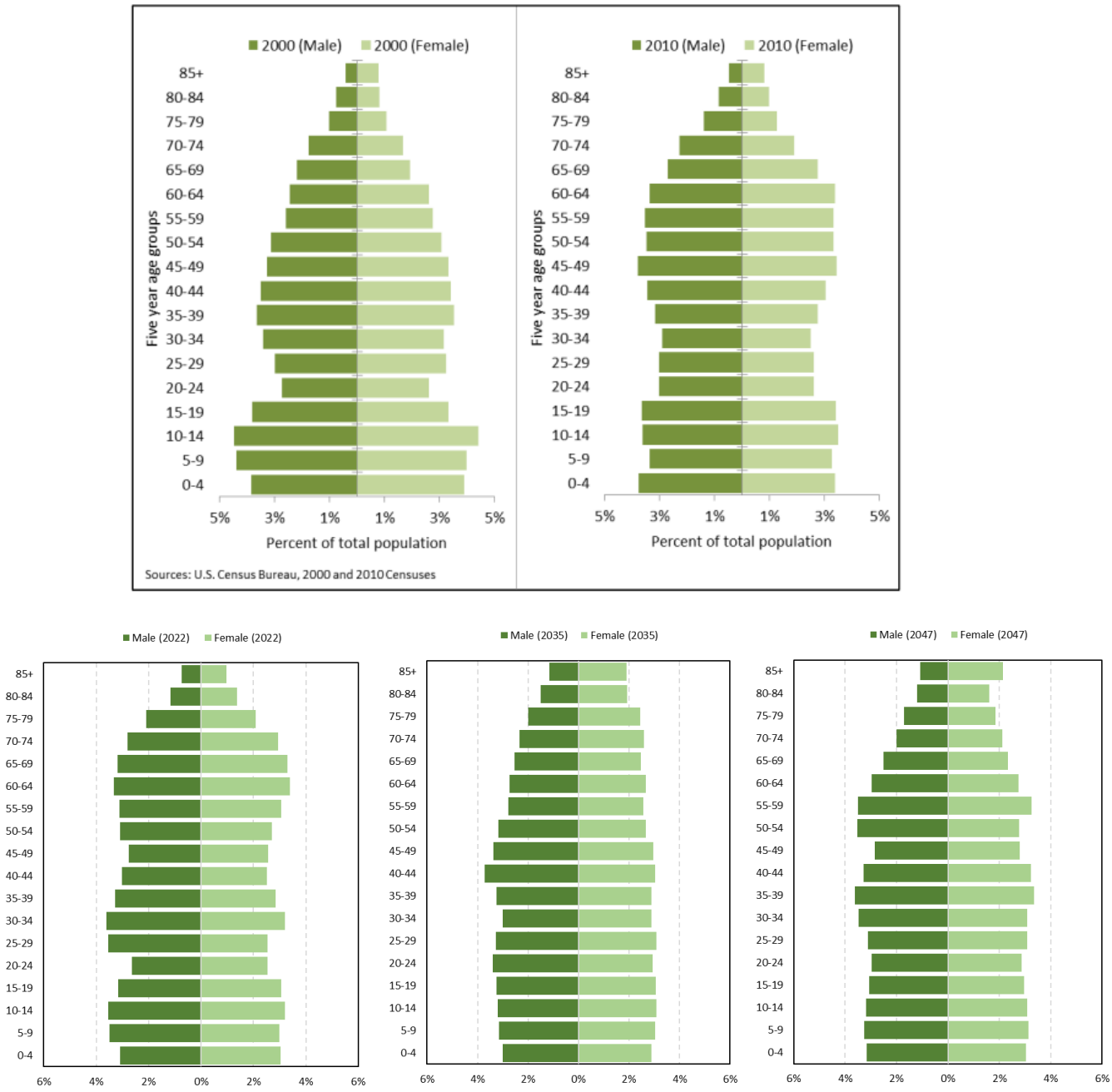


Sources: Internal Revenue Service (IRS) Tax Stats (1990-2020); American Community Survey (ACS); Population Estimates Program (PEP) 1990-2020. Calculations and forecast by Population Research Center (PRC).

Figure 6. Historical and projected total county net migration, 2000-2047.

3.4 Age Structure

As shown in Figure 7, the 2000 and 2010 censuses showed the population aging forward in the 10-year period. Population aged 5-14 accounted for the largest share of population in the 2000 census, which reflected the relatively higher county TFR compared to the state average. In the 2010 census, the share of the 5-14 age group declined along with the 30-44 age group. Among adults, the 45-49 age group accounted for the largest share of population in 2010, which is the 35-39 population aging forward from the 2000 census. In 2022, the share of the 25-34 age group increased compared to the 2010 census, which indicates a possible higher in-migration for that age group. Older ae groups also increased their share as the population continued to age forward from 2010. The age pyramids for 2035 and 2047 indicates a shift in age structure as the population share for the middle age groups increase. The county is projected to have more younger populations over time as births number is projected to increase, as indicated in Figure 4.



Sources: Calculations and forecast by Population Research Center (PRC).

Figure 7. Population structure by age and sex, historical (2000 and 2010) and forecast (2022, 2035, and 2047).

3.5 Race/Ethnicity

Table 1 shows the race/ethnicity characteristics in the county from the 2010 and 2020 censuses. Race/ethnicity was not included as a component in the current forecast model but is provided in this report for reference. Population identified as "two or more races" has the most relative gain compared to other race/ethnicity groups, followed by population of some other races alone. Among non-Hispanic and non-White alone populations, population identified as "Native Hawaiian and Other Pacific Islander alone" in the 2020 census experienced the highest percent loss. Hispanic or Latino remains as the largest non-white alone population in the county.

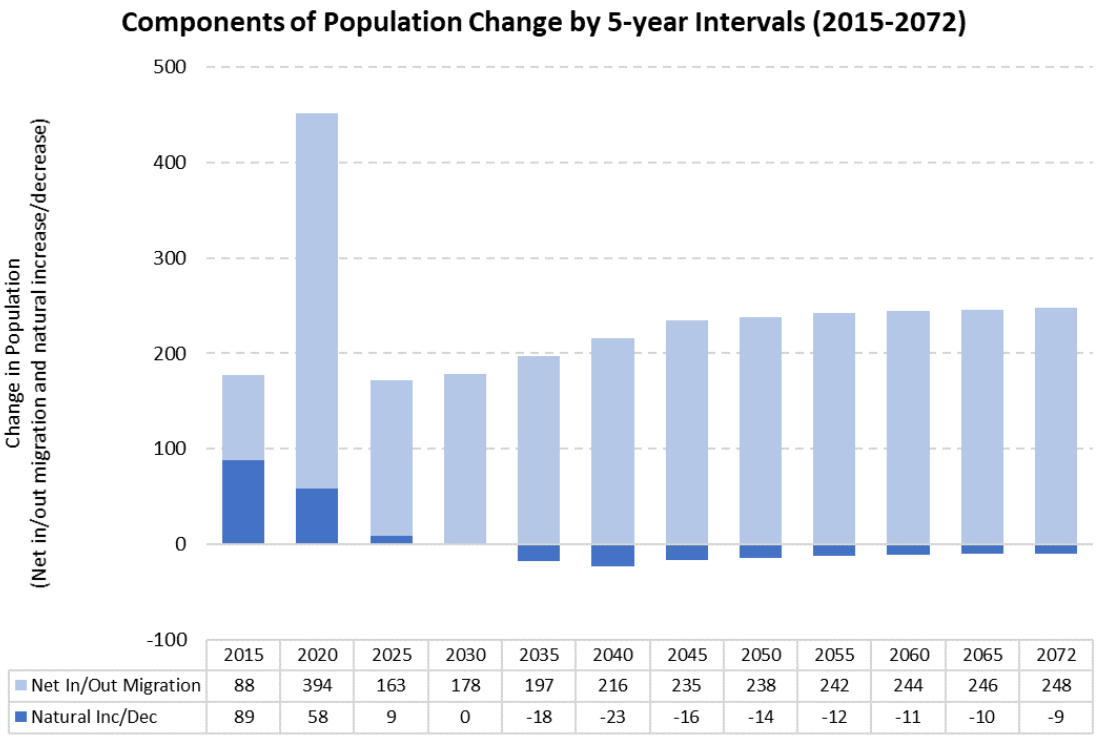
Table 1. County population by race/ethnicity.

Hispanic or Latino and Race	2010		2020		Absolute Change	Relative Change
Total Population	21,720		24,502		2,782	12.8%
Hispanic or Latino (of any race)	4,195	19.3%	5,002	20.4%	807	19.2%
Not Hispanic or Latino	17,525	80.7%	19,500	79.6%	1,975	11.3%
White alone	13,429	61.8%	15,005	61.2%	1,576	11.7%
Black or African American alone	117	0.5%	134	0.5%	17	14.5%
American Indian and Alaska Native alone	3,360	15.5%	2,981	12.2%	-379	-11.3%
Asian alone	83	0.4%	131	0.5%	48	57.8%
Native Hawaiian and Other Pacific Islander alone	23	0.1%	18	0.1%	-5	-21.7%
Some Other Race alone	34	0.2%	66	0.3%	32	94.1%
Two or More Races	479	2.2%	1,165	4.8%	686	143.2%

Sources: US Census Bureau, 2010 and 2020 Decennial Census. Calculated by PRC.

3.6 Component of Change

The component of population changes up to 2072 is shown in Figure 8. The darker blue shade indicates the natural increase/decrease, while the lighter blue shade indicates the net migration. At the county level, natural decrease is expected to occur as annual deaths outnumbers annual births around 2030. Natural decrease is projected to continue afterwards for the rest of the forecast period. In the meantime, positive net migration is projected to continue and gradually increase over time, which promotes population growth in the forecast. Higher positive migration shown in 2020 reflects an average calculated from the 2016-2020 data, however, net migration is not projected to maintain the same level throughout the forecast period, which is why lower net migration is shown after 2020.



	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2072
Net In/Out Migration	88	394	163	178	197	216	235	238	242	244	246	248
Natural Inc/Dec	89	58	9	0	-18	-23	-16	-14	-12	-11	-10	-9

Figure 8. Historical and forecast components of population change, 2015-2072.

3.7 Sub-Area Population

Sub-area populations within and outside the urban growth boundaries (UGBs) are forecasted using the housing unit method, and then adjusted to be consistent with the county level forecast. As shown in Table 2, Jefferson County has three UGBs, Culver, Madras, and Metolius. Among all UGBs, Madras has the largest population, followed by the Culver UGB. The 2010 and 2020 censuses showed that the smallest UGB, Metolius, experienced the highest AAGR in the 2010s. Other sub-areas, including the area outside of UGBs, have also experienced at least 1.0% AAGR between 2010 and 2020. As the largest UGB in the county, Madras is projected to maintain an AAGR similar to the 2010-2020 rate throughout the forecast period. In comparison, population outside of UGBs is expected to grow at a slower rate in the next 50 years.

Table 2. Historical and forecasted population and AAGR in Jefferson County and its sub-areas.

	Historical			Forecast				
	2010	2020	AAGR (2010-2020)	2022	2047	2072	AAGR (2022-2047)	AAGR (2047-2072)
Jefferson County	21,720	24,502	1.2%	25,068	29,909	36,535	0.7%	0.8%
Culver	1,361	1,602	1.6%	1,664	2,128	2,632	1.0%	0.9%
Madras	7,000	7,964	1.3%	9,069	12,776	17,150	1.4%	1.2%
Metolius	732	1,015	3.3%	1,050	1,498	2,090	1.4%	1.3%
Outside UGBs	12,627	13,921	1.0%	13,284	13,506	14,662	0.1%	0.3%

Sources: U.S. Census Bureau; Forecast by Population Research Center (PRC)

3.7.1 UGBs Shares

As shown in Table 3, the Madras UGB continues to account for most of the population shares among all UGBs, reaching 46.9% of the county population by 2072. The two smaller UGBs, Culver and Metolius, are also projected to increase their population share over time, especially Metolius, which increases its share by 1.5 percent points between 2022 and 2072. Toward the end of the forecast period, the Madras UGB is expected to replace non-UGB area as the most populated sub-area in the county. The larger population shares projected for the UGBs imply that more people are likely to move to the cities from rural areas.

Table 3. Population forecast for larger sub-areas and their shares of county population.

	Population			Share of County Population		
	2022	2047	2072	2022	2047	2072
Jefferson County	25,068	29,909	36,535			
Culver	1,664	2,128	2,632	6.6%	7.1%	7.2%
Madras	9,069	12,776	17,150	36.2%	42.7%	46.9%
Metolius	1,050	1,498	2,090	4.2%	5.0%	5.7%
Outside UGBs	13,284	13,506	14,662	53.0%	45.2%	40.1%

Sources: Forecast by Population Research Center (PRC)

4. Glossary of Key Terms

Average Annual Growth Rate (AAGR): The average rate of growth over a specific period of time. The AAGR is calculated using natural logarithm of the end-year value and the starting-year value, divided by the number of years.

Cohort-Component Method: A method used to forecast future populations based on a baseline or starting population, and cumulative changes in births, deaths, and migration.

Coordinated population forecast: A population forecast prepared for the county and sub-county jurisdictions including urban growth boundary (UGB) areas and all non-UGB area in the balance of county.

Group quarters: The US Census Bureau defines group quarters as places where "people live or stay in a group living arrangement that is owned or managed by an organization providing housing and/or services for the residents". Examples of a group quarter may include college dorms, skilled nursing facilities, groups homes, prison, etc.

Housing unit: A house, apartment, mobile home or trailer, group of rooms, or single room that is occupied or is intended for occupancy.

Housing-Unit Method: A method used to estimate current populations or forecast future populations based on changes in housing units, vacancy rates, the average numbers of persons per household (PPH), and group quarters population counts.

Persons per household (PPH): The average household size (i.e., the average number of persons per occupied housing unit).

Total Fertility Rate (TFR): The number of children a woman would have by the end of a defined childbearing age. In this report, child-bearing age is from 15 to 44.

5. Appendix A: General Survey for Oregon Forecast Program

Each year, the jurisdictions in the region that is to be forecast is surveyed. The following are transcripts of what was received from jurisdictions who responded to the OPFP survey.

County	Jefferson
Date|Time	11.05.21
Jurisdiction	City of Culver
Name and Title	Donna McCormack, City Recorder/Manager
Observations about Population (e.g. birth rates, aging, immigration, racial and ethnic change)	We have a near zero vacancy rate. Any current vacancy is a result of one renter leaving and another preparing to move in.
Observations about Housing (Vacancy rates, seasonal occupancy, demolitions, renovations)	A 159 lot subdivision has been submitted and is in the review process. They are proposing single family homes.
Planned Housing Developments or Group Quarters Facilities (including number of units, occupancy, and estimated year of completion)	No significant changes have been obvious.
Economic Development (e.g. new employers or facilities, including number of jobs and est. year of completion)	No significant differences, the businesses are operating and we have no vacant store fronts.
Infrastructure Projects (e.g. transportation and utilities)	There are ongoing projects with the majority currently focusing on street repairs and park improvements.
Other Factors Promoting Population or Housing Growth	Culver is a "bedroom" community reflecting the growth of all of Central Oregon.
Other Factors Hindering Population or Housing Growth	None I am aware of.
8a. Summary of current or proposed policies affection growth in your jurisdiction.	
8b. Findings related to growth or population change from studies conducted in you jurisdiction.	
8c. The effects of wildfires or other disasters in your jurisdiction on	None, the wildfires created smoke but no direct impact to the city.

housing, employment/economics, and infrastructure.	
8d. The effects of the COVID-19 pandemic and policy measure on employment and current and planned developments.	Again, no direct impact to the community was noted.
9. For representatives from counties only: we invite you to provide tax lot data if available. These may be sent via email to askprc@pdx.edu	
Comments?	

County	Jefferson
Date|Time	11.29.21
Jurisdiction	City of Madras
Name and Title	Nicholas Snead, Community Development Director
Observations about Population (e.g. birth rates, aging, immigration, racial and ethnic change)	There is a very low vacancy rate. There is a housing shortage. New housing units are being constructed. Monthly lease rates are increasing as a result of the shortage.
Observations about Housing (Vacancy rates, seasonal occupancy, demolitions, renovations)	GIS shapefile will be provide with this information.
Planned Housing Developments or Group Quarters Facilities (including number of units, occupancy, and estimated year of completion)	I have no basis for such observations other than the 2020 Census.
Economic Development (e.g. new employers or facilities, including number of jobs and est. year of completion)	Erickson Aero Tanker (existing business) is looking to hire 12 new people, Daimler Trucks North America is making significant facility improvements which will result in additional truck testing and thereby 5-10 additional employees.
Infrastructure Projects (e.g. transportation and utilities)	3 very large City sewer projects are being designed and constructed to accommodate the Sun Ridge, Park Place, Juniper Crossings, and Willow Heights residential developments.
Other Factors Promoting Population or Housing Growth	The City has enacted: 1) SDC reductions for housing; 2) a TIF Housing Urban Renewal District for key residential lands; 3) made significant Development Code changes to accommodate needed housing.
Other Factors Hindering Population or Housing Growth	
8a. Summary of current or proposed policies affection growth in your jurisdiction.	
8b. Findings related to growth or population change from studies conducted in you jurisdiction.	
8c. The effects of wildfires or other disasters in your jurisdiction on	

housing, employment/economics, and infrastructure.	
8d. The effects of the COVID-19 pandemic and policy measure on employment and current and planned developments.	1) people fleeing urban areas to live in areas with a higher quality of life (Madras has a urban/rural lifestyle); 2) Retirees! They are a budget conscious group. Most want to retire in a desirable place, that is cost-effective, and near family and medical. Madras has that. Housing costs here are low relatively to larger markets in Bend, Redmond, and Portland.
9. For representatives from counties only: we invite you to provide tax lot data if available. These may be sent via email to askprc@pdx.edu	
Comments?	

County	Jefferson
Date|Time	11.22.21
Jurisdiction	Jefferson County
Name and Title	County Administrative Officer
Observations about Population (e.g. birth rates, aging, immigration, racial and ethnic change)	
Observations about Housing (Vacancy rates, seasonal occupancy, demolitions, renovations)	
Planned Housing Developments or Group Quarters Facilities (including number of units, occupancy, and estimated year of completion)	Census Block 9400 (Warm Springs) indicates a 500 person drop. Seems that would be impossible. (about 3,100 to 2,600??)
Economic Development (e.g. new employers or facilities, including number of jobs and est. year of completion)	
Infrastructure Projects (e.g. transportation and utilities)	
Other Factors Promoting Population or Housing Growth	City of Madras' Housing Urban Renewal District (HURD)
Other Factors Hindering Population or Housing Growth	
8a. Summary of current or proposed policies affection growth in your jurisdiction.	
8b. Findings related to growth or population change from studies conducted in you jurisdiction.	
8c. The effects of wildfires or other disasters in your jurisdiction on housing, employment/economics, and infrastructure.	

8d. The effects of the COVID-19 pandemic and policy measure on employment and current and planned developments.	More releocation into county from larger jurisdictions to remote work.
9. For representatives from counties only: we invite you to provide tax lot data if available. These may be sent via email to askprc@pdx.edu	
Comments?	

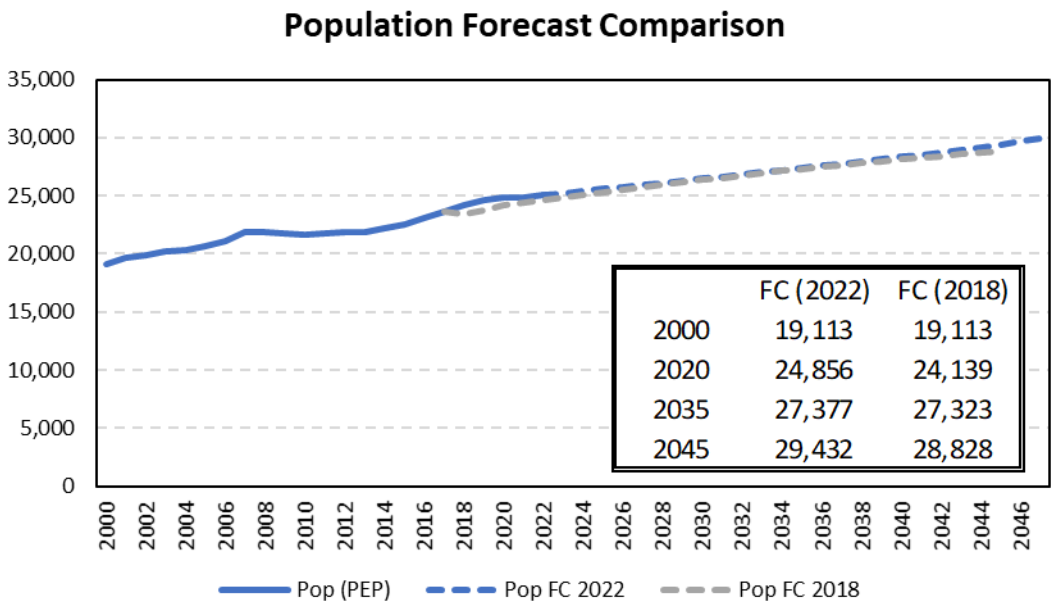
6. Appendix B: Detail Population Forecast Results

Age	2021	2022	2025	2030	2035	2040	2045	2047
0-4	1,527	1,532	1,528	1,552	1,602	1,700	1,803	1,835
5-9	1,639	1,622	1,640	1,641	1,676	1,738	1,848	1,896
10-14	1,646	1,688	1,723	1,702	1,709	1,751	1,819	1,859
15-19	1,516	1,559	1,636	1,732	1,713	1,722	1,765	1,791
20-24	1,325	1,294	1,395	1,629	1,725	1,706	1,715	1,729
25-29	1,545	1,524	1,447	1,488	1,731	1,838	1,831	1,836
30-34	1,656	1,708	1,708	1,553	1,606	1,861	1,979	1,948
35-39	1,524	1,537	1,678	1,807	1,664	1,727	1,992	2,066
40-44	1,344	1,388	1,507	1,705	1,837	1,699	1,767	1,936
45-49	1,362	1,336	1,325	1,525	1,725	1,859	1,726	1,674
50-54	1,429	1,449	1,445	1,391	1,597	1,804	1,944	1,871
55-59	1,594	1,550	1,473	1,506	1,465	1,676	1,888	2,015
60-64	1,701	1,684	1,585	1,446	1,483	1,446	1,652	1,713
65-69	1,620	1,630	1,603	1,509	1,383	1,420	1,387	1,466
70-74	1,464	1,444	1,456	1,455	1,374	1,260	1,293	1,260
75-79	974	1,052	1,199	1,240	1,247	1,177	1,079	1,103
80-84	617	639	725	927	968	976	922	886
85+	406	432	513	673	870	978	1,021	1,025

Source: PRC Estimates, 2021; Forecast by Population Research Center (PRC).

7. Appendix C: Comparison of Current and Previous Forecast

To provide a better understanding of the changes since the last round of forecast for the Region 1 counties, this section compares the current 2022 total county population forecast to the population forecast published by the Population Research Center in 2018.



	FC (2022)	FC (2018)
2000	19,113	19,113
2020	24,856	24,139
2035	27,377	27,323
2045	29,432	28,828

United States Census Bureau

QuickFacts

Jefferson County, Oregon

QuickFacts provides statistics for all states and counties. Also for cities and towns with a ***population of 5,000 or more***.

All Topics	Jefferson County, Oregon
Population Estimates, July 1, 2022, (V2022)	**25,330**
PEOPLE	
Population	
Population Estimates, July 1, 2022, (V2022)	**25,330**
Population estimates base, April 1, 2020, (V2022)	24,507
Population, percent change - April 1, 2020 (estimates base) to July 1, 2022, (V2022)	3.4%
Population, Census, April 1, 2020	24,502
Population, Census, April 1, 2010	21,720
Age and Sex	
Persons under 5 years, percent	5.9%
Persons under 18 years, percent	22.6%
Persons 65 years and over, percent	20.1%
Female persons, percent	47.5%
Race and Hispanic Origin	
White alone, percent	76.0%
Black or African American alone, percent (a)	1.2%
American Indian and Alaska Native alone, percent (a)	17.9%
Asian alone, percent (a)	0.9%
Native Hawaiian and Other Pacific Islander alone, percent (a)	0.2%
Two or More Races, percent	3.8%
Hispanic or Latino, percent (b)	21.1%
White alone, not Hispanic or Latino, percent	60.8%
Population Characteristics	
Veterans, 2018-2022	1,523
Foreign born persons, percent, 2018-2022	6.8%
Housing	
Housing units, July 1, 2022, (V2022)	10,647
Owner-occupied housing unit rate, 2018-2022	70.2%
Median value of owner-occupied housing units, 2018-2022	$307,200
Median selected monthly owner costs -with a mortgage, 2018-2022	$1,575
Median selected monthly owner costs -without a mortgage, 2018-2022	$466
Median gross rent, 2018-2022	$940
Building permits, 2022	127
Families & Living Arrangements	
Households, 2018-2022	8,591
Persons per household, 2018-2022	2.74
Living in same house 1 year ago, percent of persons age 1 year+, 2018-2022	85.8%
Language other than English spoken at home, percent of persons age 5 years+, 2018-2022	16.0%
Computer and Internet Use	
Households with a computer, percent, 2018-2022	95.3%
Households with a broadband Internet subscription, percent, 2018-2022	88.0%
Education	
High school graduate or higher, percent of persons age 25 years+, 2018-2022	87.9%
Bachelor's degree or higher, percent of persons age 25 years+, 2018-2022	21.2%
Health	
With a disability, under age 65 years, percent, 2018-2022	14.7%
Persons without health insurance, under age 65 years, percent	9.2%

Economy	
In civilian labor force, total, percent of population age 16 years+, 2018-2022	55.4%
In civilian labor force, female, percent of population age 16 years+, 2018-2022	55.0%
Total accommodation and food services sales, 2017 ($1,000) (c)	36,050
Total health care and social assistance receipts/revenue, 2017 ($1,000) (c)	70,278
Total transportation and warehousing receipts/revenue, 2017 ($1,000) (c)	12,457
Total retail sales, 2017 ($1,000) (c)	178,867
Total retail sales per capita, 2017 (c)	$7,570
Transportation	
Mean travel time to work (minutes), workers age 16 years+, 2018-2022	27.8
Income & Poverty	
Median household income (in 2022 dollars), 2018-2022	$69,345
Per capita income in past 12 months (in 2022 dollars), 2018-2022	$30,917
Persons in poverty, percent	⚠ 12.0%

BUSINESSES

Businesses	
Total employer establishments, 2021	427
Total employment, 2021	4,657
Total annual payroll, 2021 ($1,000)	198,101
Total employment, percent change, 2020-2021	-2.4%
Total nonemployer establishments, 2020	1,236
All employer firms, Reference year 2017	336
Men-owned employer firms, Reference year 2017	S
Women-owned employer firms, Reference year 2017	57
Minority-owned employer firms, Reference year 2017	35
Nonminority-owned employer firms, Reference year 2017	233
Veteran-owned employer firms, Reference year 2017	S
Nonveteran-owned employer firms, Reference year 2017	240

GEOGRAPHY

Geography	
Population per square mile, 2020	13.8
Population per square mile, 2010	12.2
Land area in square miles, 2020	1,781.70
Land area in square miles, 2010	1,780.79
FIPS Code	41031

About datasets used in this table

Value Notes

⚠ Estimates are not comparable to other geographic levels due to methodology differences that may exist between different data sources.

Some estimates presented here come from sample data, and thus have sampling errors that may render some apparent differences between geographies statistically indistinguishable.] Click the Quick Info icon to th row in TABLE view to learn about sampling error.

In Vintage 2022, as a result of the formal request from the state, Connecticut transitioned from eight counties to nine planning regions. For more details, please see the Vintage 2022 release notes available here: Releas

The vintage year (e.g., V2022) refers to the final year of the series (2020 thru 2022). Different vintage years of estimates are not comparable.

Users should exercise caution when comparing 2018-2022 ACS 5-year estimates to other ACS estimates. For more information, please visit the 2022 5-year ACS Comparison Guidance page.

Fact Notes

(a) Includes persons reporting only one race
(c) Economic Census - Puerto Rico data are not comparable to U.S. Economic Census data
(b) Hispanics may be of any race, so also are included in applicable race categories

Value Flags

- Either no or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest or upper in open ended distribution.
F Fewer than 25 firms
D Suppressed to avoid disclosure of confidential information
N Data for this geographic area cannot be displayed because the number of sample cases is too small.
FN Footnote on this item in place of data
X Not applicable
S Suppressed; does not meet publication standards
NA Not available
Z Value greater than zero but less than half unit of measure shown

QuickFacts data are derived from: Population Estimates, American Community Survey, Census of Population and Housing, Current Population Survey, Small Area Health Insurance Estimates, Small Area Income and Pov Estimates, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits.

Appendix F

Water Quality Report

Deschutes Valley Water District
881 SW Culver Hwy
Madras, OR 97741
(541) 475-3849
www.dvwd.org
Joel Gehrett - General Manager

Spanish (Espanol)

Este informe contiene informacion muy importante sobre la calidad de su agua potable. Por favor lea este informe o comuniquese con alguien que pueda traducir la informacion.

Is my water safe?

Deschutes Valley Water District is pleased to report that our drinking water is safe and meets federal and state requirements. The purity of our water is of the degree that the Environmental Protection Agency (EPA) does not require us to test for every contaminant every year. A waiver granted by the Oregon Health Division (OHD) in 1996 stipulated the elements and frequency of testing. This report is a snapshot of last year's water quality sampling data. Included are details about where your water comes from, what it contains and how it compares to standards set by regulatory agencies. We are committed to providing you with information because informed customers are our best allies.

Do I need to take special precautions?

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the **Safe Water Drinking Hotline (800-426-4791)**. We are committed to providing you with the latest information, because informed customers are our best allies.

Where does my water come from?

The **Opal Springs** aquifer supplies the domestic water for Deschutes Valley Water District's approximately 4,500 services. The artesian spring is located 5 miles Southwest of Culver at the bottom of the 850 foot deep Crooked River canyon, less than 150 feet from the river. The artesian wells are located on the East side of the canyon ranging from 300 to 600 feet South of Opal Springs.

Opal Springs flows approximately 108,000 gallons per minute at 54° degrees Fahrenheit with no seasonal variation. There has been no detectable change in flow, temperature, or pH since the spring was first tested in 1925. Well # 1 is 750 feet deep and produces 3,750 gallons per minute. Well #2 is 513 feet deep and produces 5,360 gallons per minute. Well #3 is 661 feet deep and produces 4,000 gallons per minute. It has been determined that the wells and Opal Springs are fed from the same aquifer.

Source Water Assessment and Availability

An assessment of our water system has been completed by the Oregon Department of Human Services to determine susceptibility to potential sources of contamination. A copy is on file and available by contacting the District office at (541) 475-3849. Source Water Assessment findings conclude that the water system would be moderately to highly susceptible to a contamination event inside the identified Drinking Water Protection Area. (Sec.6.2 & 7)

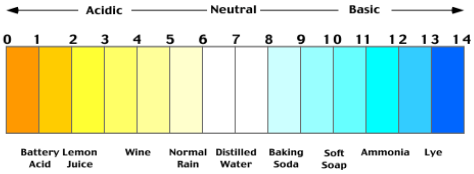
Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. Currently, there is no filtration or treatment of Opal Springs of any kind (nor is any needed). Historic and continuing water quality analysis indicates an absence of man-made contaminants in the captured Opal Springs water.

The source is well protected because it is hundreds of feet below the surface and under pressure. It is unlikely that contaminants introduced on the surface would reach the deep aquifer. The spring and wells have yet to show radiation from the WWII-era nuclear testing (1953) placing the age of the water from Opal Springs at 66 years old minimum.

According to "USGS Report 97-197" and "USGS Report 97-4233", studies show the age of the water could be one to four thousand years old. An analysis for waterborne particulates shows conclusively that Opal Springs is a ground water source, not influenced by surface water. Also see "USGS Water Supply Report 637D" for historical Spring information (p. 201).

Hardness of water is caused by the presence of magnesium and calcium. Excessive hardness is undesirable because it causes difficulties when doing laundry or washing dishes. Domestic water should have hardness less than 85 mg/l. The District's water tests at 42 mg/l and is considered very soft.

The pH of water is measured on a scale of 1 to 14. A low reading would indicate acidic water (which is corrosive) while a high reading connotes basic water. Neutral water (neither acidic nor basic) would have a reading of 7. The District's pH tested at 7.67 which means our water is just a little basic.



How can I get involved?

If you have any questions about this report or concerning your utility, please contact our General Manager at (541) 475-3849. We want our valued customers to be informed about their water utility. If you want to learn more, please attend any of our regularly scheduled Board Meetings. They are held on the second Monday of each month at 7:00 PM at the District office at 881 SW Culver Hwy, Madras, Oregon.

Water Conservation Tips

Did you know that the average U.S. household uses approximately 400 gallons of water per day or 100 gallons per person per day?

Luckily, there are many low-cost and no-cost ways to conserve water. Small changes can make a big difference – try one today and soon it will become second nature!

- Take short showers - a 5 minute shower uses 4 to 5 gallons of water compared to up to 50 gallons for a bath.
- Shut off water while brushing your teeth, washing your hair and shaving and save up to 500 gallons a month.
- Use a water-efficient showerhead. They're inexpensive, easy to install, and can save you up to 750 gallons a month.
- Run your clothes washer and dishwasher only when they are full. You can save up to 1,000 gallons a month.
- Water plants only when necessary. Try Xeriscaping (water wise gardening)
- Fix leaky toilets and faucets. Faucet washers are inexpensive and take only a few minutes to replace. To check your toilet for a leak, place a few drops of food coloring in the tank and wait. If it seeps into the toilet bowl without flushing, you have a leak. Fixing it or replacing it with a new, more efficient model can save up to 1,000 gallons a month.
- Adjust sprinklers so only your lawn is watered. Apply water only as fast as the soil can absorb it and during the cooler parts of the day to reduce evaporation.
- Teach your kids about water conservation to ensure a future generation that uses water wisely. Make it a family effort to reduce next month's water bill!

Visit http://www.epa.gov/watersense **for more information.**

Basic information about drinking water contaminants

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells.

As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals, and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- Microbial contaminants, such as viruses and bacteria which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.
- Radioactive contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems.

Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Additional Information for Lead

There is no detectable lead or copper in our water source; however, these metals can enter the drinking water supply through corrosion within the distribution system or household plumbing. If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Deschutes Valley Water District is responsible for providing high quality drinking water but cannot control the variety of materials used in plumbing components.

When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.

If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

When the water is tested at the source, neither copper nor lead have been detected.

Water Quality Data Table

The table on the following page lists all of the drinking water contaminants that we detected during the calendar year of this report. The presence of contaminants in the water does not necessarily indicate that the water poses a health risk.

Unless otherwise noted, the data presented in this table is from testing done in the calendar year of the report. The EPA or the State requires us to monitor for certain contaminants less than once per year because the concentrations of these contaminants do not change frequently.

If a contaminant is not listed, it was not detected in our sampling.

Primary Standards (directly related to the safety of drinking water)								
Inorganic Contaminants	**Units**	**MCL**	**MCLG**	**TT/AL**	**Range /Result**	**Sample Year**	**Violation?**	**Likely Source**
Arsenic	ppb	10	0	NA	2.6	2019	No	Erosion of natural deposits
Barium	ppm	2	2	NA	0.0015	2019	No	Erosion of natural deposits
Chromium	ppb	100	100	NA	1	2019	No	Erosion of natural deposits
Nitrate-Nitrite	ppm	10	10	NA	0.22	2019	No	Erosion of natural deposits
Unregulated Contaminants								
Sodium*	ppm	NA	NA	NA	11.1	2019	No	Erosion of natural deposits
***Sodium is not regulated and is a recommendation only. If you are on a sodium restricted diet, please contact your health care provider.**								

Lead and Copper	**Units**	**MCLG**	**AL**	**90th %**	**Sample Year**	**Violation?**	**Likely Source**
Lead	ppb	4.2	15	0.06*	2022	No	Household Plumbing
Copper	ppm	1.3	1.3	0.03	2019	No	Household Plumbing

Unit Descriptions	
Term	**Definition**
NA	Not applicable
ND	Not detected
NR	Monitoring not required, but recommended
ppb	Parts per billion or µg/L or micrograms per liter.
ppm	Parts per million, or milligrams per liter (mg/L)

Important Drinking Water Definitions	
Term	**Definition**
AL	Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
MCL	Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

*Two (2) sites out of the 30 sampled that exceeded Action Level (AL) for Lead. Affected customers were notified of the results of lead and copper testing. Lead and Copper tests are conducted every 3 years.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Lead in drinking water is

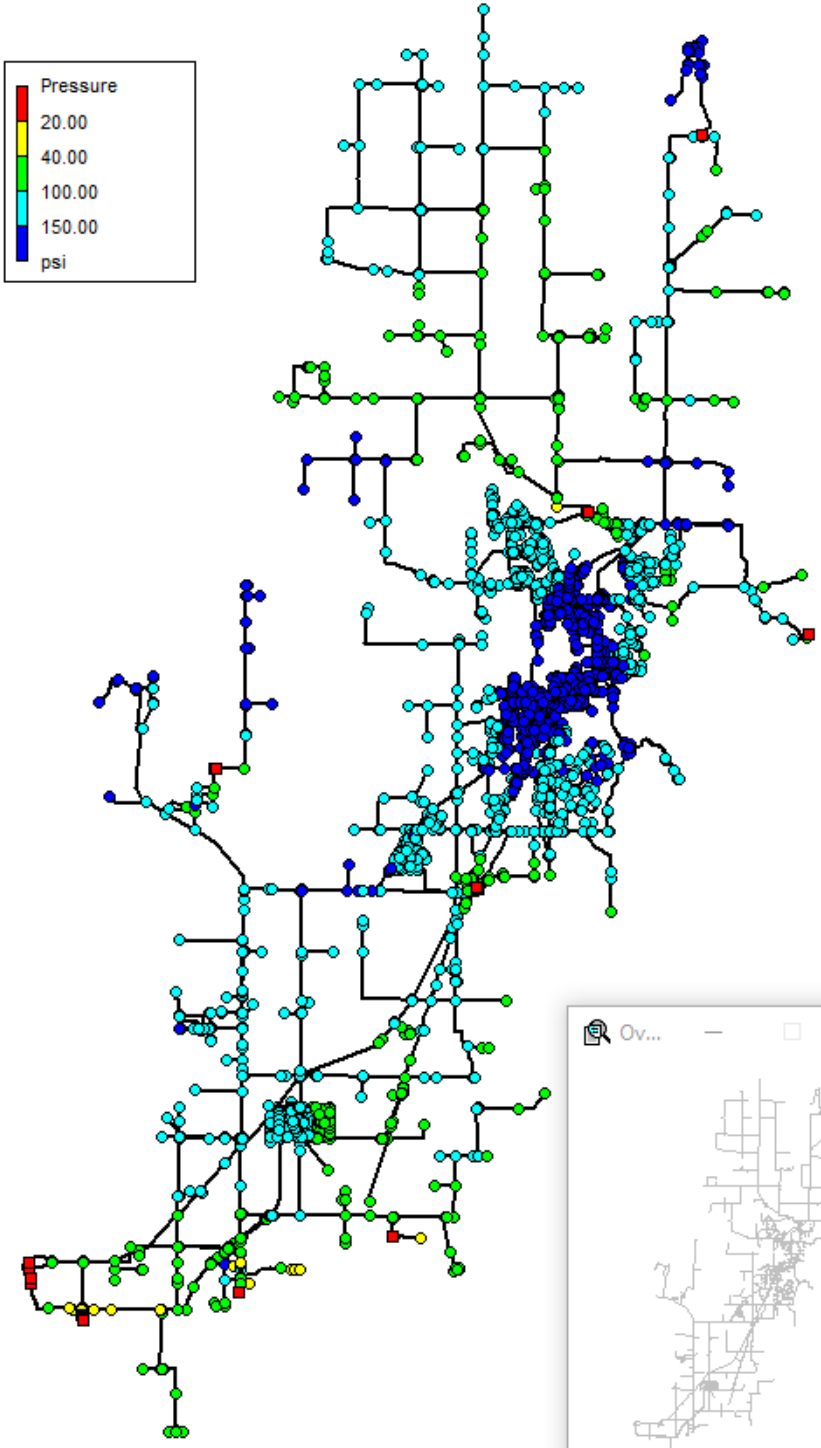
rarely the sole cause of lead poisoning, but it can add to a person's total lead exposure. All potential sources of lead in the household should be identified and removed, replaced, or reduced.

Deschutes Valley Water District is responsible for providing high quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

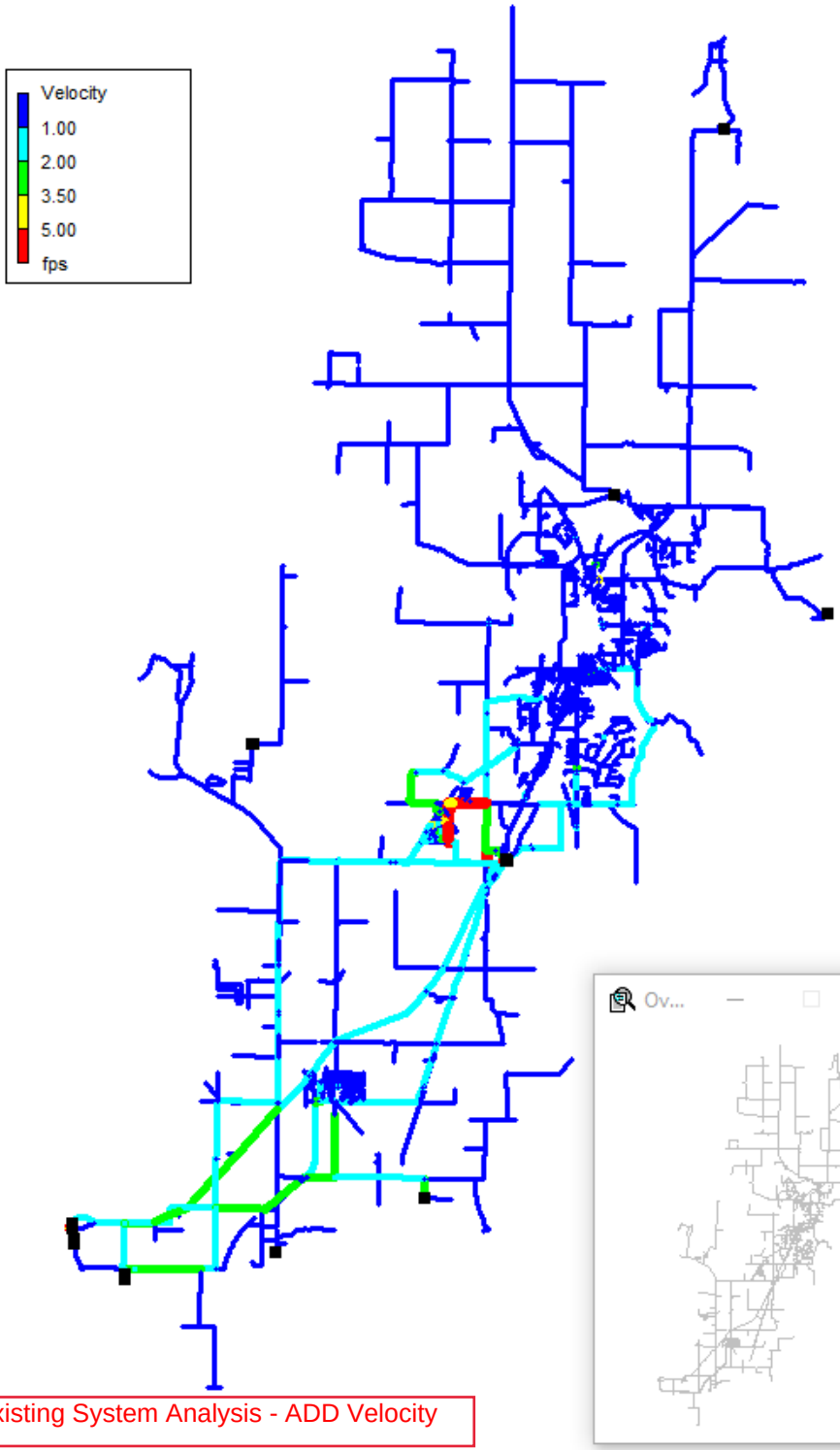
More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791. Also, you can find more comprehensive test results for Deschutes Valley Water District drinking water at the Oregon Health Division website https://yourwater.oregon.gov/inventory.php?pwsno=00501

Appendix G

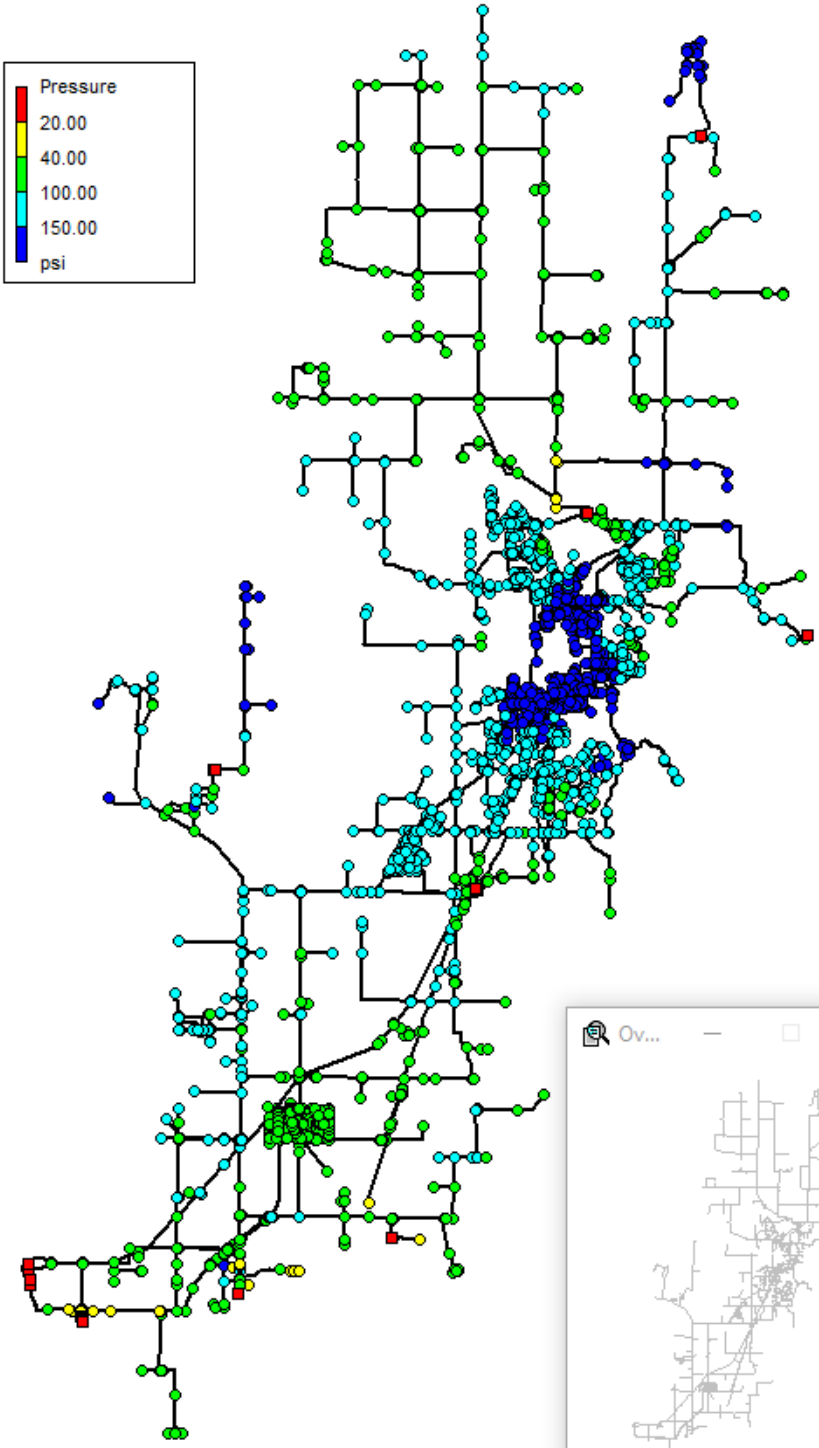
Existing Systems Analysis



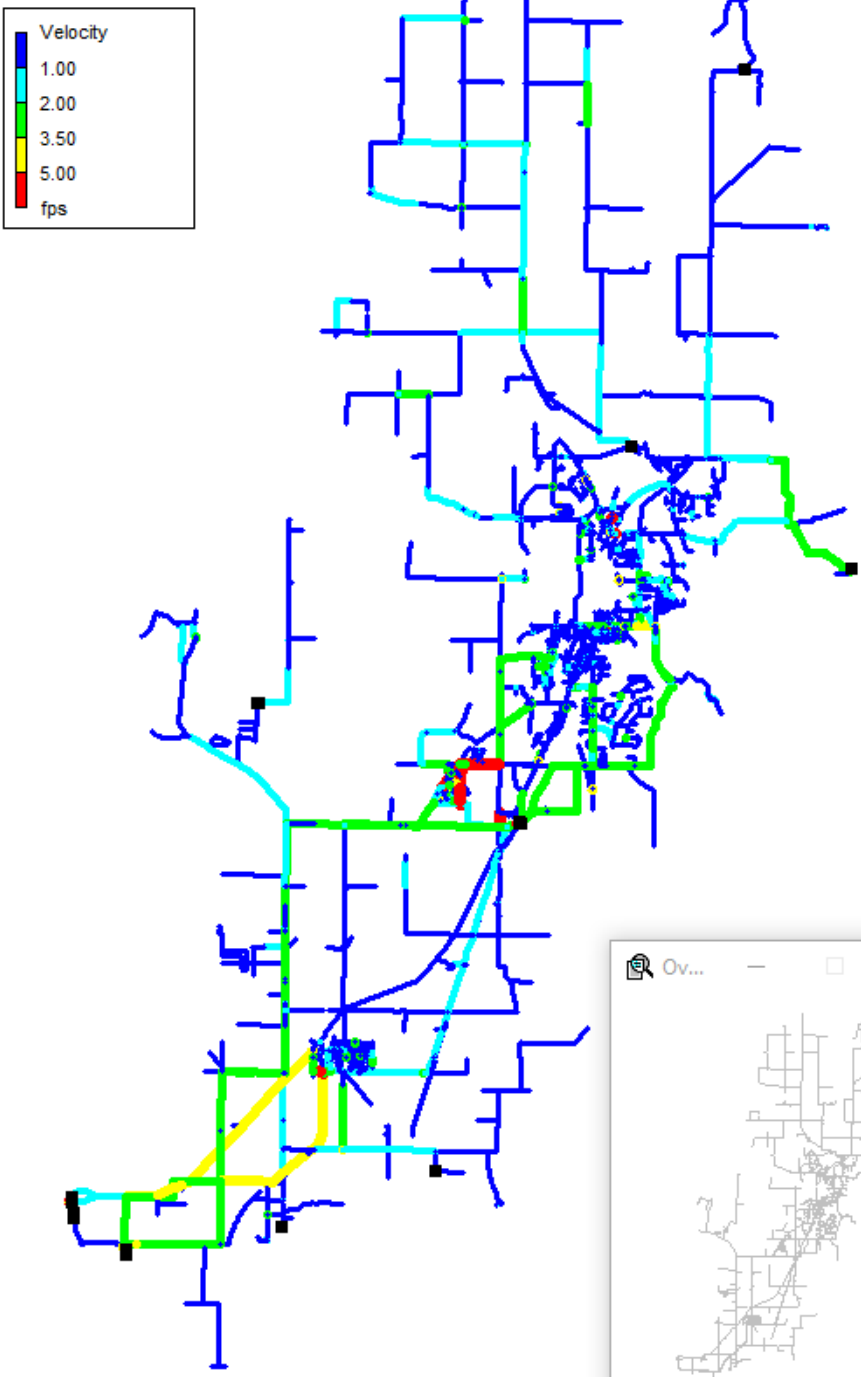
Existing System Analysis - ADD Pressure



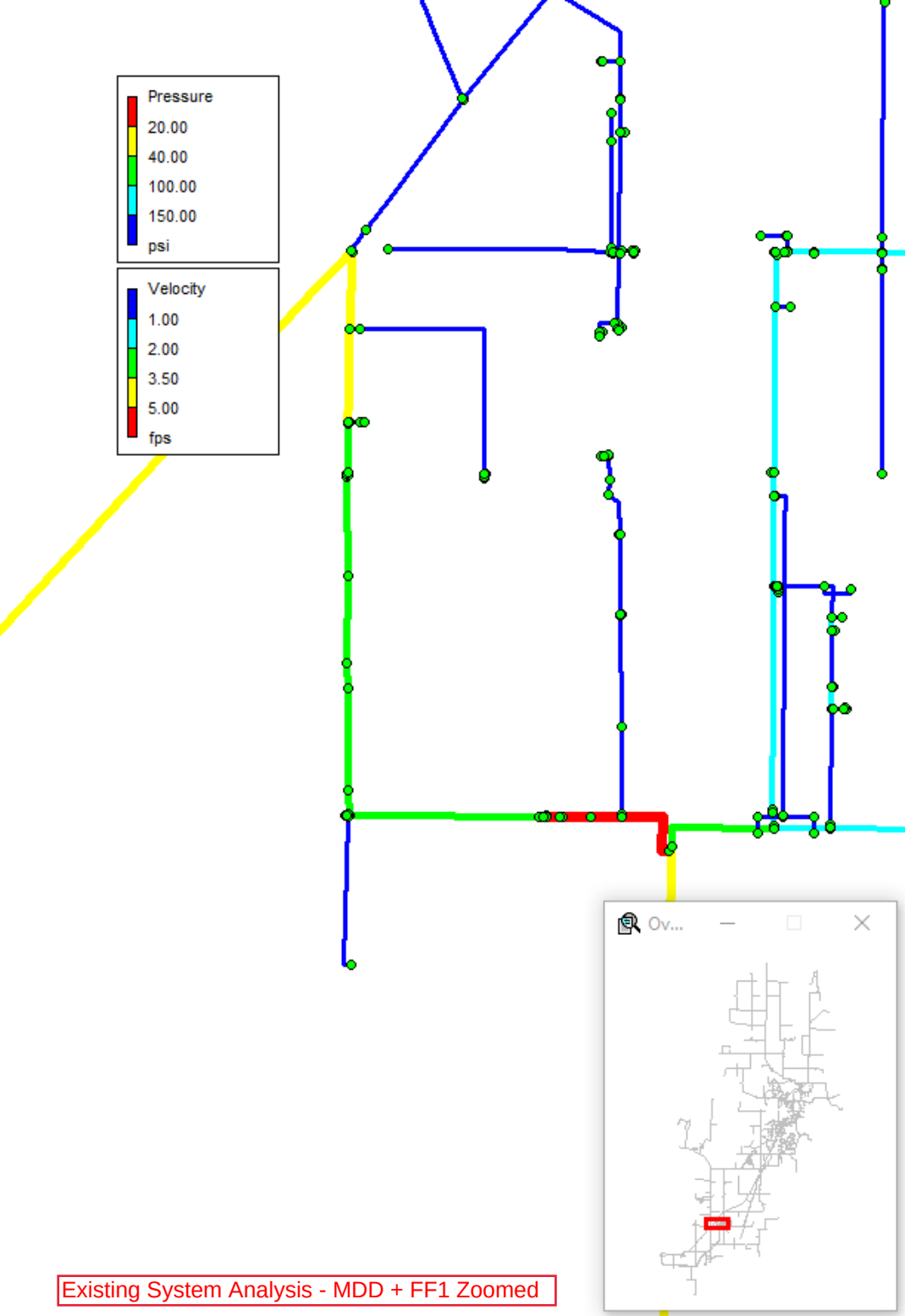
Existing System Analysis - ADD Velocity



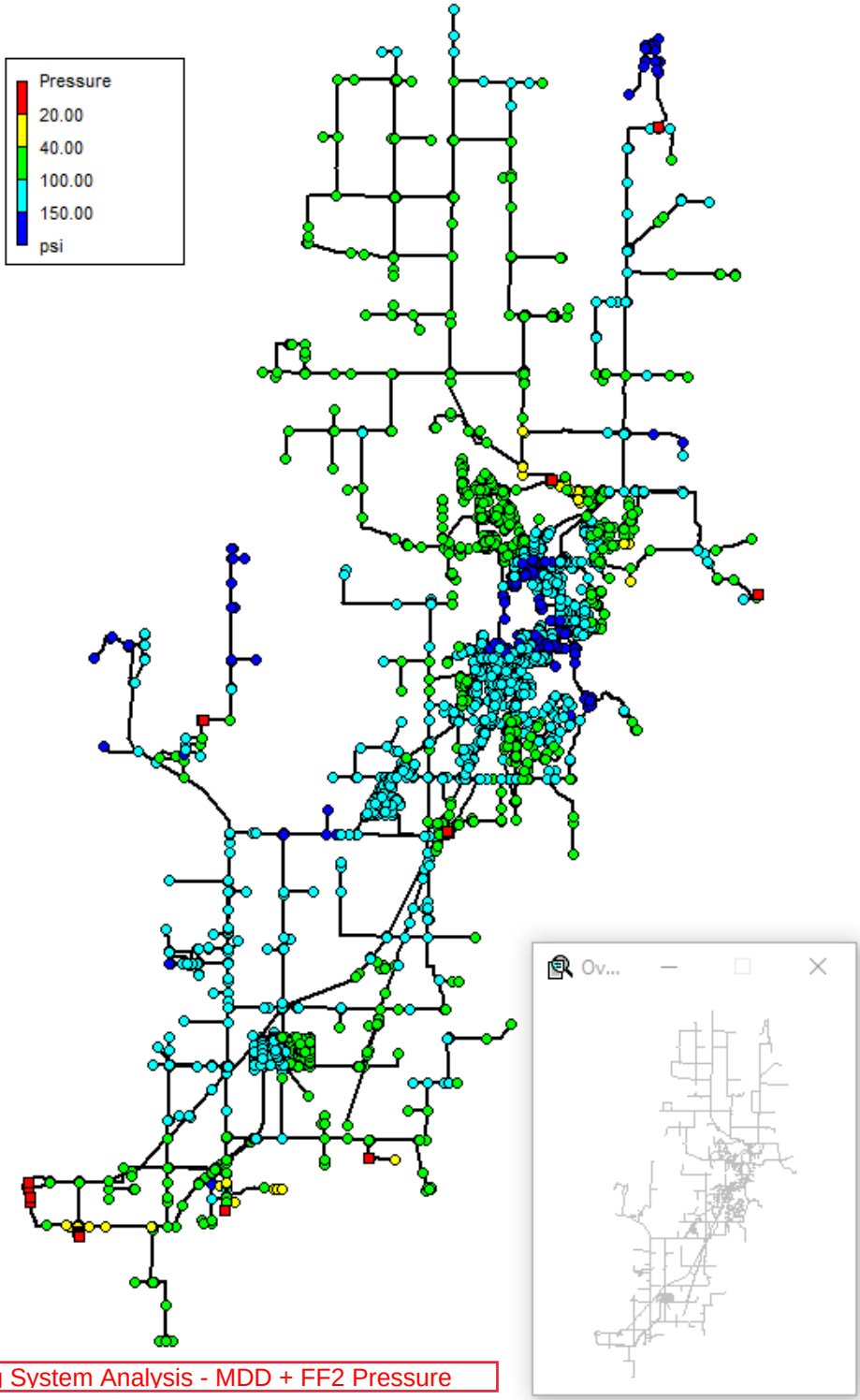
Existing System Analysis - MDD + FF1 Pressure



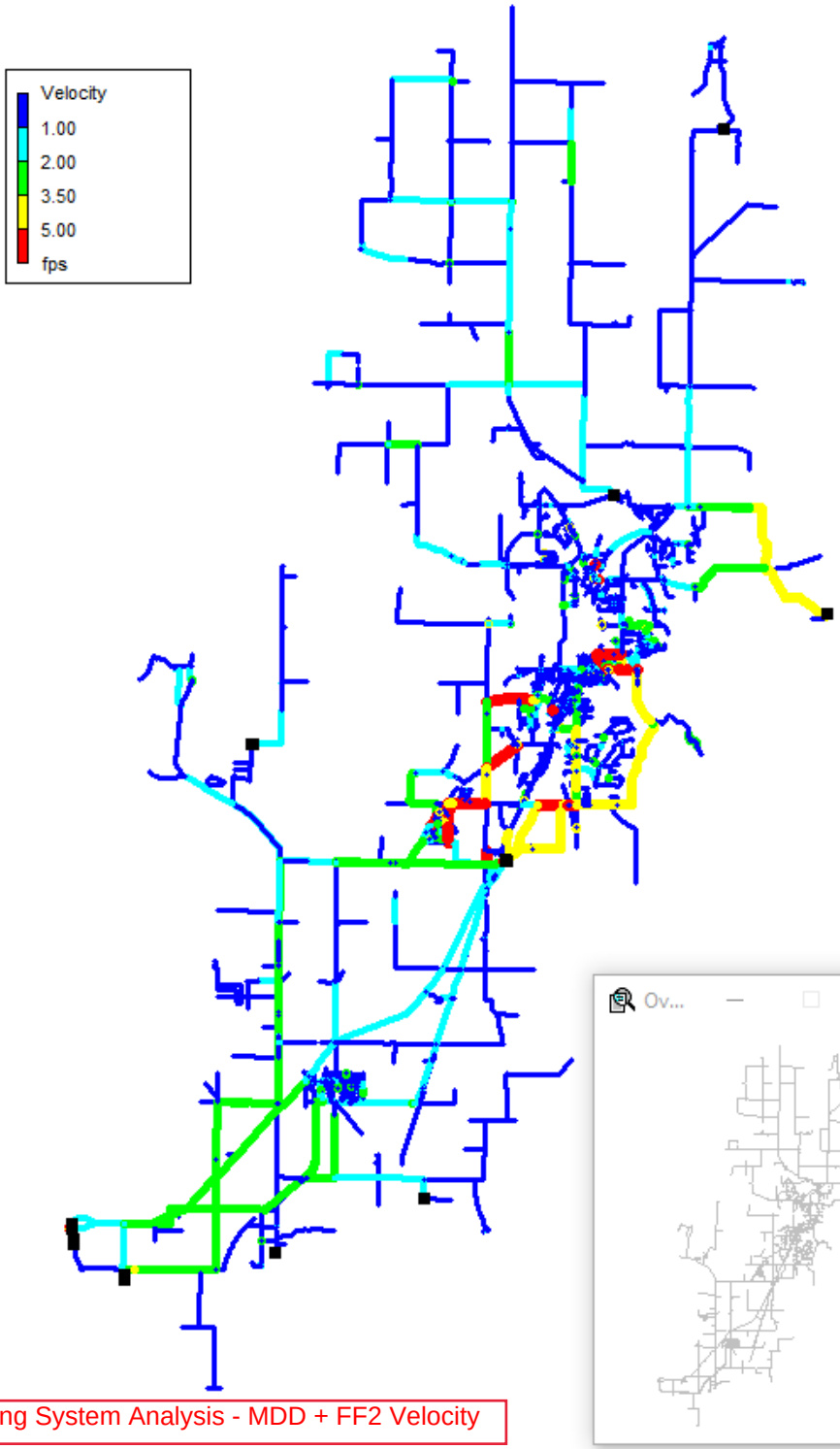
Existing System Analysis - MDD + FF1 Velocity



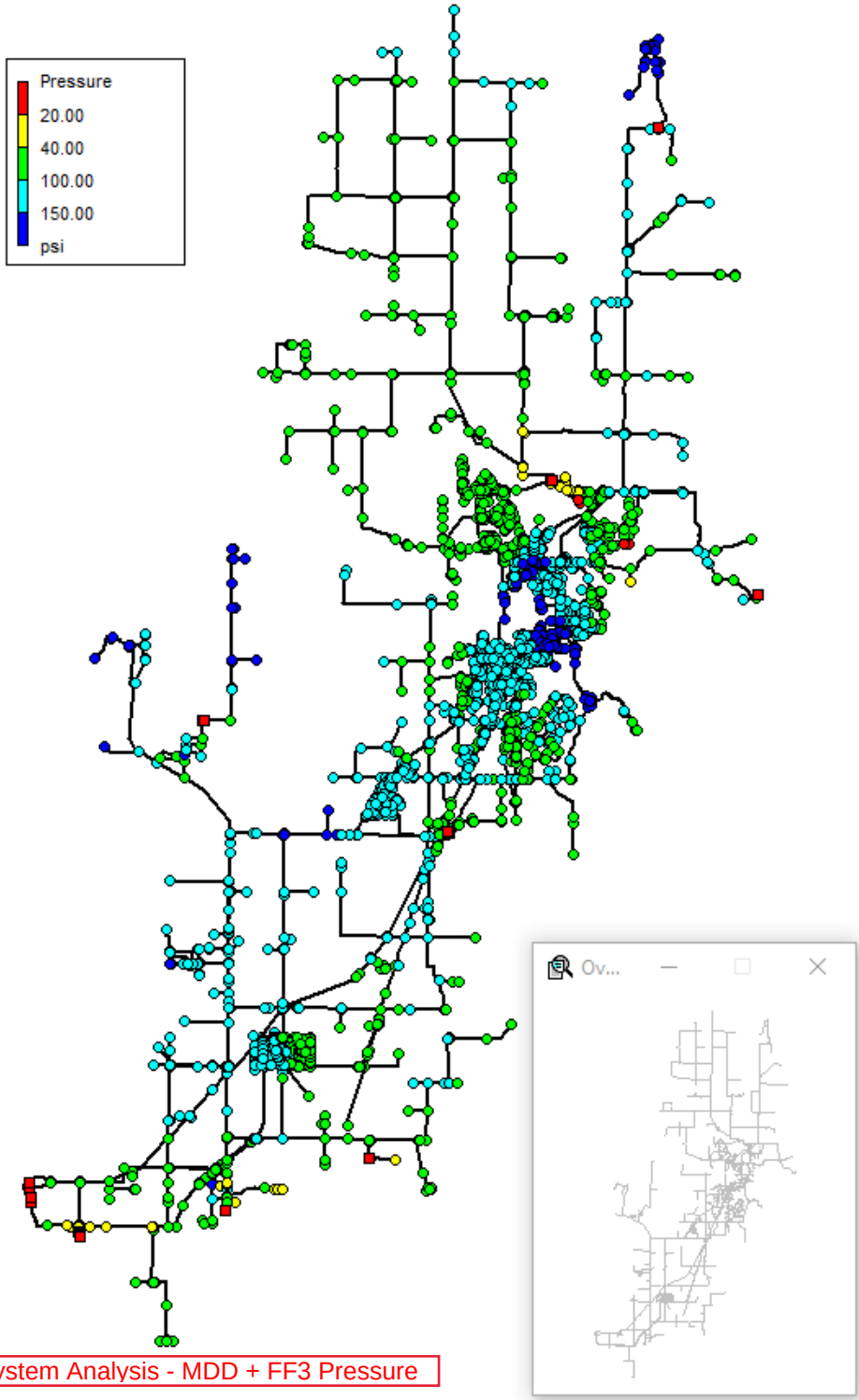
Existing System Analysis - MDD + FF1 Zoomed



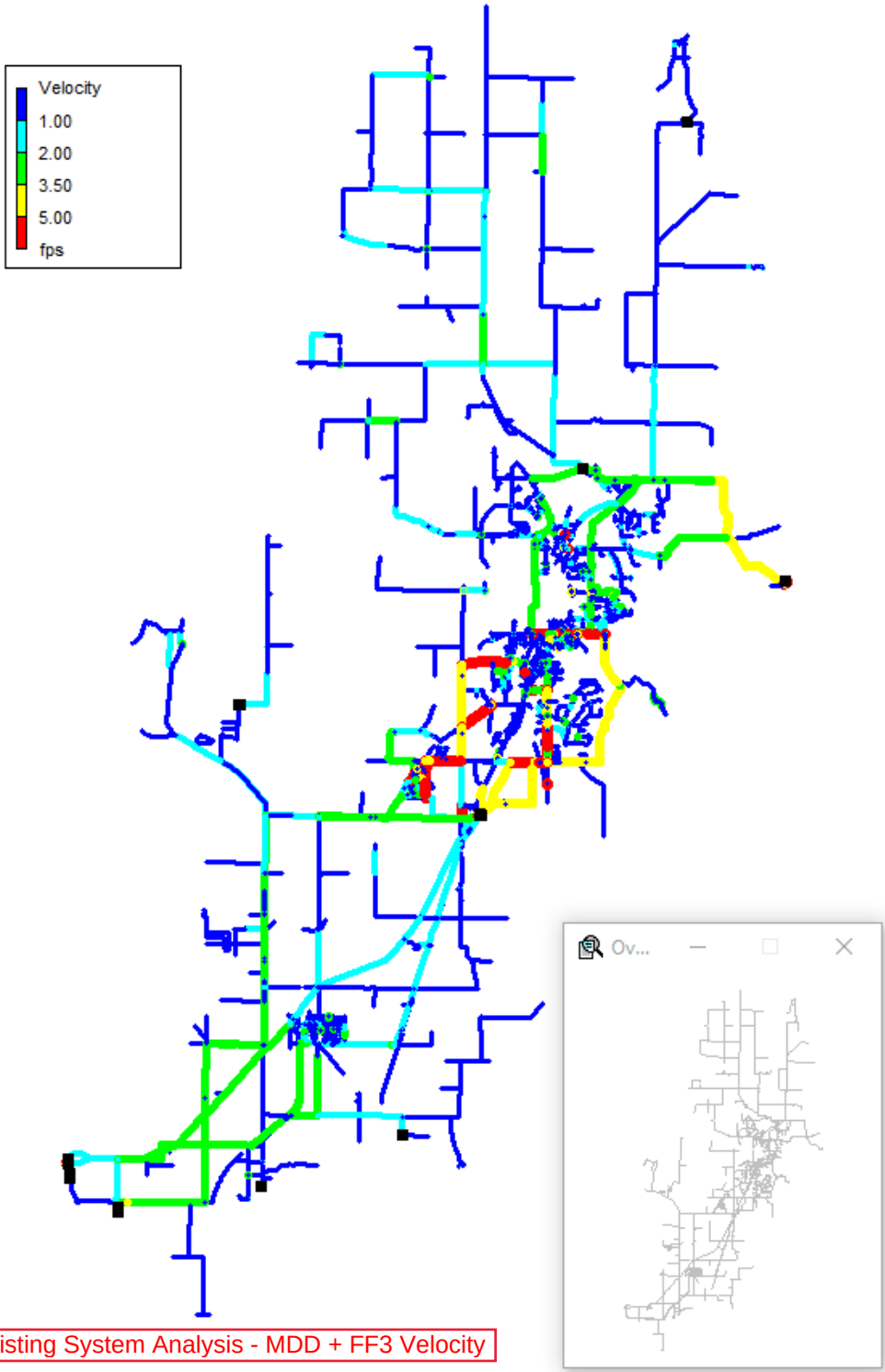
Existing System Analysis - MDD + FF2 Pressure



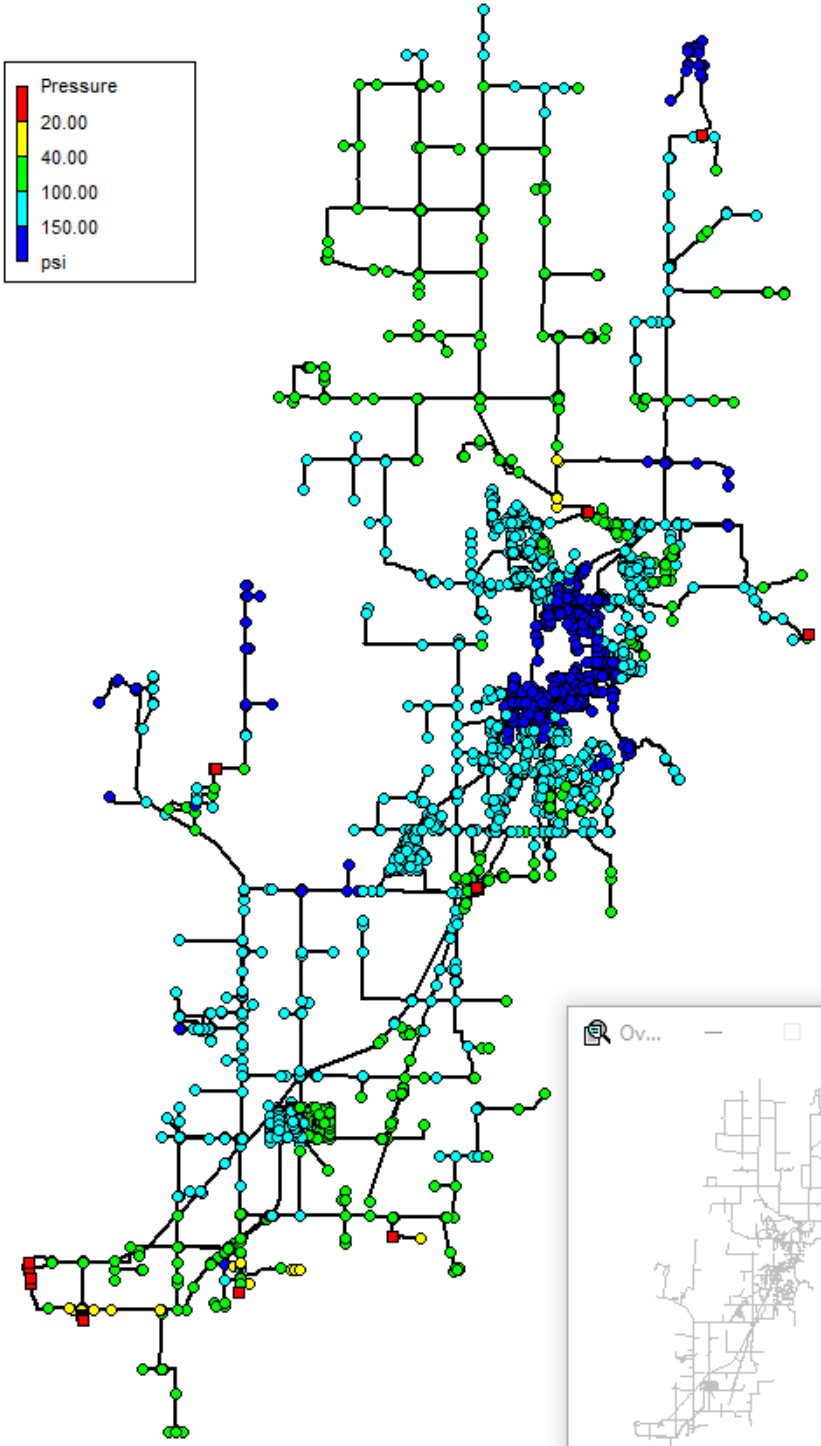
Existing System Analysis - MDD + FF2 Velocity



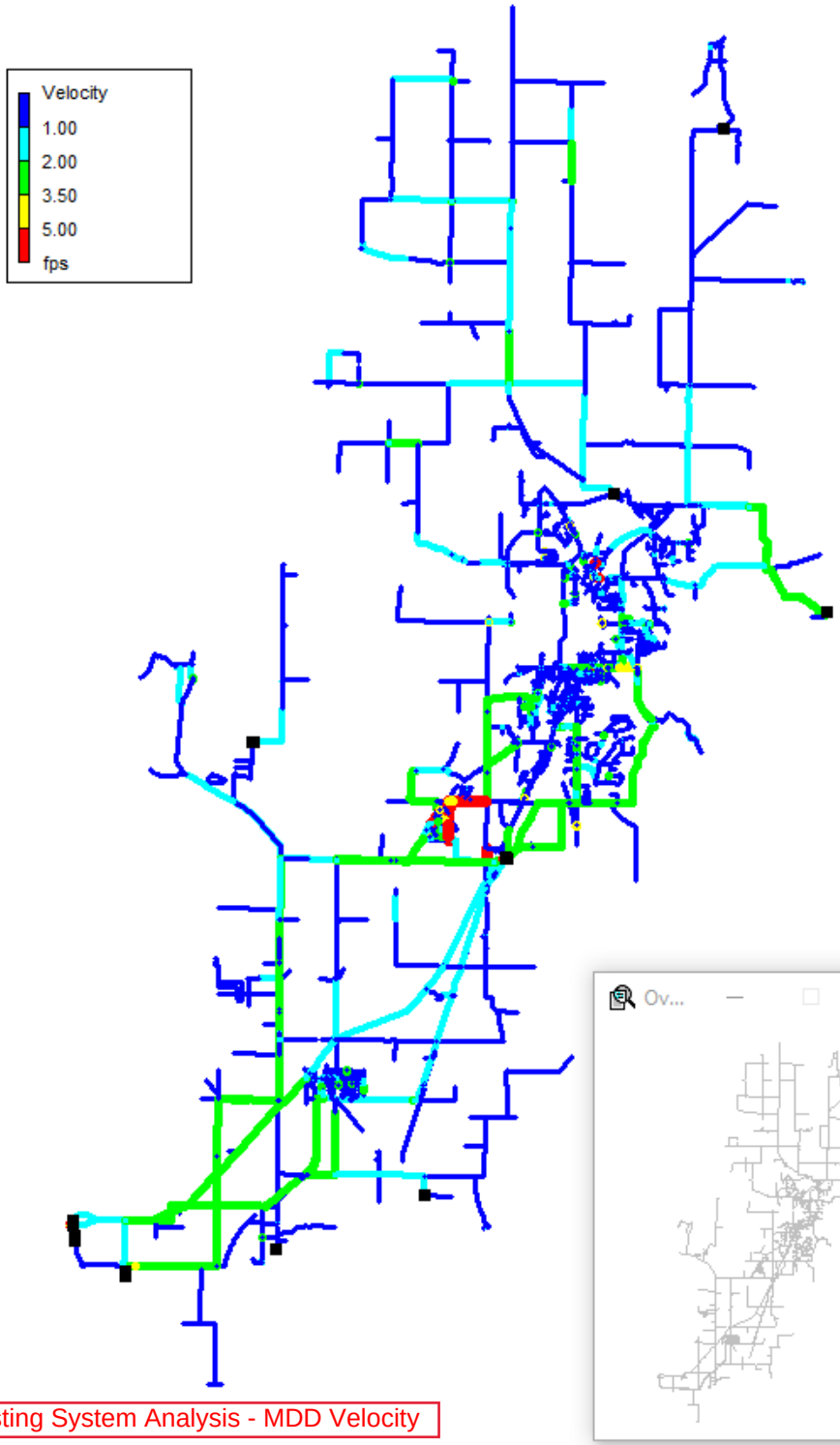
Existing System Analysis - MDD + FF3 Pressure



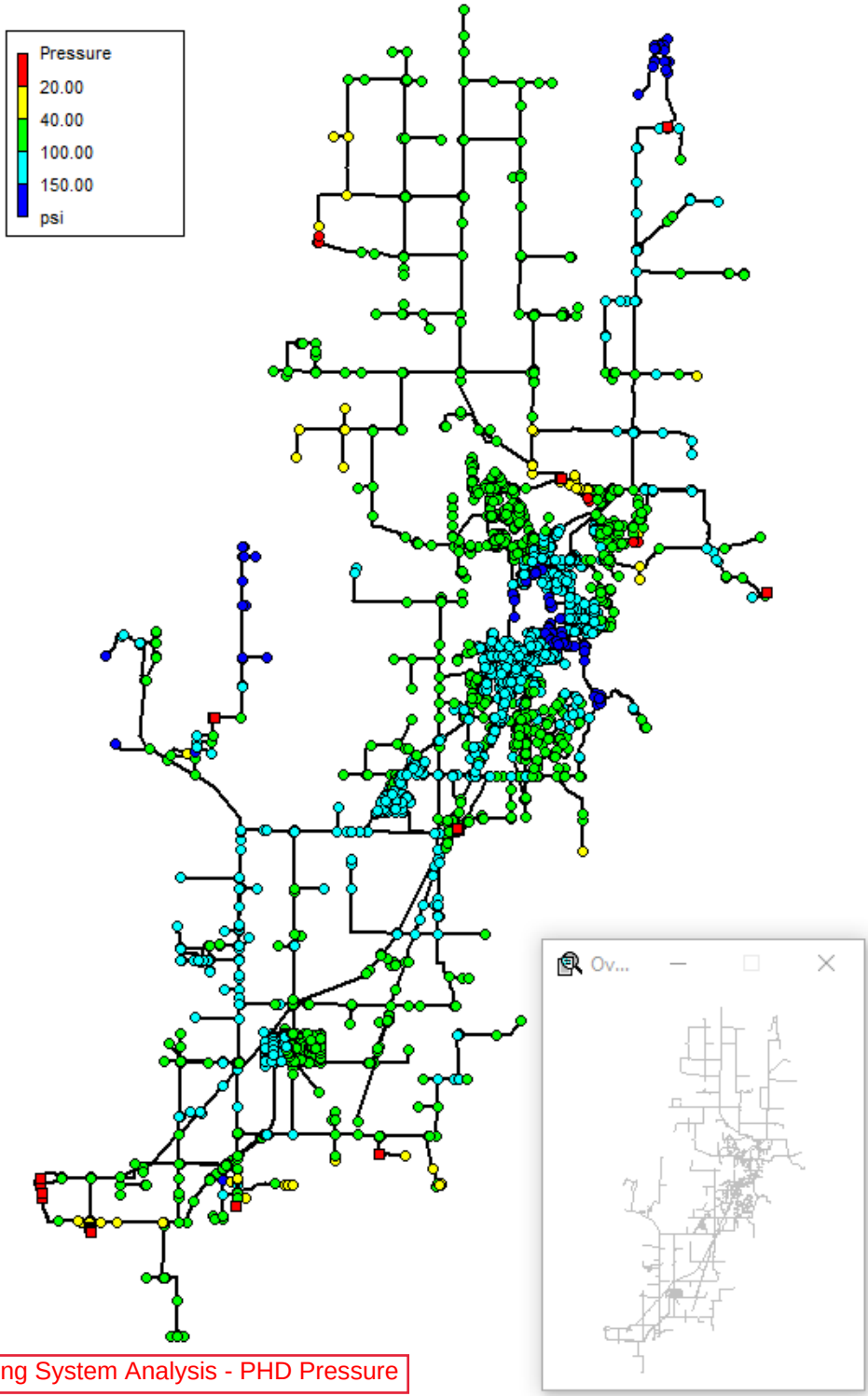
Existing System Analysis - MDD + FF3 Velocity



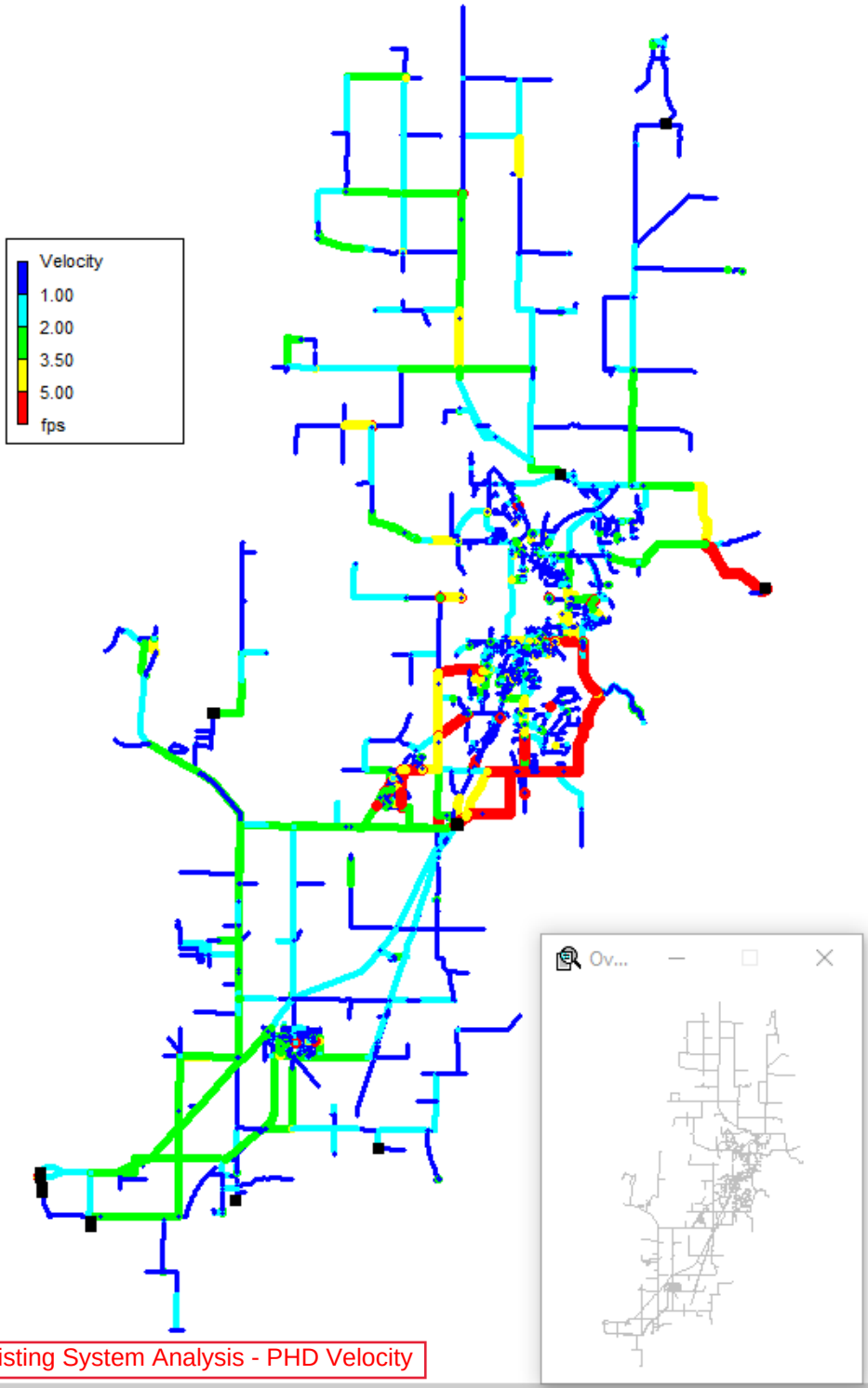
Existing System Analysis - MDD Pressure



Existing System Analysis - MDD Velocity



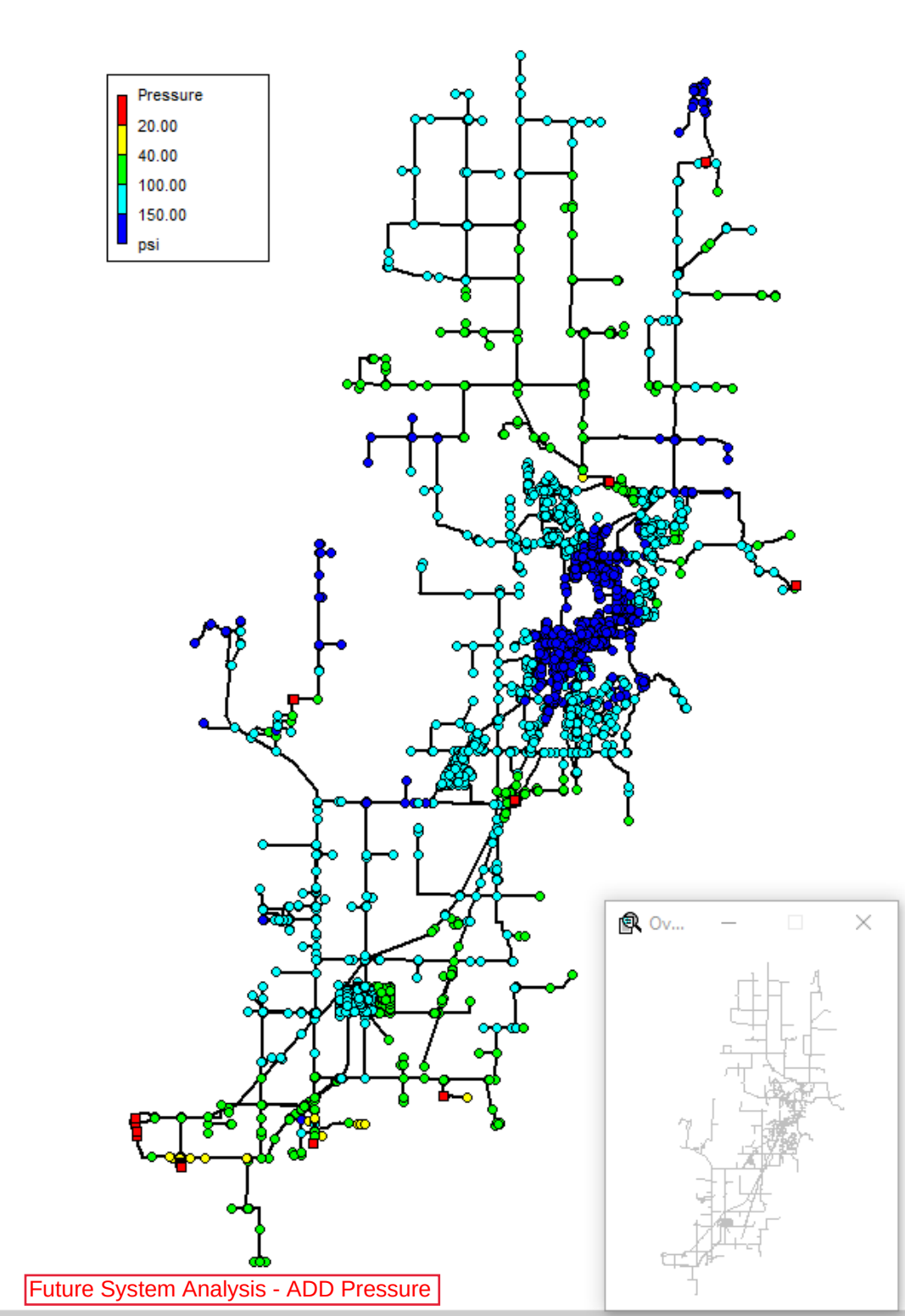
Existing System Analysis - PHD Pressure



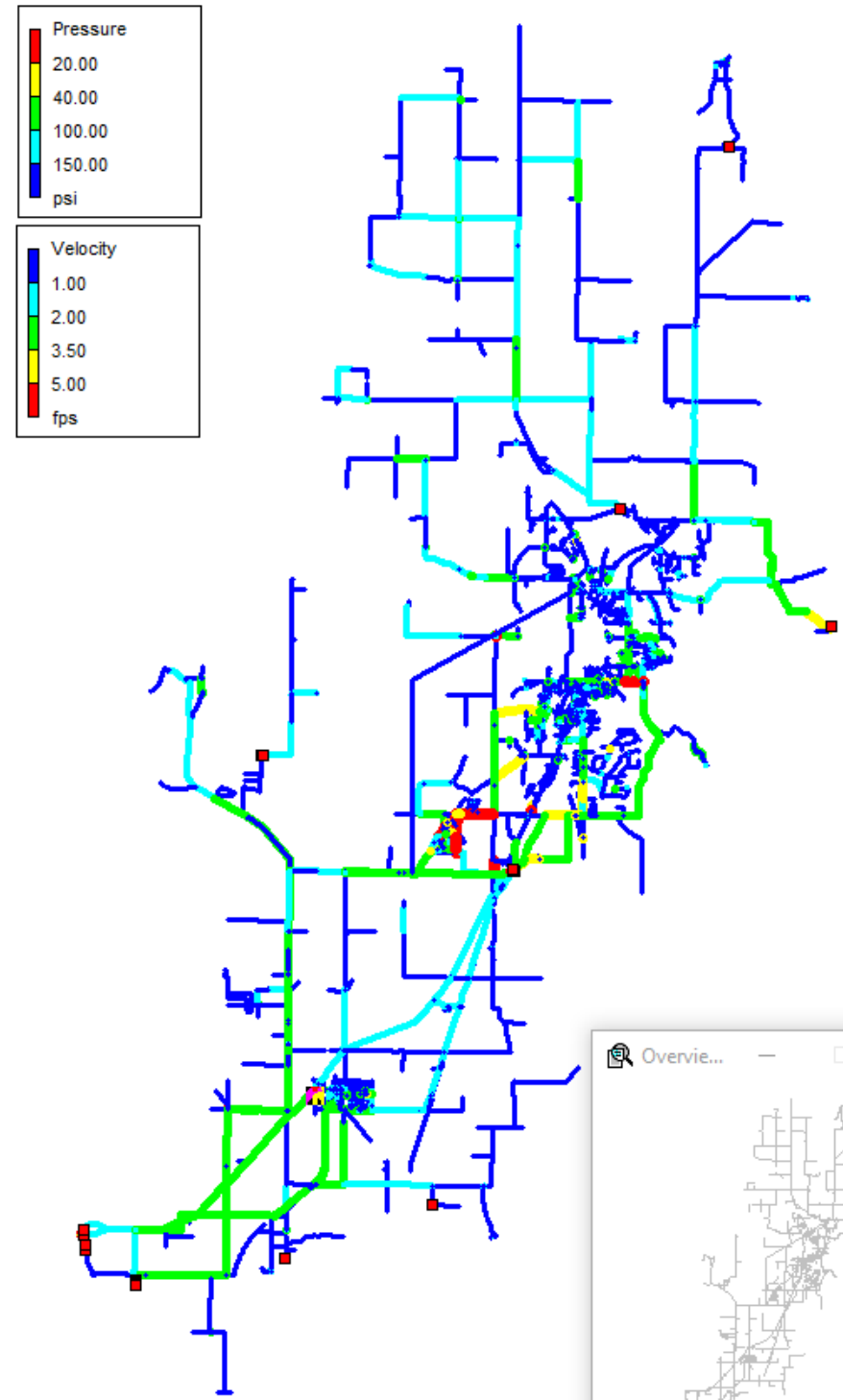
Existing System Analysis - PHD Velocity

Appendix H

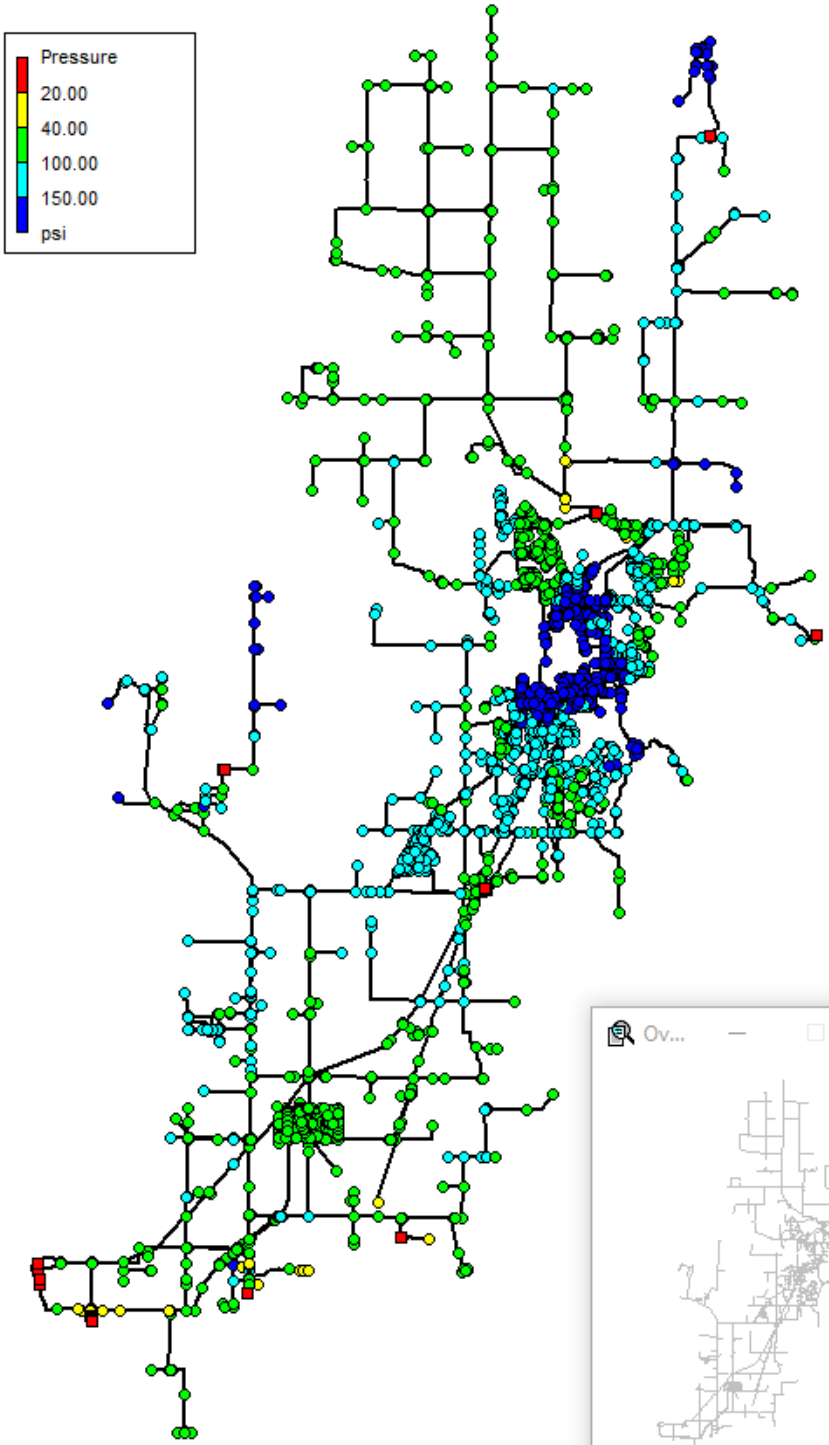
Future Systems Analysis



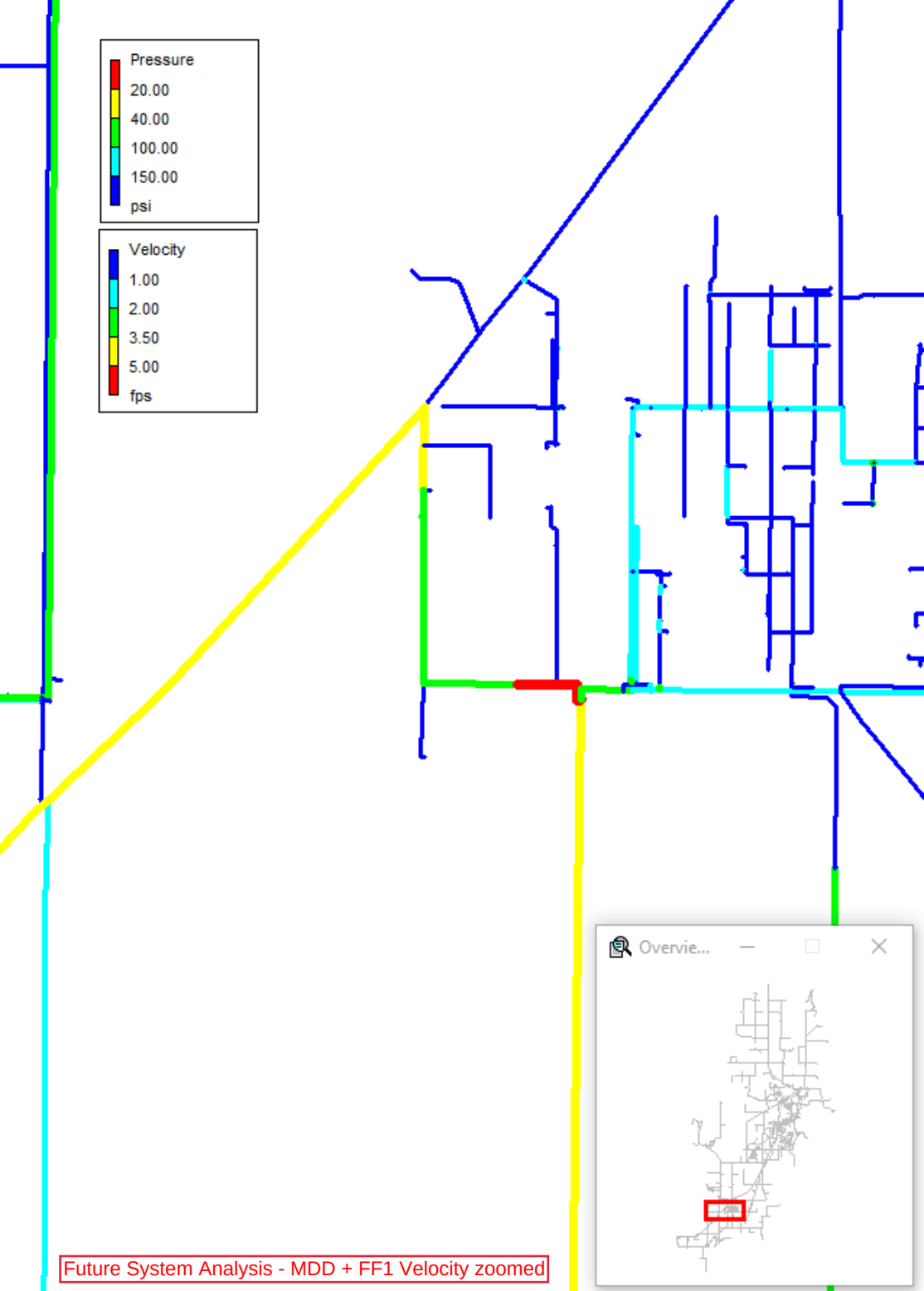
Future System Analysis - ADD Pressure



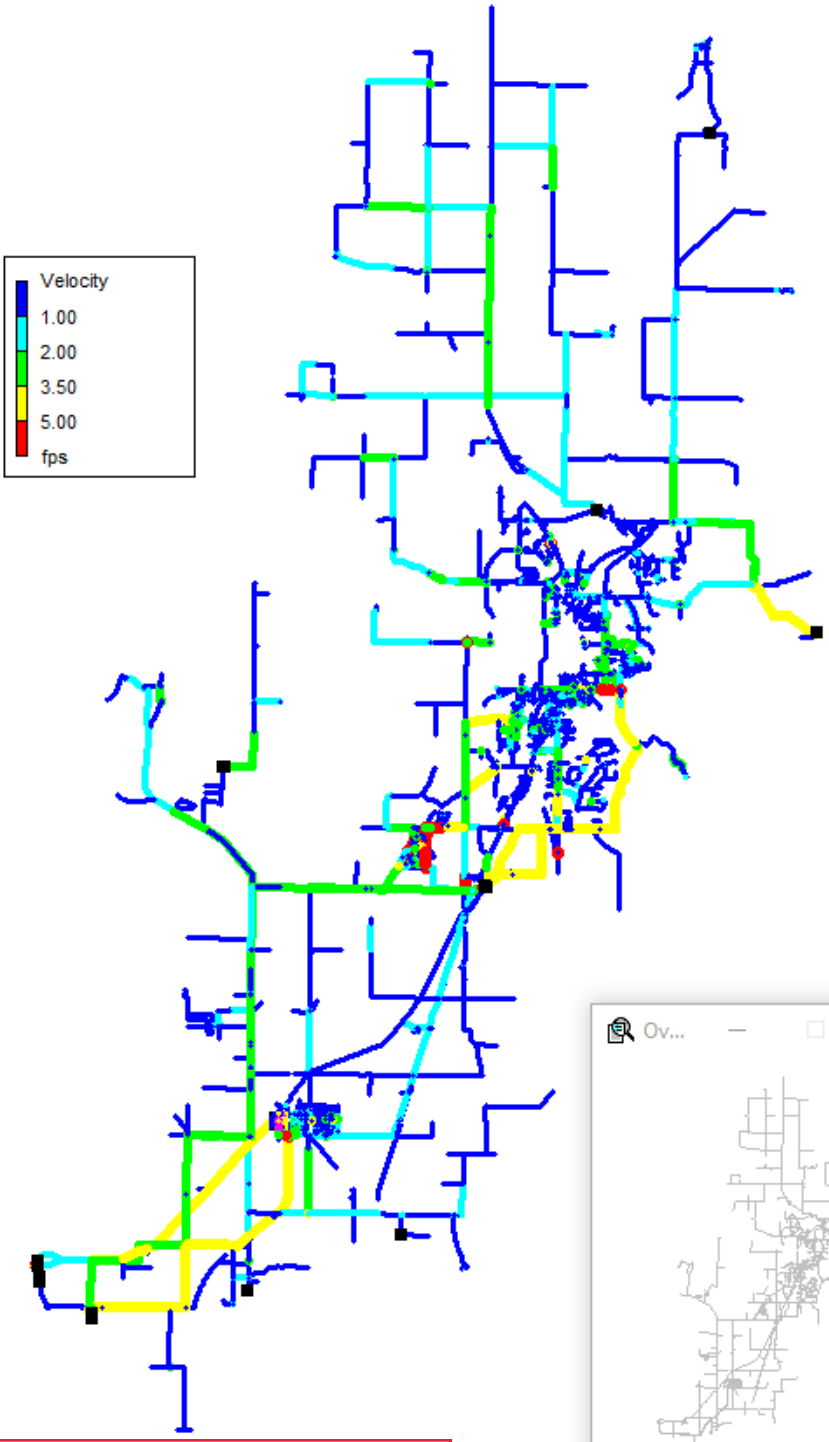
Future System Analysis - ADD Velocity



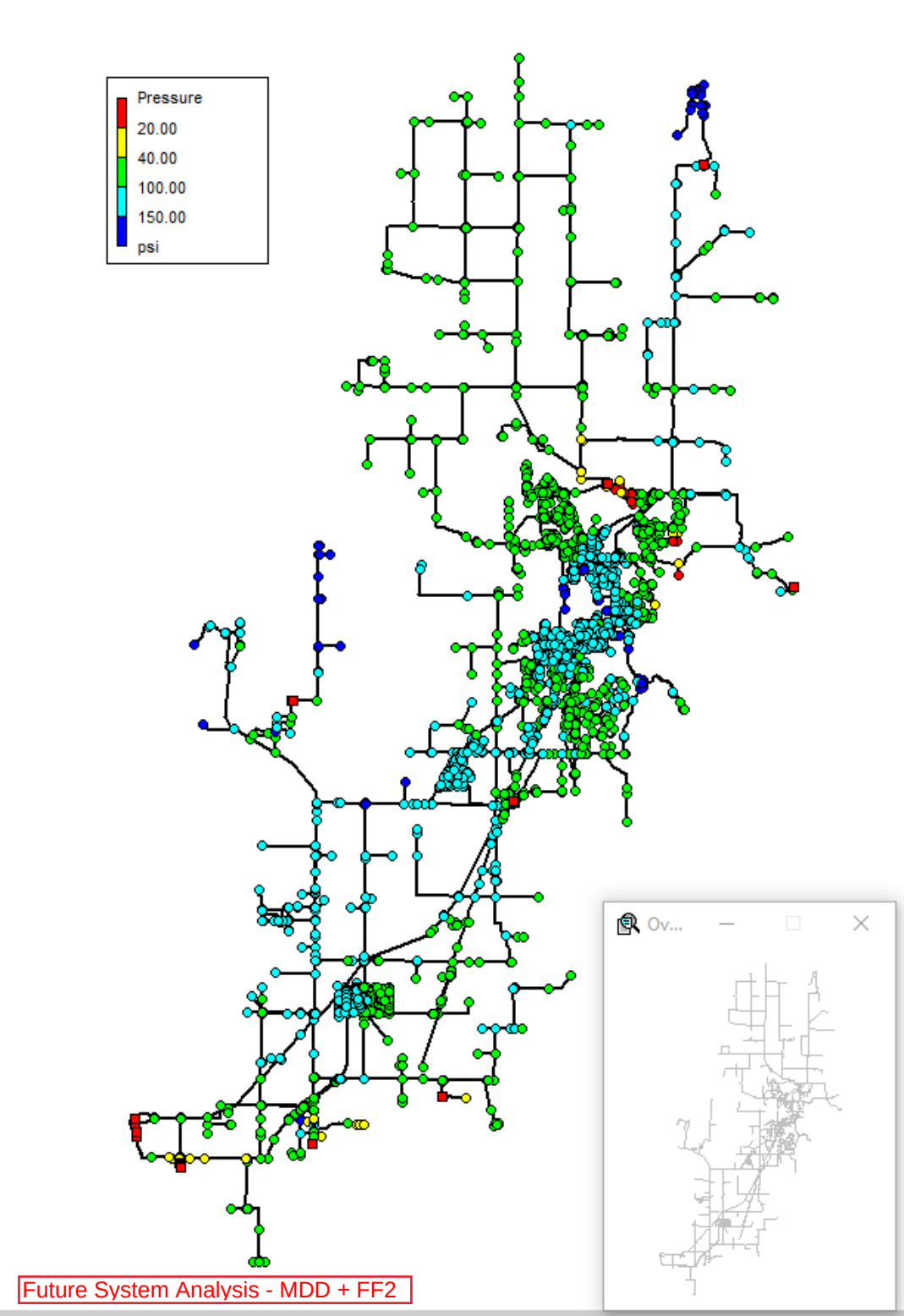
Future System Analysis - MDD + FF1 Pressure



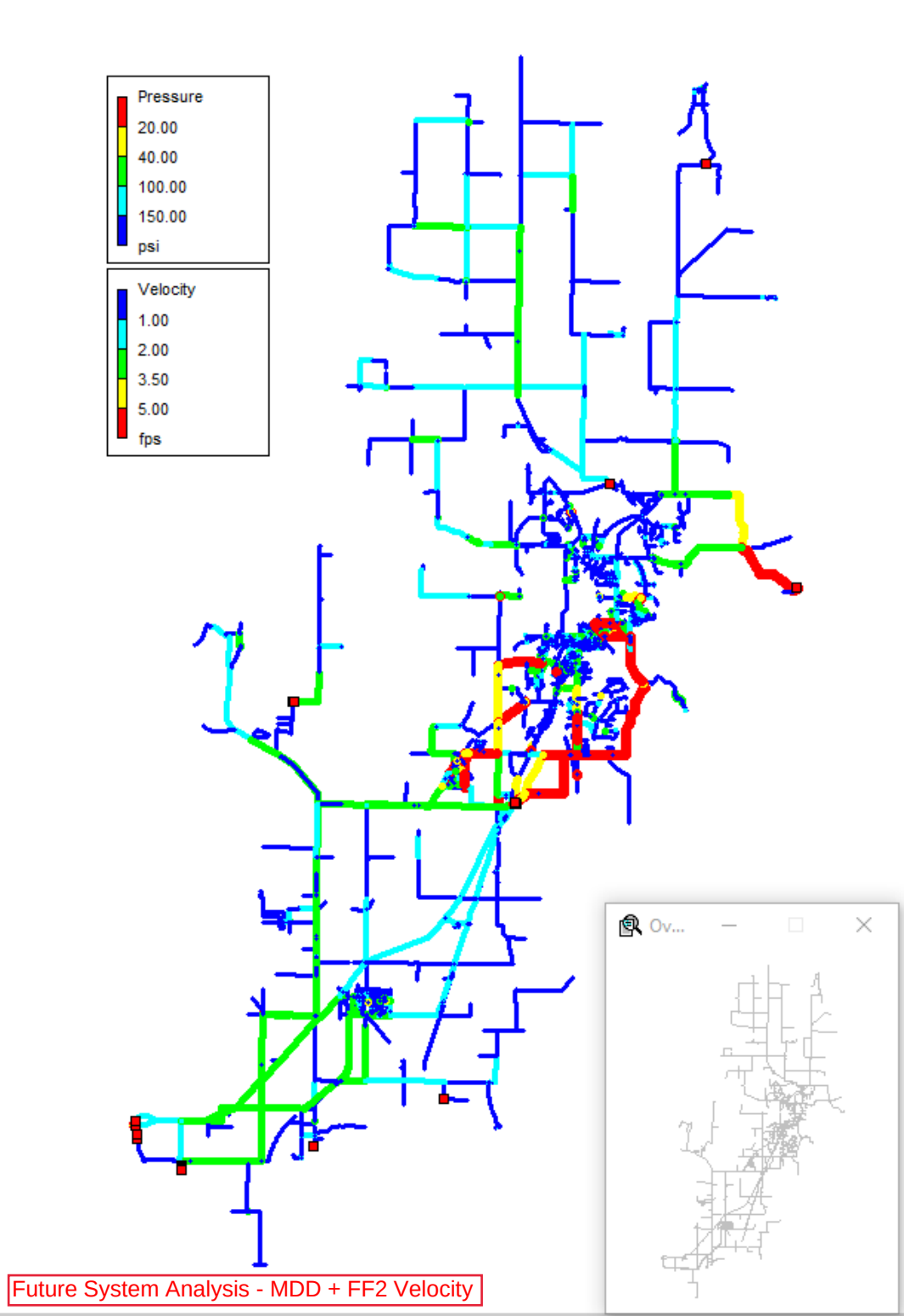
Future System Analysis - MDD + FF1 Velocity zoomed



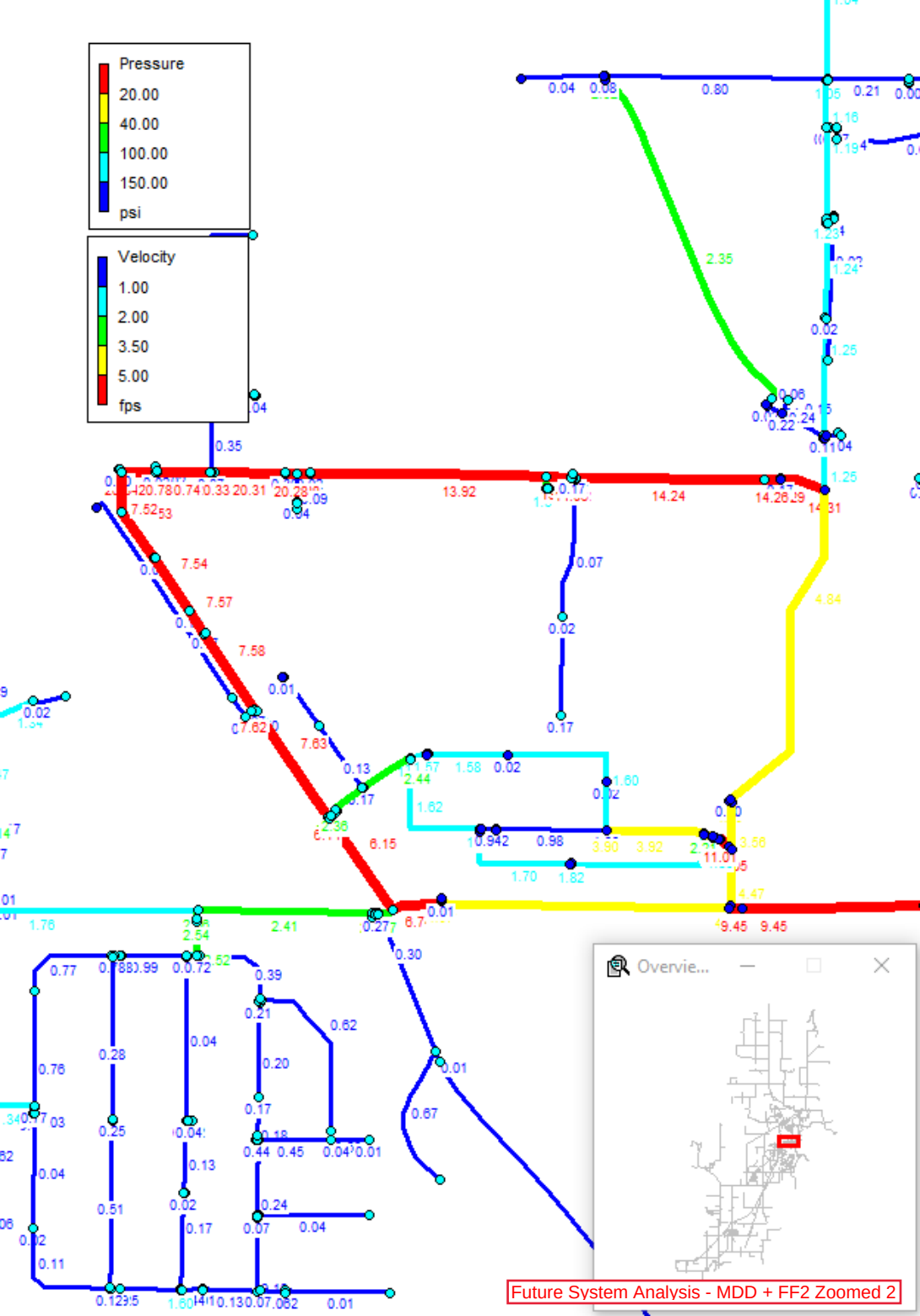
Future System Analysis - MDD + FF1 Velocity

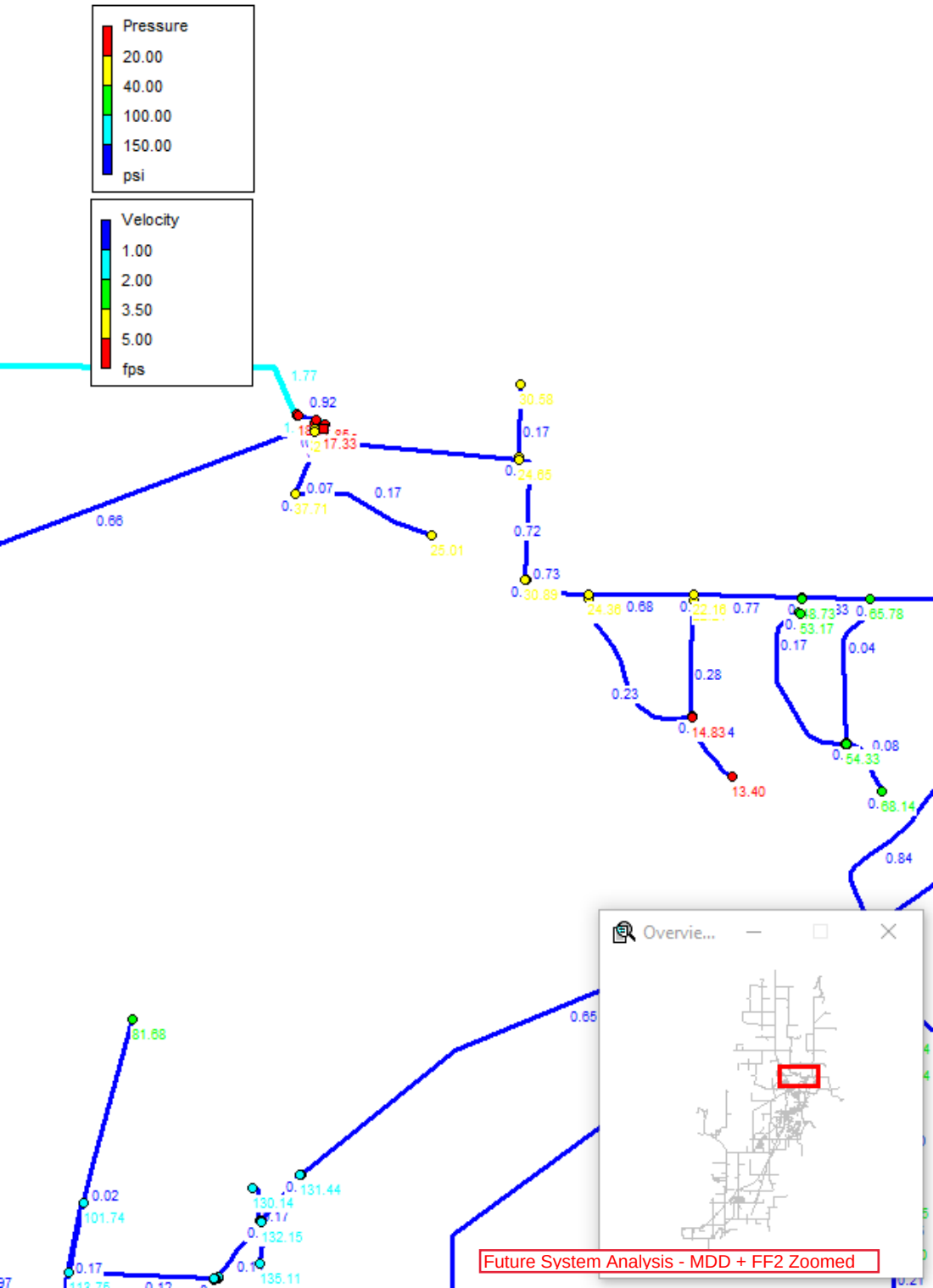


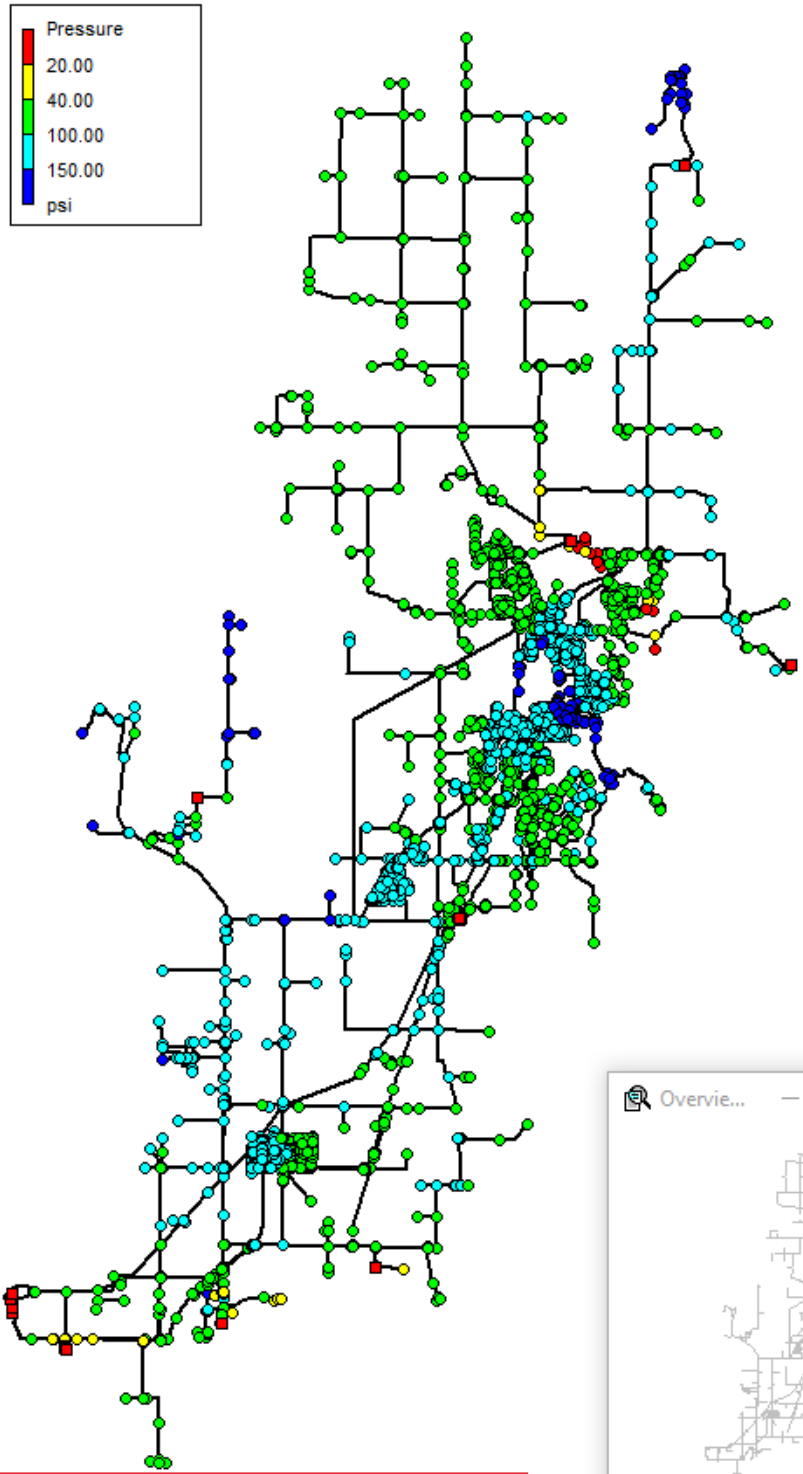
Future System Analysis - MDD + FF2



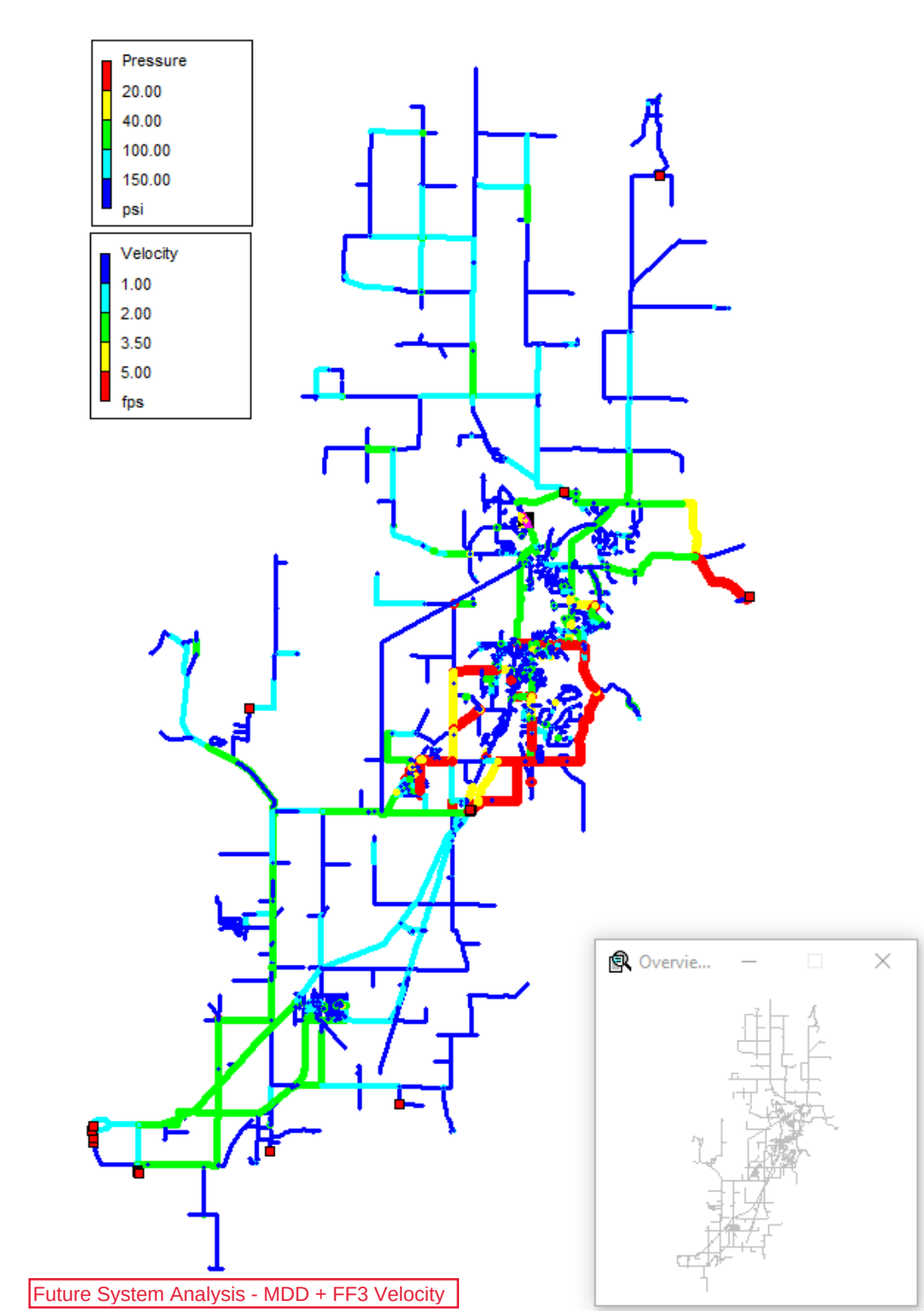
Future System Analysis - MDD + FF2 Velocity


Pressure
20.00
40.00
100.00
150.00
psi
Velocity
1.00
2.00
3.50
5.00
fps
Overvie...
Future System Analysis - MDD + FF2 Zoomed 2

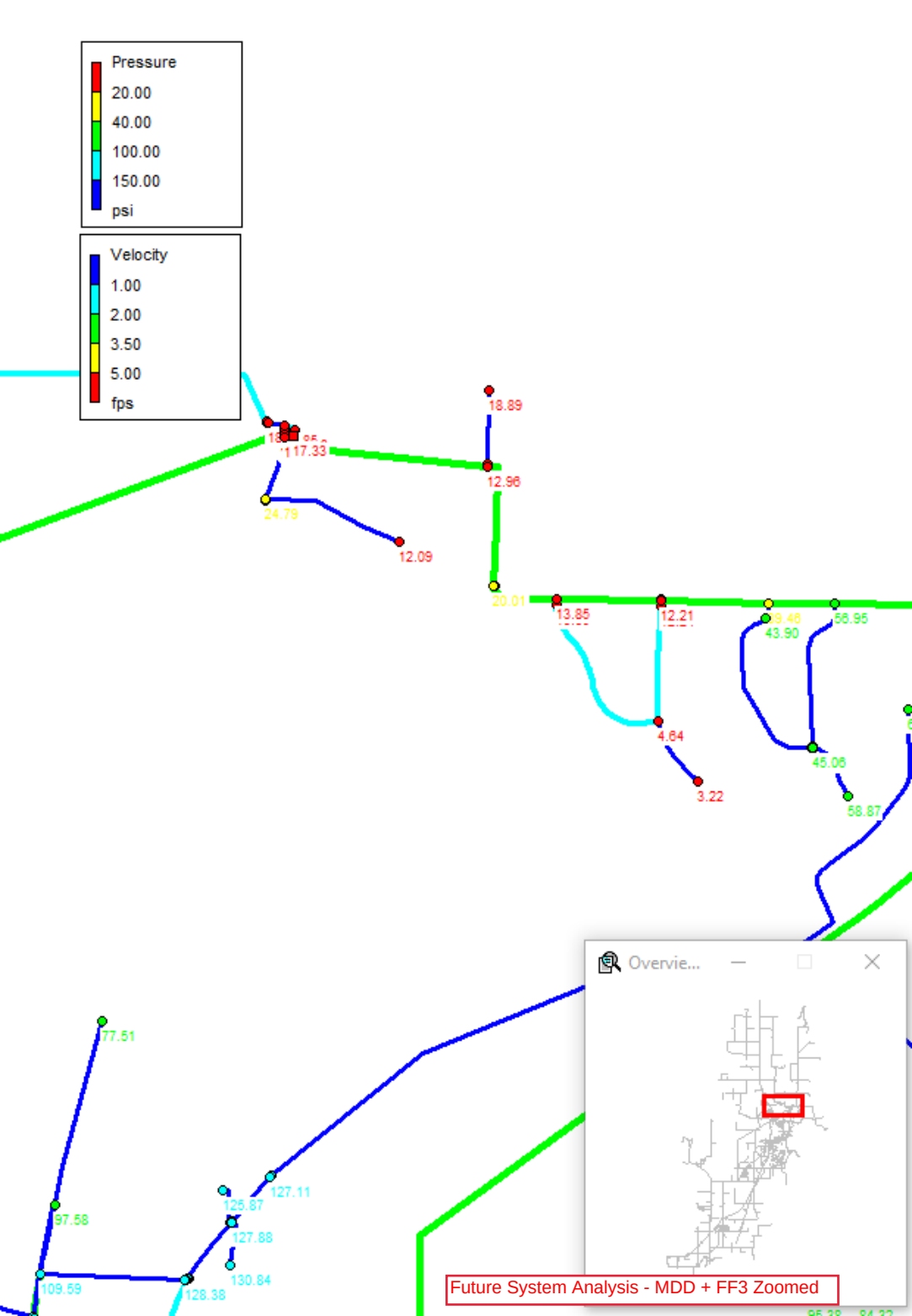

Pressure
20.00
40.00
100.00
150.00
psi
Velocity
1.00
2.00
3.50
5.00
fps
1.77
0.92
17.33
0.66
0.07
37.71
0.17
25.01
30.58
0.17
24.65
0.72
0.73
30.89
24.36
0.68
22.16
0.77
0.65.78
0.53.17
0.17
0.04
0.23
0.28
14.83
13.40
0.08
54.33
68.14
0.84
0.65
81.68
0.02
101.74
0.17
130.14
131.44
132.15
135.11
Overvie...
Future System Analysis - MDD + FF2 Zoomed

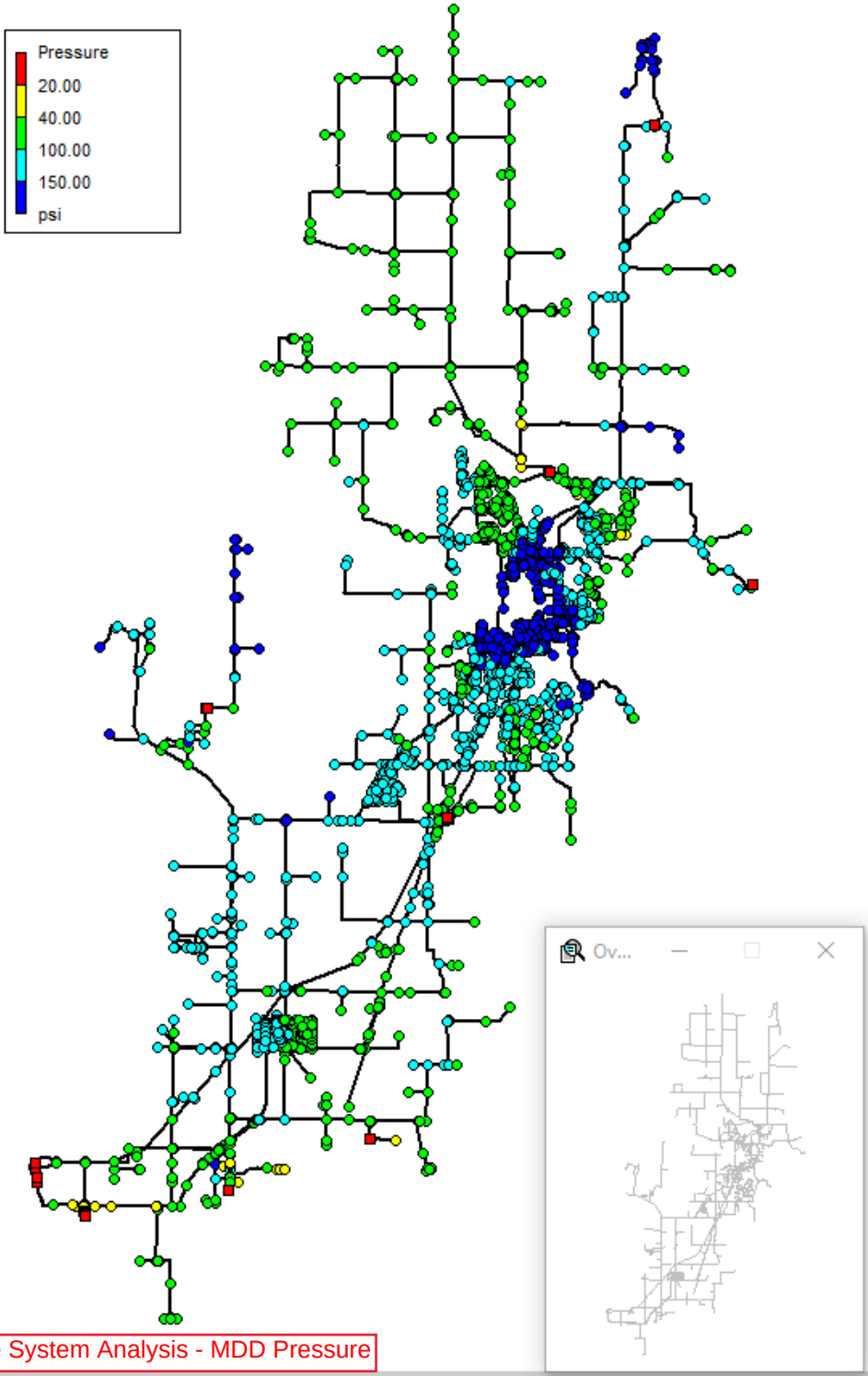


Future System Analysis - MDD + FF3 Pressure

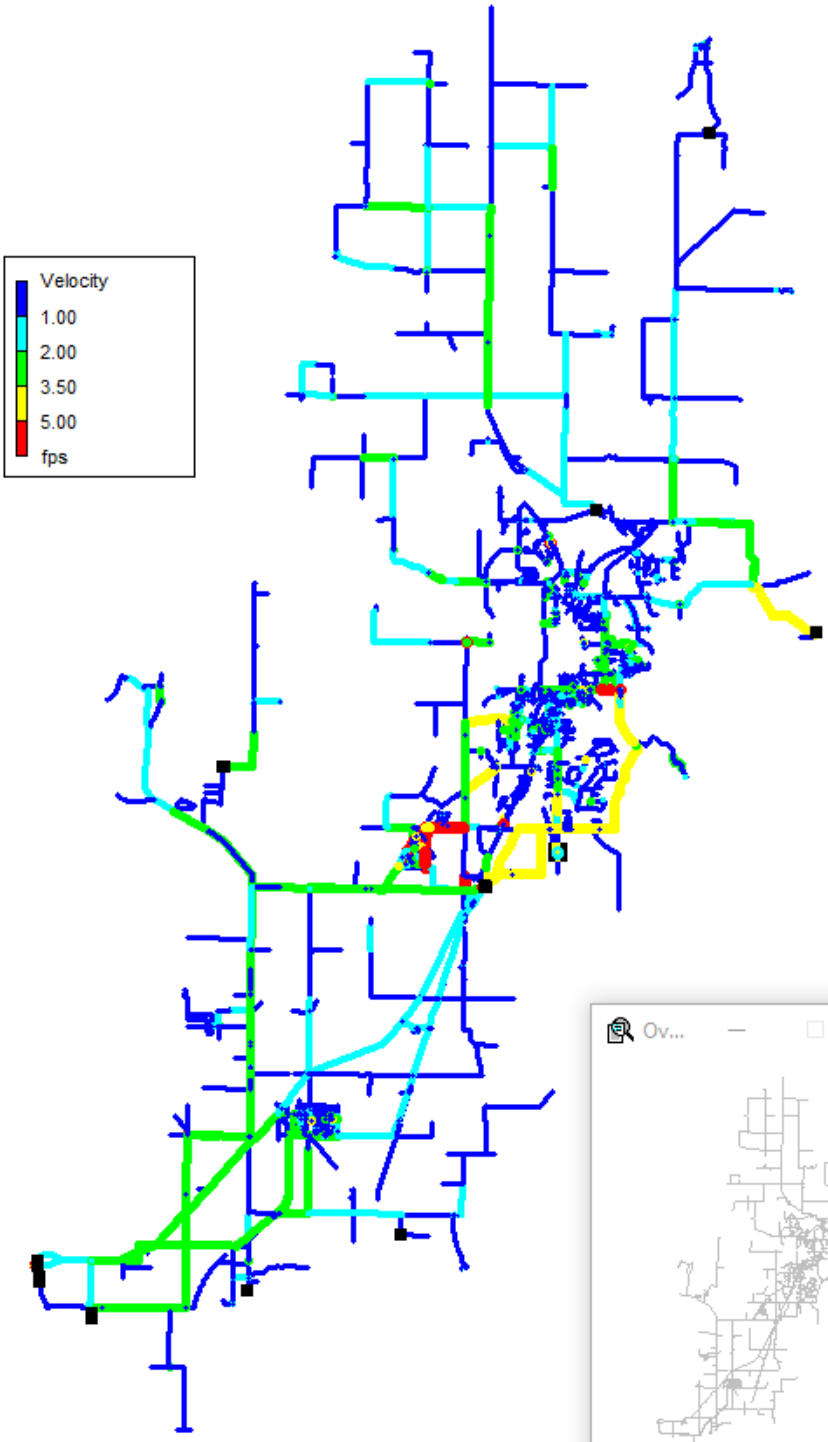


Future System Analysis - MDD + FF3 Velocity

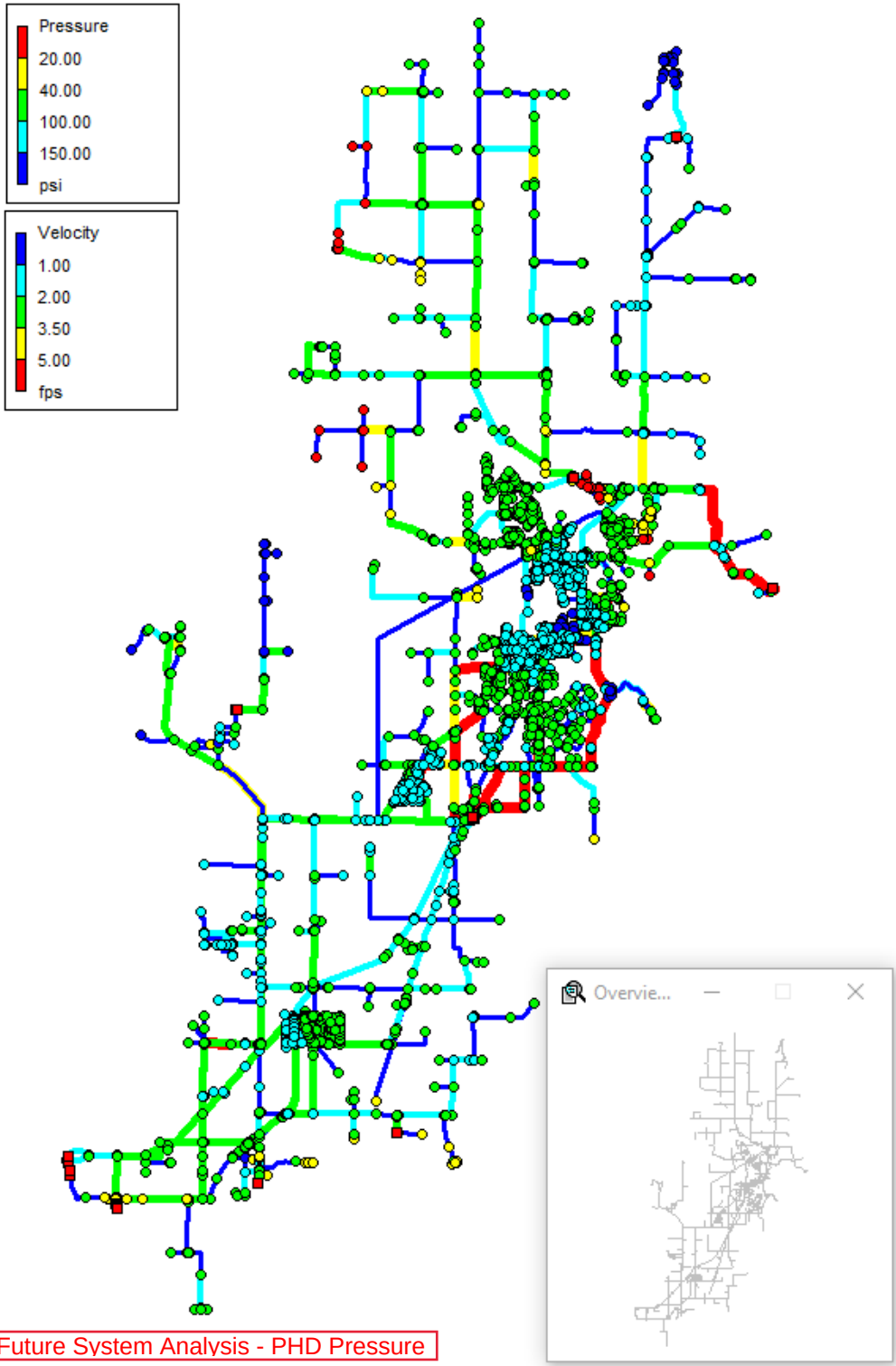

Pressure
20.00
40.00
100.00
150.00
psi
Velocity
1.00
2.00
3.50
5.00
fps
18.89
117.33
12.96
24.79
12.09
20.01
13.85
12.21
43.90
56.95
4.64
45.06
3.22
58.87
77.51
97.58
125.87
127.11
127.88
130.84
109.59
128.38
Overvie...
Future System Analysis - MDD + FF3 Zoomed



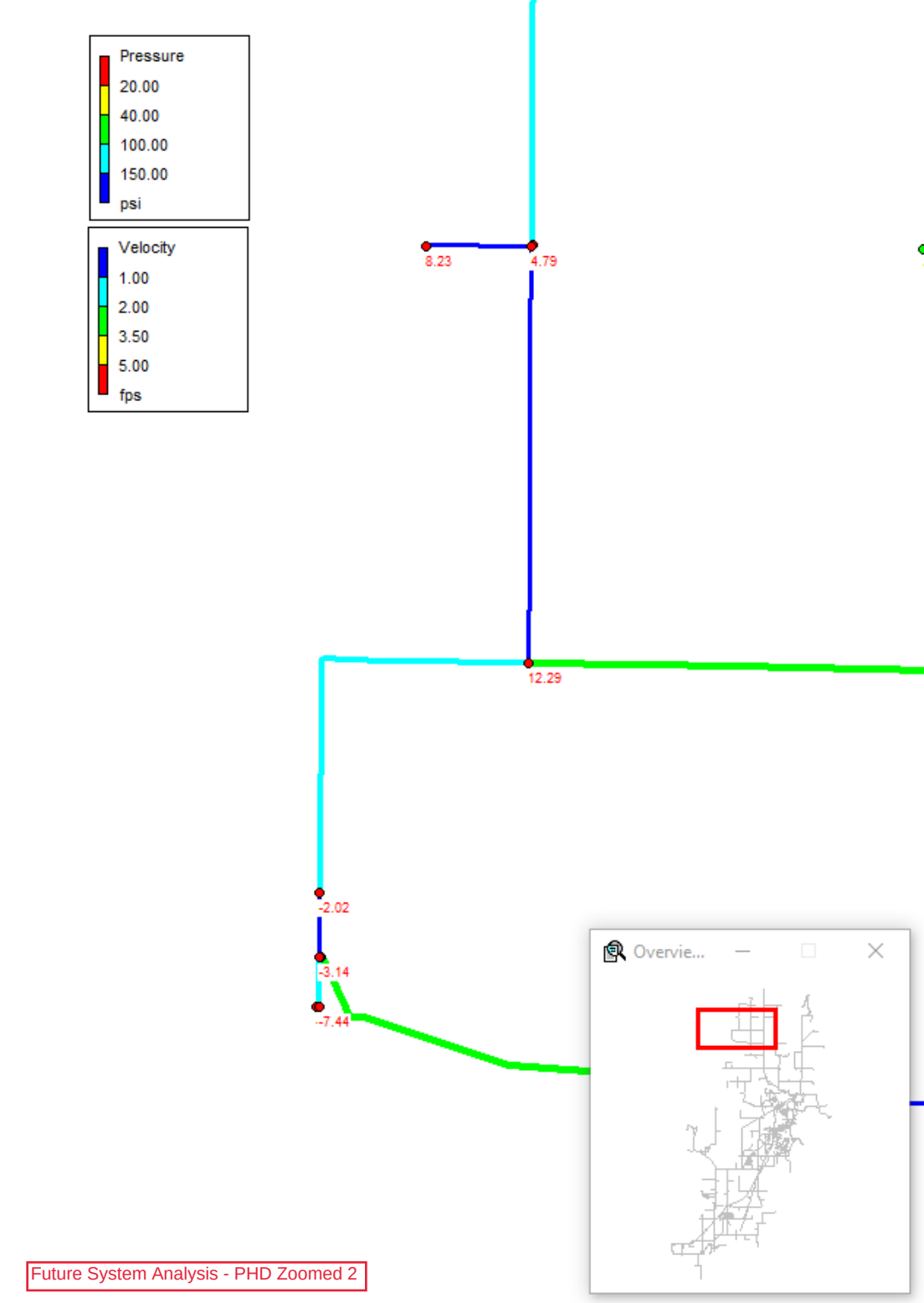
Future System Analysis - MDD Pressure



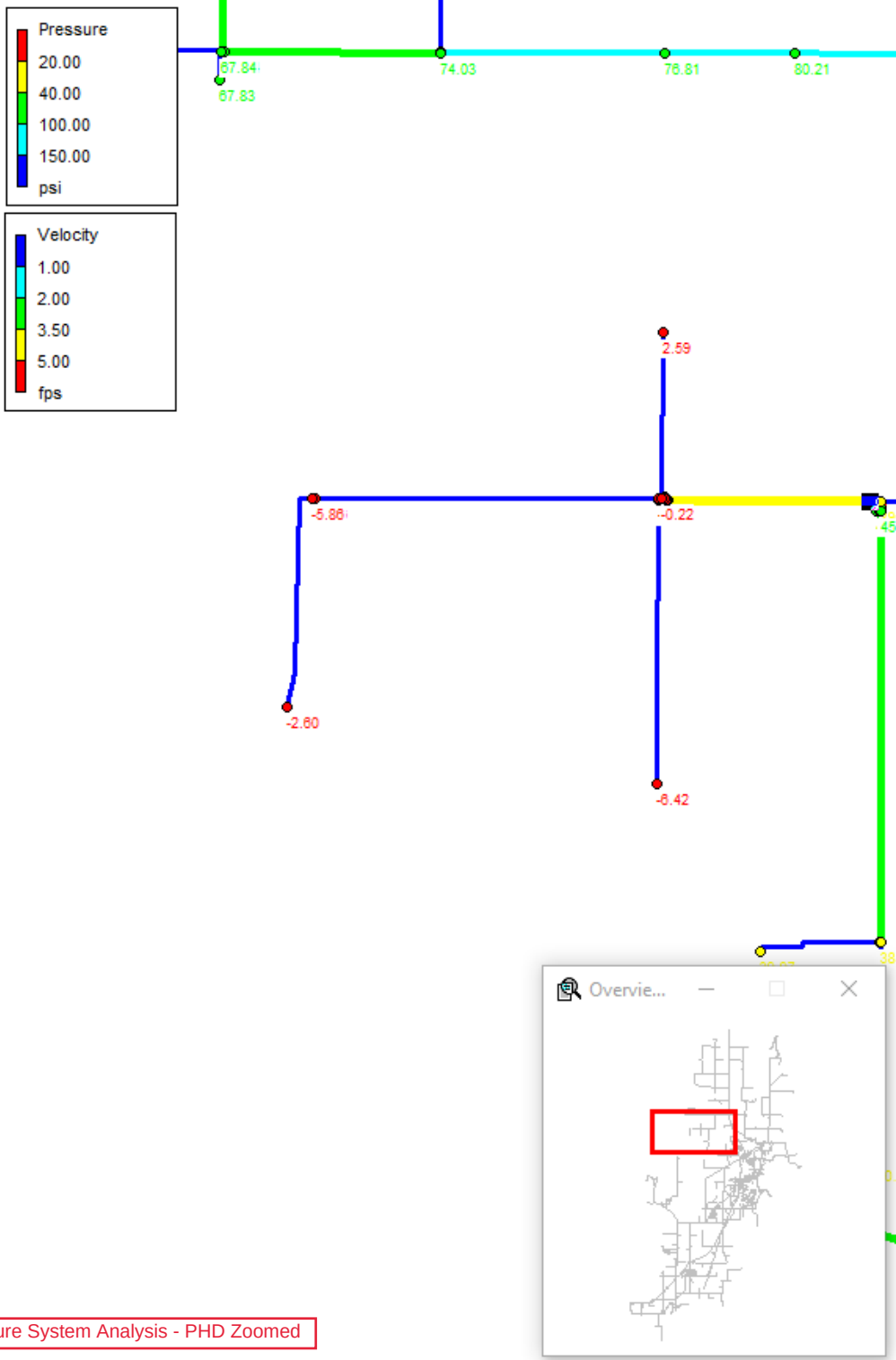
Future System Analysis - MDD Velocity



Future System Analysis - PHD Pressure



Future System Analysis - PHD Zoomed 2

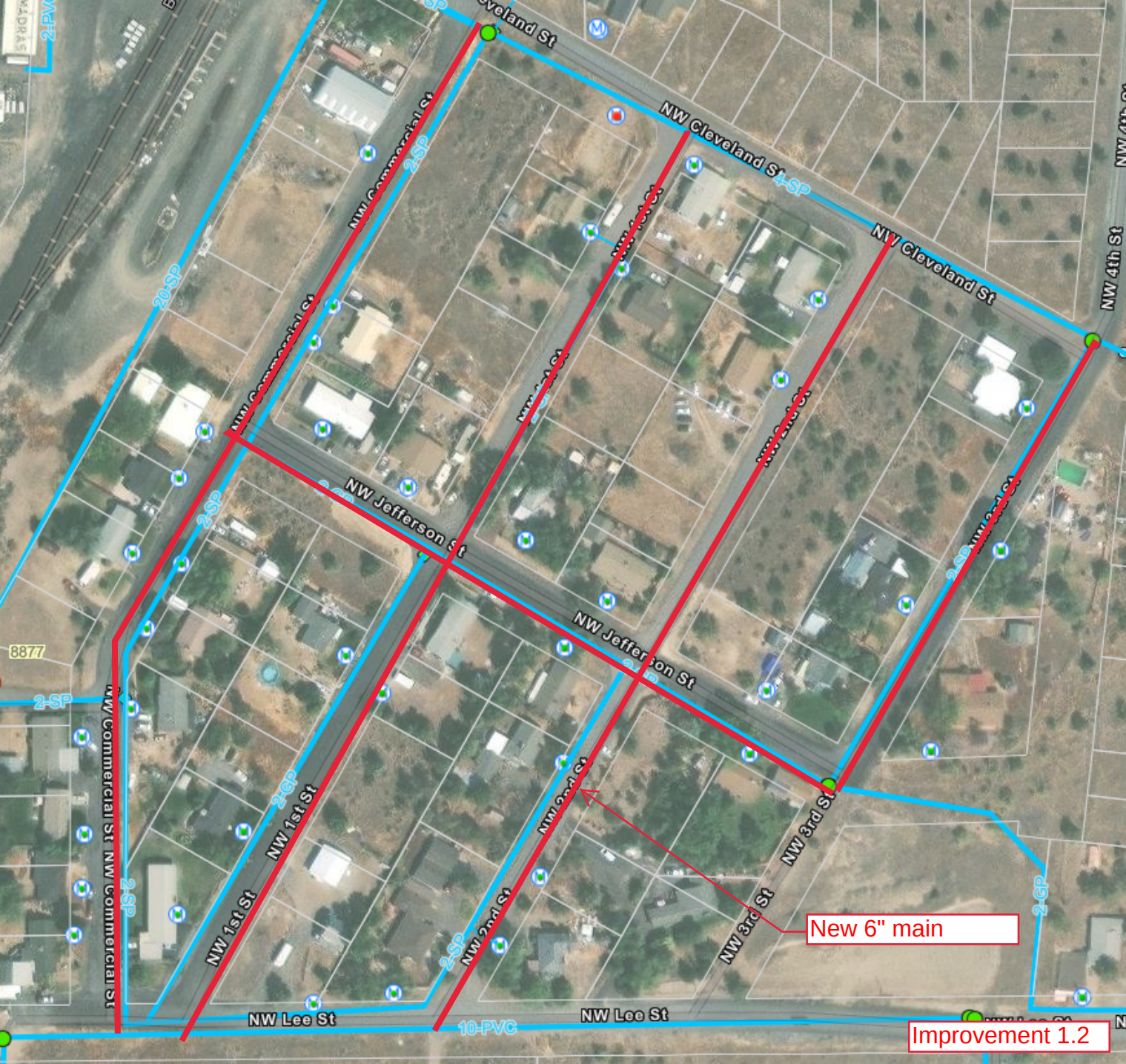


Future System Analysis - PHD Zoomed

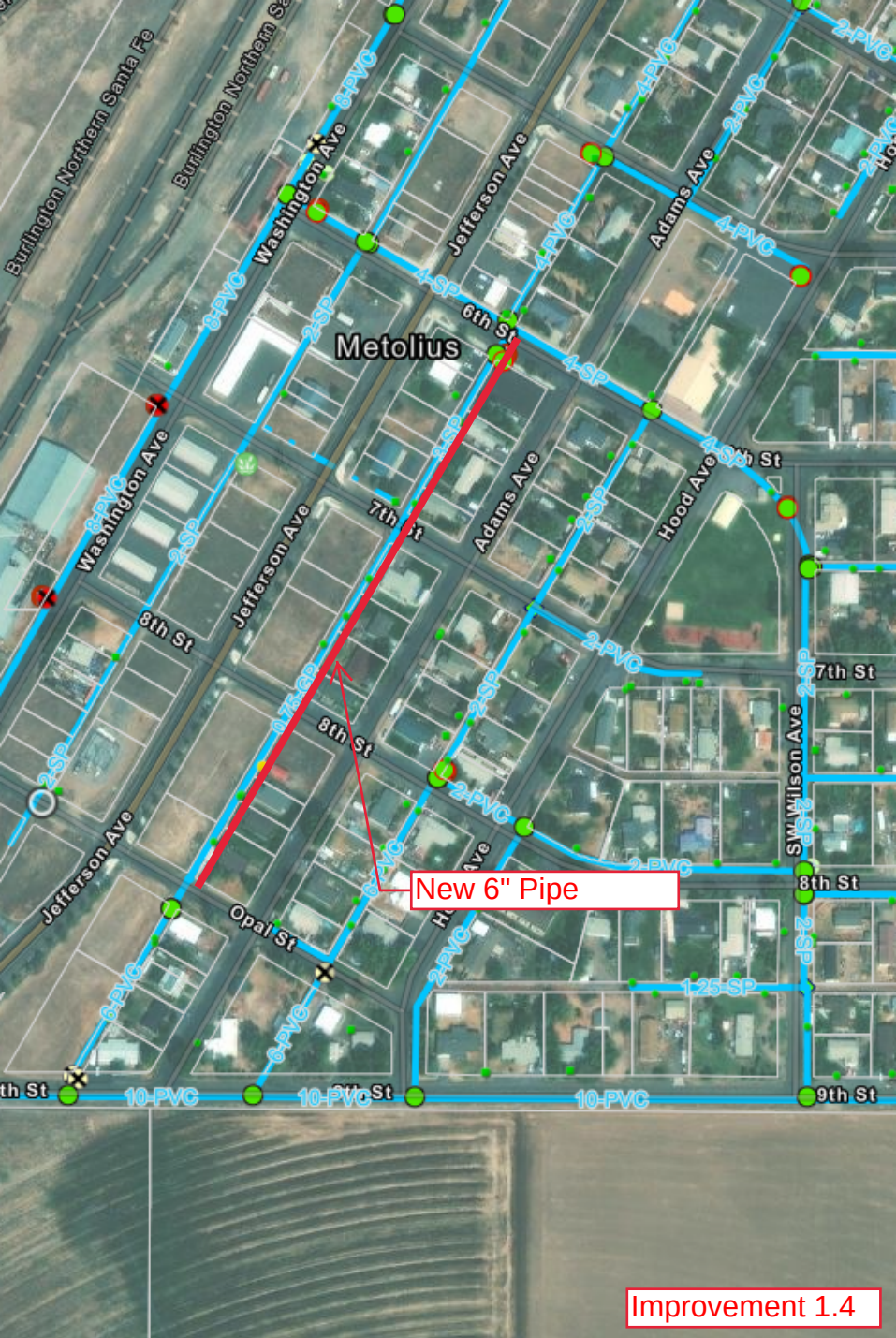
Appendix I

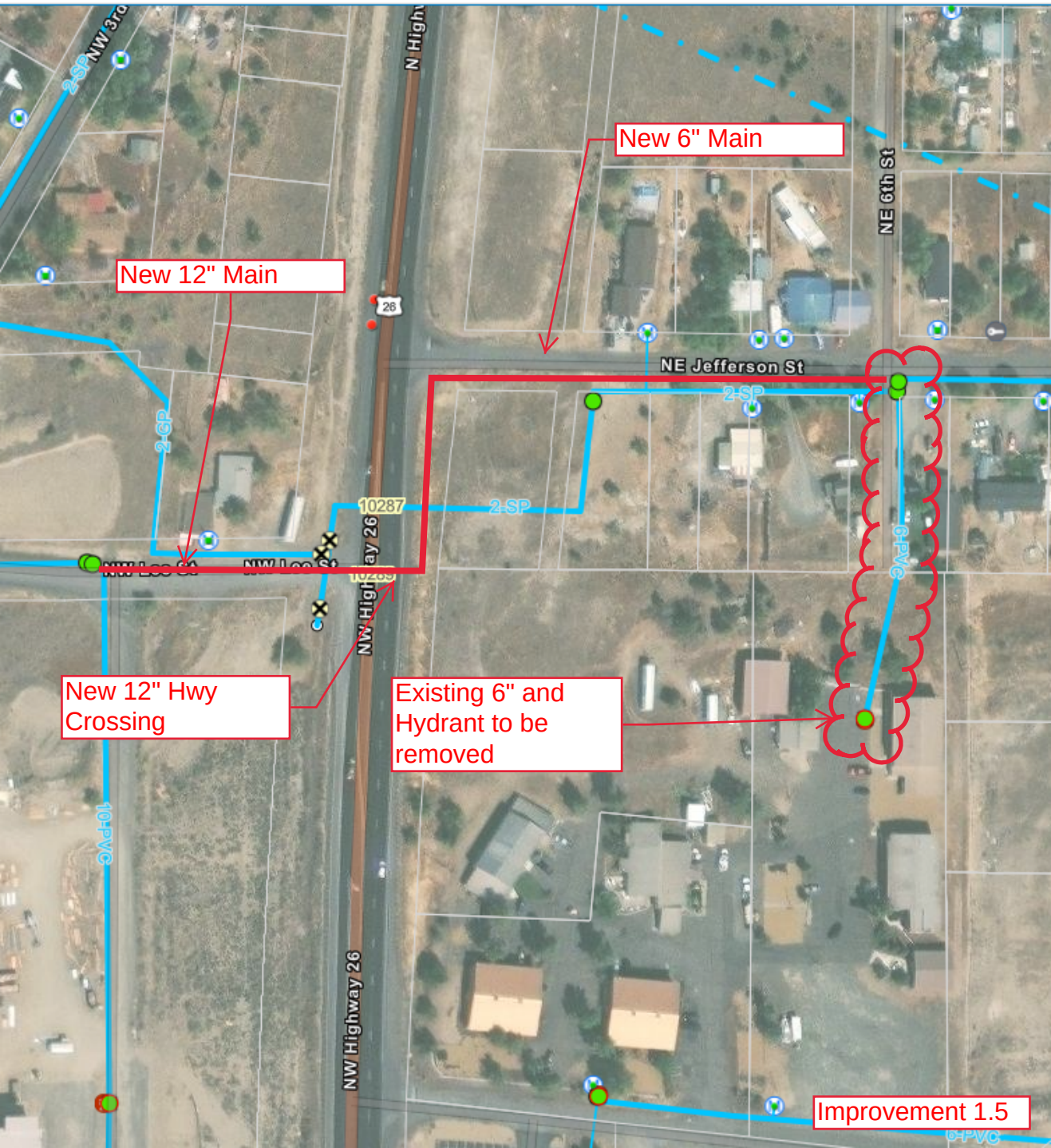
Engineering Solutions

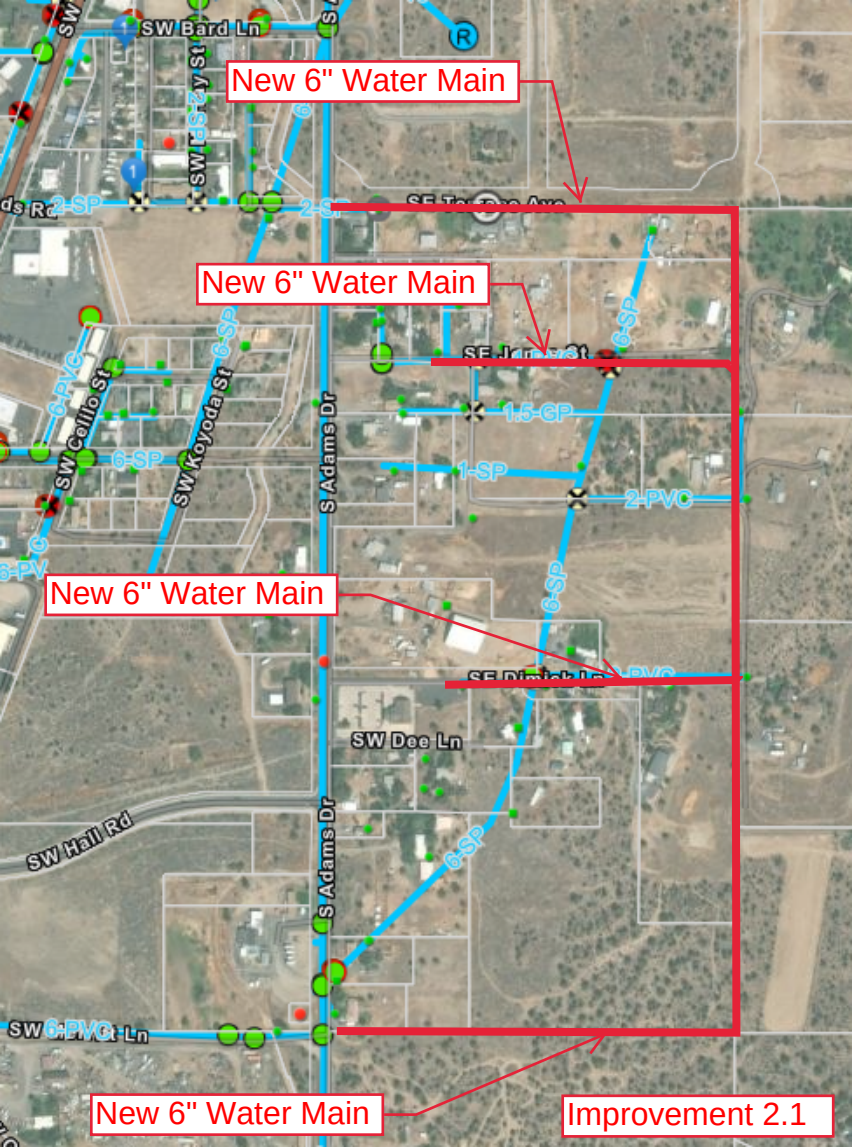

SW Kenwood Dr
SW Culver Hwy
SW Fairgrounds Rd
SW Fairgrounds Rd
SW Fairgrounds Rd
10693
SW Culver Hwy
SW Culver Hwy
SW Culver Hwy
SW Chiddix Ln
Culver Hwy
4-PVC
6-PVC
6-PVC
6-SP
6-SP
6-SP
6-SP
6-SP
1-PVC
2-SP
New 6" Pipe
To be abandoned
Improvement 1.1

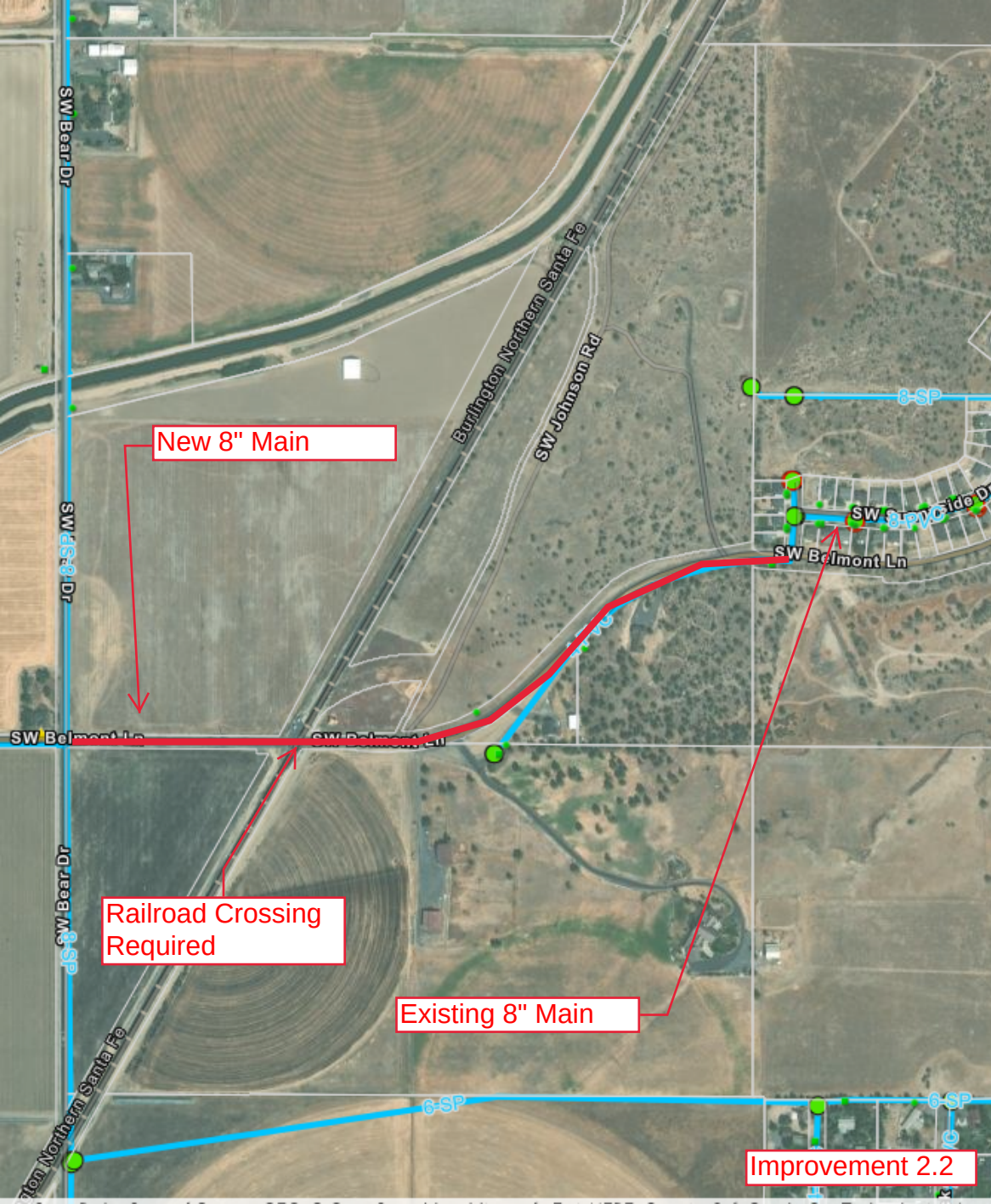

NW Cleveland St
NW Cleveland St
NW 4th St
NW Commercial St
NW Jefferson St
NW Jefferson St
NW 1st St
NW 1st St
NW 3rd St
NW 3rd St
NW Commercial St
NW Lee St
NW Lee St
8877
New 6" main
Improvement 1.2

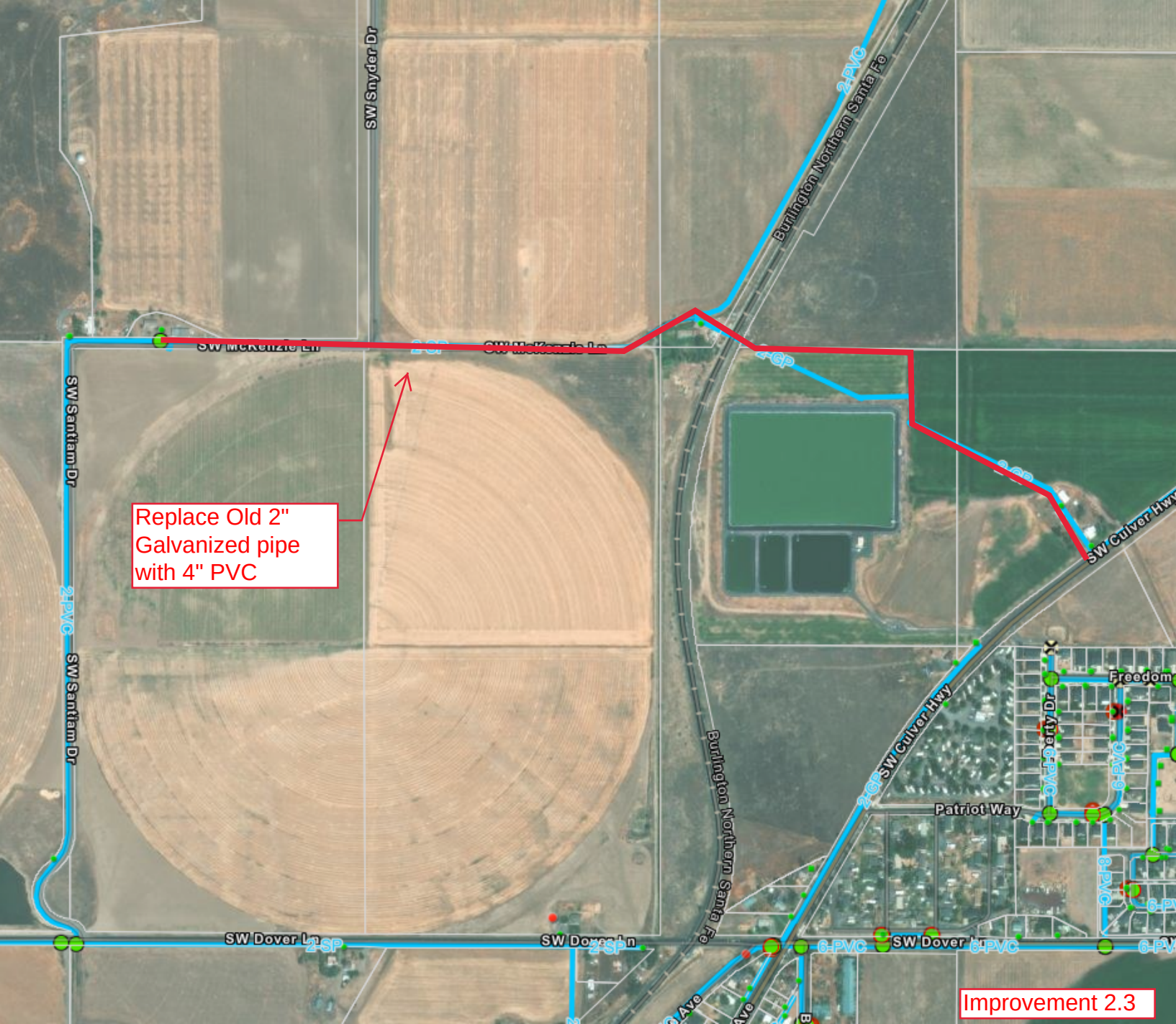

ODOT Hwy 361
Road Crossing
Road crossing already installed as part of a previous project
new 6" main
Improvement 1.3
6th St
7th St
Adams Ave
Jefferson Ave
Hood Ave
SW Wilson Ave
361
9126
9110
4-SP
2-SP
4-PVC
2-PVC
2-GP
0.75-GP

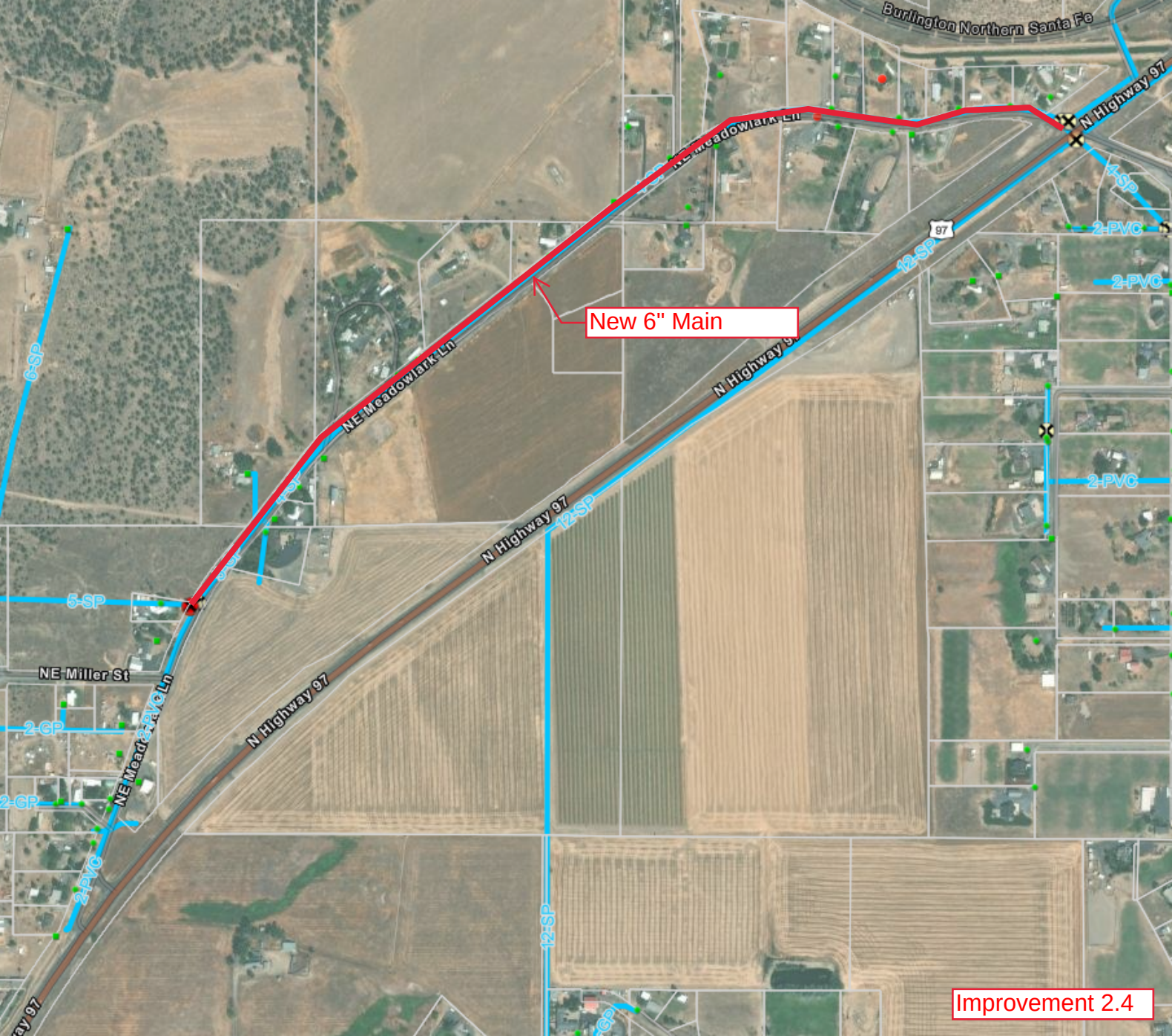

Burlington Northern Santa Fe
Burlington Northern Santa Fe
Metolius
Washington Ave
Jefferson Ave
Adams Ave
Hood Ave
SW Wilson Ave
6th St
7th St
8th St
9th St
Opal St
6-PVC
4-PVC
2-PVC
4-SP
2-SP
0.75-SP
1.25-SP
10-PVC
New 6" Pipe
Improvement 1.4


New 6" Main
New 12" Main
New 12" Hwy Crossing
Existing 6" and Hydrant to be removed
Improvement 1.5
NE Jefferson St
NE 6th St
NW Highway 26
N High
NW 3rd
NW Lee St
10287
2-SP
2-GP
6-PVC
10-PVC
26


New 6" Water Main
New 6" Water Main
New 6" Water Main
New 6" Water Main
Improvement 2.1
SW Bard Ln
SW Cellio St
SW Koyoda St
S Adams Dr
SW Dee Ln
SW Hall Rd
6-SP
6-PVC
1.5-GP
1-SP
2-PVC
2-SP

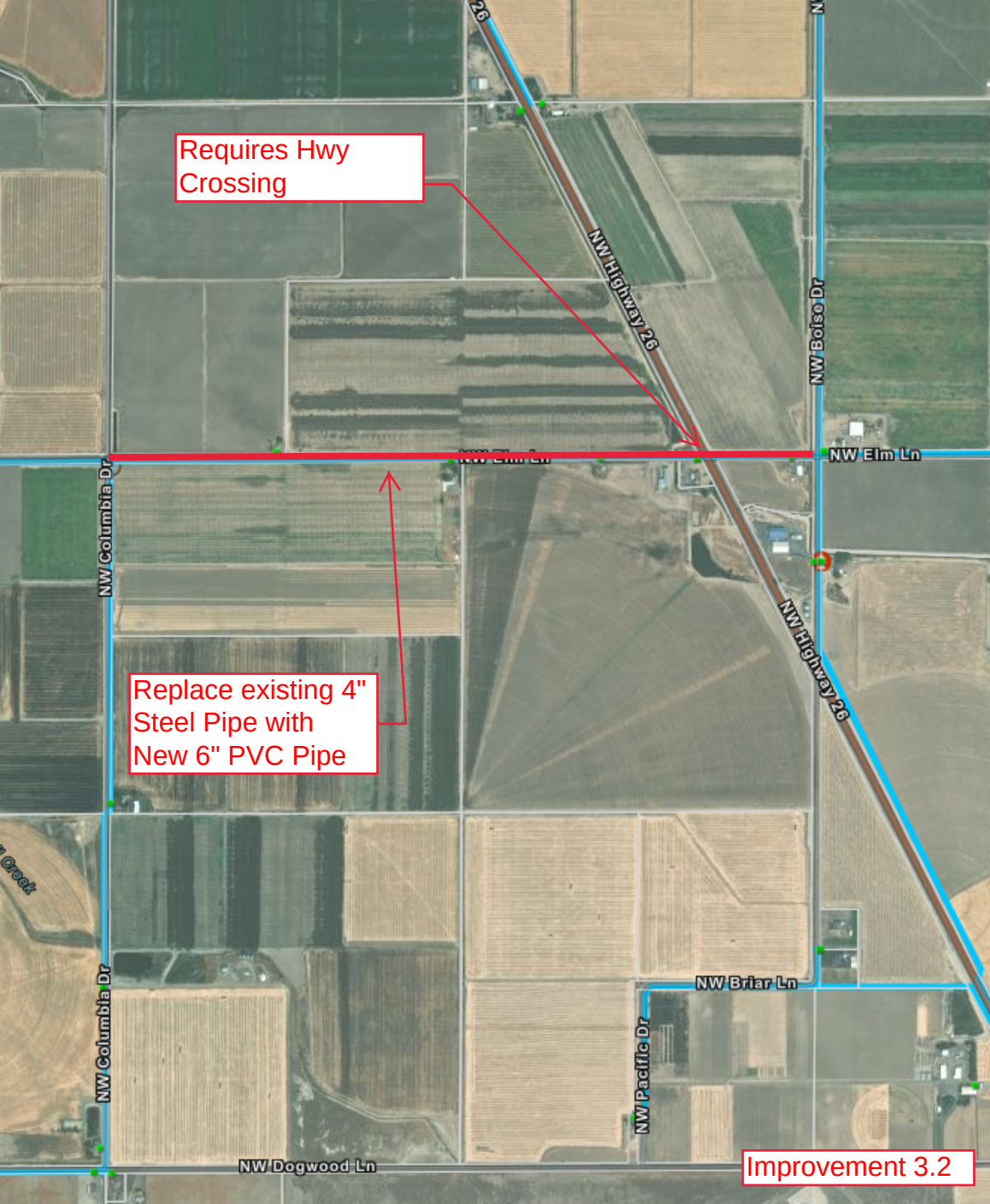

New 8" Main
Railroad Crossing Required
Existing 8" Main
Improvement 2.2
SW Bear Dr
SW Johnson Rd
Burlington Northern Santa Fe
SW Belmont Ln
8-SP
6-SP

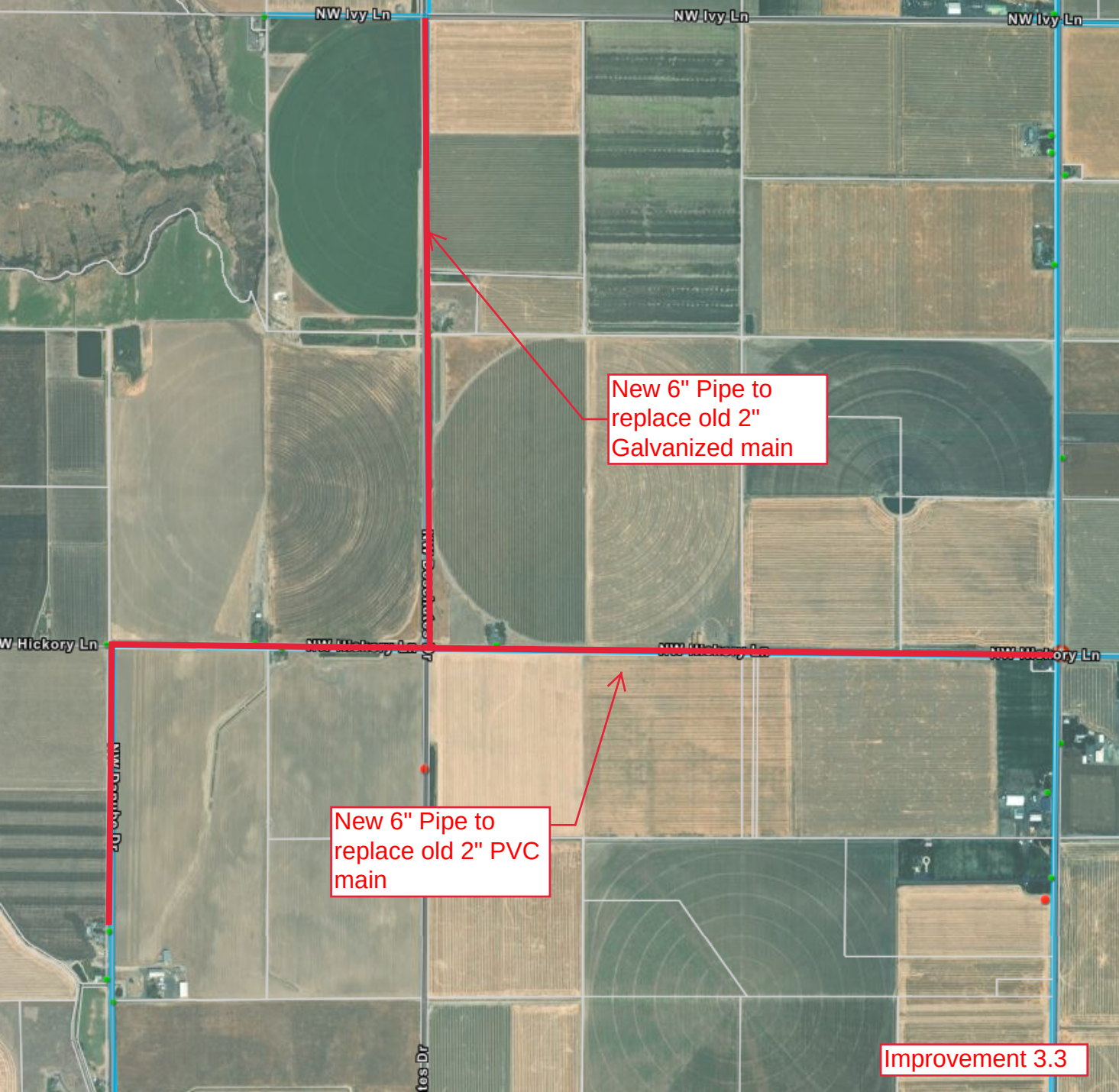

SW Snyder Dr
Burlington Northern Santa Fe
SW McKenzie Ln
SW Santiam Dr
Replace Old 2" Galvanized pipe with 4" PVC
SW Culver Hwy
Freedom
Liberty Dr
Patriot Way
SW Dover Ln
Improvement 2.3

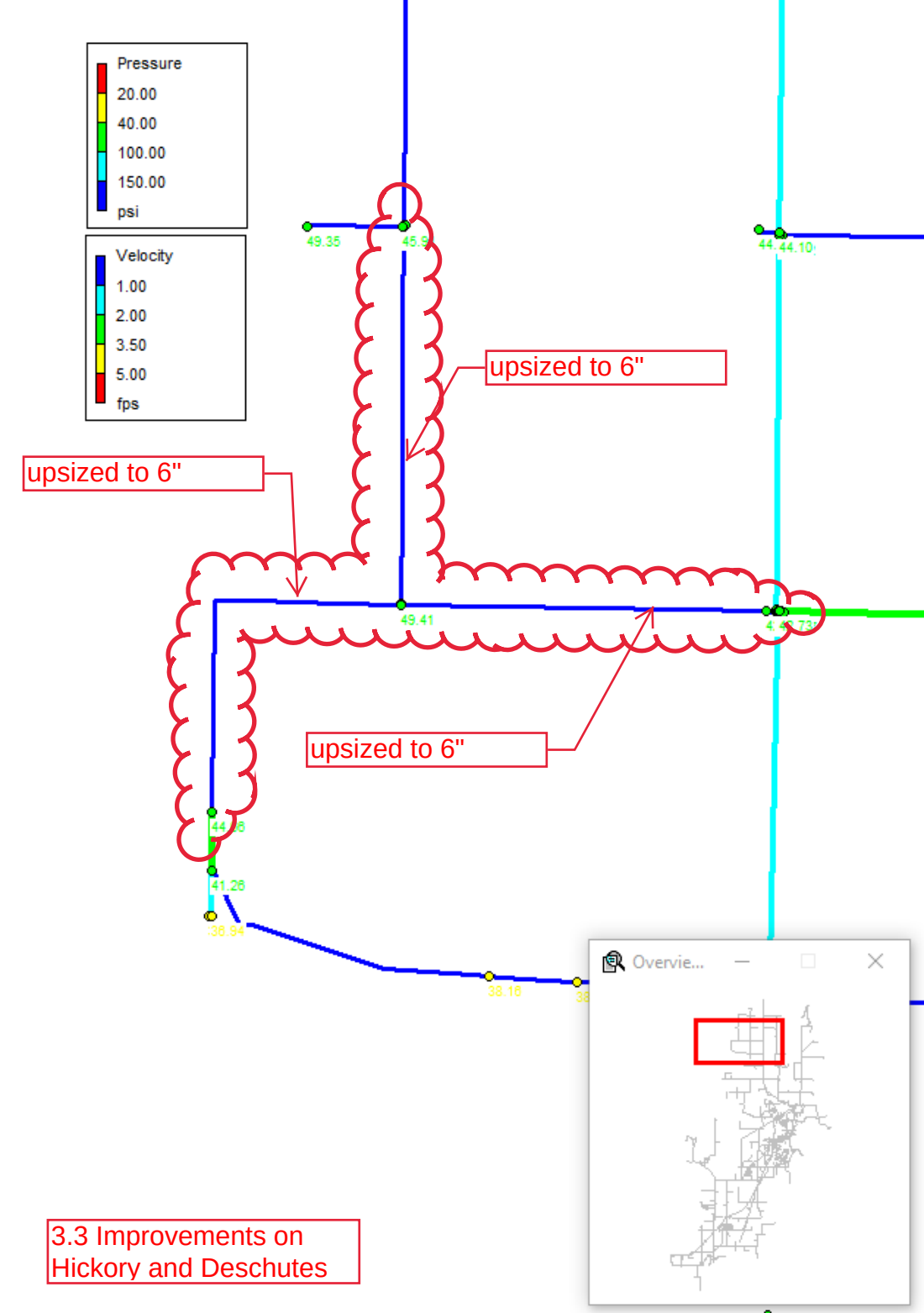

Burlington Northern Santa Fe
N Highway 97
NE Meadowlark Ln
New 6" Main
12-SP
2-PVC
6-SP
5-SP
NE Miller St
2-GP
Improvement 2.4


Existing 2" Steel Pipe and Existing 2" Galvanized Pipe to be abandoned
New 6" main
NW Gumwood Ln
NW Gumwood Ln
6-PVC
3-SP
2-SP
2-SP
2-SP
NW Highway 26
NW Highway 26
26
26
Improvement 2.5

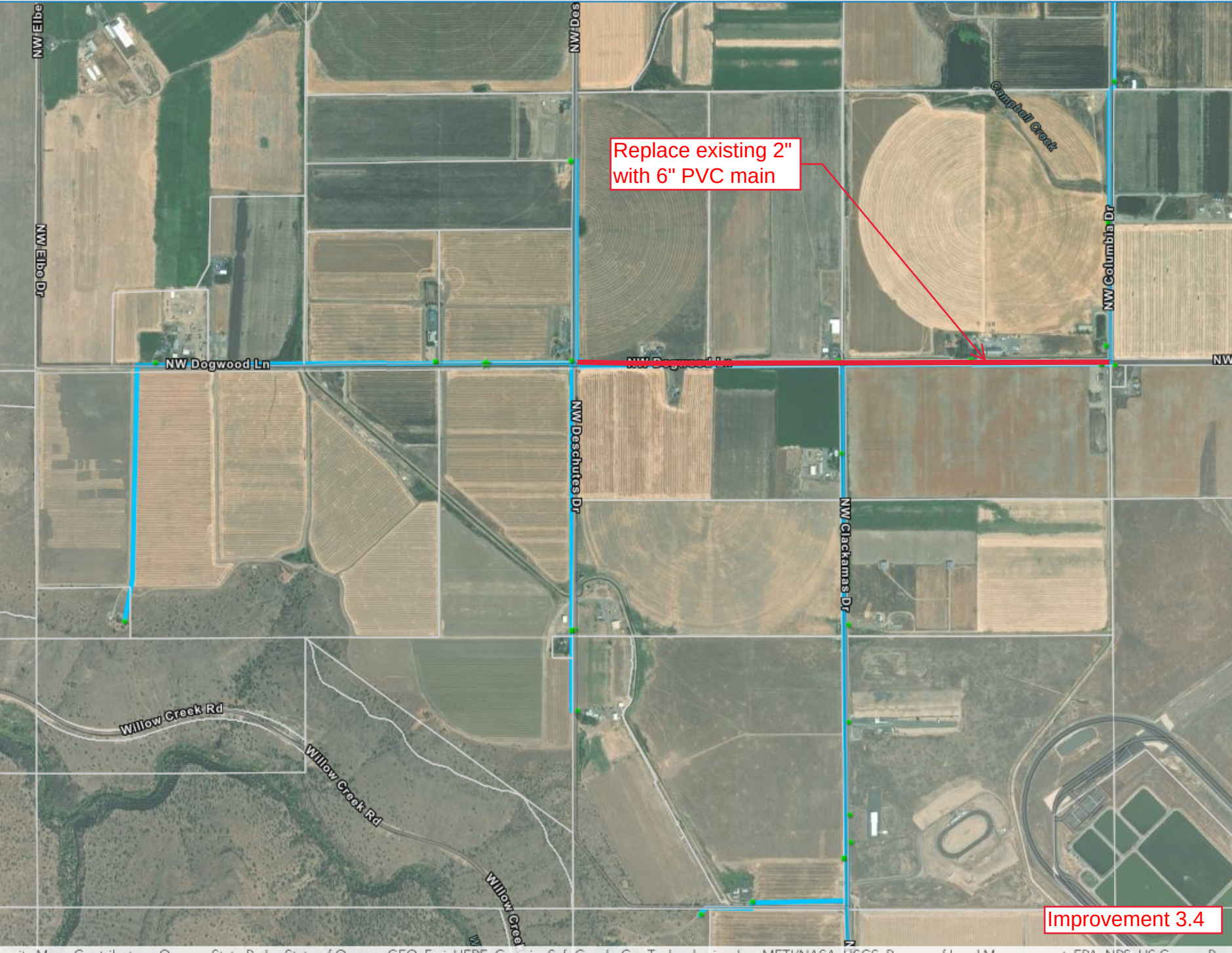

NW Boise Dr
NW Juniper Ln
N Adams Dr
New 6" PVC Main
to replace existing
2" Steel Main
NW Boise Dr
N Adams Dr
NW Ivy Ln
NW Ivy Ln
NW Boise Dr
N Adams Dr
Improvement 3.1

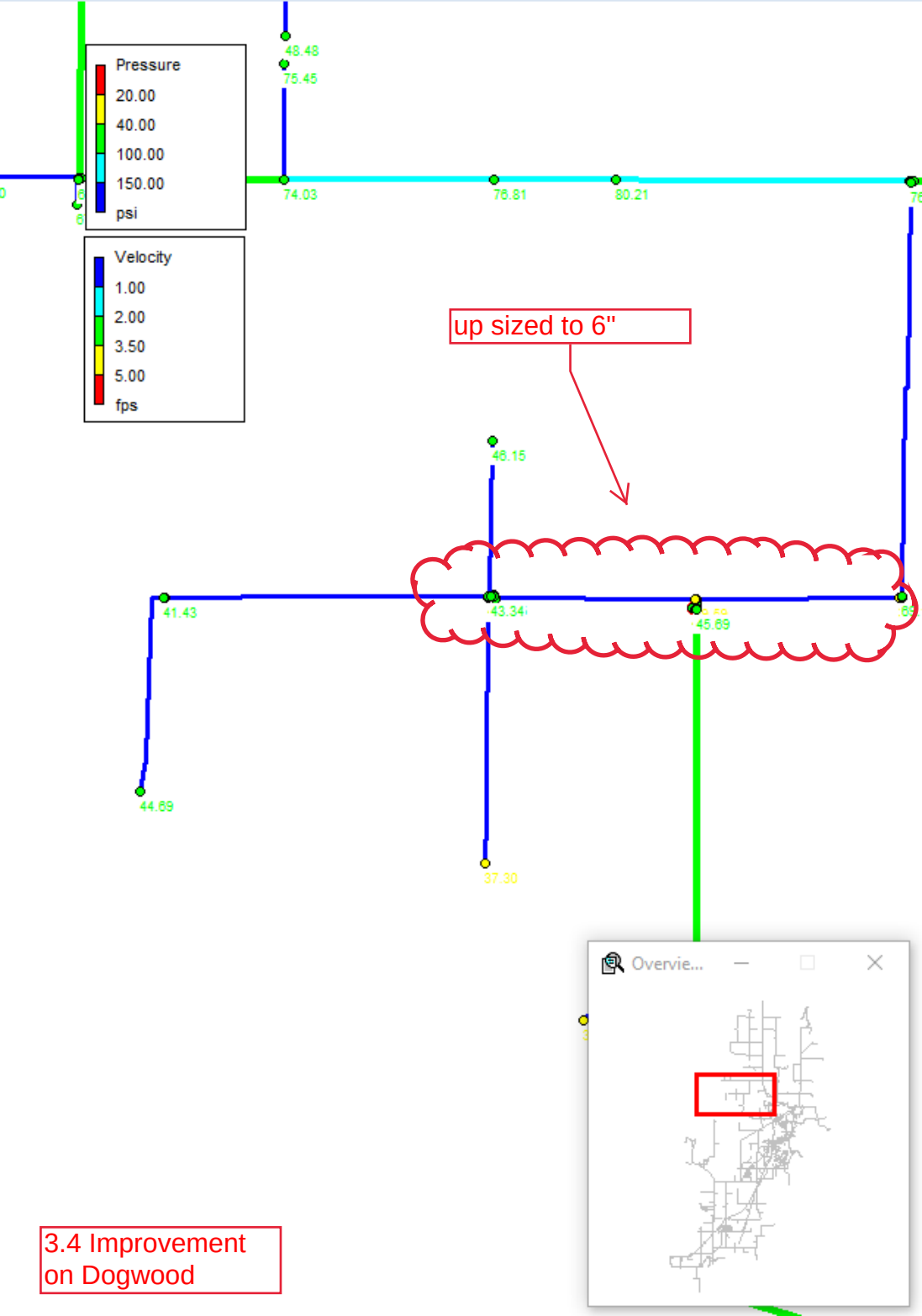

Requires Hwy Crossing
Replace existing 4" Steel Pipe with New 6" PVC Pipe
NW Highway 26
NW Boise Dr
NW Elm Ln
NW Columbia Dr
NW Briar Ln
NW Pacific Dr
NW Dogwood Ln
Improvement 3.2


NW Ivy Ln
NW Ivy Ln
NW Ivy Ln
New 6" Pipe to replace old 2" Galvanized main
W Hickory Ln
New 6" Pipe to replace old 2" PVC main
Improvement 3.3

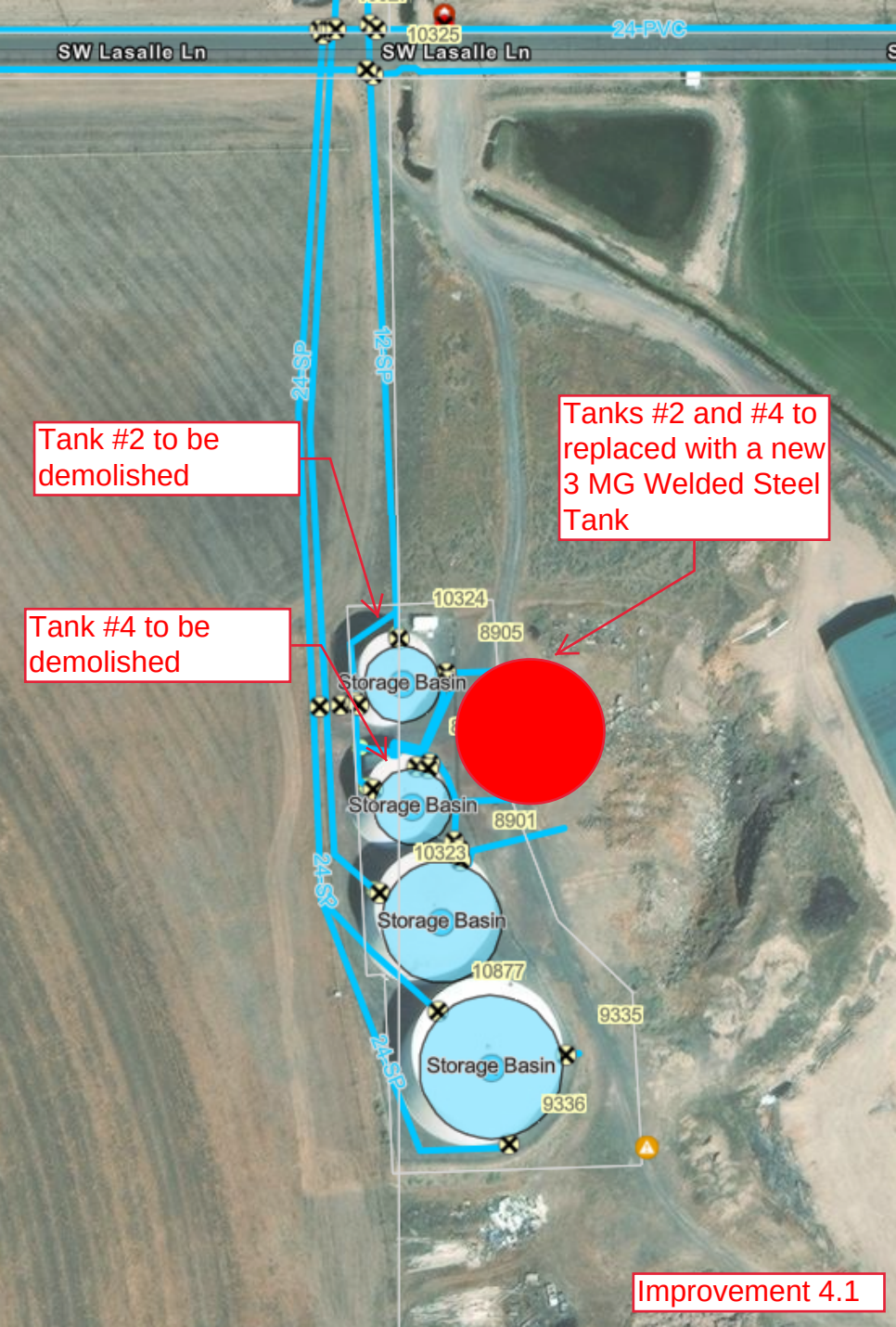


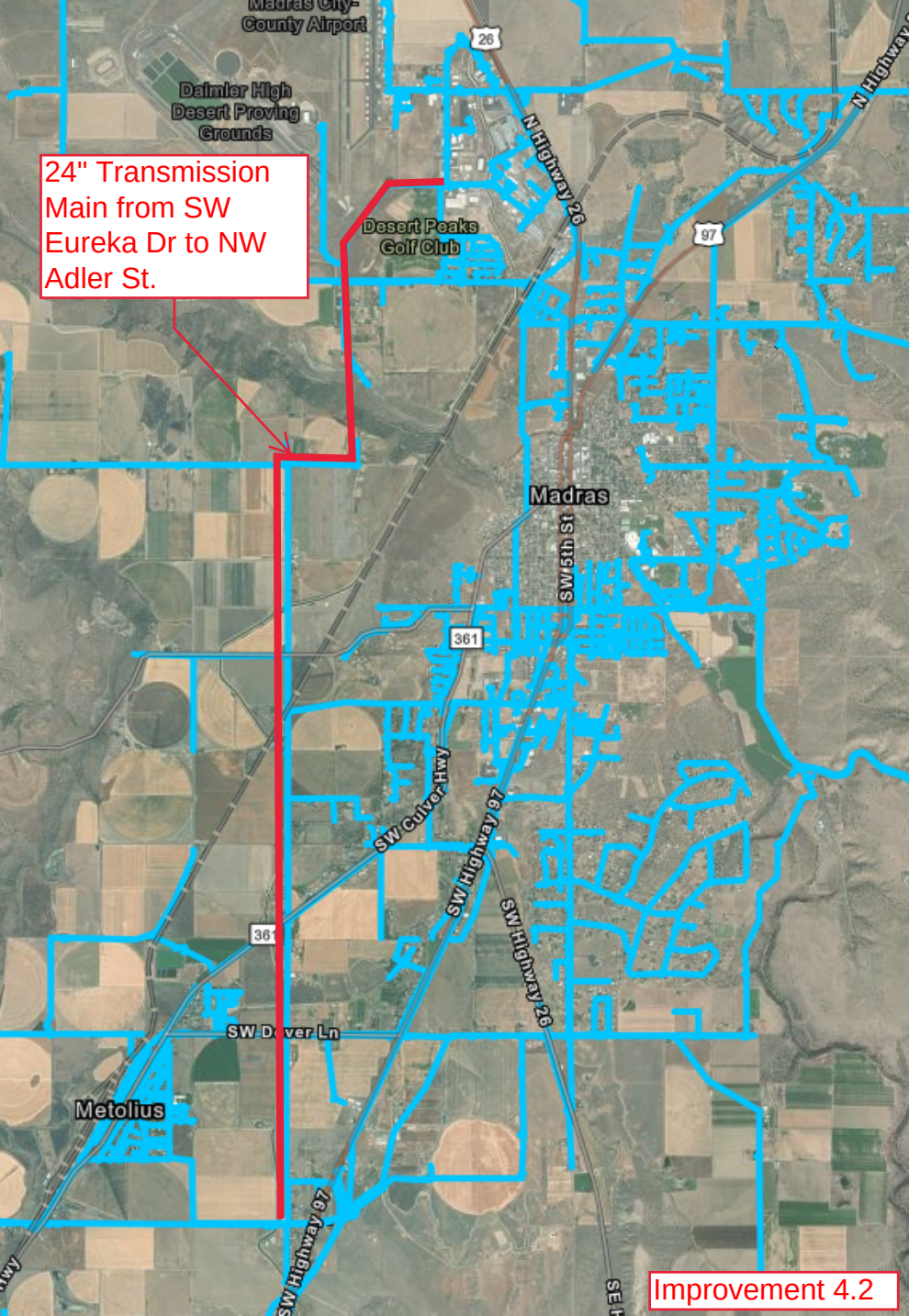
3.3 Improvements on Hickory and Deschutes

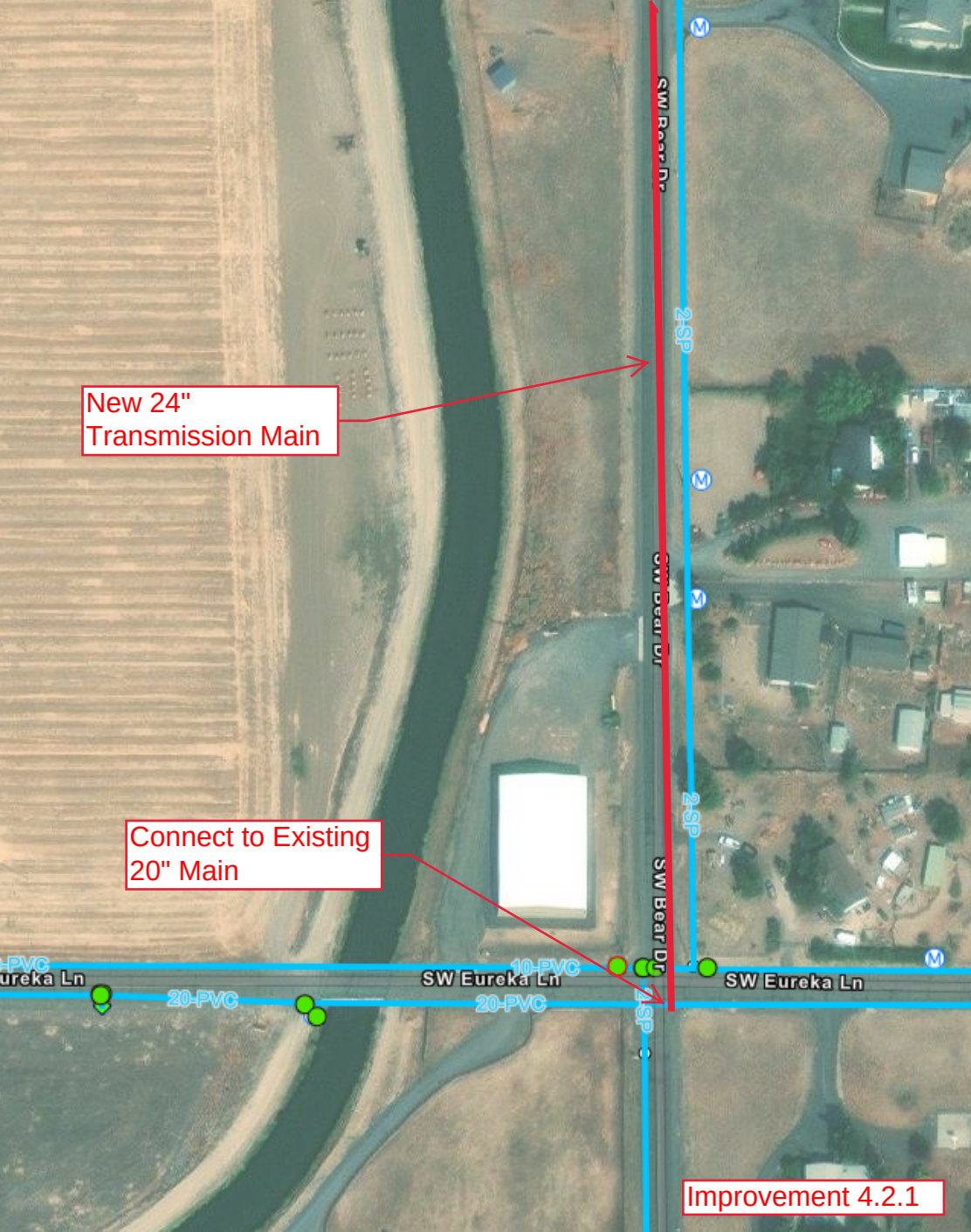

Replace existing 2" with 6" PVC main
NW Elbe Dr
NW Dogwood Ln
NW Deschutes Dr
NW Columbia Dr
NW Clackamas Dr
Campbell Creek
Willow Creek Rd
Willow Creek Rd
Improvement 3.4



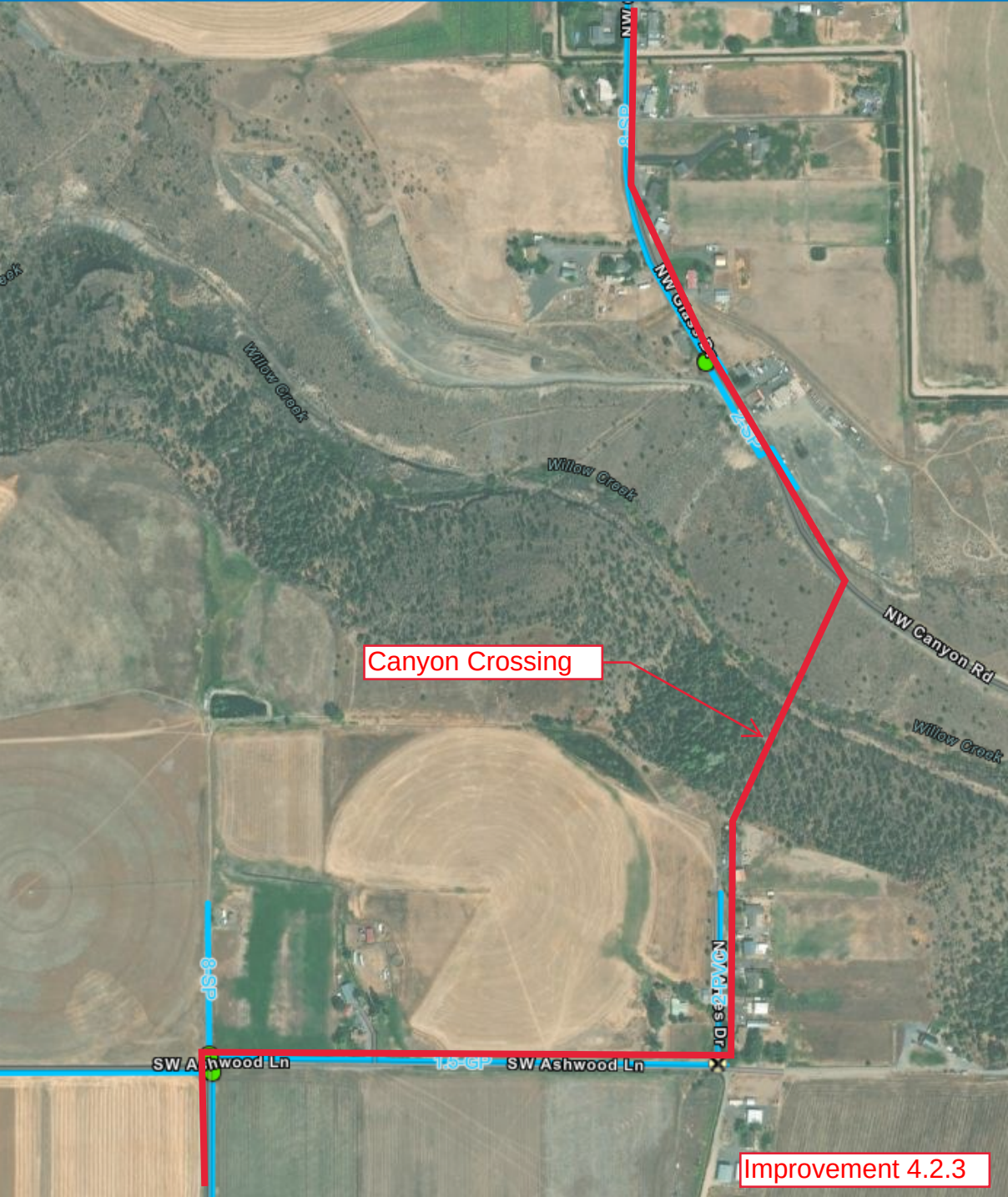
3.4 Improvement on Dogwood

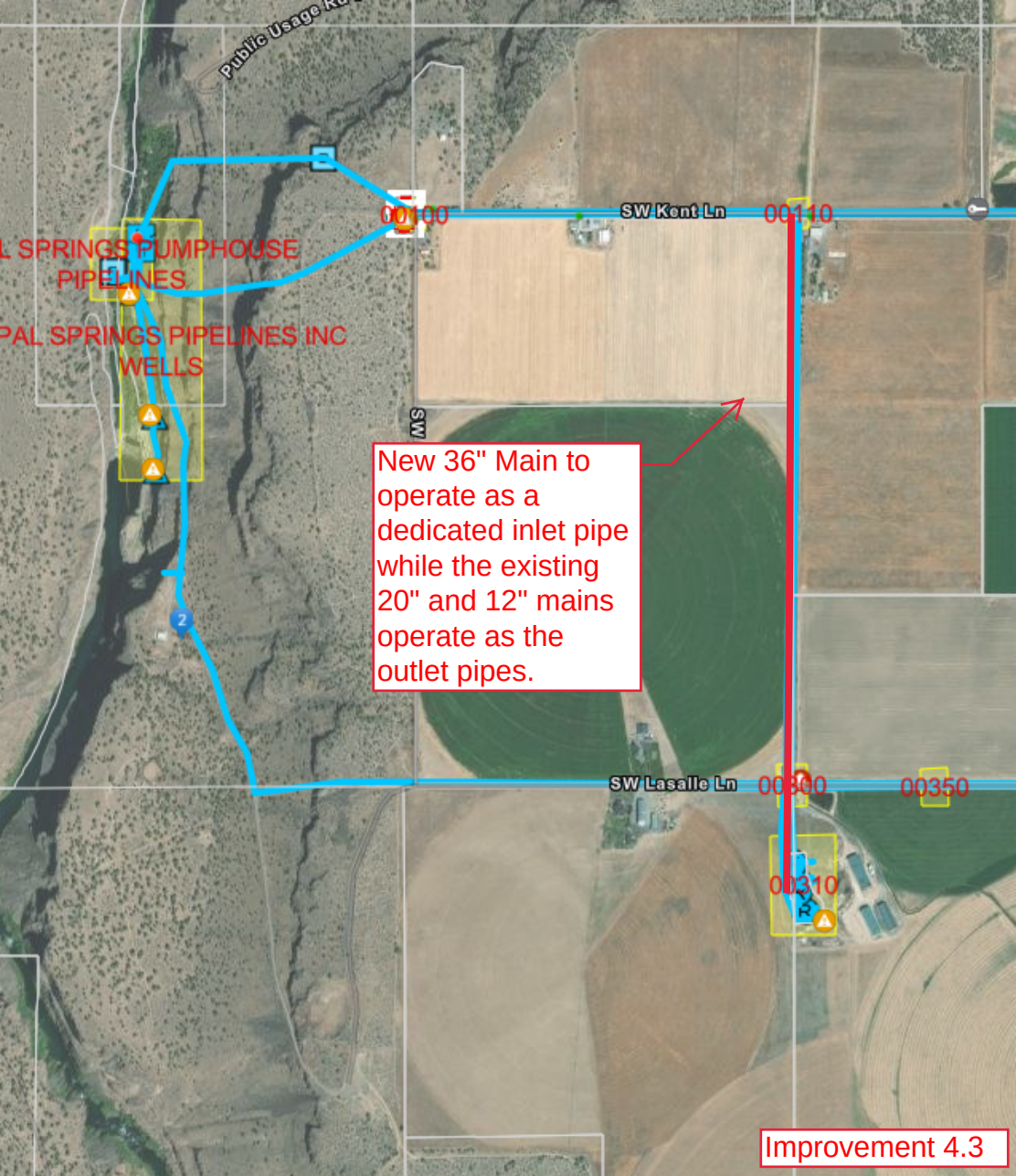

SW Lasalle Ln
SW Lasalle Ln
10325
24-PVC
24-SP
12-SP
Tank #2 to be demolished
Tanks #2 and #4 to replaced with a new 3 MG Welded Steel Tank
Tank #4 to be demolished
10324
8905
Storage Basin
Storage Basin
8901
10323
24-SP
Storage Basin
10877
9335
24-SP
Storage Basin
9336
Improvement 4.1

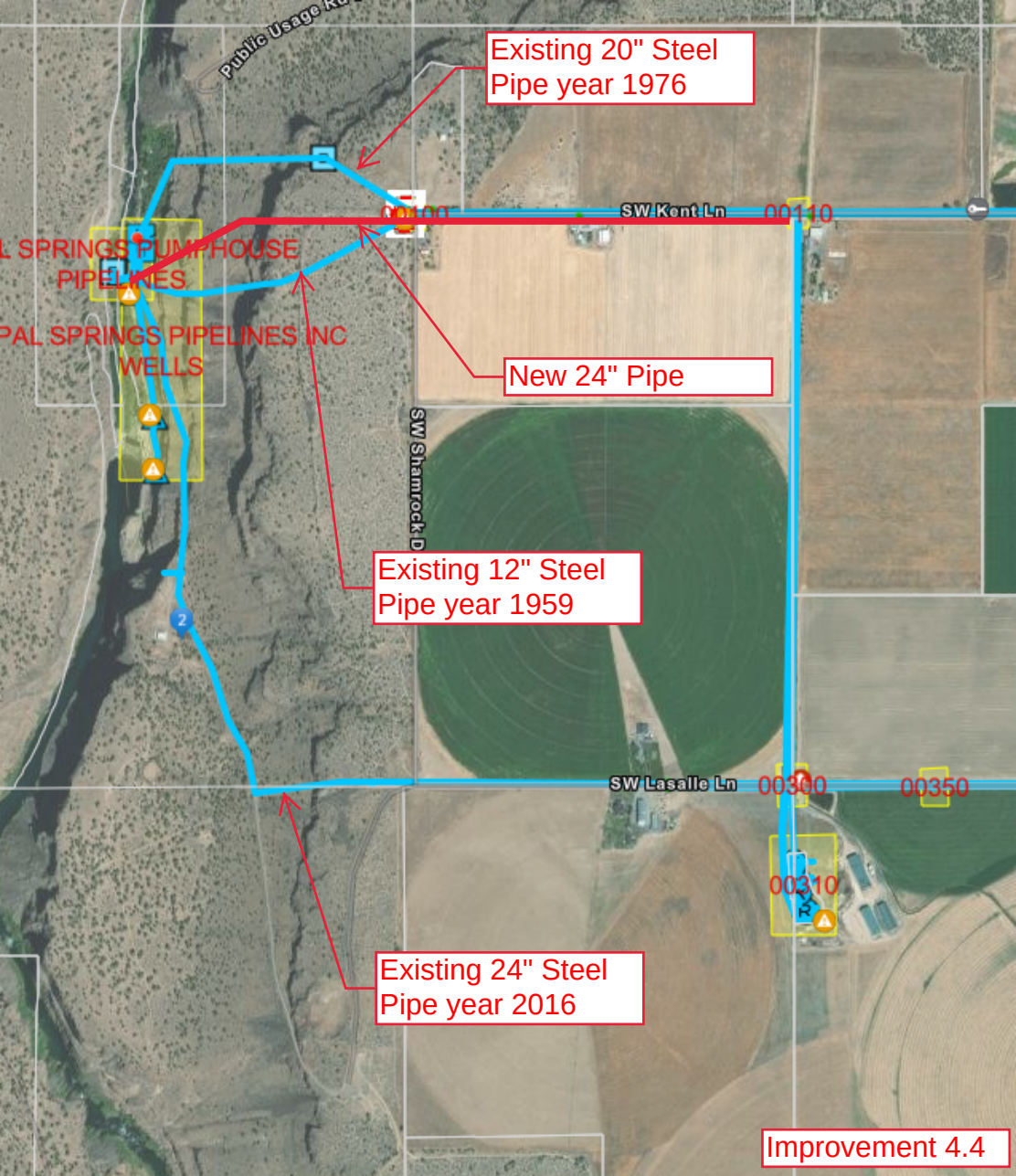

24" Transmission Main from SW Eureka Dr to NW Adler St.
Madras City-County Airport
Daimler High Desert Proving Grounds
Desert Peaks Golf Club
N Highway 26
26
97
Madras
SW 5th St
361
SW Culver Hwy
SW Highway 97
SW Highway 26
SW Dover Ln
Metolius
Improvement 4.2


New 24"
Transmission Main
Connect to Existing
20" Main
SW Bear Dr
SW Eureka Ln
SW Eureka Ln
10-PVC
20-PVC
20-PVC
2-SP
2-SP
4-SP
Improvement 4.2.1


NUID canal crossing
Railroad crossing
SW Belmont Ln
SW Belmont Ln
Improvement 4.2.2

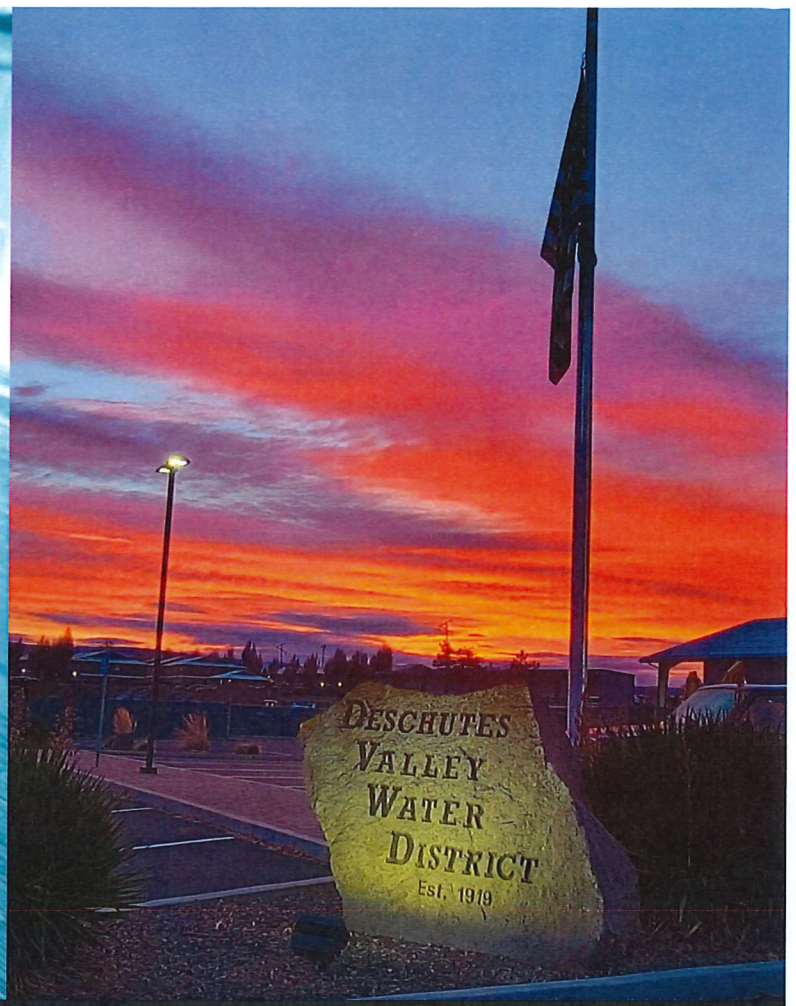

Canyon Crossing
NW Canyon Rd
Willow Creek
Willow Creek
Willow Creek
8-SP
4-SP
8-SP
1.5-GP
SW Ashwood Ln
SW Ashwood Ln
Improvement 4.2.3


Public Usage Rd
00100
SW Kent Ln
00110
L SPRINGS PUMPHOUSE
PIPELINES
PAL SPRINGS PIPELINES INC
WELLS
SW
New 36" Main to operate as a dedicated inlet pipe while the existing 20" and 12" mains operate as the outlet pipes.
SW Lasalle Ln
00300
00350
00310
RX
Improvement 4.3


Existing 20" Steel Pipe year 1976
SW Kent Ln
00110
L SPRINGS PUMPHOUSE PIPELINES
PAL SPRINGS PIPELINES INC WELLS
New 24" Pipe
SW Shamrock D
Existing 12" Steel Pipe year 1959
SW Lasalle Ln
00300
00350
00310
Existing 24" Steel Pipe year 2016
Improvement 4.4

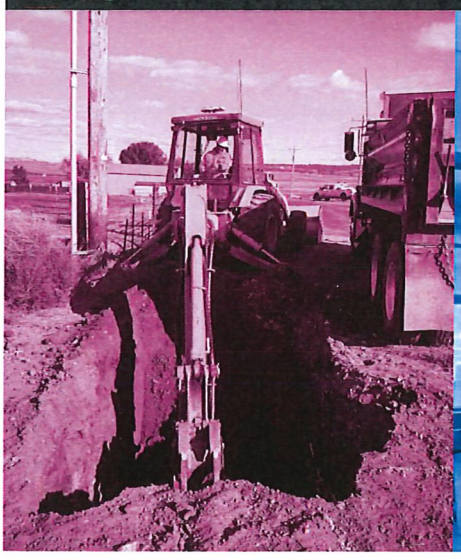
Appendix J

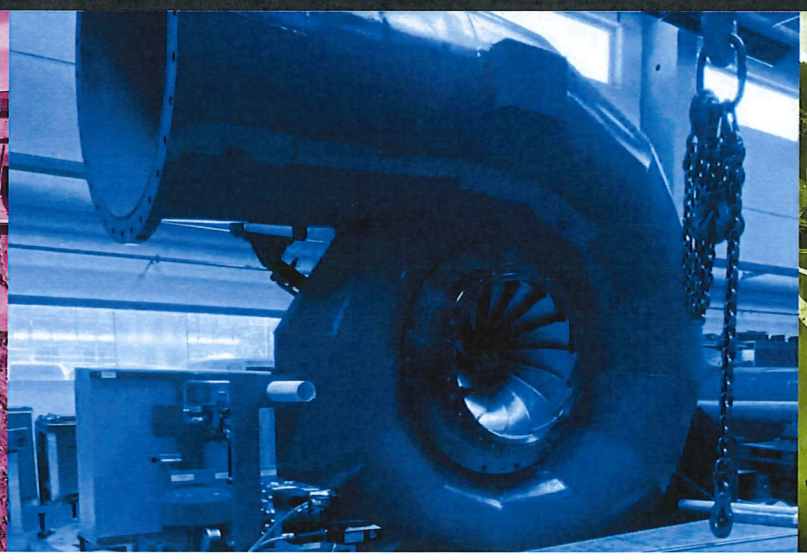
Budget

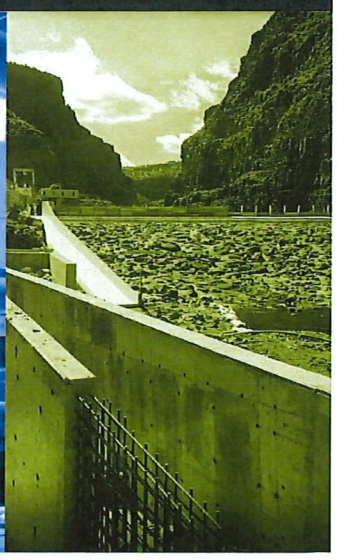


2022-2024

PROPOSED BUDGET







Deschutes Valley Water District Budget Message
2022 - 2024

Greetings Budget Committee Members!

Introduction

Deschutes Valley Water District is on a two-year budget cycle beginning July 1 2022 and ending June 30 2024. Once again, Joan Moe, our finance officer has been invaluable with this budget. Our desire is to present a clear and concise budget that will allow a satisfactory understanding of the District's financial position and direction for the next two years and beyond.

The budget is comprised of two businesses components combined into one budget, the Hydro Fund and the General Fund. The Hydro Fund component of the budget is primarily focused on the hydro-electric power plant and power generation. Other activities that support those enterprises include the fish ladder operation and fish resource management. These activities are located at Opal Springs. The General Fund component of the budget is primarily the drinking water distribution infrastructure of the District. Traditionally the Hydro Fund has operated as a primary source of capital outlay and subsidy for the General Fund.

Hydro Revenue

The District's cash flow relies upon two main sources of revenue; water sales and power sales. The Hydro Fund, through power sales, has been subsidizing the General Fund capital expenses since construction in 1985. However, the new power sales agreement effective January 2020 will effectively cover the hydro operations expenses with little excess. Expenses related to the water distribution or capital improvements will rely on water sales revenue and savings.

The District has been preparing for this time by saving and making strategic capital improvements over the years. The District is in a solid financial position to make well thought out decisions regarding future expenditures and capital improvements.

Water Sales

The District's revenue from water sales has increased over the last few years with new, more accurate ultrasonic metering and new customers (approximately 300 new connections in the last two years). Water sales now accounts for the majority of the Districts revenue. Water sales is highly dependent on summer irrigation watering which, in turn, dependent on weather conditions. Last year's dry summer increased the district's pumping and subsequent water revenue.

Several key customers also make up a large portion of water sales. It is important to note these customers and the potential impact to water revenue.

- City of Madras: The District delivers water wholesale to the City of Madras. The City has approximately 1000 connections and services those customers independently. There are also a number of City of Madras residents who live within the City boundaries that are served directly by the District. Bulk water supply is delivered at a significant discount to the City. The bulk water purchase agreement with the City will be renegotiated within this budget cycle which will take effect in July, 2023.
- Cal Farms is an organic farm with carrot processing facilities which relies on DVWD for water supply for carrot processing. During the summer months Cal Farms is the second largest customer by volume. They are a seasonal customer that use water typically from April to October. Due to the drought conditions and limited availability of irrigation water supplied by NUID, Cal Farms will be moving carrot processing to a new area outside of the District's boundaries. This transition will begin in 2022 and has the potential to reduce daily demand on the District by up to 1 million gallons per day.
- Earth2O is a water bottling facility located in Culver OR which supplies bottled water regionally. The parent company, Sweetwater Inc., was recently purchased by a large water bottling company, Primo. After six (6) months of operations Primo has decided to close the facilities in Culver OR in March 2022. Earth2O represented the third largest account to the District by volume and the second largest account in revenue.

The District may consider modest water rate increases to ensure budget stays balanced and provide for anticipated capital improvements. The last water rate increase was in 2017.

Hydro Turbine Pump

In March 2021 the District began operating a mechanical pump powered by a newly installed hydro turbine. This turbine has a twofold benefit to the District. First it provides a significant savings in electrical costs. Instead of pumping water with electrical pumps, we can operate without electricity which amounts to a savings of approximately $200,000 per year. The second benefit is resiliency in emergency conditions. The pump will work and provide baseline domestic demand to the District's customers even with a loss of power (similar to when the power grid was compromised after tornado winds in Culver).

Growth

The area and the District is experiencing a significant growth spurt. Housing starts could potentially increase the District's customer base by as much as twenty percent over the next several years. While the District currently has a robust system in place we will need to continue to evaluate the impacts of this growth on the pumping and distribution systems to ensure adequate reliability and redundancy.

In Closing

The Districts efforts will be focused on the primary goals to ***provide safe and good tasting drinking water at a reasonable cost to existing and future District patrons while continuing a high level of customer service***.

I'm grateful for the opportunity to work with the District and have your trust as a manager and budget officer.

Respectfully,

Joel Gehrett, P.E.
Budget Officer / General Manager

Deschutes Valley Water District's Mission Statement

Our mission is to provide safe and good tasting drinking water at a reasonable cost to existing and future District patrons while continuing a high level of customer service.

A	B	C	D	E	F	G	H
2				**RESOURCES (REVENUE)**			
3		Actual	Actual				
4		2016-18	2018-20	**CURRENT**	**TWENTY MONTH**	**24 MONTH**	**PROPOSED**
5	**General Fund**	Second	First	**BUDGET**	**ACTUAL**	**PROJECTED**	**BUDGET**
6		Preceding Budget	Preceding Budget	**2020-2022**	**AS OF 2-28-22**	**20-22 BUDGET**	**2022-2024**
7	Cash	64,756	151,031	$ 400,000	$ 1,334,612	$ 1,334,612	$ 1,200,000
8	Water Sales	5,072,644	5,397,224	$ 5,151,000	$ 5,178,987	$ 6,294,000.00	$ 5,845,500
9	Interest Income	239,969	216,477	$ 210,000	$ 145,393	$ 188,620.00	$ 200,000
10	Non-Utility/Hook-Ups	119,506	100,711	$ 350,000	$ 378,594	$ 492,144	$ 700,000
11	Hydro Transfers	699,000	1,350,000	$ 1,500,000	$ 250,000	$ 250,000	$ -
12	Grant Revenue	-	-	$ -	$ 692,198	$ 692,198	$ -
13	Const. Reserves	4,404,833	4,935,841	$ 4,200,000	$ 4,255,095	$ 4,255,095	$ 4,850,000
14	Subtotal	$ 10,600,708	$ 12,151,284	$ 11,811,000	$ 12,234,879	$ 13,506,669	$ 12,795,500
15							
16							
17	**Hydro Fund**						
18							
19	Cash	792,986	384,000	$ 1,000,000	$ 1,055,906	$ 1,055,906	$ 175,000
20	Electric Power	8,676,858	8,425,185	$ 3,478,547	$ 2,689,570	$ 2,905,570	$ 1,200,000
21	Interest Income	583,616	625,707	$ 645,000	$ 522,714	$ 623,529	$ 604,000
22	Restricted Reserves	9,762,180	12,028,042	$ 14,250,000	$ 14,508,546	$ 14,508,546	$ 17,225,000
23	Grants (fish passage)	1,249,215	4,380,962	$ 1,000,000	$ 301,923	$ 301,923	$ -
24	Non-Utility,REC Rev	50,118	43,628	$ 55,000	$ 79,659	$ 80,265	$ 250,000
25	Subtotal	$ 21,114,973	$ 25,887,524	$ 20,428,547	$ 19,158,318	$ 19,475,739	$ 19,454,000
26							
27	**TOTAL**	$ 31,715,681	$ 38,038,808	$ 32,239,547	$ 31,393,197	$ 32,982,408	$ 32,249,500

GENERAL FUND BUDGET FOR 2022 - 2024

ACCT NO	TITLE	Actual 2016-18 First Preceding Budget	Actual 2018-20 First Preceding Budget	CURRENT BUDGET 2020-2022	TWENTY MONTH ACTUAL AS OF 2-28-22	24 MONTH PROJECTED 20-22 BUDGET	PROPOSED BUDGET 2022-2024
	PERSONAL SERVICES						
1-1-600	administration	$ 142,961	$ 203,152	$ 135,876	$ 88,651	$ 133,735	$ 141,406
1-1-601	bookkeeping	$ 267,330	$ 281,602	$ 299,888	$ 231,305	$ 299,452	$ 323,064
1-1-603	collections	$ 392	$ -	$ 2,500	$ -	$ -	$ 2,500
1-1-604	operations & material labor	$ 1,196,467	$ 1,119,083	$ 1,118,795	$ 994,847	$ 1,193,816	$ 1,400,876
1-1-605	equipment labor	$ 181,762	$ 157,613	$ 226,612	$ 138,115	$ 165,738	$ 208,802
1-1-602	meter reading	$ 87,073	$ 80,164	$ 74,785	$ 33,628	$ 40,355	$ 6,400
1-1-612	training-labor						$ 20,000
1-1-613	water samples-labor						$ 20,000
1-1-620+621+732	health insurance	$ 550,315	$ 454,639	$ 411,916	$ 389,265	$ 467,118	$ 487,423
1-1-625+770	pers/deferred compensation	$ 647,955	$ 2,019,992	$ 583,518	$ 479,817	$ 575,780	$ 755,819
1-1-752+768	saif	see below	see below	see below	see below	see below	$ 32,095
1-1-754	social security	see below	see below	see below	see below	see below	$ 186,131
1-1-758	unemployment	see below	see below	see below	see below	see below	$ 3,000
	Subtotal Personal Services	$ 3,074,255	$ 4,316,245	$ 2,853,890	$ 2,355,628	$ 2,875,994	$ 3,587,517
	MATERIALS & SERVICES						
1-1-700	opal power	$ 916,501	$ 828,550	$ 572,493	$ 597,313	$ 712,925	$ 660,000
1-1-701	electric power - pumping	$ 39,397	$ 37,309	$ 39,182	$ 54,596	$ 65,516	$ 68,100
1-1-748	electric power-office	see below	see below	see below	see below	see below	$ 24,000
1-1-705	gas & oil	$ 67,186	$ 62,637	$ 77,760	$ 53,976	$ 64,771	$ 77,725
1-1-710	o & m material	$ 124,823	$ 133,786	$ 125,248	$ 220,931	$ 265,000	$ 265,000
1-1-716	safety material	$ 10,150	$ 7,437	$ 13,742	$ 11,228	$ 13,470	$ 13,000
1-1-718	safety labor	$ 5,940	$ 6,903	$ 7,724	$ 1,227	$ 1,227	see training above
1-1-720	office supplies	$ 14,162	$ 12,406	$ 15,886	$ 66,819	$ 80,182	$ 80,000
1-1-722	audit	$ 43,680	$ 41,300	$ 46,364	$ 42,150	$ 42,150	$ 42,150
1-1-724	legal	$ 1,913	$ 3,563	$ 9,130	$ 590	$ 708	$ 5,000
1-1-725	fees & permits	$ 48,975	$ 45,297	$ 57,596	$ 29,327	$ 58,217	$ 60,000
1-1-726	consultant	$ 31,379	$ 54,102	$ 29,733	$ 4,485	$ 5,382	$ 30,000
1-1-728	property insurance	$ 81,784	$ 93,962	$ 99,500	$ 82,775	$ 98,115	$ 100,000
1-1-734	miscellaneous	$ 3,039	$ 4,289	$ 7,744	$ 2,521	$ 3,025	$ 5,000
1-1-736+611	misc supplies	$ 163,820	$ 144,109	$ 150,670	$ 69,174	$ 83,008	$ 85,000
1-1-738	janitor	$ 24,544	$ 23,863	$ 25,221	$ 19,563	$ 23,476	$ 25,000
1-1-742	election	$ 1,320	$ 1,932	$ 1,435	$ 1,825	$ 1,825	$ 1,825
1-1-744	building repair	$ 928	$ 11,521	$ 5,015	$ 12,892	$ 14,470	$ 10,000
1-1-746	board commission	$ 5,150	$ 5,300	$ 6,000	$ 4,150	$ 5,150	$ 6,000
1-1-748	electric power-office	$ 22,942	$ 21,035	$ 25,086	$ 16,873	$ 20,247	see above
1-1-750	telephone	$ 25,041	$ 25,087	$ 27,866	$ 24,777	$ 29,732	$ 30,500
1-1-752+768	saif	$ 33,431	$ 34,079	$ 35,055	$ 21,050	$ 24,902	see above
1-1-754	social security	$ 158,600	$ 150,084	$ 146,513	$ 127,832	$ 153,398	see above
1-1-756	property maintenance	$ 25,376	$ 4,662	$ 18,059	$ 4,007	$ 4,808	$ 5,000
1-1-758	unemployment	$ 4,878	$ 1,553	$ 3,140	$ 2,251	$ 2,251	see above
1-1-760	computer maint	$ 61,878	$ 53,411	$ 64,027	$ 79,722	$ 81,722	$ 65,000
1-1-762	telemetery	$ 9,718	$ 1,950	$ 6,143	$ 180	$ 180	$ 5,000
1-1-764	cont. ed/pr	$ 50,823	$ 26,574	$ 41,728	$ 24,500	$ 29,400	see below & training above
1-1-764	continuing education						$ 15,000
1-1-765	public relations						$ 5,000
1-1-766	water samples	$ 31,457	$ 29,560	$ 30,883	$ 29,088	$ 34,905	$ 15,000
1-1-906	equipment material	$ 172,786	$ 119,758	$ 144,907	$ 74,854	$ 89,825	$ 130,000
	Subtotal Materials & Services	$ 2,181,621	$ 1,986,019	$ 1,833,850	$ 1,680,676	$ 2,009,987	$ 1,828,300
	CAPITAL OUTLAY						
1-0-119	construction reserve	$ -	$ -	$ 200,000	$ -	$ -	$ 200,000
1-0-131	inventory	$ 145,400	$ 133,828	$ 168,657	$ 316,703	$ 402,708	$ 500,000
1-0-145	construction material	$ 148,012	$ 635,158	$ 6,066,603	$ 2,212,322	$ 2,261,872	$ 5,517,150
1-1-145	construction labor	$ 89,655	$ 46,751	$ 50,000	$ 120,002	$ 144,002	$ 312,533
1-0-320	land purchased		$ -	$ -	$ -	$ -	$ -
1-0-330	meters	$ 25,675	$ 31,925	$ 23,000	$ 14,620	$ 14,620	$ 35,000
1-0-331	meter boxes	$ 26,861	$ 46,532	$ 35,000	$ 44,048	$ 44,048	$ 65,000
1-0-360	new equipment	$ 17,333	$ 531,677	$ 80,000	$ 121,033	$ 121,033	$ 250,000
	contingency	$ -					
	Subtotal Capital Outlay	$ 452,936	$ 1,425,871	$ 6,623,260	$ 2,828,728	$ 2,988,283	$ 6,879,683
	Ending Balance	$ 4,891,896	$ 4,423,149	$ 500,000	$ 5,369,847	$ 5,632,405	$ 500,000
	Total General Fund	$ 10,600,708	$ 12,151,284	$ 11,811,000	$ 12,234,879	$ 13,506,669	$ 12,795,500

HYDRO FUND BUDGET 2022 - 2024

ACCT NO	TITLE	Actual 2016-2018 First Preceding Budget	Actual 2018-2020 First Preceding Budget	CURRENT BUDGET 2020-2022	TWENTY MONTH ACTUAL AS OF 2-28-22	24 MONTH PROJECTED 20-22 BUDGET	PROPOSED BUDGET 2022-2024
	PERSONAL SERVICES						
2-2-600	administration	$ 140,054	$ 144,450	$ 135,876	$ 134,415	$ 134,415	$ 141,406
2-2-601	bookkeeping	$ 106,405	$ 90,311	$ 95,088	$ 96,696	$ 96,696	$ 101,384
2-2-605	equipment labor	$ 137	$ -	$ 5,000	$ 41	$ 41	$ -
2-2-606	power production labor	$ 54,366	$ 57,119	$ 72,375	$ 48,497	$ 58,197	$ 77,020
2-2-607	Power maintenance labor	$ 62,139	$ 59,407	$ 72,375	$ 60,048	$ 72,058	$ 77,020
2-2-608	fish labor	$ 55,348	$ 57,861	$ 72,375	$ 60,008	$ 72,010	$ 77,020
2-2-609+610	general labor	$ 473,800	$ 514,979	$ 506,627	$ 396,175	$ 475,410	$ 563,967
2-2-612	training-labor						$ 5,000
2-2-620+621+7	health insurance	$ 166,183	$ 157,170	$ 175,655	$ 137,322	$ 157,204	$ 173,515
2-2-625+770	pers/deferred comp	$ 283,601	$ 849,562	$ 267,821	$ 253,476	$ 291,776	$ 318,462
2-2-752+768	saif	see below	see below	see below	see below	see below	$ 13,851
2-2-754	social security	see below	see below	see below	see below	see below	$ 77,494
2-2-758	unemployment	$ -	$ -	$ -	$ -	$ -	$ 500
	Subtotal Personal Services	$ 1,342,033	$ 1,930,859	$ 1,403,192	$ 1,186,678	$ 1,357,807	$ 1,626,641
	MATERIALS & SERVICES						
2-2-705	gas & oil	$ 21,842	$ 22,673	$ 22,203	$ 16,679	$ 20,015	$ 24,000
2-2-707	power production operation	$ 12,120	$ -	$ 5,000	$ -	$ -	$ -
2-2-711	power production maintenance	$ 85,052	$ 58,339	$ 63,167	$ 64,021	$ 64,021	$ 65,000
2-2-713	transmission maintenance	$ 124	$ 1,203	$ 538	$ 20,672	$ 20,672	$ 10,000
2-2-716+718	safety	$ 4,760	$ 3,405	$ 4,602	$ 2,261	$ 2,715	$ 3,500
2-2-717	FERC/regulatory commission	$ 12,358	$ 11,399	$ 13,882	$ 13,763	$ 16,516	$ 16,000
2-2-719	water rights	$ 5,470	$ 5,509	$ 6,016	$ 9,149	$ 9,149	$ -
2-2-720	office supplies	$ 1,597	$ 2,909	$ 2,281	$ 1,658	$ 1,990	$ 2,000
2-2-721	fish	$ 95	$ 50,187	$ 125,830	$ 86,021	$ 103,225	$ 100,000
2-2-722	audit	$ 29,120	$ 27,700	$ 31,614	$ 28,100	$ 28,100	$ 29,000
2-2-724	legal & engineering	$ 45	$ 7,396	$ 9,141	$ -	$ -	$ 1,000
2-2-725	fees & permits	$ 800	$ 19,926	$ 7,667	$ 3,971	$ 4,765	$ 10,000
2-2-726	consultant	$ 66,775	$ 82,327	$ 72,886	$ 59,268	$ 71,122	$ 50,000
2-2-728	property insurance	$ 180,090	$ 192,371	$ 205,030	$ 194,971	$ 237,339	$ 261,000
2-2-734	miscellaneous	$ 579	$ 651	$ 1,000	$ 1	$ 1	$ 1,000
2-2-736+611	supplies	$ 3,343	$ 28,974	$ 6,600	$ 3,723	$ 4,467	$ 6,000
2-2-738	janitorial	$ 1,815	$ 2,800	$ 2,855	$ 2,663	$ 2,663	$ 3,000
2-2-750	telephone	$ 19,091	$ 18,847	$ 20,289	$ 17,648	$ 21,178	$ 22,200
2-2-752	saif	$ 9,000	$ 14,375	$ 12,359	$ 12,204	$ 13,856	see above
2-2-754	social security	$ 68,703	$ 73,930	$ 73,036	$ 68,153	$ 76,953	see above
2-2-756	property maintenance	$ 5,766	$ -	$ 5,000	$ 2,146	$ 2,575	$ 5,000
2-2-762	telemetry	$ 11,641	$ 3,763	$ 4,651	$ 54	$ 54	$ 5,000
2-2-764	cont. ed/pr	$ 3,307	$ 14,265	$ 11,526	$ 2,183	$ 2,619	see below
2-2-764	continuing education						$ 3,000
2-2-765	public relations						$ 2,000
2-2-768	workers comp	$ 573	$ -	$ 1,000	$ -	$ -	$ -
2-2-905	general material	$ 75,568	$ 43,637	$ 45,149	$ 53,220	$ 63,864	$ 65,000
2-2-906	equipment material	$ 20,923	$ 34,732	$ 38,845	$ 22,557	$ 27,068	$ 32,000
	Subtotal Materials & Services	$ 640,557	$ 721,318	$ 792,167	$ 685,086	$ 794,927	$ 715,700
	CAPITAL OUTLAY						
2-0-360	new equipment	$ 1,283	$ 139,998	$ 40,000	$ 22,664	$ 22,664	$ 60,000
2-0-145	construction material	$ 3,695,360	$ 9,346,616	$ 12,893,188	$ 317,380	$ 317,380	$ 13,251,659
2-2-145	construction labor	$ 1,674	$ -	$ -	$ 57,917	$ 57,917	$ -
	Subtotal Capital Outlay	$ 3,698,317	$ 9,486,614	$ 12,933,188	$ 397,961	$ 397,961	$ 13,311,659
	TOTAL TRANSFERS						
2-2-715	transfer to general fund	$ 699,000	$ 1,350,000	$ 1,500,000	$ 250,000	$ 250,000	$ -
	Subtotal Total Transfers	$ 699,000	$ 1,350,000	$ 1,500,000	$ 250,000	$ 250,000	$ -
	OTHER REQUIREMENTS						
	debt service	$ -	$ -	$ -	$ -	$ -	$ -
2-0-117	equip reserve	$ -	$ -	$ 2,800,000	$ -	$ -	$ 2,800,000
	Subtotal Other Requirements	$ -	$ -	$ 2,800,000	$ -	$ -	$ 2,800,000
	Ending Balance	$ 14,735,066	$ 12,398,733	$ 1,000,000	$ 16,638,593	$ 16,675,044	$ 1,000,000
	Total Hydro Fund	$ 21,114,973	$ 25,887,524	$ 20,428,547	$ 19,158,318	$ 19,475,739	$ 19,454,000