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WATER SYSTEM FACILITY PLAN

FOR

GREENFERRY WATER DISTRICT

SUBMITTED TO THE

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

JANUARY 2021

REVISED MARCH 2022

WELCH-COMER ENGINEERS | SURVEYORS

WATER SYSTEM FACILITY PLAN

GREENFERRY WATER AND SEWER DISTRICT

PROJECT NO. 41360.00.0

SUBMITTED TO THE:

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

PROFESSIONAL ENGINEER
LICENSED
16259
3/2/22
STATE OF IDAHO
ASHLEY M. WILLIAMS

JANUARY 2021
REVISED MARCH 2022

PREPARED BY:

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GLOSSARY OF TERMS AND ABBREVIATIONS

AC	asbestos cement water main material
ADD	average day demand
ADP	average day production
ac-ft/yr	acre-feet per year (a measure of water volume withdrawn from a well)
add'l.	additional
avg.	average
capacity	This refers to the amount of water a given system component can provide. For example, if a pump can supply 100 gallons per minute, its capacity is 100 gallons per minute. Capacity can also refer to the overall ability of the system to supply water.
CDBG	Community Development Block Grant
cfs	cubic feet per second
CY	cubic yards
demand	This term is used throughout this document and references the amount of water that needs to be supplied by the system. For purposes of this analysis, demands based on production meter readings have been utilized in order to account for system loss.
DI	ductile iron water main material
dia.	diameter
DS	dead storage
elev.	elevation
EDU	equivalent dwelling unit (a measure of water demand in terms of an equivalent number of single-family dwellings)
ES	Equalizing Storage
FF	Fire Flow, the flow rate and duration of flow required to adequately fight a fire on the system. This is set by the local fire authority.
FFS	fire suppression storage
gal(s)	gallons
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HP	horsepower

IDAPA	Idaho Administrative Code
IDEQ	Idaho Department of Environmental
IOC	inorganic chemicals
LF	lineal feet
LID	Local Improvement District
max	maximum
MCL	maximum contaminant level
MDD	max day demand
MDP	max day production
MG	million gallons
mgd	million gallons per day
mg/L	milligrams/liter
MHI	median household income
mi.	mile
min	minimum
NRCS	Natural Resources Conservation
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
OS	operational storage
PHD	peak hour demand
PHP	peak hour production
PRV	pressure reducing valve
PVC	polyvinyl chloride (plastic) water main material
ROW	right-of-way
SS	standby storage
SCADA	supervisory control and data acquisition (i.e., computerized control system)
suppl.	supplemental
UGA	Urban Growth Area
USDA-	USDA Rural Development
VOC	volatile organic chemicals
WSDM	Water System Design Manual (published by DOH)
WSE	water surface elevation
WSP	Water System Plan

EXECUTIVE SUMMARY

The Greenferry Water and Sewer District ("District") has procured the services of Welch Comer & Associates, Inc. to complete a Water System Facility Plan for the District's water system. This plan reviews the current service area, expected growth of the system, analyzes the existing system components and their operation, and provides recommendations for system modifications and improvements necessary to serve existing customers. A summary of the major findings of this report is provided below.

The primary concern for the water system is a lack of capacity with deficiencies in storage and booster capacity with regard to current system demands. The system does not currently have capacity to provided recommended fire flows during the summer months. The District serves an area that is seeing rapid growth and system improvements will be necessary to serve the growing population.

The following is a summary of the existing system deficiencies with respect to current demands and the current IDAPA rules:

- Source: The existing source capacity is exhausted with the District's current demand. Deficiency will occur with any future growth within the system.
- Booster Capacity: Booster capacity is currently sufficient in the Snowshoe/Tanglewood, Highland, and Greenferry Booster Stations. Bella Ridge booster station is currently at capacity to meet the maximum daily demand and equalization storage requirements. However, the Highland booster station needs a second back-up pump to meet current IDAPA rules. Any future growth within the system will produce booster capacity deficiencies.
- Storage: The Riverview/Tanglewood datum has a deficit of -111,375 gallons; largely, due to the dead storage requirement within the Highland reservoir. The Greenferry/Bella Ridge datum has a deficit of -84,267[1] gallons due to inability to provide a fire flow of 1,500 gpm for 2 hours.
- Distribution:
    - The distribution system saw a water loss of 28% from July 03, 2019 to July 01, 2020.
    - The existing system is not sufficient to provide the calculated current PHP, while maintaining a minimum pressure of 40 psi specifically at Cedar Creek, Upper Highland, and Northwest Riverview. All other locations appear to sufficiently meet this requirement.

[1] Bella Ridge was constructed under the rules of the 1997 Uniform Fire Code, requiring 1,000 gpm for a duration of 2 hours. Thus, storage deficiency would instead be -24,267 gallons under this requirement.

- The existing system does not appear to be capable of providing fire flows while maintaining MDP and a minimum pressure of 20 psi throughout the system.

Future demands were projected based on the anticipated growth rates. The system was then analyzed based on providing the projected 20 year demands along with Growth A, B, and C (varying degrees of buildout within the District and growth to surrounding areas)[2] while complying with the IDAPA rules. The deficiencies noted above continue to grow in size into Growth A, B, and C.

Recommended source, storage, booster and distribution improvements were identified to address the deficiencies. The capital improvement plan is summarized on the following page.

[2] Growth A consists of adding 63 connections by including the Riverview Heights and Cedar Creek expansions. Growth B represents serving all parcels with the District's existing service boundary. Growth C represents the buildout (possible subdivision) of all parcels within the existing service boundary.

Capital Improvement Plan

	Description	Issue Addressed	WC/ACE	IDEQ Requirement?	5-Year	10-Year	20-Year
Source	Well Pump Replacement / New Well	Non-Fire Flow Capacity	WC	Yes	$945,000		
	Generators (Included in Well Work)	Reliability - Operation	ACE				
Storage	Bella Ridge Expansion	Fire Flow	WC			$457,100	
	Highland Reservoir Replacement	Reliability - Maintenance	ACE			$280,000	
	SCADA Upgrades	Reliability - Operation	ACE			$99,160	
Boosters	Upper Highland Booster Reconfiguration	Fire Flow – System Pressure	WC	Yes		$602,600	
	Greenferry Bypass	Fire Flow – System Pressure – Reliability	ACE		$95,000		
	Greenferry Booster Replacement	Fire Flow – System Pressure	WC	Yes		$300,700	
	Snowshoe/Tanglewood Upgrade	Fire Flow	ACE				$637,020
Distribution	Greenferry Upsize	Fire Flow	WC				$449,100
	Riverview Upsize	Fire Flow	WC				$1.17M
	Transmission from Wells to Greensferry Rd.	Non-Fire Flow Capacity	ACE	Yes	$498,125		
	Greenferry Terrace Upgrades	Fire Flow – Reliability - Operation	ACE		$1.1M		
	Crystal Bay Upgrades	Fire Flow	ACE				$1.1M
	Snowshoe/Tanglewood Upgrade	Fire Flow	ACE				$637,020
Maintenance	Easement	Reliability - Operation	ACE				$50,000
				Total:	$2.6M	$1.7M	$3.4M

Note: ACE Solutions proposed improvements to the Snowshoe Booster Station as well as a Recharge Booster Station which are currently underway. These are described more fully in their Preliminary Engineering Report, included for reference in Appendix L

1. INTRODUCTION

1.1. PURPOSE

The Greenferry Water and Sewer District (District) has authorized Welch Comer and Associates, Inc. to prepare this water system facility plan for the District's water system, located in Kootenai County, Idaho. The system (Idaho Department of Environmental Quality (IDEQ) PWS ID1280077) is owned and operated by the District.

The purpose of this report is to:

1. Describe the current water facilities and operation of the Greenferry Sewer and Water System,
2. Identify existing and future sub-standard components of the system and to, and
3. Develop a facility plan to implement the improvements necessary to provide an adequate supply of water to its user for the next 20 years.

The District previously engaged with ACE Solutions to prepare a water system facility plan for the District's water system. Welch Comer and Associates, Inc. has incorporated portions of the previous version prepared by ACE Solutions to the extent practicable. References to the report prepared by ACE are included throughout. ACE's Report is available in Appendix K.

1.2. SCOPE

This report is intended to serve as the Facility Plan for the Greenferry water system.

This report will include the following:

- Population and Growth
    - Identify current service area
    - Project the size and location of future growth
- Demands
    - Review historic demands
    - Project future demands based on growth projections
- Source
    - Review current water rights
    - Review existing pump capacities and status
    - Evaluate capacity and condition of pumps
- Storage
    - Evaluate capacity and condition of storage

- Distribution System
    - Evaluate capacity and condition of existing system
- Hydraulic Model
    - Construction Based on current system conditions
    - Calibration based on field tests
    - Evaluation of current system to support
        - Current peak hour, maximum day, and average day demands
        - Projected peak hour, maximum day, and average day demands
    - Evaluate expansions and improvements to the system
- Financial
    - Identify potential capital improvements and opinions of probable cost

1.3. Project Responsibility

The District was organized in 1970 and currently serves 371 connections. The District is governed by a five-member board which meets monthly.

The District has demonstrated its financial capabilities by building a large cash reserve to help pay for the cost of required system improvements. Throughout the planning process, the District has also made a significant effort to work with both ACE Solutions and Welch Comer Engineers to analyze a large number of improvement options to ensure that the most cost-effective improvements are in place to bring the water system in compliance with Idaho Rules for Public Drinking Water Systems (IDAPA 58.01.08) while minimizing the financial impact these improvements have on its existing customers.

A revenue bond issue was approved in May 2018, allowing for the issue of $1.8 million in improvements as outlined in the water facility plan. The Board would like to bond for up to $1.5 million in projects as soon as possible, specifically for the Greenferry Terrace, and the Greenferry Bypass improvement project. Pump tests and potential well upgrades were also considered during the issuing of the revenue bond.

If the District wanted to further finance other improvement projects, they may need to secure some level of private, state or federal loans and/or grants. In addition, a vote of the existing service customers would be required for the District to obligate debt (beyond what has already been authorized).

If land acquisition for the project is required, the appropriate state and local procedures will be followed.

2. Existing Conditions

2.1. Ownership and Management

The water system is owned by the Greenferry Water and Sewer District. The District is managed by a Board that meets monthly and daily operation is managed by Robert Kuchenski who is licensed by the Idaho Bureau of Occupational Licenses (IBOL) and holds a Drinking Water Distribution 2 (DWD2-14719) and Drinking Water Treatment 2 (DWT2-10956) licenses. The backup operator is Ian Kuchenski who is licensed as Drinking Water Distribution 1 (DWD1-21471).

2.2. System Background

The District is supplied by two groundwater wells pumping from the Rathdrum Prairie Aquifer. The water is pumped/booster to four reservoirs. From here, the water is then distributed in the water system via gravity or booster pumps. The well house contains a sodium hypochlorite treatment system that energizes in coordination with individual well actuation. The distribution system consists of approximately 50,150 lineal feet (LF) of water mains serving the community. All the system components (wells, booster pumps, and storage reservoirs) are located on District property. Refer to Figure 2.2 for a conceptual drawing of the system operation. The system is currently obligated to serve 397 connections[3], 351 of which are metered as of October 2020.

The District serves only single-family residences on parcels ranging in size from 0.15 to 64 acres. Some connections use over 100,000 gallons per month during the summer with the largest connections using as much as 263,000 gallons in a single month.

Refer to Figure 2.1 and 2.2 for a map depicting the existing system. Refer to Figure 2.3 for a conceptual overview of the water system operation.

2.2.1. Current Boundaries

The Existing Service Area Map is provided as Figure 2.1. A large copy of this map is provided in Appendix A. The map shows the current service area (based on billed connections).

Also refer to Section 9 for a discussion of the existing environmental conditions.

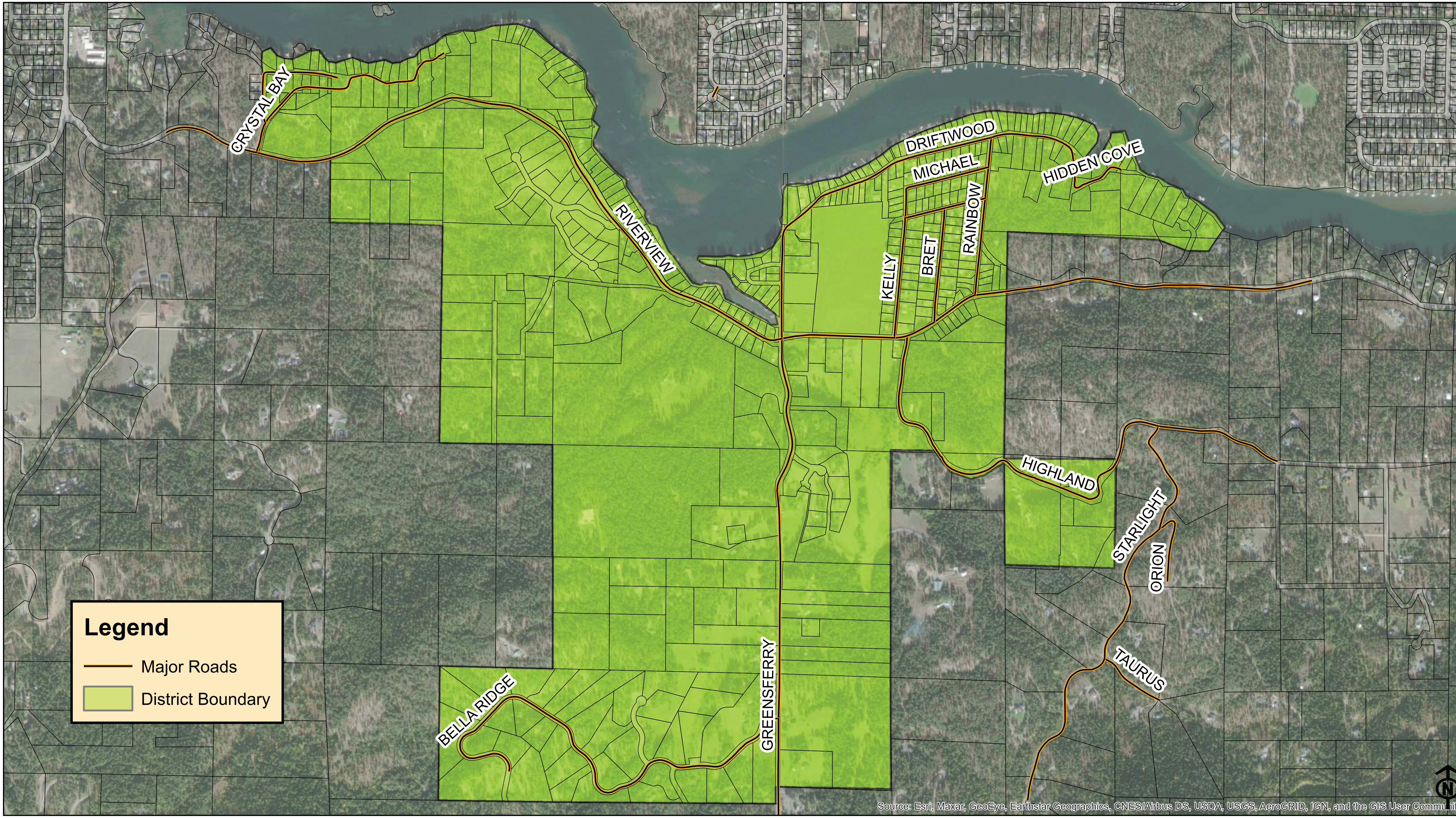
2.3. Existing Service Area Characteristics

2.3.1. Current Boundaries

All connections within the current service boundary are single-family residential connections. There are currently 351 service connections within the District boundaries. The District has also approved the addition of 20 vacant connections with the new Cedar Creek development and some areas in Bella Ridge. The District

[3] This is explained further in Section 2.3.1.

conditionally agreed to serve the subdivision of a large parcel of land just north of the Snowshoe and Tanglewood reservoir location once their system capacity deficits are addressed with regard to IDAPA rules. This area is referred to as Riverview Heights and consists of 26 lots. Thus, the total obligated connections for the District are 397. This will be discussed further in Section 2.8.



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Sources: Kootenai County GIS

Greenferry Water and Sewer District

Greenferry Water System

Figure 2-1

PROJECT NO.........................41360
DRAWN BY............................CSH
FILENAME.............................41360_ServiceArea
DATE......................................01/27/2021

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Greenferry Water and Sewer District

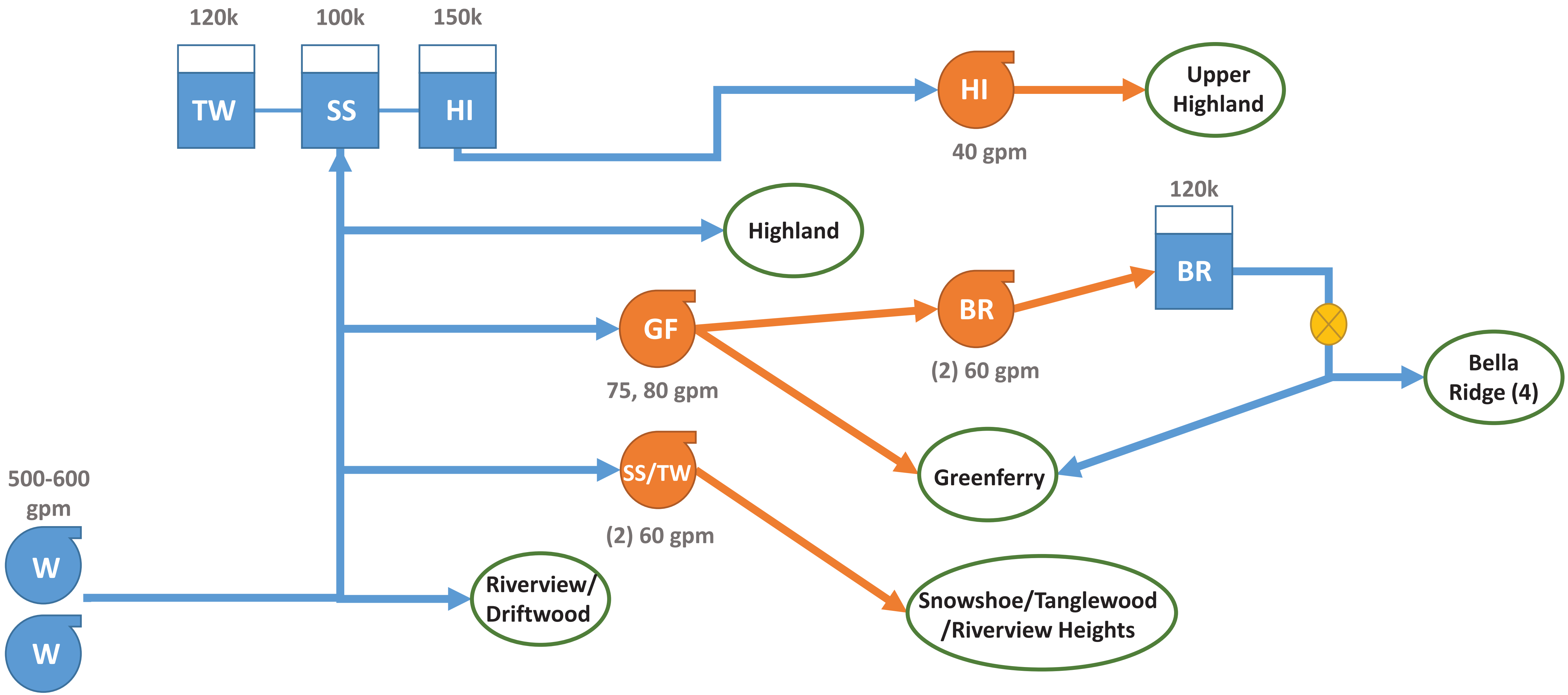
Existing Water System Overview

Figure 2-2

Sources: Kootenai County GIS

PROJECT NO...................41360
DRAWN BY.......................CSH
FILENAME.........................12302020_GreenferryWaterSystemOverview
DATE................................01/27/2021

Greenferry Water System Conceptual Overview



2.3.2. *Planning Area*

Growth for the District water system is based on the maximum subdivision of existing parcels within the District's service area as well as the anticipated development of surrounding areas.

Refer to Section 3.1 for an in-depth discussion about projected growth rates.

2.3.3. *Sewer Collection and Treatment*

The sewer collection and treatment are provided in the District area by individual septic tanks and drainfields, primarily under the jurisdiction of Panhandle Health District.

The District is currently considering development of a Sewer System Feasibility Analysis. Any future sewer system improvements will be planned, designed, and constructed in accordance with all applicable DEQ and IDAPA requirements as well coordinated with the recommended improvements of this facility plan.

2.4. Water Rates

The current water rate structure consists of a base rate of $35.00 per month for up to 25,000 gallons of water, with a tiered overage rate. From 25,000-50,000 gallons, customers are billed $0.75 per 1000 gallons, $1.30 per 1000 gallons for 50,000 – 100,000, and $2.00 per 1000 gallons for any use over 100,000 gallons. Meters are read monthly from June 1st to October 1st, with no readings occurring during the winter months. Table 2.1 summarizes the District's current rate structure. Refer to Section 5.1 for a history of the District's water rates.

Table 2.1: Rate Schedule

Billing Classification	Monthly Base Rate	Gallons Included in Base Rate	Overage Rate per 1,000 gallons (25,000-50,000 gallons)	Overage Rate per 1,000 gallons (50,000-100,000 gallons)	Overage Rate per 1,000 gallons (100,000+ gallons)	Capital Reserve Fee
Residential	$35	25,000	$0.75	$1.30	$2.00	$15.00

The District is currently considering a zero-base water rate. This would provide a base rate fee for every user irrespective of the water used for that connection. Water use would be assessed through a tiered structure (similar to the above). Refer to Section 5.1 for further information. Debt repayment for proposed water improvements will be discussed in Section 4.4; the District's intention is to utilize the Capital Reserve Fee to repay the current bond. A summary of the District's water rates, payment policies, and procedures is supplied in Appendix C.

2.5. Inventory of Existing Facilities

This section is intended to provide a basic system background and includes a general description of the existing facilities and their use. An extensive assessment of the system's capabilities is provided in Section 2.9.

2.5.1. *TELEMETRY*

The District uses remote telemetry (phone line) to monitor the reservoir's water levels. A signal is sent to an autodialed alarm to alert the system in the event of a high or low water level indication. The source wells are controlled by level transducers located in the Highland or Snowshoe Reservoirs. In the event the Highland reservoir needs to be taken offline, the source wells can be switched over to the level transducer in the Snowshoe reservoir. The District has installed altitude valves (level control valves) in the Highland reservoir tank to control the level of that tank. The single acting valve closes at a preset maximum water level in the reservoir to prevent overflow and opens to refill when the water level in the reservoir lowers. The Highland tank level is set 1 foot lower than the Snowshoe and Tanglewood tanks to prevent overflow. All three reservoirs have transducers in them and are monitored at the well house.

The Bella Ridge tank is filled from the 4-inch feed line in Bella Ridge Drive. Level control is operated from a level transducer in the Bella Ridge tank. When the reservoir level drops 1 foot the Bella Ridge Booster is switched on. The drop in pressure measured via a pressure transducer at the Bella Ridge Booster Station switches the Greenferry booster on. The source wells are controlled through the pressure transducer at the Greenferry Booster Station. The Bella reservoir levels are monitored at the well house and high or low levels trigger an alarm to the system operator.

2.5.2. *SOURCE*

The system is supplied by two production wells, Well No. 1 and Well No. 2, located at 9191 W. Michael Way. Well No. 1 was drilled to a depth of 250 feet in December of 1989. Well No. 2 was drilled to a depth of 245 feet in October of 2001. The static water level depths for each well respectively is 124 and 150 feet. Well No. 1 contains a 75-HP vertical turbine line shaft pump and producing a capacity of approximately 500-525 gpm. Well No. 2 contains a 65-HP submersible pump that produces 530-600 gpm. There are no observed or reported physical or operational deficiencies for either of these wells. Table 2.2 provides a summary of each well.

Table 2.2: Existing Sources

	Year Drilled[1]	Year Current Pump/ Motor Installed	Casing Dia. (inch)	Static Water Level (ft.)	Motor HP	Pump Model	Pump Operating Point (gpm)[2]	Back-up Power Supply	Pump Type
Well 1	1989	1989	12	124	75	N/A	525	N/A	Vertical Turbine Line Shaft
Well 2	2001	2001	10-12	150	65	N/A	600		Submersible

Notes:

1. Based on well logs (included in Appendix D).
2. Pump production for Well 1 and Well 2 is based on operator observation.

Photo 1: Wellfield lot (facing west)

Photo credit to IDEQ

Photo 2: Well 2

Photo credit to IDEQ

Photo 3 and 4: Inside Well House

Photo 5: Well Meter

2.5.2.1. WATER RIGHTS

The District holds two water rights and one permit, as can be seen in Table 2.3. Copies of these water rights can be found in Appendix E. IDWR has confirmed that due to previous demonstrated use, they have limited Water Right No.'s to 95-08613 and 95-09082 to the combined water right maximum diversion rate to 1.25 cfs. This total allowed diversion is 2.05 cfs, as indicated below. The District recently tested the capability of briefly running their two wells together and produced approximately 900-950 gpm. This would be within the allowed diversion rate.

In 2014 and 2015, the District took part of a regional planning effort by water purveyors in Kootenai County that utilize the Rathdrum Prairie Aquifer as their source of water. One primary objective of this group is to define a long range, coordinated plan for water service for the region. Each purveyor has defined their 30-year service boundary. An independent agency reviewed the boundaries to determine purveyor conflicts, and all conflicts have been resolved. A second objective of this group is to secure water rights in accordance with Idaho Code § 42-202 necessary to serve reasonably anticipated growth occurring within this boundary, referred to as RAFN (Reasonably Anticipated Future Need). The District filed its RAFN application in February of 2015, and the application included a 30-year planning period. Thus, the proof of beneficial use is due in 2045.

Table 2.3: Existing District Water Rights

Water Right No.	Basis	Beneficial Use	Period of Use	Priority Date	Diversion Rate
95-08613	License	Municipal	Jan. 1 to Dec. 31	2/9/1989	1.00 cfs
95-09082	License	Municipal	Jan. 1 to Dec. 31	5/5/2004	1.00 cfs
95-09531	Permit	Municipal	Jan. 1 to Dec. 31	8/25/2008	0.8 cfs
Maximum Diversion for License and Permit:					**2.05 cfs**

The District participated in the adjudication process and their original two water rights (95-08613 and 95-09082) have been confirmed/decreed.

2.5.2.2. WATER QUALITY AND TREATMENT

A 12.5% sodium hypochlorite solution is injected on individual well discharge, prior to the distribution manifold. The solution is pumped into the well discharge lines at a rate 0.6 gallons per hour against a maximum pressure of 150 psi by Iwaki electronic pumps. The solution is delivered in 50-gallon barrels, the barrels are vented to outside of the well house. Secondary containment of day tanks is not provided nor required; however, it is recommended by IDEQ. Each metering pump is equipped with an automatic flow cut off in the event either well is energized but fails to discharge. Finished sample taps are provided on individual well discharge prior to the distribution manifold within the pump house.

The District currently monitors free chlorine residual twice per week at the District office, the first service connection served by the wells. The chlorine residual data are summarized in a monthly operation report and submitted to DEQ prior to the 10th day of the following month.

The District follows sampling regulations stipulated by IDEQ. Drinking water quality testing was summarized and is included in Appendix F for reference. The levels of regulated contaminants were found to be below state and federal standards. IDEQ has recorded 25 instances of violations for the District's system since 1980.

The last monitoring and maximum contaminant level violations were reported in 2000. These violations were regarding Nitrate and Total Coliform Residual for monitoring and maximum contamination level, respectively. The District has not had any violations since 2000. There are no observed or reported physical or operational deficiencies in the treatment system.

2.5.3. Storage

The system has four primary storage tanks that provide drinking water and pressure to the system. These tanks are filled by the two wells as well as some of the District's booster stations. The pressure zones served by the reservoirs generally consist as follows:

- Riverview/Tanglewood – Main datum fed by the wells or the Highland, Snowshoe, and Tanglewood tanks (by gravity)
  - There is also an area downgradient from the Highland reservoir that is referred to as the Highland datum, but it is not separated hydraulically from the main datum, so it is included in this datum.
- Upper Highland – Fed by Upper Highland Booster Station
- Snowshoe – Fed by Snowshoe Booster Station
- Greenferry – Fed by Greenferry Booster Station
- Bella Ridge – Fed by Bella reservoir (by gravity). The Greenferry and Bella Mid-Level Booster Stations are used to fill the Bella reservoir.

Accurate elevation data for these tanks were not available. For the purposes of this report, base elevations were estimated using reported capacities, record drawings, and google earth elevations.

Table 2.4 shows the capacities, elevation, and operating level.

Table 2.4: Existing Reservoirs

Reservoir	Pressure Zone	EDUs[1] Served	Total Capacity (gallons)	Base Elevation (feet)	Tank Dimensions	Depth (feet)	Operating Level (feet)
Highland	Riverview/ Tanglewood	353	150,000	2321	21' Radius	14.0	1
Snowshoe			100,000	2318	16.75' Radius	15.1	0.6
Tanglewood			120,000	2326	73.5' x 33.5'	6.7	0.6
Bella	Greenferry/ Bella Ridge	44	120,000	2891	68' x 33'	7.7	0.4

Note:
1. EDUs is equivalent dwelling unit and is defined in Section 2.8.1

Photo 1: Highland Reservoir

Photo 2: Highland Reservoir

Photo 3: Snowshoe Reservoir

Photo 4: Tanglewood Reservoir

Photo 5: Bella Ridge Reservoir

Photo 6: Bella Ridge Reservoir

Water system personnel and operators have reported leaking at the Highland reservoir. This is proposed to be addressed through a replacement project, identified in Section 4. All other system reservoirs have no reported or observed physical or operational deficiencies.

The system also has small storage tanks at the Greenferry Booster Station and at the Bella Mid-Level Booster Station (the booster stations are discussed in Section 2.5.4 below). These provide operational storage for the booster stations. The tanks are both 3,000 gallons and are in-ground concrete structures. DEQ had reported a deficiency in contamination protection at the Greenferry Booster Station in their 2015 Sanitary Survey. This deficiency has since been addressed by the water system operator; further detail to this deficiency is provided in Section 2.6 and the Sanitary Survey is included in Appendix B. These smaller tanks have no observed or reported deficiencies.

2.5.4. BOOSTER STATIONS

The system has four booster pump stations that supply reservoirs and pressurize the system for higher elevation metered connections. Table 2.5, on the following page, summarizes the basic pump information for each existing booster pump.

Table 2.5: Existing Booster Pumps

Booster Station	Zone Served	EDUs Served	Pump	Year Current Pump/ Motor Installed	Horsepower	Pump Information	Estimated Capacity (gpm)
Greenferry	Greenferry/ Bella	44	#1	2005	7	McDonald 24000T	80
			#2	2005	5	Grundfos 75S50-8	75
Snowshoe	Snowshoe	15	#1	1980	5	Centrifugal	60
			#2	1981	5	Centrifugal	60
Bella Mid Level	Greenferry/ Bella	44	#1	2008	10	Grundfos 75S100-16	60
			#2	2008	10	Grundfos 75S100-16	60
Highland	Upper Highland	2	#1	1981	2	Grainger CJ101C201	40

It is important to note the District is underway with an improvement project to the Snowshoe Booster Station as well as installing a Recharge Booster Station below the Snowshoe and Tanglewood Tanks. The Snowshoe Booster Station will be relocated to the tank site and will provide adequate pressure and fire flow (through fire pumps) to the Snowshoe pressure zone (which will also include Riverview Heights). These booster station improvements are described in ACE Solutions Preliminary Engineering Report, included in Appendix L for reference. There have been no observed or reported physical or operational deficiencies for any of the booster stations.

Photo 1: Greenferry Booster Station

Photo credit to IDEQ

Photo 2: Existing Snowshoe Booster Station

Photo credit to IDEQ

Photo 3: Existing Snowshoe Booster Station Pumps

Photo credit to IDEQ

Photo 4: Bella Ridge Boosters Station Pumps

Photo credit to IDEQ

Photo 5: Bella Ridge Booster Station Pump Controls
Photo credit to IDEQ

Photo 6: Upper Highland Booster Station Pump and Discharge Appurtenances
Photo credit to IDEQ

Photo 7: Upper Highland Booster Station

Photo 8: Upper Highland Booster Station
Photo credit to IDEQ

2.5.5. *Distribution System*

The following table provides an inventory of the system piping based on ACE's reported quantity of the current system.

Table 2.6: Summary of Existing Waterlines

Pipe Diameter	Material	Length (ft)
1.5-inch	PVC Sch 40	600
2-inch	PVC Sch 40	2,000
3-inch	PVC Sch 40	6,600
4-inch	PVC Sch 40	14,050
6-inch	PVC Sch 40	7,900
8-inch	AC	17,700
10-inch	PVC	1,300
Total		50,150

2.6. Sanitary Survey, Violations of Safe Drinking Water Act and Cross Connection Control

The sanitary survey for the system was completed by IDEQ on September 16, 2015 the District was found to be in substantial compliance with Idaho Rules for Public Drinking Water Systems. No significant deficiencies were identified during the survey.

However, the following deficiencies and requirements were listed in the Survey:

1. "Two of the three hydropneumatics tanks installed on the Snowshoe booster pump discharge have failed and must be either physically disconnected from distribution or replaced as per the responsible charge operator's direction."
2. "Adequate protection from contamination must be provided on the overflow outlet of the 3,000-gallon reservoir supplying the Greenferry booster station."

These deficiencies have since been addressed by the District. The complete sanitary survey as well as the Cross Connection Control Program can be found in Appendix B.

2.7. Hydraulic Modeling

2.7.1. *Modeling Software*

The hydraulic analysis of the water system was performed using the WaterCAD Water Distribution Modeling Software, Version 8.0, which was developed and distributed by Haestad Methods, Inc. The water system model layout is shown in Appendix G.

2.7.2. *Model Construction*

The base model used for analysis of the distribution system was supplied by ACE Solutions. The base model was then updated to accurately represent the system's current configuration and add newly serviced parcels. The elevations within the supplied model were supplied by ACE, and several points were verified with those available from Google Earth. It should be noted, however, that the elevations within Google Earth are considered accurate to ±10 feet systemwide. Therefore, the results of the model are subject to inaccuracies.

One of the major factors that affect the performance of a distribution system is the demand and the distribution of that demand. In WaterCAD, demand is assigned to individual nodes throughout the system. To accurately model the pressure losses within the system, the demand distribution in the model must accurately represent that of the existing system. In order to establish the existing demand distribution, demand was added to each node based on the number of active equivalent dwelling units (EDU[4]) within the vicinity of that node. Because there are no commercial connections served by the District, EDUs were assigned to each parcel that currently has a meter (both active and inactive) on the basis that each parcel represented 1 EDU.

2.7.3. Model Calibration

Once the model has been constructed, its accuracy should be tested through calibration. Calibration is the process of comparing model results to field observations and making any necessary adjustments to the model. System characteristics that often need to be adjusted include, but are not limited to, the following: demands, demand distribution, pipe characteristics, pump settings, elevations and valve settings. By adjusting these factors, the model can be adjusted to better represent the field conditions.

Observed fire hydrant pressures were collected and reported by ACE Solutions. After inputting in junction node elevations, the pressures predicted in the model were found to be within 1 psi or 2 percent (on average) of those reported by ACE Solutions. A summary of the calibration is included in Appendix G.

It is important to note the variation in the observed and model predicted results may be attributed to the following factors:

- Inaccuracy in the measuring equipment.
- The actual operating characteristics of the system during the time pressure was measured are unknown. These include:
  - Demand and demand distribution
  - Water levels in reservoirs
  - Pump status and discharges
- Service locations where measurements were taken were higher or lower in elevation than the main, and the size and condition of the services could contribute some errors.

The Haestad Methods "Water Distribution Modeling, First Edition," gives

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[4] EDU will be defined and discussed in greater detail in Section 2.8.1.

guidelines for acceptable calibration levels. The reference states that for master planning of small systems (systems with smaller than 24-inch pipe), *"The model should accurately predict hydraulic grade line (HGL) to within 5-10 feet at calibration data points during fire flow tests and to the accuracy of the elevation and pressure data during normal demands."*

The American Water Works Association (AWWA) "Modeling, Analysis and Design of Water Distribution Systems" reference states that *"A key use of a calibrated model is to determine relative differences in the results of various actions. In other words, it is not so much that the model has been precisely calibrated, but rather that it can be used as a basis for comparison; thus, it is the differential values that become important."*

Following the Haestad recommendations for master planning the pressure data obtained from the model should be as accurate as the data gathered from the field. The difference between the field results and the model results may be attributed to errors in data collection, the difference in demand estimated for each location, and the actual pipe roughness. Because the predicted pressures are within an acceptable range of the observed pressures, and because it would not be practical to precisely track demand at each junction and roughness of each pipe in the system, the model was accepted as calibrated at this point.

Since the model results are only as accurate as the elevations entered into the model, as previously discussed, a measure of caution should be used when applying the model results. As more accurate elevation information becomes available from additional surveys within the system, the elevation information in the model should be updated to achieve the most accurate results.

2.8. EXISTING SYSTEM DEMAND

The District does not read individual consumption meters from October 1st to May 31st. Meter readings for the well are read year-round on a weekly basis. Individual consumption meter readings are collected on either the 1st or 3rd day of each month through June 1st to October 1st . Data for this report was provided by the District between June 2013 and July 2020. To properly reflect the systems current demand, the individual consumption meter data from June 1, 2019 to June 1, 2020 (2020 Water Year) was used.

The total production for the system was determined by summing the metered gallons produced by the wells within the 2020 water year. Metered consumption for the system was summed from the individual consumption meter data. It should be noted that there were several customer meter readings throughout the year that showed a negative consumption rate for the given month[5]. Because it is not possible to

[5] According to the system operator, the meter readings showing negative consumption were a result of meter misreads. Most of the District's meters are direct read meters that require the operator to physically read the meter data each month. Occasionally the numbers are misread or incorrectly recorded which can result in consumption values that appear to be negative.

retroactively account for actual consumption at these connections in months where the misreads occurred, these data points were excluded from the analysis[6]. Theoretically, the metered production and the metered consumption should match. However, there is always a discrepancy between production and consumption. This difference is known as system loss and will be further discussed in Section 2.9.5.2.

The annual production and metered consumption, based on data for the period discussed above (June 2018 to June 2019), is as follows:

- Total Production: 73,177,000 gallons
- Total Metered Consumption: 52,679,000 gallons

2.8.1. EQUIVALENT DWELLING UNIT (EDU)

The term "equivalent dwelling unit" or EDU will be used extensively throughout this document. An EDU is defined in The Idaho Rules for Public Drinking Water Systems – IDAPA 58. Title 01, chapter 8 as a unit of measure that standardizes all land use types (housing, retail, office, etc.) to the level of demand created by a single-family detached housing unit within a water system. The demand for one EDU is equivalent to the amount of water provided to the average single-family detached housing unit within a water system. For example, if a typical single-family household within a given system uses 300 gallons per day (i.e. one EDU equals 300 gpd) and a particular commercial connection uses 600 gallons per day, that commercial connection would account for 2 EDUs within that system

Individual account information was provided by the District for June 3, 2019 through June 1, 2020. The meters are read monthly from June 1st to October 1st with no reading occurring from October 2nd to May 31st. Meters are typically read on the 1st or 3rd of each month. The consumption quantities included in this report are based on the twelve months of data provided by the District.

During this time, the average daily metered water use per active residential connection was 424 gallons. Therefore, on an average use basis, 1 EDU for the system is 424 gallons per day.

Table 2.7: Summary of Existing Connections and EDUs

	Total Current Connections	Total Current EDUs
Residential	340[1]	340[1]
Inactive	11	11
Vacant	46[2]	46[2]
Total System	397	397

Notes:
1. The number of EDUs used for calculating ADD was 340. This represents the average number of active

[6] Individual customer meter use is only used in calculating system loss, while the system capacity analysis is based on production data. Therefore, removing these data points conservatively raises the calculated system loss and does not have an effect on demands used to analyze the system's capacity in the following sections.

service connections throughout the year, as the total connections varied widely during this time period.
2. The vacant properties consist of approximately 20 in the Bella Ridge area and the 26 properties within the Riverview Heights subdivision.

2.8.2. Average Daily Production (ADP)

The average day production is the average volume of water produced by a given system calculated over the course of a year and is often expressed on a per EDU basis. System losses throughout the distribution system have a direct effect on the demand a system experiences. For instance, the demand at a given service connection is equal to the water that particular user consumes whereas the demand at the production wells includes the actual consumption as well as the system loss. Systems that experience significant loss will exhibit a significant difference between production and consumption demands. Therefore, it is important to recognize the difference and use the appropriate demand for each analysis. The District's system experiences significant loss, thus, the demand used within this report will be based on production and will therefore include system losses. Average Day Production (ADP) will be presented on a gallons per day per EDU basis.

The following ADP values are based on the production well meter data provided by the District from June 2019 through June 2020 and use 340 service connections as the average number of active dwellings during this period. This value has been used throughout this report and associated analyses:

- ADD = 424 gallons per day per EDU
- ADP = 590 gallons per day per EDU

2.8.3. Maximum Daily Production (MDP)

Maximum Day Production (MDP) is the maximum gallons of water produced in one day over a period of one year. The MDP was estimated using the District's well house meter which reads every 5 minutes. This well house meter was installed in and began recording flow data in August, 2020. It is understood that this is not consistent with the same analysis period used for the Average Daily values; however, the June 2020 to June 2021 data is not available at the time of developing this document. Thus, this is the best available information. The data from the newly installed meter contained well production meter readings for August 23, 2020 through September 22, 2020. The peak occurred on August 24, 2020 and produced a total of 595,393 gallons. This data period likely captured the peak production for the 2020 year. Unfortunately, as stated above, data prior to August does not exist with the meter in place; thus, this is the best available information. The total production for that day was then divided by the number of active service connections on the day peak production occurred, to calculate the MDP per EDU.

Therefore, this report will use the following MDP value:

- MDD = 1,261 gallons per day per EDU
- MDP = 1,751 gallons per day per EDU

2.8.4. *PEAK HOUR PRODUCTION (PHP)*

Peak hour production (PHP) is the maximum gallons of water produced in one hour over a period of one year and is generally reported in gallons per minute. Equation 5-1 (provided below) from the Washington Design Manual (Washington Department of Health, 2020) was used to estimate the peak hour production since peak hour data was not available from the system. The peak hour production was calculated based on MDP rather than MDD. The peak hour demand can be calculated using MDD.

Equation 5.1:

PHP = (MDP/1440) x [(C x N) + F] + 18

Where:

PHP = Peak Hourly Production, (gallons per minute)

C = Coefficient Associated with Ranges of EDUs

N = Number of EDUs

F = Factor Associated with Ranges of EDUs

MDP = Maximum Day Production, (gallons per day/EDU)

A peak hour production of 915 gallons per minute was calculated by applying the following values to Equation 5.1:

- C = 1.8 (for an EDU range of 251 to 500)
- N = 340 EDUs
- F = 125 (for an EDU range of 251 to 500)
- MDP = 1,751 gallons per day per EDU (estimated from meter data)

Application of Equation 5-1 yields the following, which will be used within this report:

- PHD = 664 gallons per minute[7]
- PHP = 915 gallons per minute

2.8.5. *FIRE FLOW REQUIREMENTS*

The District is located within the Kootenai County Fire District. The standard minimum fire flow requirement for the entire existing system is 1,500 gallons per minute for a duration of 2 hours[8]. It should be noted, however, that future developments may be required to provide a larger fire flow requirement depending on

[7] This would be calculated using MDD (1,261 gpd per EDU) in lieu of MDP.
[8] Portions of the District were approved for 1,000 gpm for 2 hours. This will be referenced as appropriate in subsequent sections of the report.

the type of buildings proposed. Therefore, fire flow requirements for new development will be determined on a case-by-case basis. For planning purposes, the requirement noted above has been utilized in this report. Communication with the Fire District is included in Appendix B.

2.9. Existing System Analysis

2.9.1. Analysis Criteria

The system analysis of source, storage, distribution, and treatment was performed in accordance with the IDEQ Rules for Public Drinking Water Systems, IDAPA 58.01.08. In addition, the Washington Design Manual is referenced as a design guide.

Table 2.8 on the following page outlines the performance and design criteria used within this report to analyze the various system components.

Table 2.8: Analysis Criteria

System Component	Analysis and Design Criteria	Reference/Rule
Source	1. A community water system shall have a minimum of two sources and the total source capacity, with any source out of service, should be capable of producing either the PHD or the MDD plus equalizing storage 2. A community water system that uses surface water shall be designed such that plant design capacity (MDD plus equalization storage or PHD) can be maintained with any component out of service. 3. The capacity of a public drinking water system shall be at least 800 gallons per day per residence provided the system has equalization storage sufficient to compensate for peak hour demand. 4. New source and booster pumps are required to have dedicated standby-power or standby-storage sufficient to pressurize the system for a minimum of eight hours during a power outage.	IDAPA Section 501.17 Ground Water Source Redundancy IDAPA Section 501.03 IDAPA Section 552.01 Quantity and Pressure Requirements. IDAPA Section 501.07 Reliability and Emergency Operation
Booster Stations	1. Each booster station shall contain not less than two (2) pumps with capacities such that peak hour demand, or a minimum of the maximum day demand plus equalization storage, can be satisfied with any pump out of service. 2. Pumping systems supporting fire flow capacity must be able to provide maximum day demand plus fire flow with the largest pump out of service. 3. Individual booster pumps at individual service connections may be allowed by IDEQ on a case-by-case basis with full knowledge and agreement by public water system and ensuring it will cause no adverse effects on system operation.	IDAPA Section 541.04 Booster Pumps AND IDAPA Section 501.18 Redundant Fire Flow Capacity IDAPA 552.01.b.iiv
Equalization Storage	1. ES = (peak hour demand – Qs)*(150 min) but in no case less than zero Where: ES = Equalizing storage component in gallons peak hour demand = Peak hourly demand, in gpm. Qs = Sum of all installed and active source of supply capacities, except emergency with the largest source offline, in gpm.	WSDOH Water System Design Manual: Equation 9-1 IDAPA Section 003.16
Standby Storage	1. SS = 8 hours x ADP Where: ADP = Average Day Production	IDAPA Section 501.07 Reliability and Emergency Operation
Fire Suppression Storage	1. FSS = (FF) * (tm) Where: FF = Required fire flow rate, expressed in gpm tm = Duration of FF rate, expressed in minutes	WSDOH Water System Design Manual: Equation 9-4
Distribution System	1. Water systems shall maintain a minimum pressure of forty (40) psi throughout the distribution system, during peak hour demand conditions, excluding fire flow. 2. Water systems shall maintain a minimum pressure of twenty (20) psi throughout the distribution system, during maximum day demand conditions, including fire flow.	IDAPA 552 .01 Quantity and Pressure Requirements IDAPA 552 .01 Quantity and Pressure Requirements

2.9.2. *Source*

The "Reliability and Emergency Operation" rule requires new sources to have either standby power or standby storage sufficient to provide 8 hours of average day production plus fire flow in the event of a power outage. The District does not currently have standby power at the well site, so standby storage has been evaluated in Section 2.9.4.

The "Ground Water Source Redundancy" rule requires systems with all existing sources constructed prior to July 1, 1985 to have a minimum of two sources and a total source capacity capable of producing the either PHP or MDP plus Equalization Storage with any source out of service upon substantially modifying the system after July 2002. In the current system configuration, the wells pump to several storage reservoirs and water is distributed to portions of the system with booster pumps. Therefore, source capacity will be evaluated on the basis of meeting MDP plus Equalization Storage. As can be seen in Table 2.9, the system's current source capacity is currently at capacity and just slightly deficient in gpm to supply the MDP plus Equalization Storage with the largest source offline.

Table 2.9: Source Capacity Analysis – MDP with Largest Source Offline

Source Capacity (gpm)	EDUs	Current MDP + Equalization Storage (gpd)	Available Source Capacity with Largest Source Down (gpd)	Source Capacity Surplus or Deficit (-) (gpd)	Source Capacity Surplus or Deficit (-) (gpm)
Production Wells Well No. 1 (538 gpm) Well No. 2 (602 gpm)	397	*Calculation:* (397 x 1,751 gpd) + 79,560 gal[1] =	538 gpm	-49	0
		774,769 gpd	774,720 gpd		

Notes:

1. The calculation for the whole system equalization storage is provided in the Storage capacity analysis, refer to Section 2.9.4.3.

The system must also be able to meet MDP plus fire flow through a combination of source and storage with the largest source offline. As shown in Table 2.10, the system has a 3,185 gpm surplus with regard to meeting this demand criteria.

Table 2.10: Source Capacity Analysis -
MDP Plus Fire Flow Over Two Hours Based on Current Demand

	Existing Conditions (Gallons)
EDUs	397
MDP + EQ	64,564[1]
Fire Flow	180,000
Total Draw	244,564
Available Source	64,560[2]
Available Storage	490,000[3]
System Surplus or Deficit (-)	309,996
GPM Equivalent	2,583

Notes:
1. MDP + EQ = 774,769 gpd x (2/24 hours) = 64,564 gallons
2. Based on source capacity for two hours with largest source offline (538 gpm x 2 hours).
3. Maximum available storage minus operating storage and dead storage. Storage capacity is discussed further in Section 2.9.4.

2.9.3. Booster Station

Greenferry's water system has four booster stations, as discussed previously:

- Snowshoe
- Highland
- Greenferry
- Bella Mid-Level

The Snowshoe and Highland Booster Stations supply water and pressure to smaller pressure datums within the system. Because these smaller datums feed water directly to the consumers via booster pump, per IDAPA rules, the booster pumps must be able to supply PHP or MDP plus Fire Flow with the largest pump offline. Both Snowshoe and Highland do not currently provide fire flow[9]; thus, the boosters were analyzed with respect to PHP with largest pump offline. The results of this analysis for the Snowshoe and Highland Booster Stations are shown below in Table 2.11.

[9] As noted previously, the District is currently underway with an improvement project to the Snowshoe Booster Station. Refer to Appendix L for further information. The existing pump station capacity was analyzed herein.

Table 2.11: Booster Capacity Analysis – PHP with Largest Pump Offline

Booster Pump Capacity (gpm)	Zone Served by Booster	Zone Served by Booster (No. of EDUs)	Current PHP (gpm)	Available Booster Capacity w/ Largest Pump Down (gpm)	Booster Capacity Surplus or Deficit (-) (gpm)
Snowshoe Pump 1 (60 gpm) Snowshoe Pump 2 (60 gpm)	Snowshoe	15	40	60	20
Highland Pump 1 (40 gpm)	Highland	2	5	40	35

The Greenferry and Bella Booster stations provide water to the Bella Ridge Reservoir which feeds the Bella and Greenferry datums by gravity through a series of PRVs (pressure reducing valves). Telemetry and operation between these two booster stations and the Bella Ridge reservoir is detailed further in Section 2.5.1: Telemetry. Booster stations in this configuration must be able be able to provide the MDP as well as supply equalization storage with the largest pump offline (fire flow is provided by the reservoir). The results of this analysis are presented in Table 2.12.

Table 2.12: Booster Capacity Analysis –
MDP and Equalizing Storage with Largest Pump Offline Based on Current Demand

Booster Pump Capacity (gpm)	Zone Served by Booster	Zone Served by Booster (No. of EDUs)	Current MDP + Equalizing Storage (gpd)	Available Booster Capacity w/ Largest Pump Down (gpd)	Booster Capacity Surplus or Deficit (-) (gpm)
Greenferry Pump 1 (75 gpm) Greenferry Pump 2 (80 gpm)	Bella and Greenferry	44	85,813	108,000	15
Bella Mid Pump 1 (60 gpm) Bella Mid Pump 2 (60 gpm)		44	85,813	86,400	0

2.9.4. *STORAGE*

The storage requirements for the water system will be discussed within this section. Storage within a system is comprised of the following components:

- Operating Storage (OS)
- Dead Storage (DS)
- Equalizing Storage (ES)
- Standby Storage (SS)
- Fire Suppression Storage (FSS)

Each of these components will be discussed in the following sections. These sections include the Washington Design Manual recommended equations for estimating the minimum requirements for each storage type and any IDAPA rules applying to storage requirements. It is important to note that the storage components are additive and cannot be nested, per the IDAPA rules.

The system currently has four, above ground reservoirs. Table 2.4 provides more information on the systems existing reservoirs.

Greenferry's current distribution configuration creates two pressure areas, the Riverview/Driftwood Datum and the Greenferry/Bella Datum. The Bella Ridge reservoir is only responsible for supplying water to the 44 EDUs within the Bella/Greenferry pressure datums. Highland, Snowshoe, and Tanglewood Reservoirs supply water to the system's remaining 353 EDUs in the Riverview/Driftwood pressure datum. For this analysis, the storage components will be evaluated for each zone.

2.9.4.1. Operating Storage (OS)

Operating storage is the volume of water used from the time the pump(s) feeding the reservoir turn off until it turns back on. This volume is usually determined by one of two things: the manufactures specifications on how frequently the pump can cycle, or the minimum water level change in the tank required by the pump control sensors.

The Highland, Snowshoe, and Tanglewood reservoirs are fed by the system's two production wells whereas the Bella Ridge reservoir is fed by the Greenferry and Bella Mid Booster stations. The wells and boosters turn on when the water level drops below their operating storage depth elevations. The operating storage for each tank and pressure datum is shown in Table 2.13 below.

Table 2.13: Operating Storage

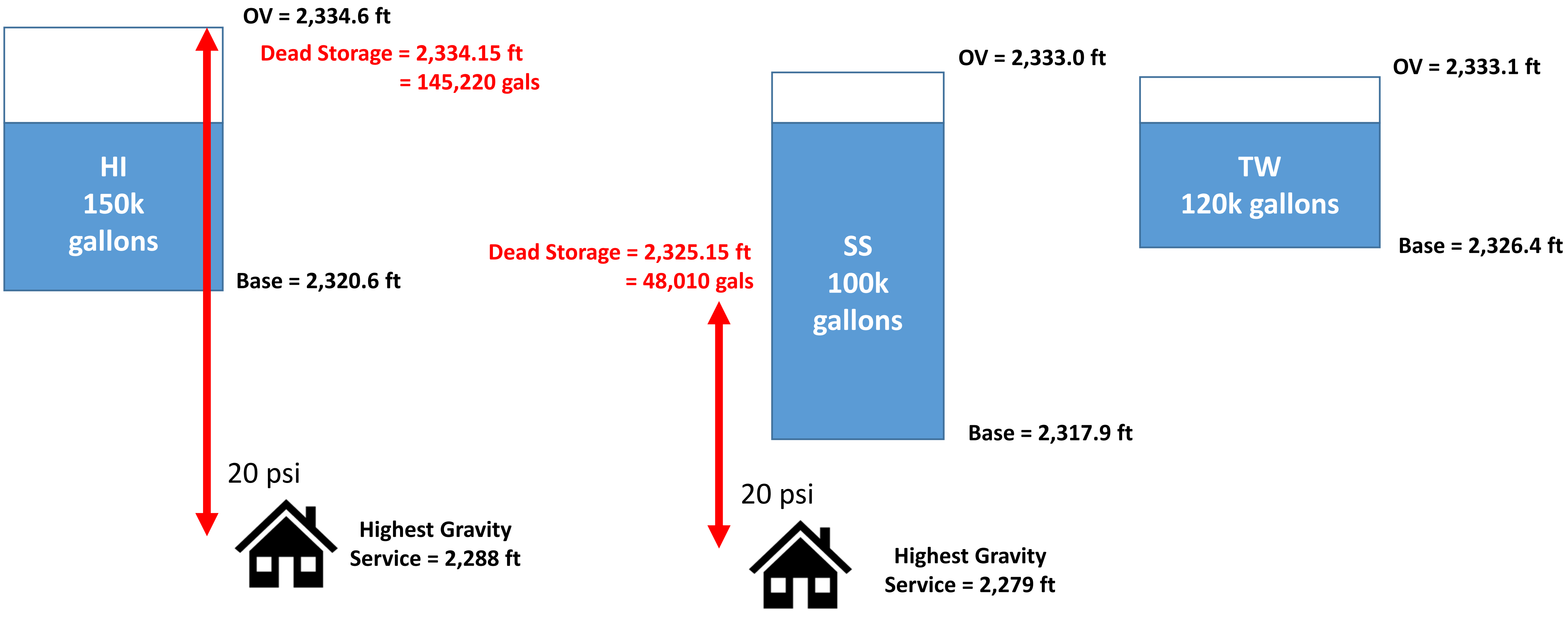
Pressure Datum	No. of EDUs	Reservoir	Operating Storage Depths (ft)	Gallons per Vertical Foot	Total Operating Storage (gallons)
Riverview/Driftwood	353	Snowshoe	0.6	6,623	25,434
		Highland	1.0	10,714	
		Tanglewood	0.6	17,910	
Greenferry/Bella	44	Bella Ridge	0.4	15,666	6,266

2.9.4.2. Dead Storage (DS)

Dead storage is calculated as the volume of water not available to all customers at a minimum pressure of 20 pounds per square inch (psi), as required by IDEQ. This pressure is supplied by the elevation of the reservoirs relative to the highest gravity service connection. The Bella Ridge reservoir has a base elevation of approximately 2,893 feet while the highest gravity service downstream of the reservoir has an elevation of approximately 2,750 feet, estimated using Google Earth. This elevation difference supplies an estimated 62 psi to the customer; thus, the Bella Ridge reservoir does not contain dead storage.

The highest gravity service in the Riverview/Tanglewood pressure datum is at an estimated elevation of 2,288 feet, retrieved using Google Earth. This gravity service is located near the Highland reservoir and estimated to have insufficient pressure at the service meter (refer to Section 2.9.5 for further analysis). The highest gravity service near the Snowshoe and Tanglewood reservoirs is at an estimated elevation of 2,279 feet. The dead storage for Highland and Snowshoe and Tanglewood were analyzed separately due to the distance between the reservoirs and the likelihood that dead storage would be attributable to the closer reservoir. The estimated dead storage is 145,220 gallons for the Highland reservoir (essentially the entire tank) and 48,039 gallons for the Snowshoe and Tanglewood reservoirs. Figure 2.4 shows a graphic depiction of the dead storage for this pressure zone. Recommended projects to address the dead storage and pressure deficiency in the Highland area are further discussed in Section 4.1.2. and Section 4.1.3.

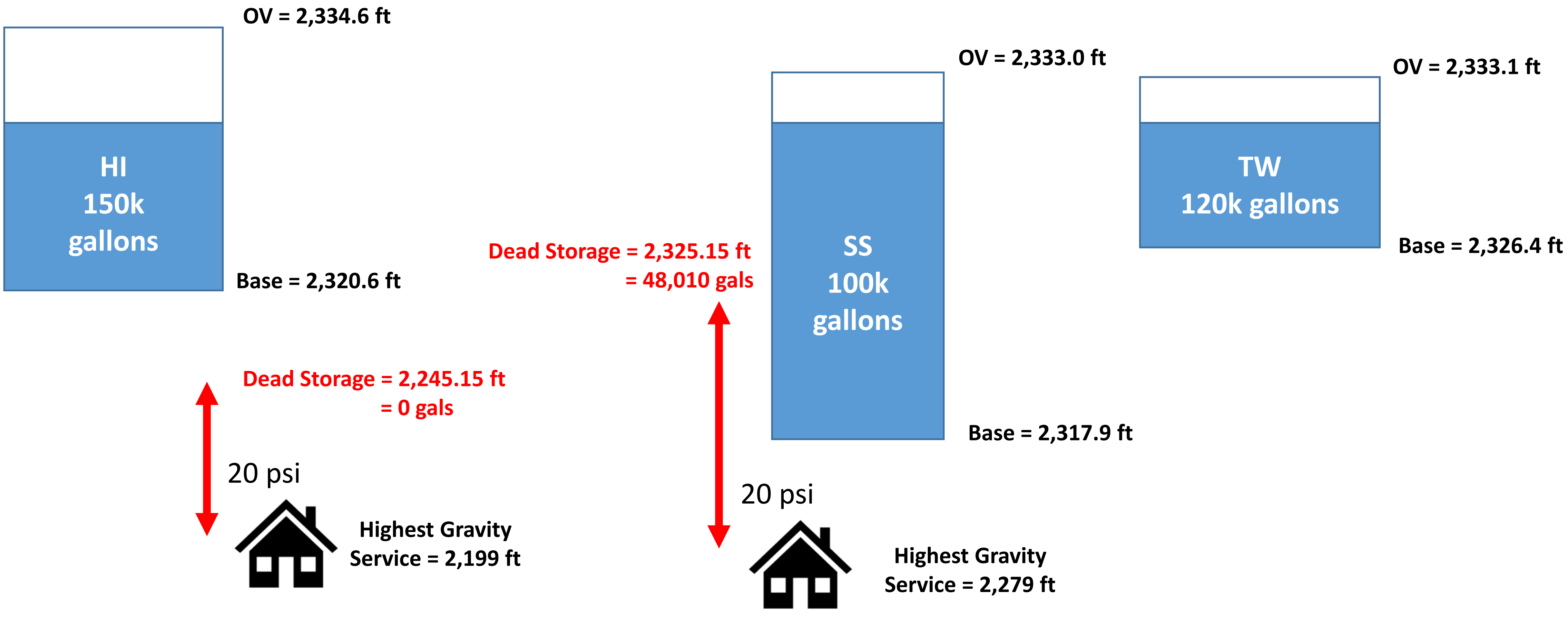
Dead Storage – Existing Condition



WELCH-COMER ENGINEERS | SURVEYORS

FIGURE 2.4

Dead Storage – Post Project



2.9.4.3. Equalizing Storage (ES)

Equalizing storage is required in the event that peak hour productions for the water system cannot be met by the source capacity. Equalizing storage was determined using "Equation 9-1" (below) from the Washington Design Manual:

Equation 9-1:

ES = (peak hour production – Qs)*(150 min) but in no case less than zero

Where:

ES = Equalizing storage component in gallons

peak hour production = Peak hourly production, in gpm.

Qs = Sum of all installed and active source of supply capacities, except emergency, with largest source offline[10], in gpm.

Equation 9-1 was used to estimate the minimum equalizing storage requirements. If water use records indicate values for equalizing storage that are different from those determined by Equation 9-1, actual records should be used. Since existing records are not sufficient to determine peak hour production, Equation 9-1 was utilized for this analysis.

Table 2.14 below provides the current equalization storage is requirement for the system.

Table 2.14: Equalization Storage Requirements Based on Current Demand

Pressure Datum	No. of EDUs	Total Available Source Capacity (gpm)	PHP (gpm)	Equalization Storage Required (gallons)
Riverview/Driftwood	353	538	950.0	61,798
Greenferry/Bella	44	60[1]	118.4	8,762
Whole System[2]	397	538	1,068	79,560

Notes:
1. Greenferry/Bella Reservoir is fed by the Bella Mid-Level Booster Station which has a pumping capacity of 60 gpm.
2. The calculation for the whole system is provided for the basis of reviewing Source capacity, refer to Section 2.9.2.

2.9.4.4. Standby Storage (SS)

Standby storage should be provided for in the event that one or more of the water system's sources fail, or if unusual conditions impose higher demands than

[10] IDEQ's definition of Equalization Storage indicates maximum pumping capacity should be used. Maximum pumping capacity is defined as the pumping capacity minus the largest source.

anticipated. The standby storage required for the system must be able to supply the ADP of the system for at minimum 8 hours. Standby storage was determined using "Equation 7-2" (below) from the Washington Design Manual:

Equation 7-2:

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

Where:

SB = Standby storage component in gallons

N = Number of EDUs based on the EDU_{MDD} value.

SB_i = Locally adopted unit SB volume in gallons per day per EDU (ADP).

T_d = Number of days selected to meet water system-determined standard of reliability. (8 Hours)

The standby storage component may increase if the District were to choose a longer time. The standby storage component is also not required if the District were to install backup generators at the well and booster pump locations.

2.9.4.5. Fire Suppression Storage (FSS)

Storage reservoirs must be capable of delivering fire flows in accordance with standards made by the local fire protection authority, if the fire flow is not pumped. A minimum pressure of 20 psi must be maintained throughout the system during fire flow conditions. The minimum fire suppression storage for a system is estimated using Equation 9-4 (below) from the Design Manual.

Equation 9-4:

$FSS = (FF) * (t_m)$

Where:

FF = Required fire flow rate, expressed in gpm

t_m = Duration of FF rate, expressed in minutes

The system is served by the Kootenai County Fire District. Based on communication with the Fire District (refer to Appendix B), the fire flow requirement for this system is 1,500 gallons per minute for 2 hour, or 180,000 gallons. Thus, the fire suppression storage requirement for the total storage in each pressure zone is 180,000 gallons.

2.9.4.6. Total Storage

Table 2.15 below provides a summary of the current storage requirements as have been discussed above. It is important to note that the various storage requirements are additive and cannot be nested.

Table 2.15: Storage Requirements Based on Current Demand

Pressure Datum	EDUs	Dead Storage (gallons)	Operating Storage (gallons)	Equalization Storage (gallons)	Standby Storage (gallons)	Fire Suppression Storage (gallons) [1]	Total Storage Required (gallons)	Total Storage Available (gallons)	Storage Surplus or Deficit (-) (gallons)
Riverview/ Driftwood	353	193,258	25,434	61,798	69,384	180,000	481,375	370,000	-159,874
Greenferry/ Bella	44	0	6,266	8,762	8,648	180,000	204,267	120,000	-83,676

Notes:
1. The District serves only single-family residences on parcels ranging in size from 0.15 to 64 acres.

2.9.5. *DISTRIBUTION SYSTEM*

A hydraulic analysis of the existing distribution system was completed for the current demands using the WaterCAD model. This analysis was used to identify required system improvements and allow for the identification of any special operational needs. The WaterCAD model also accounted for the altitude valve at the Highland Reservoir in terms of available storage and operational constraints. The following modeling scenarios were run:

1. Scenario 1 – Steady state analysis with PHP throughout the system under the condition where all equalizing storage volume has been depleted and assuming that all sources, except emergency, are under normal operation. The objective is to maintain a minimum pressure of 40 psi at each node.[11]
2. Scenario 2 – Steady state analysis with MDP throughout the system under the condition where all equalization and fire suppression storage volume has been depleted and assuming all sources, except emergency, are under normal operation. The objective is to maintain a minimum pressure of 20 psi at each node.[12]

2.9.5.1. *MODEL ANALYSIS BASED ON CURRENT DEMANDS*

The above scenarios were run in the model based on the current demands and the various facilities were modeled based on current configurations and capacities. Generally modeling is completed to analyze the system with regard to meeting IDAPA source redundancy rules. A complete set of results can be found in Appendix G.

Scenario 1: (PHP, Maintain 40 psi Throughout the System)

The objective of this scenario is to maintain a minimum pressure of 40 psi during PHP under the condition where all equalizing storage has been depleted and the well and boosters are operating as normal. The following is a summary of the operating conditions modeled in this scenario:

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[11] Based on IDAPA 58.01.08-Idaho Rules for Public Drinking Water Systems, Subsection 552.01.b: part v)
[12] Based on IDAPA 58.01.08-Idaho Rules for Public Drinking Water Systems, Subsection 552.01.b: part i

- Sources operating:
  - Well 1 on (538 gpm)
- Reservoir Depleted Water Levels:
  - Highland: 3.85 feet (OS + ES Removed)
  - Snowshoe: 2.25 feet (OS + ES Removed)
  - Tanglewood: 2.35 feet (OS + ES Removed)
  - Bella: 0.5 feet (OS + ES Removed)
- Boosters operating:
  - All current booster pumps operating in simplex mode.

The results of this scenario show that the existing distribution system is not sufficient to supply the estimated peak hour productions at a minimum pressure of 40 psi at certain locations within the system. The following locations show deficient pressures:

- Cedar Creek:
  - The estimated pressures at entrance of the Cedar Creek subdivision range between 17 to 31 psi.
- Riverview (S Ironwood Ln):
  - The existing 3-inch line travelling west along Riverview was estimated to have pressures ranging between 29 to 35 psi.
- Highland Rd:
  - Highest gravity service nodes in the Riverview/Tanglewood datum only supply an estimated 16 psi.

Scenario 2: (MDP + FF, Maintain 20 psi Throughout the System)

The objective of this scenario is to provide fire flows and maximum day productions while maintaining a minimum pressure of 20 psi under the condition where all equalizing and fire suppression storage has been depleted and the well and boosters are operating as normal. This models the system at the end of a fire at any given node. The following is a summary of the operating conditions modeled in this scenario:

- Sources operating:
  - Well 1 on (525 gpm)
- Reservoir Depleted Water Levels:
  - Highland: 9.1 feet (OS + ES + FSS removed)
  - Snowshoe: 7.5 feet (OS + ES + FSS removed)
  - Tanglewood: 7.0 feet (OS + ES + FSS removed) (Depleted)

    - Bella: 7.0 feet (OS + ES + FSS removed) (Depleted)
- Boosters operating:
    - All current booster pumps were operating.

The results of this scenario show that the existing distribution system is sufficient to supply the current maximum day productions at a minimum pressure of 20 psi with all pumps operating. However, none of the fire hydrants can meet the minimum fire flows while maintaining these pressures. The hydrants at Cedar Creek and Highland are at too high of elevations within the Riverview/Tanglewood datum. If fire flow were pulled off these hydrants, other areas within the system are expected to drop below the minimum 20 psi and possibly depressurize the system. For this reason, they were removed from the model.

Fire flows available within the Greenferry/Bella system were insufficient, ranging between 0.0-7.3 gpm. This is largely attributed to Bella Ridge's storage and boosting capacity, which, ran in conjunction, is not able to supply the 180,000 gallons of required fire flow.

Fire flows available in the Riverview/Tanglewood pressure datum ranged between 207-484 gpm. This indicates that if fire flows were required in the system, the pressure would likely drop below 20 psi in most of the system.

2.9.5.2. System Loss

System loss may be in the form of "lost" water or "unaccounted" for water. Water is lost when leaks occur in distribution lines or when there is unauthorized use or illegal service connections. Unaccounted for water is a result of accounting errors, inaccurate source or customer meters, and/or water leaving the system for unmetered usage such as flushing of mains and fire flows. For most water systems, system loss is between 10 and 20 percent of the total water supplied to the system[13]. AWWA's Leak Detection and Accountability Committee gave a recommendation of 10 percent for system loss in 1996.

System loss for the system was calculated as the difference between total metered production (73,177,000 gallons) and total metered consumption (52,679,000) for the year of data provided.

- System Loss = 20,498,000 gallons (28% of total production) [32.1 EDUs]

As seen, the system loss is not within the acceptable ranges listed above. The District should monitor their meter data to locate potential leaks in the distribution system as well as seek opportunities to remedy known leaks or meter errors. It is also important to note the District has observed leakage from the Highland Reservoir. This will be discussed further in Section 4.

[13] Civil Engineering Reference Manual, Sixth Edition, Michael R. Lindeburg, 1992.

2.9.6. *Operation and Maintenance Concerns*

Significant operation and maintenance concerns within the system have been focused on the age of the system as well as inability to provide pressure at higher service elevations. These concerns as well as other operation concerns are discussed more in depth in Section 4.

2.10. Existing System Deficiencies

This section summarizes the source, booster, storage, and distribution system deficiencies determined in the above analysis under current system demands.

- Source Capacity: no deficiency
- Booster Capacity:
  - Bella Mid-level booster demand is at capacity.
  - Highland Booster Station requires redundant second booster pump
- Storage:
  - Riverview/Tanglewood
    - Large amount of dead storage needed (145,220 gallons) at Highland tank to supply whole system with minimum 20 psi
    - Storage capacity deficit of 111,375 gallons.
  - Greenferry/Bella Ridge
    - Storage capacity deficit of 84,267 gallons.
- Distribution:
  - The current distribution system suffered from approximately 28% loss.
  - The existing system is not sufficient to distribute the calculated PHP and maintain a minimum pressure of 40 psi at certain locations in the system.
    - Riverview: 30-36 psi
    - Upper Highland: 15 psi
    - Cedar Creek: 17-35 psi
  - The existing system does not appear to be capable of providing fire flows while maintaining MDP and a minimum pressure of 20 psi throughout the system.
    - The Tanglewood, Bella, and Highland tanks are all depleted at the end of a fire flow event.

These deficiencies can be improved by a series of recommended improvements, which are identified in Section 4.

3. FUTURE CONDITIONS

3.1. GROWTH PROJECTIONS

The District is currently reviewing potential expansion of their service boundary and an increase to their total service connections. This growth is expected to occur through the splitting of parcels within their existing boundary. For the purpose of this report, no growth was assumed to be out of the existing District boundary.

According to U.S. Census data, the population in Kootenai County has increased from approximately 140,000 in 2010 to 155,000 in 2017. This equates to an annual growth rate of approximately 2 percent. With the District's willingness to grow and the current influx of people to the north Idaho region, it is reasonable to expect the District to grow at an equivalent rate.

For the purposes of this document, all growth in the immediate future will be within the existing boundary. For this reason, a conservative growth rate of 2 percent has been used to project future demand. The current number of EDUs was determined in Section 2.8.1 based on actual consumption data provided by the District. The estimated growth rate mentioned was applied to the current EDUs for the system to project growth.

The District's growth is anticipated to occur in multiple growth categories, which have been added to the projections to categorize the type of growth anticipated. The Growth scenarios are also shown in Figure 3.1 below, as well as supplied in Appendix A. These are described below:

- Growth A: Will-Serve Areas- The District has two areas that have already received a will-serve and will be implemented into the Greenferry water system (Bayshore, 57 lots and the remaining areas within Cedar Creek, 6 lots). Once the system's capacity deficits are addressed, it is anticipated that these will-serve areas will increase the number of residential connections by approximately 63 (63 EDUs). This is considered Growth A for the purposes of this report.
- Growth B: Not-Served Parcels within District Boundary– This assumes that each of the existing lots within the current district boundary will all be connected to the system. This is considered Growth B for the purposes of this report. Refer to Figure 3.1 for an overview of this growth.
- Growth C: Full Buildout of Existing Boundary– This assumes that each of the existing lots within the current district boundary that is not currently served are split into multiple smaller acre lots. Existing lots within the District's boundaries can be subdivided into 3, 4, and 5 acre lots, depending on the lot's location and subsequent current zoning allowance. This is considered Growth C for the purposes of this report. Refer to Figure 3.1 for an overview of this growth.

Table 3.1 below summarizes the current and projected future EDUs for the District's system based on the District's growth rate and the growth categories discussed above.

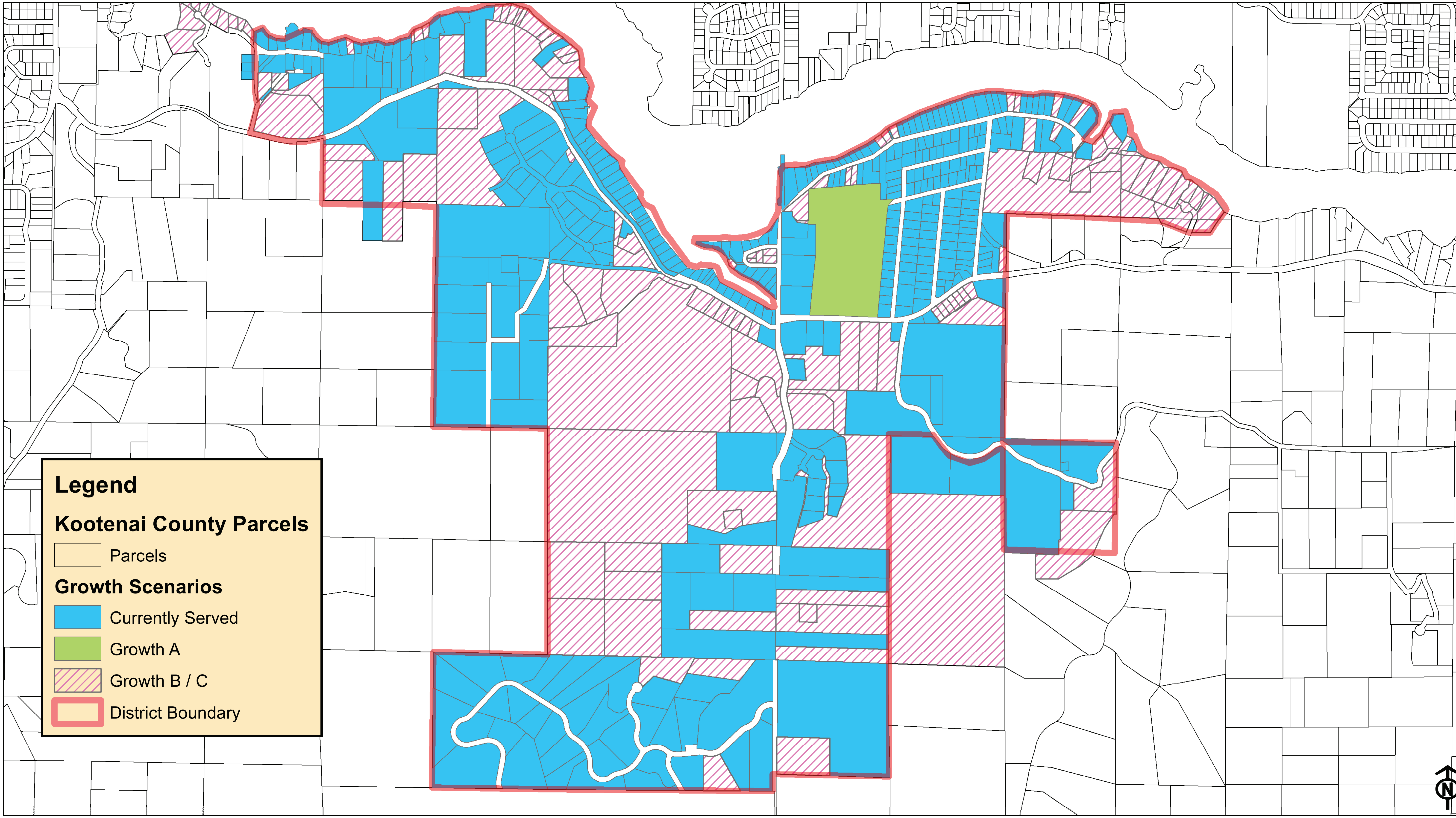
Table 3.1: Summary of Future EDUs

Current EDUs	Growth A (2028)		10-Year (2030)		Growth B (2037)		20-Year (2040)		Growth C (2043)		RAFN (2045)	
	EDU	Pop.	EDU	Pop.	EDU	Pop.	EDU	Pop.	EDU	Pop.	EDU	Pop.
397	460	1,127	484	1,186	551	1,350	590	1,456	618	1,514	651	1,595

The current and projected future EDUs for the District's different pressure zones have also been analyzed to account for future system deficiencies. The growth Table 3.2 below summarizes the current and projected Future EDUs and associated population.

Table 3.2: Future EDU Growth Scenarios

Pressure Zone	Current EDUs	Growth A (2028)		10-Year (2030)		Growth B (2038)		20-Year (2040)		Growth C (2043)	
		EDU	Pop.	EDU	Pop.	EDU	Pop.	EDU	Pop.	EDU	Pop.
Riverview/ Driftwood	353	416	1019	430	1,054	485	1,242	525	1,286	531	1,301
Pressure Zone	Current EDUs	Growth A (2020)		10-Year (2030)		20-Year (2040)		Growth B (2040)		Growth C (2054)	
		EDU	Pop.	EDU	EDU	EDU	Pop.	EDU	Pop.	EDU	Pop.
Greenferry/ Bella	44	44	108	54	132	65	159	66	162	87	213



Sources: Kootenai County GIS

WELCH-COMER ENGINEERS | SURVEYORS

www.welchcomer.com 208-664-9382

Greenferry Water and Sewer District

Areas of Growth

Figure 3.1

PROJECT NO..................41360
DRAWN BY.......................CSH
FILENAME.........................12302020_GrowthAreas
DATE................................12/30/2020

3.2. Demand Forecast

The estimates for future demands are based on the assumption that the demand per EDU will remain constant throughout the growth period (refer to Section 2.8.1 for a discussion on the EDU determination).

Tables 3.3 and 3.4 below show the estimated future demand for the 10-year, 20-year, Growth A, B and C growth periods. These demands have been used for the purposes of this report. It should be recognized that growth and demand have been estimated and will not likely occur exactly as shown.

Table 3.3: Summary of Riverview/Tanglewood Projected Future Demands

	EDUs	ADP (gpm)	MDP (gpm)	PHP (gpm)
Current	353	145	429	950
Growth A	416	170	506	1,120
10-Year	430	176	523	1,157
Growth B	485	199	590	1,305
20-Year	525	215	638	1,413
Growth C	531	217	646	1,429

Table 3.4: Summary of Greenferry/Bella Projected Future Demands

	EDUs	ADP (gpm)	MDP (gpm)	PHP (gpm)
Current	44	18	54	118
Growth A	44	18	54	118
10-Year	54	22	66	145
20-Year	65	27	79	175
Growth B	66	27	80	178
Growth C	87	36	106	234

3.3. Future System Analysis

3.3.1. Source

The future source analysis is based on providing the projected MDP for the entire system with the largest source offline. These are the same criteria that were used in the analysis of the existing source capacity in Section 2.9.2. Source requirements were based on the projected number of EDUs and the associated demand as presented in Section 3.2. Table 3.5 provides a summary of the analysis. As can be seen, the current source capacity is deficient to serve projected growth based on providing MDP with the largest source offline.

Table 3.5: Source Capacity Analysis –
MDP with Largest Pump Offline Based on Future Demand

Source Capacity (gpm)	Growth Phase	EDU	MDP + Equalization (gpd)	MDP (gpd)	MDP (gpm)	Available Source Capacity with Largest Source Down (gpd)	Source Capacity Surplus or Deficit (-) (gpd)	Source Capacity Surplus or Deficit (-) (gpm)
Well No. 1 - 538 gpm	Current	397	774,769	695,209	483	774,720	-49	0
	Growth A	460	892,761	805,532	559	774,720	-118,041	-82
	10-Year	484	940,441	847,560	589	774,720	-165,721	-115
	Growth B	551	1,079,970	964,887	670	774,720	-305,250	-212
	20-Year	590	1,164,413	1,033,182	717	774,720	-389,693	-271
	Growth C	618	1,215,867	1,082,215	752	774,720	-441,147	-306

As mentioned in Section 2.9.2, the system must also be able to meet MDP plus fire flow through a combination of source and storage with the largest source offline. As shown in Table 3.6, the current system has a deficit with regard to meeting this demand criteria in each growth phase.

Table 3.6: Source Capacity Analysis –
MDP Plus Fire Flow Over Two Hours Based on Future Demands

	Existing Conditions (Gallons)	Growth A	10-Year	Growth B	20-Year	Growth C
EDUs	397	460	484	551	590	618
MDP	64,564	75,127	78,370	91,468	98,471	103,499
Fire Flow	180,000	180,000	180,000	180,000	180,000	180,000
Total Draw	244,564	255,127	258,370	271,468	278,471	283,499
Available Source	136,800	136,800	136,800	136,800	136,800	136,800
Available Storage	370,000	370,000	370,000	370,000	370,000	370,000
System Surplus or Deficit (-)	262,236	251,673	248,430	235,332	228,329	223,301
GPM Equivalent	2,185	2,097	2,070	1,961	1,903	1,861

3.3.2. BOOSTER STATION

Per the IDAPA rules, each booster station is required to have sufficient capacity such that either the PHP or the MDP plus fire flow can be supplied with any pump out of service. The zones these boosters provide water to do not supply fire flow, thus the future capacity will be based on the estimated corresponding PHP or the MDP plus Equalization storage.

Table 3.7: Greenferry Booster Capacity Analysis –
MDP and Equalization Storage with Largest Pump Offline

Booster Pump Capacity (gpm)	Growth Phase	Zone Served by Booster (No. of EDUs)	PHP (gpm)	Available Booster Capacity with Largest Pump Down (gpm)	Booster Capacity Surplus or Deficit (-) (gpm)
75	Current	44	60	75	15
	Growth A	44	60	75	15
	10-Year	54	75	75	0
	20-Year	65	91	75	-16
	Growth B	66	93	75	-18
	Growth C	87	124	75	-49

Table 3.8: Bella Mid Booster Capacity Analysis –
MDP and Equalization Storage with Largest Pump Offline

Booster Pump Capacity (gpm)	Growth Phase	Zone Served by Booster (No. of EDUs)	PHP (gpm)	Available Booster Capacity with Largest Pump Down (gpm)	Booster Capacity Surplus or Deficit (-) (gpm)
60	Current	44	60	60	0
	Growth A	44	60	60	0
	10-Year	54	75	60	-15
	20-Year	65	91	60	-31
	Growth B	66	93	60	-33
	Growth C	87	124	60	-64

Table 3.9: Snowshoe Booster Capacity Analysis –
PHP with Largest Pump Offline Based on Future Demands

Booster Pump Capacity (gpm)	Growth Phase	Zone Served by Booster (No. of EDUs)	PHP (gpm)	Available Booster Capacity with Largest Pump Down (gpm)	Booster Capacity Surplus or Deficit (-) (gpm)
60	Current	15	24	75	51
	10-Year	18	31	75	44
	20-Year	22	39	75	36
	Growth A	42	57	75	18
	Growth B	48	71	75	4
	Growth C	51	80	75	-5

As previously stated, the Snowshoe Booster Station is currently being replaced to upsize it and provide fire flow capability. Thus, the projected capacity of the existing Snowshoe Booster Station should be revised upon completion of the project to reflect the updated capacity. Refer to Appendix L for further information on the planned improvements.

Table 3.10: Highland Booster Capacity Analysis – PHP with Largest Pump Offline Based on Future Demands

Booster Pump Capacity (gpm)	Growth Phase	Zone Served by Booster (No. of EDUs)	PHP (gpm)	Available Booster Capacity with Largest Pump Down (gpm)	Booster Capacity Surplus or Deficit (-) (gpm)
40	Current	2	5	40	35
	10 Year	2	5	40	35
	Growth A	2	5	40	35
	Growth B	2	5	40	35
	Growth C	2	5	40	35
	20 Year	3	8	40	32

3.3.3. *STORAGE*

The future storage analysis was performed based on the same analysis criteria and will evaluate the same storage components as the current storage analysis. Storage requirements for the system were evaluated based on the projected number of EDUs and associated demands as presented in Section 3.2.

Tables 3.11 and 3.12 below summarize the future storage analysis for the both the Riverview/Tanglewood and Greenferry/Bella pressure datums. As with the current storage situation, the future storage deficiency continues to grow significantly if no changes are made. However, the addition of new source and/or booster capacity can significantly decrease the deficit values.

Table 3.11: Storage Capacity Analysis Based on Future Demands (Riverview/Tanglewood)

Growth Phase	EDUs	Operating Storage (gallons)	Dead Storage (gallons)	Equalization Storage (gallons)	Standby Storage (gallons)	Fire Suppression Storage (gallons)	Total Storage Required (gallons)	Total Storage Available (gallons)	Storage Surplus or Deficit (-) (gallons)
Current	353	25,434	193,258	61,798	69,384	180,000	481,375	370,000	-159,874
Growth A	416	25,434	193,258	87,229	81,766	180,000	519,650	370,000	-197,688
10-Year	430	25,434	193,258	92,881	84,518	180,000	528,053	370,000	-206,092
Growth B	485	25,434	193,258	115,083	95,329	180,000	561,066	370,000	-239,104
20-Year	525	25,434	193,258	131,230	103,191	180,000	585,075	370,000	-263,113
Growth C	531	25,434	193,258	133,652	104,370	180,000	588,676	370,000	-266,715

Table 3.12: Storage Capacity Analysis based on Future Demands (Greenferry/Bella Ridge)

Growth Phase	EDUs	Operating Storage (gallons)	Dead Storage (gallons)	Equalization Storage (gallons)	Standby Storage (gallons)	Fire Suppression Storage (gallons)	Total Storage Required (gallons)	Total Storage Available (gallons)	Storage Surplus or Deficit (-) (gallons)
Current	44	6,266	0	8,762	8,648	180,000	204,267	120,000	-83,676
Growth A	44	6,266	0	8,762	8,648	180,000	204,267	120,000	-83,676
10 Year	54	6,266	0	12,799	10,614	180,000	210,270	120,000	-89,679
20 Year	65	6,266	0	17,239	12,776	180,000	216,872	120,000	-96,281
Growth B	66	6,266	0	17,643	12,973	180,000	217,472	120,000	-96,882
Growth C	87	6,266	0	26,120	17,100	180,000	230,077	120,000	-109,486

3.3.4. *DISTRIBUTION SYSTEM*

Typically, distribution modeling is not conducted for the growth scenario because the location is unknown. However, due to the complexity of the improvements recommended in Section 4, an abbreviated future model was created to review the suitability of the improvements. This will be discussed in Section 4. We recommend that prior to approving growth (new developments or significant change to the growth scenarios presented here), the District require the developer to fund an analysis of the impacts to the distribution system.

3.4. ANALYSIS RESULTS (THROUGH GROWTH C)

This section summarizes the current source, booster, storage and distribution system deficiencies determined in the above analysis under Growth system demands.

- Source - The following surpluses and deficiencies (-) were identified with respect to meeting MDP plus Equalization Storage with largest source offline:
  - Current: 0 gpm
  - Growth C: (-324) gpm
- Booster Capacity-The following surpluses and deficiencies (-) were identified:
  - Greenferry Booster (MDP + EQ Storage w/ Largest Pump Offline)
    - Current: 15 gpm
    - Growth C: (-49) gpm
  - Bella Ridge Booster (MDP + EQ Storage w/ Largest Pump Offline)
    - Current: 0 gpm
    - Growth C: (-64) gpm
  - Snowshoe Booster (PHP w/ Largest Pump Offline)
    - Current: 22 gpm

        - Growth C: (-77) gpm[14]
    - Highland Booster (PHP w/ Largest Pump Offline)
        - Current: 35 gpm
        - Growth C: 35 gpm
- Storage: The following surpluses and deficiencies (-) were identified assuming no system upgrades have been made.
    - Riverview/Tanglewood Pressure Datum:
        - Current: (-111,375) gallons
        - Growth C: (-218,216) gallons
    - Greenferry/Bella Ridge Pressure Datum:
        - Current: (-84,267) gallons
        - Growth C: (-110,077) gallons
- Distribution:
    - It is assumed the same deficiencies demonstrated by the hydraulic model grow under the projected growth scenarios.

[14] Refer to note previously regarding the replacement of this booster station; refer to Appendix L for further information.

4. CAPITAL IMPROVEMENT PLAN

System deficiencies were identified in the previous analysis sections and the District plans to install improvements to serve projected demands through Growth C. This section presents the estimated cost of each improvement and illustrates potential phasing of improvements. Refer to Appendix H for the Engineer's Opinion of Probable Project Costs. Also refer to Section 9 for a discussion of the environmental impacts of each improvement presented.

The report prepared by ACE Solutions also included a list of capital improvements; some of those improvements have been included herein (and are noted as such). Improvements recommended in this section that conflict with any of ACE's listed improvements, are considered our alternative improvement suggestion. Refer to Appendix H for further information.

4.1. DEVELOPMENT AND EVALUATION OF IMPROVEMENTS

4.1.1. SOURCE ALTERNATIVES

4.1.1.1. UPSIZE WELL SOURCE CAPACITY

The District can add capacity to the system by upsizing the existing pumps and motors at their existing wells. The existing well casings are each 12-inch and could potentially house larger pumps that can produce up to 850 gpm with submersible pumps or vertical line shaft turbine pumps. The current wells consist of one submersible pump and one vertical line shaft turbine. It is recommended that an alignment test and well video be completed prior to design to evaluate the well casing since the status of the well casings and existing pumps is relatively unknown. The well alignment will inform the District as to the suitability of submersible versus vertical line shaft turbine. This investigation will also allow the District to examine the condition of the existing pumps. IDEQ will also require a re-analysis of the potential influence of the Spokane River (groundwater under direct influence, GUIDI) at the higher pumping rate; this can be completed in conjunction with test pumping. The estimated project cost of this improvement is $715,100 and assumes vertical line shaft turbine pumps discharging to system pressure at approximately 850 gpm each with a standby generator. Under this scenario, a total diversion of 850 gpm would need to be authorized through the District's water rights. The current maximum allowable diversion rate is 2.05 cfs, equivalent to approximately 920 gpm and should be sufficient.

Environmental impacts associated with this option can be found in Section 9.2.1.1.

4.1.1.2. NEW WELL

The District can also add source capacity by drilling a new 600 gpm that is capable of pumping directly to distribution. The existing well site is likely not large enough to house a third well; thus, the District would need to pursue a new well site elsewhere. The new well site would likely need to be north of Riverview Drive in the vicinity of the existing wells. The estimated cost of this improvement is approximately $945,000, and includes land acquisition (estimated), new well house and standby generator. Under this scenario, a total diversion of 900-950 gpm[15] would need to be authorized through the District's water rights; the new well would be backup to the existing two wells. The current maximum allowable diversion rate is 2.05 cfs, equivalent to approximately 920 gpm and should be sufficient. The new well would need to be added to the District's existing water rights as a point of diversion.

Environmental impacts associated with this option can be found in Section 9.2.1.2.

4.1.1.3. <u>Other Source Improvements</u>

ACE Solution's report listed a standby generator at the existing well site as an improvement option. This has been incorporated into the estimates above.

4.1.1.4. <u>No Improvement</u>

As mentioned previously, the District's source capacity is estimated to be "at capacity" and no current deficiency exists. The District is expected to serve additional connections, as discussed in Section 3. Thus, if additional connections are sought within the District, source improvements will need to occur.

Environmental impacts associated with this option can be found in Section 9.2.1.3.

4.1.2. <u>Storage Alternatives</u>

4.1.2.1 <u>Expand Bella Ridge Reservoir</u>

A storage deficiency was identified at the Greenferry/Bella Ridge datum in Section 2.9.4. One solution is to add an additional reservoir to the datum. This improvement would allow for the entire existing pressure datum to meet fire flow requirements. This improvement, in conjunction with the Greenferry Bypass improvement, would increase the fire flow available for the entire system.

The existing Bella Ridge reservoir site allows for another equally sized tank. Based on Bella Ridge's existing dimensions and capacity of 120,000 gallons, the total capacity would sum to 240,000 gallons. This improvement would provide sufficient storage through the projected Growth C scenario with a small surplus. The Bella Mid-Level booster pump station would need to be expanded in conjunction with this improvement (upsize to (3) 70 gpm pumps). The estimated project cost of the additional reservoir and booster upgrades is $457,100.

Environmental impacts associated with this option can be found in Section

[15] Refer to Section 2.5.2.1 discussing the District's recent test of running the existing wells together, producing approximately 900-950 gpm. This pumping rate will need to be further tested and finalized with modifications to the system to facilitate this operational scenario.

9.2.2.1.

4.1.2.2 Highland Reservoir

The District's existing Highland reservoir is in poor condition and has been investigated for leakage. The investigation yielded that the reservoir has existing leaks. The District believes it should be replaced as part of their capital improvement plan. Further structural investigation should be completed to determine the appropriate prioritization of this replacement or if a different rehabilitation can be completed. ACE Solutions provided an estimate for replacing the reservoir of $280,000. We would recommend budgeting for replacement but if a lesser cost rehabilitation could be completed, the district should consider the lesser cost alternative.

Additionally, the reservoir currently has an excess of dead storage. This can be addressed in a number of ways:

- Replace and increase height of reservoir to allow for dead storage (refer to Section 4.1.2.2.1)
- Relocate reservoir further up the hill (refer to Section 4.1.2.2.2)
- Reconfigure Upper Highland Booster Station to feed elevated services (refer to Section 4.1.3.1.1)
- Request individual booster stations from IDEQ and reduced fire flow from Fire District (refer to Section 4.1.3.1.2)
- Per ACE Solutions – install recharge booster and configure to feed elevated services (refer to Section 4.1.3.1.3)

The first two options are discussed below. It is important to note these options could create hydraulic issues within the system's operation due to the reservoirs higher elevation with respect to the existing Snowshoe and Tanglewood tanks. This could be overcome with appropriate valving, but it could create a challenge long-term for system operation.

4.1.2.2.1 Replace and Increase Height of Highland Reservoir

This improvement option would consist of replacing the existing Highland reservoir with a new reservoir at an increased height to supply dead storage pressure to the lower services and increase available storage. This option would require minimal piping to connect to the existing system. However, this would include more of a "standpipe" type reservoir which may be difficult to negotiate with the adjacent property owners. This option's project cost is estimated to be $655,700.

Environmental impacts associated with this option can be found in Section 9.2.2.2.

4.1.2.2.2 Relocate Highland Reservoir

The District can also opt to relocate the reservoir to a higher elevation to eliminate the dead storage and maintain the existing usable storage volume. This improvement would require an extension of 8-inch water line as well as land acquisition and booster reconfiguration at the Upper Highland Booster Station. This improvement project cost is estimated to be $599,500.

Environmental impacts associated with this option can be found in Section 9.2.2.1.

4.1.2.3 Other Storage Improvements

ACE Solutions included implementation of a SCADA system within the District's recommended improvements. This would allow for real time data collection on the District's facilities. ACE Solutions' estimated improvement costs for this project are $99,160.

4.1.2.4 No Improvement

The District currently has a storage deficit at the Greenferry/Bella Ridge and cannot meet the required storage capacity needs based on IDAPA Rules, specifically with respect to fire flow. The Highland area also has an issue with dead storage while meeting system pressure requirements for several elevated services. Thus, if additional connections are sought within the District, system improvements will need to occur. Additionally, if no improvements are made, the system is not able to reliably meet customer demand during peak months. Thus, it is not reasonable for the District to avoid storage improvements.

Environmental impacts associated with this option can be found in Section 9.2.2.3.

4.1.3. Booster Alternatives

4.1.3.1 Highland Pressure

The District can address service pressure deficiencies in the Riverview/Tanglewood pressure datum experienced by approximately four services in a couple different ways (as outlined in Section 4.1.2.2):

- Reconfigure Upper Highland Booster Station to feed elevated services (refer to Section 4.1.3.1.1)
- Request individual booster stations from IDEQ and reduced fire flow from Fire District (refer to Section 4.1.3.1.2)
- Per ACE Solutions – install recharge booster and configure to feed elevated services (refer to Section 4.1.3.1.3)

These options are discussed below.

4.1.3.1.1 Reconfigure Upper Highland Booster Station

This improvement option would consist of reconfiguring the existing, small Upper Highland Booster Station to include two 35 gpm pumps as well as two 1,500 gpm fire pumps. This will supply sufficient pressure to the upper highland services as well as provide adequate fire flow while also eliminating the dead storage calculated for the Highland reservoir. The improvement includes installing approximately 950 feet of 8-inch waterline extension down to the end of the existing 3-inch line. The booster station would require 3-phase power for the fire pumps, which has been approximated for the purpose of this report. The estimated project cost of this improvement is approximately $602,600. A map of this improvement is shown in Figure 4.1 as well as included in Appendix A.

Environmental impacts associated with this option can be found in Section 9.2.3.1.

4.1.3.1.2 Request Individual Booster Stations from IDEQ and Reduced Fire Flow from Fire District

Since there are only approximately four services scattered along the Highland Road waterline that require higher pressure, this option involves installing individual booster pumps at each of these services. These booster pumps would be installed and maintained by the District and would provide the necessary pressure to the higher elevation services[16]. It is important to note that these would need to be approved by IDEQ as they are allowed on a case-by-case basis. Additionally, the fire flow available at the hydrant is approximately 500 gpm. This should be alerted to and accepted by the Fire District before finalizing this option[17]. This option is estimated to cost $57,500. A map of this improvement is shown in Figure 4.1 is included in Appendix A.

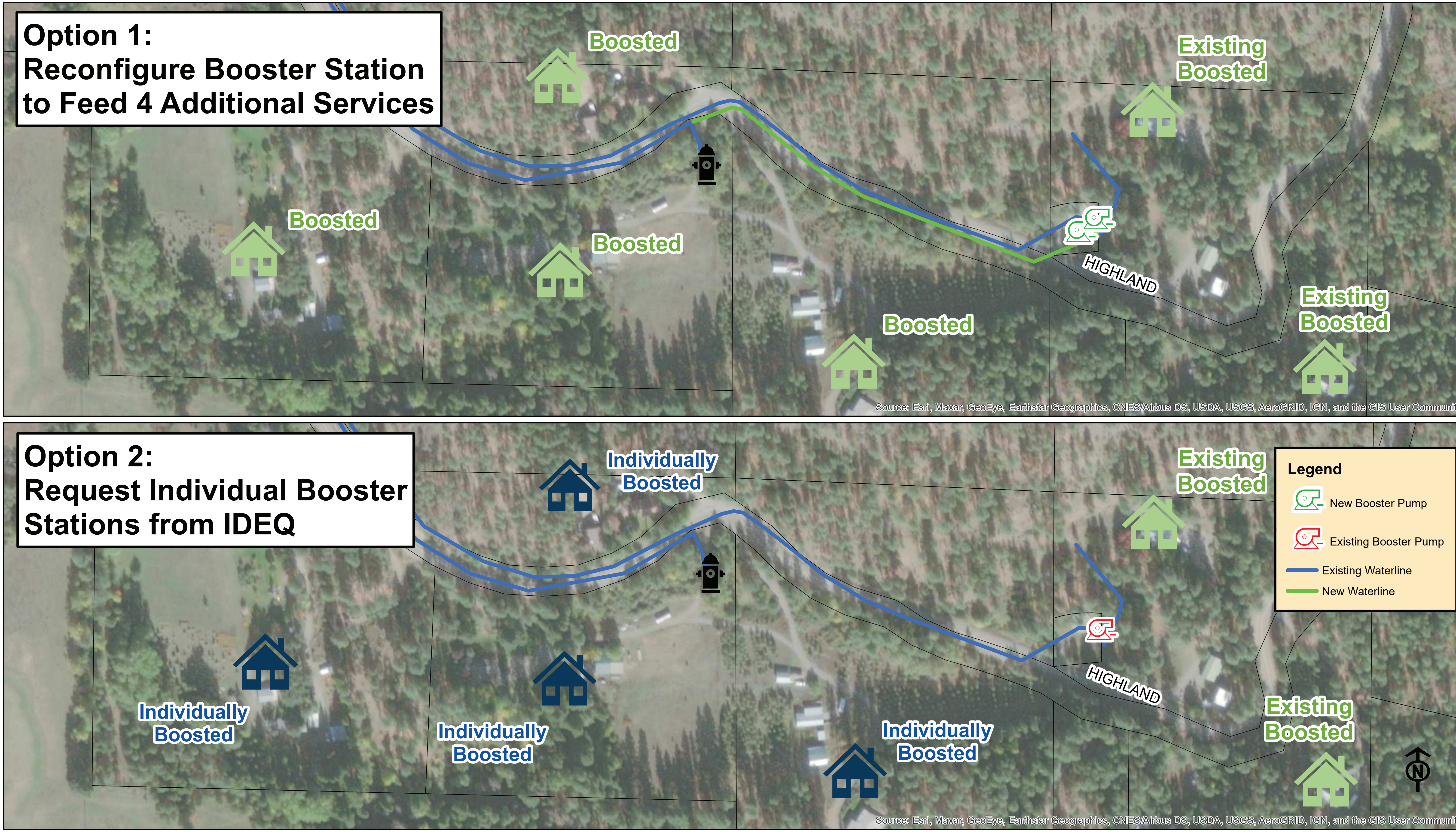
Environmental impacts associated with this option can be found in Section 9.2.3.2.

4.1.3.1.3 Per ACE Solutions – Install Recharge Booster and Configure for Services

Section 4.1.3.4.1 below discusses a booster station relocation project proposed by ACE Solutions. This option could be modified to include facilities to pressurize the elevated services as well as provide fire pumps. This option was not estimated as Welch Comer does not believe it is the most efficient method for addressing the Highland service issue, but it could be pursued by the District if desired.

[16] It is important to note the mainline may still experience substandard pressures in these locations even if the individual boosters are installed at each of the services mentioned.

[17] This may also impact the homes' fire insurance rating; however, this would be determined by the Fire District.



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Greenferry Water and Sewer District

Highland Booster Station Improvements

Figure 4.1

Sources: Kootenai County GIS

PROJECT NO..................41360
DRAWN BY.......................CSH
FILENAME........................010420201_HLBoosterStationImprovements
DATE................................01/27/2021

4.1.3.2 Greenferry Bypass

ACE Solutions proposed installing a bypass around the Greenferry Booster Station to allow flow from the Greenferry/Bella Ridge datum to transfer to the main Riverview/Tanglewood datum. A dual flow PRV will be installed at Reserve Drive to equalize the elevation of the Greenferry/Bella Ridge pressure datum as well as allow water to flow in from the Riverview/Tanglewood pressure datum when under fire demand. This would increase fire flow available within the main system (by up to approximately 200 gpm) as well as allow the Highland reservoir to be taken offline in emergency situations. ACE's estimate for this improvement is $95,000.

Environmental impacts associated with this option can be found in Section 9.2.3.3.

4.1.3.3 Greenferry Booster Station

As mentioned previously, the current system is not able to supply adequate pressure and fire flow to the Cedar Creek area under the current configuration. There are two primary methods for addressing this issue, which are discussed below.

4.1.3.3.1 Relocate Greenferry Booster Station

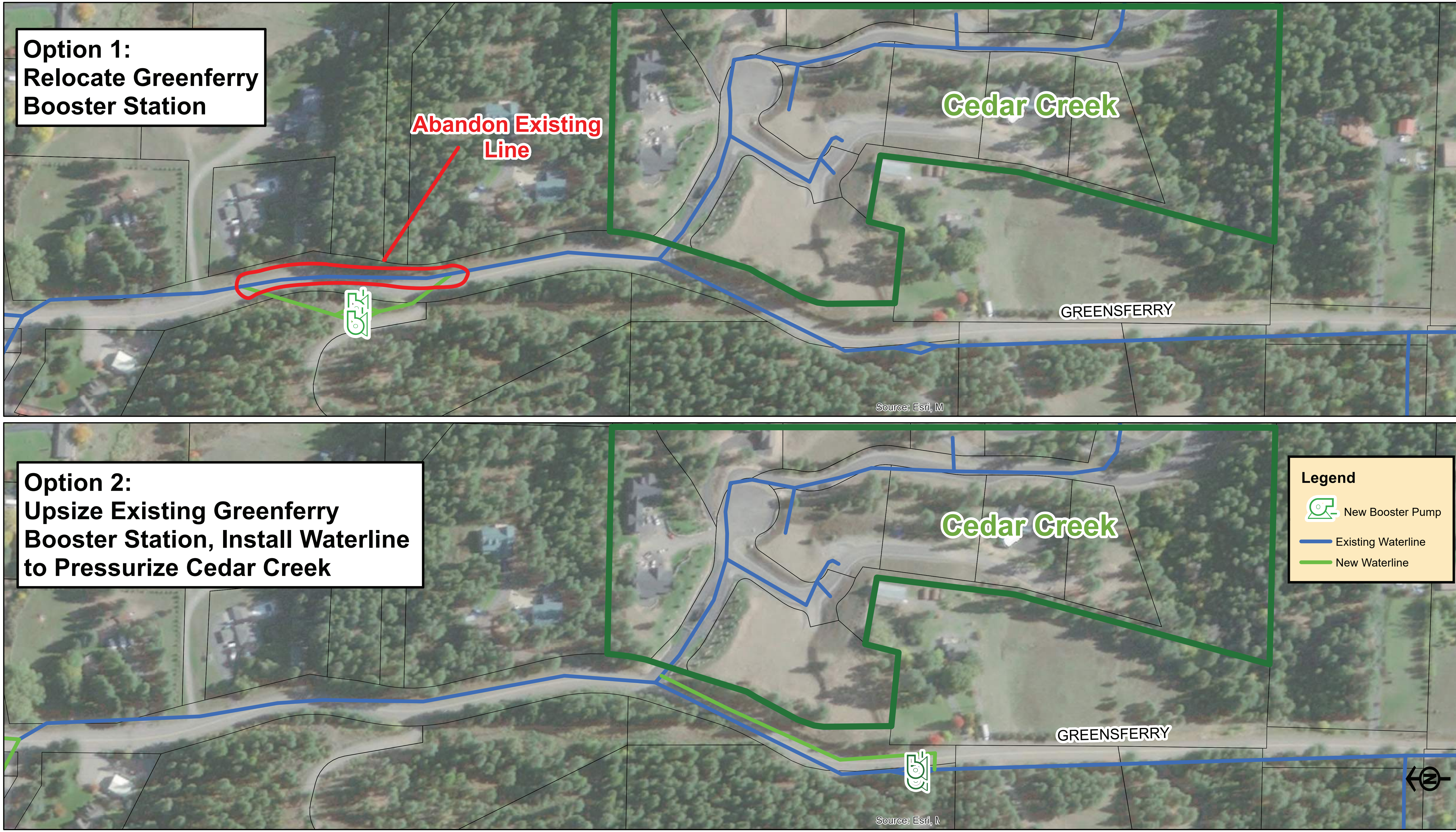
The District can supply pressure and water to Cedar Creek by relocating the Greenferry Booster Station approximately 800 feet north. The Cedar Creek area would then be pressurized by the Greenferry Booster Station and fire flow would be served through the Greenferry Bypass (refer to Section 4.1.3.2). The booster station would be upsized to account for Cedar Creek as well as anticipated growth in the area to 160 gpm with the largest pump offline. The upgrade would require 3-phase supply the upgraded boosters. The estimated cost of this improvement is $300,700. A map of this improvement is shown in Figure 4.2 as well as included in Appendix A.

Environmental impacts associated with this option can be found in Section 9.2.3.1.

4.1.3.3.2 Expand Existing Greenferry Booster Station

The District could also supply Cedar Creek by expanding the existing booster station and installing a boosted waterline to the area. This option was developed as a shorter-term solution compared to booster station relocation. However, the Greenferry Booster Station is aging and needs to be replaced and the upgrade would likely require 3-phase power. Thus, relocation is likely a more efficient use of funds, but this option is presented as well. The estimated cost of this improvement is $269,500.

Environmental impacts associated with this option can be found in Section 9.2.3.1.



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Greenferry Water and Sewer District

Greenferry Booster Station Improvements

Figure 4.2

Sources: Kootenai County GIS

PROJECT NO...................41360
DRAWN BY.......................CSH
FILENAME........................12312020_HLBoosterStationImprovements
DATE.................................12/31/2020

4.1.3.4 *Other Booster Improvements*

ACE Solutions recommended several other booster station upgrades, as follows.

4.1.3.4.1 *Booster Station Relocation*

This project, referred to in ACE's report as Project #4 consisted of relocating and upgrading the Greenferry Booster Station and Snowshoe Booster Station as well as installing a new booster station below Highland Reservoir. The purpose of this project was to increase available head, provide water and pressure to existing and new connections with the overall intention to recharge the reservoirs quicker. Welch Comer does not concur this is the most efficient way to address these issues; however, these options could be pursued by the District. It is important to note the Snowshoe Booster Station upgrade is underway, as part of the agreement with Riverview Heights (to provide better pressure and fire flow). Additionally, a recharge booster station was installed downgradient of the Snowshoe and Tanglewood tanks as part of that project. Both these projects are discussed further in Appendix L.

4.1.3.4.2 *Booster Station Upgrades*

This project, referred to in ACE's report as Project #8 consisted of bringing the Highlands and Snowshoe booster stations into compliance with upgrades mentioned in the recent sanitary survey. These are addressed in other alternatives discussed above and thus are not included herein.

4.1.3.5 *No Improvement*

The booster pump station upgrades discussed above will address sub-standard system pressure and other system deficiencies; however, these are isolated to specific areas in the system. The District should seek to remedy these issues to provide adequate pressure to their customers as funding is available.

Environmental impacts associated with this option can be found in Section 9.2.3.4.

4.1.4. *Distribution Alternatives*

The hydraulic model has identified several areas within the current service area that do not appear to be able to meet recommended fire flows, even after source deficiencies are addressed (if the District were to select this option). Sections of water main within these areas must be replaced in order to increase fire flow capacity and/or address system pressures. A map highlighting these Distribution improvements is shown in Figure 4.3, this map is also included in Appendix A. These projects are discussed below.

4.1.4.1 *Greensferry Water Main Upsize*

This improvement will replace approximately 2,450 linear feet of 4-inch water main with 8-inch waterline. The water line will be replaced along Greensferry Road between the Well Site location and the beginning of W. Granite Point Road. This improvement would improve the fire flow within this location as well as reduce overall system pressure in the area. The estimated cost of this improvement is $449,100.

Environmental impacts associated with this option can be found in Section 9.2.4.1.

4.1.4.2 Riverview Water Main Upsize

This improvement is proposed to supply sufficient pressure to the east end of Riverview Road. Approximately 4,800 lineal feet of water main will need to be upsized from 6-inch to 12-inch waterline from Snowshoe Road to S. Ironwood Lane. This improvement would improve the fire flow within this location as well as supply operating appropriate pressure. The location of this improvement is challenging located along a busy roadway as well as in rocky terrain. Thus, the District should seek opportunities to partner with transportation projects or development in the area to reduce cost. The estimated cost of this improvement is $1,170,400.

Environmental impacts associated with this option can be found in Section 9.2.4.1.

4.1.4.3 Transmission from Wells to Greensferry Road

Source water currently reaches the system through undersized transmission and distribution mains. This improvement will replace approximately 3,100 lineal feet of 3-inch and 4-inch line with 10-inch and 8-inch piping. 10-inch piping will be installed from the Well lot along Kelly Road to Patrick Drive. South of Patrick Drive, new 8-inch piping will continue south to Riverview Drive and tie into new 10-inch piping which will be installed in between Greenferry Road and Highland Drive. 10-inch stubs for the proposed subdivision will be installed half-way between Greenferry Road and Highland Drive, along Riverview Road as well as at the intersection of Kelly Road and Patrick Road. This will reduce head loss through this section and increase overall fire flow and distribute system pressure more adequately. The estimated cost of this improvement (provided by ACE Solutions) is $498,125[18].

Environmental impacts associated with this option can be found in Section 9.2.4.1.

4.1.4.4 Greenferry Terrace Upgrades

The existing lines within the Greenferry Terraces area range between 3-inch and 4-inch; this is causing large pressures at services and an inability to supply sufficient fire flow. Upsizing these lines to 8-inch (approximately 3,600 lineal feet) would remedy these deficiencies. The upgraded lines would connect into the proposed transmission

[18] ACE Solutions proposed an alternate to this option that would consist of a dedicated transmission. The cost estimate for this is $307,577.

upgrade (refer to Section 4.1.4.3). These improvements are estimated (by ACE Solutions) to be approximately $1,055,687.

Environmental impacts associated with this option can be found in Section 9.2.4.1.

4.1.4.5 Snowshoe/Tanglewood Upgrades

The Snowshoe/Tanglewood area (in the area currently boosted by the Snowshoe Booster Station) is not capable of providing fire flow. The waterline in that area is also undersized. This improvement would consist of upsizing approximately 2,400 lineal feet of 4-inch main with 8-inch main. Hydrants would also be installed in the area. ACE Solution's estimated cost for this improvement is $637,020. It is important to note a part of this project has been completed in agreement with the Riverview Heights developer.

Environmental impacts associated with this option can be found in Section 9.2.4.1.

4.1.4.6 Crystal Bay Upgrades

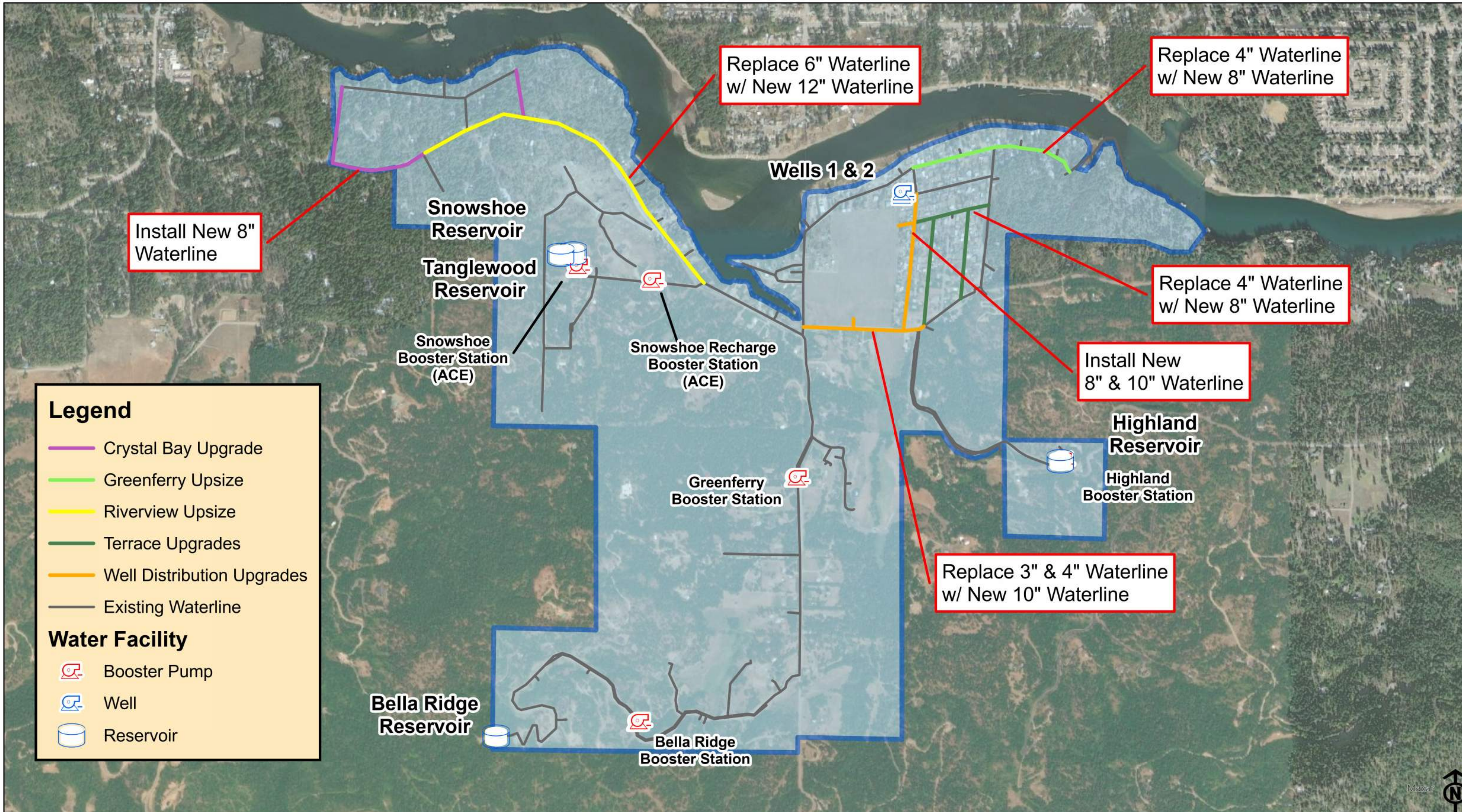
The hydraulic model shows the Crystal Bay area is deficient in providing fire flow. This improvement will include the installation of approximately 2,825 lineal feet of 8-inch to loop the existing Crystal Bay area. This will allow water to be distributed in multiple directions to increase fire flow and pressure within the area. ACE Solution's estimated cost for this improvement is $1,102,440.

Environmental impacts associated with this option can be found in Section 9.2.4.2.

4.1.4.7 No Improvements

Under this improvement option, all transmission pipe would remain as is, with no major improvements. However, the system's large amount of water loss will not be addressed, and fire flow requirements will remain deficient. With the existing system's deficits and District's desire to grow, the transmission main must be upsized to meet future demand. Therefore, it is impractical for the District to choose the "no improvement" option.

Environmental impacts associated with this option can be found in Section 9.2.4.3.



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Sources: Kootenai County GIS

Greenferry Water and Sewer District

Distribution Improvements
Figure 4.3

PROJECT NO..................41360
DRAWN BY.......................CSH
FILENAME........................01042021_FutureDistImprovements
DATE.................................02/09/2022

4.2. HYDRAULIC MODELING

The hydraulic model was updated to broadly apply anticipated growth and recommended improvements. The scenarios discussed in Section 2.9.5 were then run in the model to evaluate the suitability of the options discussed above.

The source was updated to reflect the larger pumps installed in the existing wells. The addition of another well would likely add further capacity; thus, it was not modeled. Storage was added at Bella Ridge to increase storage available in that zone. The various distribution replacements and upsizes were modeled as well.

The Highland pressure issue was modeled utilizing the booster station reconfiguration; further modeling of the reservoir (height or relocation) can be done at a future date. The Greenferry/Cedar Creek issue was modeled as both the booster station relocation and the booster station expansion. This will be discussed further below.

A complete set of results can be found in Appendix G.

Scenario 1: (PHP, Maintain 40 psi Throughout the System)

The objective of this scenario is to maintain a minimum pressure of 40 psi during PHP under the condition where all equalizing storage has been depleted and the well and boosters are operating as normal. The following is a summary of the operating conditions modeled in this scenario:

- Sources operating:
  - Well 1 (850 gpm)
- Reservoir Depleted Water Levels:
  - Highland: 5.3 feet (OS + ES Removed)
  - Snowshoe: 3.7 feet (OS + ES Removed)
  - Tanglewood: 3.8 feet (OS + ES Removed)
  - Bella: 0.7 feet (OS + ES Removed)
- Boosters operating:
  - Boosters operating with largest pump offline

The results of this scenario show that (with all the improvements installed), the system is able to support Growth C peak hour productions at a minimum pressure of 40 psi in the majority of the system.

Scenario 2: (MDP + FF, Maintain 20 psi Throughout the System)

The objective of this scenario is to provide fire flows and maximum day productions while maintaining a minimum pressure of 20 psi under the condition where all equalizing and fire suppression storage has been depleted and the well and boosters are operating as normal. This models the system at the end of a fire at any given node. The following is a summary of the operating conditions modeled in this scenario:

- Sources operating:
  - Well 1 (850 gpm)
- Reservoir Depleted Water Levels:
  - Highland: 10.5 feet (OS + ES + FSS removed)
  - Snowshoe: 8.9 feet (OS + ES + FSS removed)
  - Tanglewood: 7.0 feet (OS + ES + FSS removed) (Depleted)
  - Bella: 5.9 feet (OS + ES + FSS removed)
- Boosters operating:
  - Boosters operating with largest pump offline

The results of this scenario show that the existing distribution system is sufficient to supply the Growth C maximum day productions at a minimum pressure of 20 psi. It is also important to note that the current system can now provide the recommended fire flow to any fire hydrants within the system at Growth C, with some areas between 1,000 gpm (the historically approved fire flow level) and 1,500 gpm.

The options for serving Cedar Creek were modeled (relocating Greenferry Booster Station vs. expanding the existing Greenferry Booster Station). The notable difference was found in the fire flow scenario. The relocation provides approximately 1,500 gpm to 1,800 gpm whereas the expansion only can support 1,000 gpm to 1,200 gpm. This is likely due to the location of boosted pressure and effectively re-zoning the Cedar Creek area.

The District has desired to prioritize the improvements at Greenferry Terraces and thus this improvement was modeled in isolation of the other improvements (no other improvements made in the model). The model showed this improvement (without any other modifications to the system) would increase fire flow from 480 gpm to 1,180 gpm in that area.

4.3. Sustainability Review

4.3.1. Capital Improvement Plan and Budget

The District has been in the facility planning process since 2016 and has since implemented a capital reserve portion of their rate structure. This is intended to fund improvements to the system, including asset replacement. The capital reserve portion of the rate is deposited into a capital fund.

4.3.2. *Consumption Based Pricing*

The District currently includes a set base amount of water in their base monthly pricing (25,000 gallons per month) and charges extra fees for consumption over the base use. The overage fees are tiered and increase for higher water use each month; these fees are intended to encourage conservation and reduce overall use. The District is considering a zero-base rate, as discussed in Section 2.4; however, this has been met with resistance from the District customers in the past. The actual rate and base fee will be determined at the time the Board chooses to change the rate structure.

4.3.3. *EPA Green Power Partner*

The District is considering becoming an EPA Green Power Partner. By becoming a Green Power Partner, the district commits to using green power (renewable energy) for all, or a portion, of their annual electricity consumption. In return, the EPA provides technical assistance, resources, and opportunities, including but not limited to: credible usage benchmarks, market information, and public recognition to companies and other organizations that use green power.

4.3.4. *EPA Green Building Management*

By becoming a Green Power Partner, the district also commits to designing, constructing, and operating existing and future facilities to save energy, water, and other resources. The District will also work to reduce waste and emissions at their facilities as well as maintain a safe, healthy, and sustainable work environment. The district will implement the following green building principles for future facilities: site analysis, water conservation, storm management, material reduction/recycling, and improved indoor environmental quality.

4.3.5. *Subsidize Voluntary Purchase of Water-Efficient Fixtures*

The District is considering subsidizing customers' purchase of water-efficient fixtures to encourage water conservation (discussed further in Section 5). The District is evaluating the budget, reserves, and other available funds to complete this.

4.3.6. *Consolidation with Other Water Systems*

The District is not currently located adjacent to any other water systems. However, new development is constantly arising. The District strives to work with developers to annex into the District in lieu of creating new public water systems in the area.

4.3.7. *Variable Frequency Drive Pumps*

The well pumps discussed previously have been proposed to pump to pressure, or directly into the system. VFDs can be utilized in these situations to allow the pumps to gradually "ramp up" to meet appropriate demands. This will be critical to the ability of the wells to pump directly to distribution without over pressurizing the system, while maintaining the capability to serve rising demands from future growth. New VFDs are currently being implemented into the new Snowshoe booster station improvements. The cost estimates for the well improvements have included VFDs.

4.3.8. *Energy Efficient Motors*

The District will likely choose NEMA approved motors to power the new source pumps to minimize the additional costs associated with increasing the systems source capacity.

4.3.9. *Supervisory Control and Data Acquisition System (SCADA)*

If it is financially feasible, the District's operator has expressed interest in installing a SCADA system to help monitor the water system. The current system has minimal monitoring capability, making it difficult to accurately track system use and monitor operations. Based on the systems current configuration, operation without a SCADA system is manageable. However, if the recommended system upgrades are put into place and a new source is able to pump directly to distribution, a SCADA system may be integral in ensuring the system is able to operate effectively and efficiently.

4.4. Final Screening of Principal Alternatives

4.4.1. *Capital Costs and Financing Plan*

The options presented above have been summarized in Table 4.1 on the following page. Detailed cost estimates can be found in Appendix H.

Table 4.1: Improvement Option Summary

Category	Improvement Description	WC/ACE	Estimated Project Cost
Source	Upsize Well Source Capacity	WC	$715,100
	New Well	WC	$945,000
	No Improvements		$0
Storage	Expand Bella Ridge Reservoir and Booster Upgrades	WC	$457,100
	Highland Reservoir		
	Replace Highland Reservoir	ACE	$280,000
	Replace and Increase Height of Highland Reservoir	WC	$655,700
	Relocate Highland Reservoir	WC	$599,500
	SCADA Improvements	ACE	$99,160
	No Improvements		$0
Booster	Highland Pressure		
	Reconfigure Upper Highland Booster Station	WC	$602,600
	Request Individual Booster Stations and Reduced Fire Flow from Fire District	WC	$57,500
	Greenferry Bypass	ACE	$95,000
	Greenferry Booster Station		
	Relocate Greenferry Booster Station	WC	$300,700
	Expand Existing Greenferry Booster Station	WC	$269,500
	No Improvements		$0
Distribution	Greenferry Water Main Upsize	WC	$449,100
	Riverview Water Main Upsize	WC	$1,170,400
	Transmission from Wells to Greensferry Road	ACE	$498,125
	Greensferry Terrace Upgrades	ACE	$1,055,687
	Crystal Bay Upgrades	ACE	$1,102,440
	Snowshoe/Tanglewood Upgrades	ACE	$637,020
	No Improvements		$0

There are only a few areas where multiple options exist to address a particular issue. These will be compared in the subsequent sections herein (Section 4.3.2-4.3.5). The options are shown in Table 4.2.

Table 4.2: Multiple Option Summary

Category	Improvement Description	WC/ACE	Estimated Project Cost
Source	Upsize Well Source Capacity	WC	$715,100
	New Well	WC	$945,000
	No Improvements		$0
Storage	Highland Reservoir		
	Replace Highland Reservoir	ACE	$280,000
	Replace and Increase Height of Highland Reservoir	WC	$655,700
	Relocate Highland Reservoir	WC	$599,500
	No Improvements		$0
Booster	Highland Pressure		
	Reconfigure Upper Highland Booster Station	WC	$602,600
	Request Individual Booster Stations and Reduced Fire Flow from Fire District	WC	$57,500
	Greenferry Booster Station		
	Relocate Greenferry Booster Station	WC	$300,700
	Expand Existing Greenferry Booster Station	WC	$269,500
	No Improvements		$0

4.4.2. *Operation and Maintenance Costs*

The operation and maintenance costs are not substantially different for the source options. There may be slightly more energy consumption for the new well (in addition to the existing wells); however, with the more efficient pump may account for this slight increase. The operation and maintenance costs for the Greenferry Booster options are not substantially different either. It is likely the costs to operate the relocated booster station would be slightly lower due to more efficient pumps. The distribution options are not anticipated to increase operation costs.

A comparative analysis has been developed (Table 4.3) to review the improvement options to assist with decision-making for the Highland pressure issue. Each cost category was evaluated independently for each option. The overall O&M cost was estimated based on the individual cost categories for each option.

Table 4.3: Operation and Maintenance Cost Comparison for Highland Pressure

Cost Category	Replace and Increase Height of Reservoir	Relocate Reservoir	Reconfigure Upper Highland	Individual Boosters
Power	Low	Low	High	Moderate
Operator	Moderate	Moderate	Moderate	Moderate
Administration	Low	Low	Moderate	High
Maintenance	Moderate	Moderate	Moderate	High
Overall	Low	Low	Moderate	High

The options for increasing the height or relocating the reservoir could be challenging to operate hydraulically, but it will likely be less maintenance than the booster station options. The individual boosters may require increased maintenance and administration due to their individuality for each service.

4.4.3. *Cost Escalation Factors for Energy Use*

The increase in energy use costs for the additional sources is expected to be minimal in the short term. Therefore, it is anticipated that the upsized wells and boosters will only run at peak times during the summer months through energy efficient VFD motors. Many of the improvements noted above are intended to reduce reliance on pumping or power and thus cost escalation for energy use should not impact the improvement suitability over the long-term.

4.4.4. *Present Worth Analysis*

A "present worth" analysis consists of comparing various alternatives on an "apples to apples" basis. This is typically done by computing 20 years of O&M expenses to a present worth value, assuming 3 percent interest. Then the present value of O&M is added to the estimated capital project cost, in order to determine the "present worth" value with which to compare alternatives. This analysis is helpful where the O&M costs vary significantly for the improvement options.

The O&M expenses were evaluated comparatively in Section 4.4.2 for the Highland pressure issue. This is included along with the estimated capital costs to provide a comparative present worth analysis below in Table 4.4 for the Highland pressure issue. The other improvements can be evaluated based on capital costs.

Table 4.4: Present Worth Analysis for Highland Pressure

	Cost Category	Replace and Increase Height of Reservoir	Relocate Reservoir	Reconfigure Upper Highland	Individual Boosters
Operations and Maintenance	Overall O&M Comparison	Low	Low	Moderate	High
Capital Cost	Upfront Improvement Costs	$655,700	$599,500	$500,700	$57,000

The present worth analysis shows that individual boosters may be the most cost effective; however, this would need to be approved by two separate entities. The reconfiguration of the Upper Highland Booster would be the lower upfront cost of the remaining options.

4.4.5. *Reliability of Supply Source*

The system operator has reported that the existing source is capable of supplying current peak day demand without seeing significant drops in pressure. However, this is with all existing source and booster pumps operating and no fire flow required. If any pump went offline or a fire flow were needed, the current source would not be able to meet demand. The addition of new source capacity provides the necessary redundancy for the current system demand while satisfying IDAPA regulations.

4.4.6. *Alternative Comparison (Environmental)*

Refer to Section 9.3 for the environmental comparison analysis of each alternative.

4.4.7. *Alternative Refinement*

The District Board met on several occasions to review the improvement options discussed in the previous sections. The recommended options to address the following issues were refined to the following (shown in red in Table 4.5).

Table 4.5: Multiple Option Summary

Category	Improvement Description	WC/ACE	Estimated Project Cost
Source	Upsize Well Source Capacity	WC	$715,100
	New Well	WC	$945,000
	No Improvements		$0
Storage	Highland Reservoir		
	Replace Highland Reservoir	ACE	$280,000
	Replace and Increase Height of Highland Reservoir	WC	$655,700
	Relocate Highland Reservoir	WC	$599,500
	No Improvements		
Booster	Highland Pressure		
	Reconfigure Upper Highland Booster Station	WC	$602,600
	Request Individual Booster Stations and Reduced Fire Flow from Fire District	WC	$57,500
	Greenferry Booster Station		
	Relocate Greenferry Booster Station	WC	$300,700
	Expand Existing Greenferry Booster Station	WC	$269,500
	No Improvements		$0

The existing well pumps and well casings are relatively unknown, so the District is planning (for budgetary purposes) to install a third well. The options for addressing the Highland pressure are challenging. The booster station reconfiguration is likely the best option from a hydraulic and regulatory agency perspective. However, the District should pursue the individual booster pumps with the agencies since it is a much lower cost. Lastly, relocating the Greenferry Booster Station is a more efficient use of funds when compared to expanding the existing booster station.

4.5. Recommended Alternative Description

The Board prioritized improvements based on the following categories:

1. Non-Fire Flow Capacity
2. Fire Flow – System Pressure
3. Fire Flow – Reliability – Operation
4. Fire Flow
5. Reliability – Maintenance or Operation

In consideration of the information presented in this section along with the priorities identified by the District, the following improvements are recommended. These are intended to address the deficiencies identified in Section 2 and 3, as outlined in Section 4. It should be noted that the recommended improvements are designed to support buildout of Growth C. Table 4.6 summarizes the recommended capital improvement plan. A map of the recommended capital improvements is provided in Figure 4.4 and in Appendix A.

- Short-Term Improvements (5-Year):
  - Increase Source Capacity: Upgrade existing source capacity or develop one new source that is capable of pumping to the distribution system and upsize Well 1 to produce 850 gpm to the storage reservoir. One source will provide the source redundancy required by IDAPA regulations.
  - Upsize Transmission from Wells to Greensferry Road: Upsize the water line from the wells to Greensferry Road. This is to reduce possible leakage in the distribution system, supply more fire flow throughout the Riverview/Tanglewood pressure datum, and reduce system pressure in the Greenferry Terraces.
  - Greenferry Bypass: Implement a bypass at the Greenferry booster station to supply extra fire suppression storage from the Bella Ridge reservoir in the event of a fire in the Riverview/Tanglewood pressure datum.
  - Greenferry Terrace Upgrades: Upsize the existing Greenferry water main sizes to reduce distribution system leakage and supply more fire flow and reduce the system pressure in the Greenferry Terraces area.
- Mid-Term Improvements (10-Year):
  - Increase Bella Ridge Storage Capacity: Construct a new tank at the existing Bella Ridge Reservoir site and upsize Bella Mid-Level booster station. This will allow the Greenferry/Bella Ridge pressure datum sufficient fire flow storage.
  - Highland Reservoir Replacement: Replace the aging Highland reservoir with an equal or larger reservoir to increase storage capacity and decrease probability for operational failure.
  - Reconfigure Upper Highland Booster: Reconfigure the Upper Highland Booster station to provide water and pressure to the higher elevation gravity services. This will remove the dead storage component of the existing Highland tank demand and provide more storage to the system. Reconfiguration requires upsizing the booster pumps as well as providing fire flow via a Fire Pump to this boosted pressure zone.
  - Greenferry Booster Station Replacement: Relocate the existing Greenferry booster station further north to pressurize the Cedar Creek

area. This will include upsizing the pumps to supply the large increase capacity and the increase in operating head.

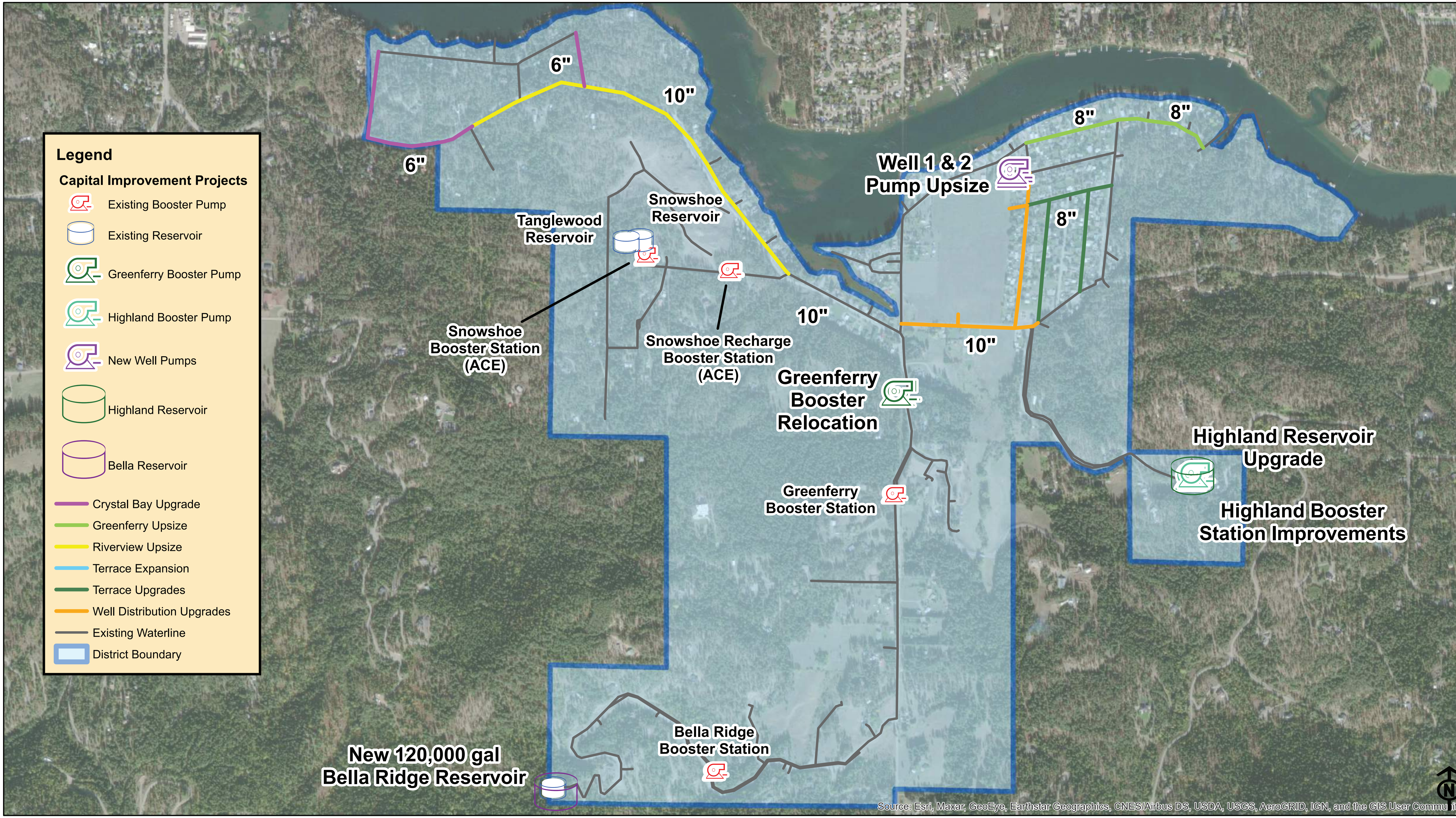
  - SCADA Improvements: Implementation of SCADA technology into the system will allow for simultaneous data collection on the District's various and spread out water facilities.

- Long Term Improvements (20-Year):
  - Riverview Upsize
  - Greensferry Upsize
  - Crystal Bay Upgrades
  - Snowshoe/Tanglewood Upgrade
  - System-Wide Easements

Table 4.6: Capital Improvement Plan

	Description	Issue Addressed	WC/ACE	IDEQ Requirement?	5-Year	10-Year	20-Year
Source	Well Pump Replacement / New Well	Non-Fire Flow Capacity	WC	Yes	$945,000		
	Generators (Included in Well Work)	Reliability - Operation	ACE				
Storage	Bella Ridge Expansion + Booster Upgrades	Fire Flow	WC			$457,100	
	Highland Reservoir Replacement	Reliability - Maintenance	ACE			$280,000	
	SCADA Upgrades	Reliability - Operation	ACE			$99,160	
Boosters	Upper Highland Booster Reconfiguration	Fire Flow – System Pressure	WC	Yes		$602,600	
	Greenferry Bypass	Fire Flow – System Pressure – Reliability	ACE		$95,000		
	Greenferry Booster Replacement	Fire Flow – System Pressure	WC	Yes		$300,700	
	Snowshoe/Tanglewood Upgrade	Fire Flow	ACE				$637,020
Distribution	Greenferry Upsize	Fire Flow	WC				$449,100
	Riverview Upsize	Fire Flow	WC				$1.17M
	Transmission from Wells to Greensferry Rd.	Non-Fire Flow Capacity	ACE	Yes	$498,125		
	Greenferry Terrace Upgrades	Fire Flow – Reliability - Operation	ACE		$1.1M		
	Crystal Bay Upgrades	Fire Flow	ACE				$1.1M
	Snowshoe/Tanglewood Upgrade	Fire Flow	ACE				$637,020
Maintenance	Easement	Reliability - Operation	ACE				$50,000
				Total:	$2.6M	$1.7M	$3.4M

Note: ACE Solutions proposed improvements to the Snowshoe Booster Station as well as a Recharge Booster Station which are currently underway. These are described more fully in their Preliminary Engineering Report, included for reference in Appendix L



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Greenferry Water and Sewer District

Capital Improvement Projects

Figure 4.4

Sources: Kootenai County GIS

PROJECT NO...................41360
DRAWN BY.......................CSH
FILENAME........................01052021_CIPMaps
DATE................................01/27/2020

4.5.1. *ESTIMATED COSTS AND POTENTIAL FUNDING FOR RECOMMENDED OPTION*

The estimated cost of the recommended improvements (5-year) identified above total $2.6 million. The other recommended improvements (10- and 20-year) total $5 million.

The District recently passed a revenue bond for $1.8 million in improvements. They have also saved approximately $500,000 in capitalization fees, totaling approximately $2.3 million available to fund the projects listed above. It is possible with project phasing and advantageous bidding; the District will be able to accomplish the 5-year projects within their existing funds. The District recently secured a private bank loan for their bond ($1.8 million), with an estimated monthly rate of $22[19] per month per customer. The District will need to consider other funding mechanisms (rates or another bond) to fund the remaining CIP total (approximately $5.1 million). If the District pursued loan funding for $5.1 million, the debt service (increase) would be approximately $50-60 per month per customer (in addition to the rate associated with the 5-year projects listed above), based on current agency loan terms with no grant included.

4.5.2. *IMPACT TO SEWER COLLECTION AND TREATMENT*

The recommended improvements are not anticipated to impact the existing sewer collection and treatment in the area. The required setbacks to on-site sewer collection and treatment will be verified and maintained for the new redundant well.

4.5.3. *ORGANIZATIONAL AND STAFFING REQUIREMENTS*

The recommended improvements are not anticipated to impact the existing organizational and staffing requirements for the system.

[19] The current fee is $15 but will be raised to $22 in a phased approach in order to repay the loan.

5. Water Conservation

The following section is included and summarized based on the report prepared by ACE Solutions. Refer to Appendix K for further information.

5.1. District Water Rates History

The District has been actively monitoring water rates since 2003 when they were $23 per month for 25,000 gallons of water, with an overage rate of $0.50 per 1000 gallons above that.

By 2006, staff made it clear that the rate structure was insufficient to meet the repairs and maintenance of the system. The rates were increased to $33.00 per month for 25,000 gallons. The Board also implemented a tiered rate structure, with $0.50 per 1000 gallons from 25,000-50,000 and $1.00 per 1000 gallons from 50,000-100,000 gallons and then reduced to $0.50 per 1000 gallons above 100,000. It was the water operator's constant repair of leaking mains that led to a drastic decrease in the amount of water lost, and it was made possible by the increased base water rates since then.

In 2016, as part of a discussion on issuing $1.8 million in revenue bonds to upgrade the system (refer to Section 4.5.1), the Board considered a Capital Reserve Fee of $15.00 per month, to initially cover the costs of maintenance (including $80,000 to replace one substandard line), and then to cover the debt service on the bonds. They also considered a zero-based rate structure, of $32.00 per month, with a tiered rate above that, to encourage residents to engage in water conservation. When presented in a public hearing, the outcry from residents was resounding, and threatened the defeat of the revenue bond. As a result, the base rate of $35.00 was retained for 25,000 gallons, and $15.00 for the Capital Reserve Fee were implemented. However, customers using water in excess of 25,000 were again billed just $0.50 per 1000 gallons.

In May 2018 the Board modified the structure to its current rates and passed its revenue bond with over 80% approval. To address the issue with DEQ on water conservation, the rates above 25,000 gallons were increased. The current base is $35.00 per month for up to 25,000 gallons of water, plus $15.00 per month for the Capital Reserve Fee, with a tiered overage rate. From 25,000-50,000 gallons, customers are billed $0.75 per 1000 gallons, from 50,000-100,000 $1.30 per 1000 gallons and for any use over 100,000 gallons the much higher fee of $2.00 per 1000 gallons.

Residents are billed the base rate and Capital Reserve Fee (total of $50.00) whether they use water or not. Meters are read monthly from June 1st – October 1st, with no readings occurring during the winter months. Table 17 summarizes the District's rates:

Table 5.1: District Water Rates

Structure	FY 2003	FY 2006	FY 2016	Current
Base Rate to 25,000 gallons	$23.00	$33.00	$35.00	$35.00
Capital Reserve Fee (per month)			$15.00	$15.00
25,000 – 50,000 gallons	$0.50	$0.50	$0.50	$0.75
50,000 – 100,000 gallons	$0.50	$1.00	$0.50	$1.30
Above 100,000 gallons	$0.50	$0.50	$0.50	$2.00

5.2. Telemetry and Controls Updates

The District's current telemetry and controls are briefly summarized in Section 2.5.1 and need upgrading and automation. The proposed improvements are discussed in Section 4.1, but with upgrades to the telemetry and controls the District will be able to conserve more water by minimizing overflow of the reservoirs, track water usage to aid in finding areas of leaks. These improvements will also provide a more accurate depiction of the District's water system which will be instrumental in future demand predictions and water system planning.

5.3. Watering Restrictions

The District currently has a water allowance built into its water rates. The higher the water use the greater the rate charged per 1,000 gallons. During drought years, the District could implement watering restrictions for irrigation of lawns, gardens, etc. to certain days or during certain hours of the day to help conserve water. The District does provide water conservation tips in its Annual Drinking Water Quality Report. One of the water conservation tips in the report is to apply water for irrigation during the cooler parts of the day or at night to reduce evaporation. If the District feels that residents are not utilizing water effectively it could propose additional water restrictions, to be approved by the public through Board meetings and appropriate public hearing processes.

5.4. Leak Detection Study

The District currently has a large discrepancy between its source meter data and individual water user metered data as shown in Section 2.9.5.2. This could indicate inaccuracies in the source water meters or water user water meters, leaks in existing water mains, or illegal connections (unaccounted for water flows) and use of District water. A currently known leak is present at the highland reservoir which attributes to large loss experienced by the system. Some leaks have been addressed by the District within the last year. The District completed a survey in the last year to locate illegal connections to the distribution system by identifying possible sites and using ground penetrating radar. The District located two illegal non-paying connections and were either eliminated or the owner was required to purchase a connection and have a meter installed. The District also installed locks and hydrant meters on hydrants and implemented a fee to purchase water by contractors. These efforts have helped to reduce the amount of unaccounted water.

As the District installs new meters, they are replaced with remote read meter sets. Once the District has half of their meters replaced, they will look at replacing the remainder and upgrading to a remote or touch read system. This improvement to the existing water meters will provide more accurate flow measurements. The District is aware portions of the system have been leaking; they have replaced some water mains to help minimize leaks. Most of these leaks are due to shallow pipelines that have been damaged during the Winter, improperly installed water mains or substandard water pipe and fittings. The District will continue to replace water mains to current District and state standards.

In the meantime, it would serve the District well to complete a leak detection study to determine the extent of the leaks in the District's water system and help isolate the locations. The leak detection study would help determine where and what the discrepancy is between the water user water consumption data and source metered data.

It will also help determine the priority of water pipeline replacement projects and help the District conserve additional water freeing more ERU's.

Lastly, as mentioned previously, the District has observed leakage from the Highland Reservoir. This is proposed to be addressed through a replacement project, identified in Section 4.

5.5. Replacement of Service Water Meters, Service Lines, and Older Water Mains

As mentioned in the previous section, the District is adding transmitter ready meter units to newly installed water sets. Once complete this will save the District time allowing its employees to devote time to other parts of the water system. The District will also be replacing existing shallow buried service water meters and service lines as required as it replaces existing shallow water mains. The replacement of service water meters, service lines, and water mains will help the District conserve water by helping prevent future leaks in the water system and providing more accurate meter readings.

6. FUNDING SOURCES

The following table shows potential funding sources that may be explored for the District's water system improvements.

Table 6.1: Financing Options

Federal Options
USDA – RD Grant/Loan
State Options
IDEQ Loan
ICDBG – Block Grant (LMI Income Survey)
Other Options
Bank Loan
District Options
Revenue Bond
LID

We recommend a staff-level meeting be held with representatives from the agencies listed above to discuss potential funding packages.

6.1. STATE AND FEDERAL FUNDING SOURCES

6.1.1. USDA – RURAL DEVELOPMENT LOAN

Rural development funds are allocated for rural systems for communities with a population of 10,000 or less. Funding is provided by Federal Budget Appropriation and distributed to applicants for repair, improvement or expansion of water facilities. The application for this funding is open and can be applied for at any time.

6.1.2. IDEQ LOAN

The primary source of loan assistance for improvements to the water system is through the IDEQ Loan funds are allocated on the basis of a statewide priority list. Letters of Interest for this funding are due in January. The statewide priority list is published in March and finalized offers are typically mailed in June or July.

6.1.3. BANK LOAN

Interest rates on bank loans have come down to the point they can be very competitive with federal and state loans. The other advantage to this funding is the significantly reduced "red tape" typically required with state or federal sourced funds.

6.1.4. IDAHO DEPARTMENT OF COMMERCE (IDOC)-IDAHO COMMUNITY DEVELOPMENT BLOCK GRANT (ICDBG)

These grants are available for assistance to Idaho cities and counties with a population of less than 50,000. The purpose of this type of grant is to aid the development of public infrastructure and housing in order to support and stimulate economic diversification and growth. Funds received from the U.S. Department of Housing and Urban Development are allocated into the six available grant types. The maximum amount that an IDOC grant would cover would be 30 percent of the total project costs, requiring a minimum 70 percent match from the community. The 2022 deadline for Block Grant application is past so the District would have to wait for the 2023 grant cycle to apply for funding.

6.1.5. FEMA Building Resilient Infrastructure and Communities (BRIC) Grant

This grant is available for assistance to states, local communities, tribes and territories that are involved with natural hazard mitigation projects. The District should apply for this grant to help fund the implementation of backup generators in the case of a power outage in the system. This grant, however, places the funding of generators as a low priority. It is recommended that the District reach out to other water systems looking to add backup generators to increase the project size or look for other natural hazard mitigation projects to increase the probability of being rewarded this grant. The BRIC Grant would cover up to 75% of the total project costs, requiring a minimum 25% match. The 2023 application submission deadline for this grant is January 1, 2023.

6.1.6. FEMA State Homeland Security Grant (SHSP)

This grant assists state, local, tribal, and territorial projects that are preventing, protecting against, mitigating, responding to and recovering from acts of terrorism and other threats. This grant is applied for through Kootenai county and the funds are later distributed amongst approved projects. The District is expected to have greater success in approval applying for this grant than with the BRIC grant. The application date for the 2022 funding year was August 10, 2021. However, Kootenai County takes applications throughout the year as on occasion, additional funding becomes available. The next funding date is anticipated to be in August 2022. It is recommended that the District pursue applying for this grant to fund risk mitigation capital improvements.

6.2. Local Match Funding

6.2.1. Revenue Bond

A revenue bond is formed by an election of resident voters within the District. A simple majority (50%) is required to pass the bond. The bond is repaid by user fees (revenue) generated by the utility. Vacant lots cannot be charged for the bond costs under a revenue bond.

6.2.2. LID

A Local Improvement District (LID) is formed by public hearing process, rather than an election. A LID bond is repaid by assessments against real property, which is benefited by the public improvement. Any owner of property which is proposed to be assessed under the LID, regardless of residency, has the right to support or object to formation of the LID. This factor could make the proposal more democratic to out-of-state property owners who cannot vote in an election. If 60 percent of the property owners within the LID object to the LID formation, then the District cannot proceed without resubmitting the LID after 6 months' time, or without appeal to the Board of County Commissioners.

All property owners have two options regarding financing the LID. Each property owner can either pay the amount of the LID assessment in full after completion of the project and prior to finalization of the assessment roll, or the owner can choose to amortize the amount at a set interest rate for a fixed number of years (typically 10 to 20 years). An LID assessment, which is amortized, becomes a lien on the property as security for repayment of the assessment. Or in the case of leased property, a promissory note will be written for the assessment. Refer to Table 5-2 for the LID procedures per Idaho Code.

Table 6.2: LID Process per Idaho Code

1.	LID Initiated By Resolution
2.	Resolution Of Intent To Create The LID
3.	Notice Of Hearing Published And Mailed To Property Owners
4.	Public Hearing To Consider Protests And Support
5.	Ordinance Creating LID Adopted
6.	Engineer Authorized To Prepare Plans And Bidding Documents
7.	Construction Phase
8.	Prepare Final Costs And Assessment Roll
9.	Notice Of Final LID Hearing
10.	Hearing On Objections To Assessment Roll
11.	Confirmation Of Assessment Roll
12.	Notice Of Final Assessment To Property Owners
13.	30-Day Pre-payment Period
14.	Assessments Not Pre-Paid Will Be Amortized At LID Bond Term And Rate

7. Public Participation

This section will be completed after the District holds a public meeting presenting the Facility Plan, anticipated in summer of 2021.

8. Selected Alternative Description and Implementation Requirements

This section will be completed after the public participation component is complete.

9. ENVIRONMENTAL REVIEW INFORMATION

9.1. EXISTING ENVIRONMENTAL CONDITIONS

The District is located on the southern shore on the Spokane River and approximately half a mile south of the City of Post Falls in Kootenai County, Idaho. The northern border of the system is the Spokane River, and the District covers an area of 1.79 square miles. The District serves only single-family residences on parcels ranging in size from 0.15 to 64 acres. The system and service area are generally located in Sections 10, 11, 12, 13, and 14 Township 50N, Range 05W.

The service area is located in the valley between the Spokane River and Blossom Mountain, the area consists of mountainous terrain and is mainly surrounded by forest. The elevation of the system varies from 2,125 feet near the northern boundary to 2,898 feet at the southern boundary. The service area consists entirely of residential development.

For the purpose of the environmental review, an Area of Potential Effect (APE) and a Proposed Project Planning Area (PPPA) have been developed. These areas delineate the expected effect area and project planning area. For the District, the APE/PPPA will consist of the existing service area, totaling to 1,144 acres of land. As is implied, the APE and PPPA are one in the same for the District and proposed project. This boundary is delineated on a map (Environmental Review Area) in Appendix I-1. It is important to note the RAFN area was not included in the APE and PPPA at this time. The improvements discussed in this report are anticipated to serve the area in Growth C. Future improvements will likely be authorized or analyzed in further detail at a future date.

9.1.1. <u>PHYSICAL ASPECTS (PHYSIOGRAPHY, TOPOGRAPHY, GEOLOGY AND SOILS)</u>

The existing topography is relatively flat in the northeast section of the district boundary. The systems lowest point can be found within this area. However, the remaining sections are dominated by steep mountain side and rolling roads. The system reaches its highest elevation at the very southwest corner of the district boundary. The northern boundary of the district is directly adjacent with the shoreline of the Spokane River. Refer to Appendix I-2 for a topographical map.

The Geologic Map of Coeur d'Alene, Idaho Quandrangle (Lewis et. al, 2002) was consulted to determine the geologic information for the Association. This map can be found in Appendix I-2. In addition, Appendix I-2 provides an enlarged version of the above map for the Association. The types of rock present are:

- Catastrophic Flood Deposits and Reworked Outwash – Distal gravel deposits (Pleistocene)
- Catastrophic Flood Deposits and Reworked Outwash – Distal sand and silt deposits (Pleistocene)
- Holocene Deposits – Alluvial Deposits (Holocene)
- Intrusive Rocks – Orthogneiss (Cretaceous)

Detailed descriptions of these deposits and bedrock can be found in Appendix I-2. A portion of the normal fault and detachment fault of the Purcell-Coeur d Alene Fault (not active) goes through the District, which can be seen on the larger scale map.

The soils in the area are mapped as mostly McGuire-Marble, Skalan Rock, and silt loam by the USDA Soil Survey. These soils are generally well drained and have a moderate shrink-swell potential. All the whole soils in the District have a generally high possibility of erosion due to steep slopes and the small grain size. A Natural Resources Conservation Service, Web Soil Survey map and soil descriptions are provided in Appendix I-2. In addition, the erosion potential survey is included in Appendix I-2.

9.1.2. Surface and Ground Water Hydrology

9.1.3. Surface Water

The District is located along the southern shore of the Spokane River. The status of the Spokane River was reported in IDEQ's 2012 Integrated Report, the results of which are shown below:

Category 5: Impaired waters Needing a TMDL

- Spokane River – Post Falls Dam to Idaho/Washington border
  - Cadmium, Lead, Phosphorous (Total), Zinc
- Spokane River – Coeur d'Alene Lake to Post Falls Dam
  - Cadmium, Lead, Phosphorous (Total), Zinc

Refer to the topographical map and excerpts from the Integrated Report in Appendix I-3 for an overview of the surface water in the APE/PPPA.

9.1.4. Ground Water

The entire project area is within the source area for the Spokane Valley-Rathdrum Prairie Aquifer, with a majority of the district located over the aquifer, as can be seen in the map of the Aquifer in Appendix I-3. The Aquifer is classified as a sole source aquifer by the US Environmental Protection Agency (EPA). A sole source aquifer classification indicates that the aquifer supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. Discussion of water rights and water quality is included in Section 2.5.2.1 and 2.5.1.2, respectively.

9.1.5. Fauna, Flora and Natural Communities

The area is treed and is home to many wildlife species. A list of endangered, threatened, and candidate species for Kootenai County was obtained from the US Fish and Wildlife Services website and is included in Appendix I-4. Threatened species that could potentially be found within the District's boundaries include: Grizzly Bears, Yellow-billed Cuckoos, Canada Lynx, and Bull Trout. There are also no reported critical habitats near the District boundaries.

9.1.6. *Housing, Industrial and Commercial Development*

The residences served by the system are single-family dwellings, with most, if not all, customers being year-round consumers. The zoning designation for the area is designated by Kootenai County and consists generally of AG-Suburban and Rural. Refer to the zoning map included in Appendix I-5.

9.1.7. *Cultural Resources*

There are no known historic resources within the District. The nearest historic resource is located in Post Falls, approximately 0.5 miles northwest of the APE/PPPA. A search of the Kootenai County, Idaho sites listed on the National Register of Historic Places, provided in Appendix I-6, shows the nearest historical sites to the District.

The District is approximately 10.6 miles north of the Coeur d'Alene Tribal Reservation Boundary, as shown in the Tribal Boundary map in Appendix I-6.

9.1.8. *Utility Use*

The utilities used by the system are power provided by Kootenai Electric Cooperative.

9.1.9. *Floodplains and Wetlands*

FEMA (Federal Emergency Management Agency) has determined floodplain boundaries which are found in the Flood Insurance Rate Maps (FIRMs). These boundaries were utilized to determine which portions of the District are in the floodplain. According to the FIRM, a small portion of the District's area is within the floodplain for the Spokane River. Adjacent to the floodplain, the District has 19.5 acres of service area that has a 0.2% annual chance flood hazard. Refer to Appendix I-7 for the FEMA floodplain mapping for the service areas.

United States Fish and Wildlife Service provides a National Wetlands Inventory database[20]. A map of wetlands within the project area was prepared using the database and is included in Appendix I-7. As can be seen on the map there are a few small areas designated as wetland within the perimeter of the APE/PPPA of the District. Most of these wetland types are designated as Freshwater Emergent Wetland and Riverines. The remaining designated areas are classified as Freshwater Forested/Shrub Wetland and Freshwater Ponds.

9.1.10. *Wild and Scenic Rivers*

The nearest designated Wild and Scenic River is a segment of the Saint Joe River approximately 60 miles to the southeast of the District. Therefore, no designated Wild and Scenic Rivers are located within the APE/PPPA. A map of the Wild and Scenic Rivers in the United States can be found in Appendix I-8 as well as an

[20] The dataset represents the extent, approximate location and type of wetlands and deepwater habitats in the US. Refer to http://www.fws.gov/wetlands/Data/Wetlands-Geodatabase-User-Caution.html for more information on the geodatabse.

enlargement of this map to show the District and the designated segment of the Saint Joe River.

9.1.11. *PUBLIC HEALTH AND WATER QUALITY CONSIDERATIONS*

As mentioned in Section 2.5.2.2, the water quality of the system is monitored according to IDEQ rules and regulations. The levels of regulated contaminants were below state and federal standards.

Kootenai County regulates the division of properties in the District's area. Panhandle Health District has set the minimum parcel size for parcels using septic drainfields to five acres in areas over the Rathdrum Prairie Aquifer. The Health District utilizes the 1978 boundary for the Aquifer (refer to Section 9.1.13 below) to evaluate this limitation, which is on the north side of the Spokane River. It has been noted previously the District's wells are considered to be over the Aquifer along with some portions of the District. To address this concern about the high density, use of septic tanks and potential impact on the District's wells, the District Board has supported a petition submitted in November 2020 to the IDEQ Board. This petition is to recategorize the groundwater supply as sensitive resource aquifer providing additional protection from development (as discussed in Section 9.1.13 below).

It is also important to note, previous authorizations for septic drainfields on smaller lots is available in the lower elevation parcels, thus minimum parcel size is significantly reduced from the required 5 acres to as small as 0.5 acres.

9.1.12. *PRIME AGRICULTURAL FARMLANDS PROTECTION*

Prime agricultural classification is provided as part of the USDA Soil Survey conducted for the soil information in Section 9.1.1. According to the Soil Survey, *"farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops."* According to this soil survey, 59.7% of the District's land is rated as "Not Prime Farmland", 36.6% is rated "Prime Farmland if Irrigated", and the remaining 3.7% classified as "Prime Farmland" and "Farmland of Statewide Importance". Maps of the USDA Soil Survey information for the District are provided in Appendix I-8.

9.1.13. *PROXIMITY TO SOLE SOURCE AQUIFER*

The nearest sole source aquifer is the Spokane Valley-Rathdrum Prairie Aquifer (see Appendix I-3 for a map of the Aquifer), and the District lies entirely within the source area. The Aquifer is classified as a sole source aquifer by the US Environmental Protection Agency. A sole source aquifer classification indicates that the aquifer supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer.

The Panhandle Health District and IDEQ use the boundary identified in Appendix I-3, which was developed in 1978 to identify the boundary of the Aquifer; it is considered by some to be outdated. The IDWR and USGS have revised the boundary to include a larger area, over the District, based on more current data. The District Board is supporting a petition to the Board of IDEQ to recharacterize the boundary of the Aquifer to include the District's wells and nearby land.

9.1.14. LAND USE AND DEVELOPMENT

Many of the parcels within the District's boundaries are designated as shoreline and suburban use. The zoning map for the APE/PPPA can be found in Appendix I-5. The designated land use in the area consists of country with small areas of transitional and suburban designation. The land use map for the APE/PPPA can be found in Appendix I-5.

9.1.15. PRECIPITATION, TEMPERATURE AND PREVAILING WINDS

The following climate information for the District was obtained from Western Regional Climate Center, based on monthly averages:

- Average Annual Temperature High – 59.0 °F
- Average Annual Temperature Low – 36.9 °F
- Average Annual Precipitation – 25.33 inches
- Average Annual Snow Fall – 45.8 inches[21]

The prevailing wind in the area (Coeur d'Alene) is North-Northeast, according to the Western Regional Climate Center.

9.1.16. AIR QUALITY AND NOISE

The State of Idaho has been delegated authority to regulate air quality through the EPA and the Clean Air Act. The State Implementation Plan provides the rules and regulations to maintain acceptable air quality standards within the state and site-specific plans delineating areas that do not meet air quality standards. Areas that do not meet specific air quality standards are known as Nonattainment Areas. A map showing Nonattainment Areas and Areas of Concern for the State of Idaho is provided in Appendix I-10. The District is not located in a Nonattainment Area or an area of concern. The nearest non-attainment area to the District is the Pinehurst Non-Attainment Area. This Area of Concern is located approximately 27 miles from the District. Noise from the existing facilities is not disruptive and has not been an issue for the residents.

9.1.17. ENERGY PRODUCTION AND CONSUMPTION

The District currently meters individual water consumption with service meters at all connections monthly between June 1st to October 1st. Users are charged a base

[21] Average annual climate for the District was obtained from Western Regional Climate Center, for the Bayview Model Basin station (1948-2005).

rate which includes an allotted amount of water. Additional fees are charged for water use in excess of the base allotment of water, encouraging water conservation.

9.1.18. Socioeconomic Profile

The system serves a population of approximately 1,068[22] residents through 397 EDUs. The population of the current service area has been growing consistently and the District has plans to grow significantly in the years to come. All homes served by the District are single family dwelling units on parcels of land ranging from small to large. Although no socioeconomic data is available specifically for this project planning area, the US Census Bureau reports that 10.6 percent of the population in Kootenai County is below the poverty level. The median household income in 2017 was reported as $53,189.

9.2. Environmental Impacts for Proposed Alternatives

9.2.1. Source

9.2.1.1. Upsized Pumps for Wells 1 and 2

The primary environmental impacts associated with upsizing the pump at Well 1 include constructing an installation of a new pump and distribution piping at the existing well. The installation of the improvements would impact the following existing environmental conditions:

- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (increased energy supply to power the upsized pump motor), and
- Public health (positive impact to system service and reliability in the long-term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Section 4.1.1.1.

9.2.1.2. New Well

The primary environmental impacts associated with installation of a new well

[22] Average persons per household for 2013-2017 for Kootenai County multiplied by the number of residential EDUs equaling an approximate population.

consist of drilling for the new well. The installation of the improvements would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the new well and well house),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Floodplains and wetlands (potential long-term impact due to encroachment on the shoreline, to be mitigated through appropriate BMPs),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (improved overall system efficiency), and
- Public health (positive impact to system service and reliability in the long-term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Section 4.1.1.2.

9.2.1.3. NO IMPROVEMENTS

Since there would be no action taken to improve the current system, there would be no environmental impacts due to new construction. However, the current wells are not large enough to serve the system during a maximum day condition for any future growth (with the largest well out of service). It is possible that some customers may not receive optimum service during this situation. If the deficiency is not addressed, the District would have no potential for growth or expansion without first improving the well source capacity.

9.2.2. STORAGE

8.2.2.1 GROUND LEVEL STORAGE (BELLA RIDGE AND HIGHLAND RESERVOIRS)

The primary environmental impacts associated with installing a new ground level storage reservoir is associated with temporary disturbance due to construction activities. The improvement would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the new storage tank),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),

- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Cultural resources (potential long-term impact due to installation in new, undisturbed areas),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity), and
- Public health (positive impact to system service and increased reliability in situations where fire flow may be required).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement options associated with these environmental impacts can be found in Sections 4.1.2.1. and 4.1.2.2..

8.2.2.2 Highland Reservoir (Increase Storage Height)

The primary environmental impacts associated with installing a high-level storage reservoir is associated with temporary disturbance due to construction activities. The improvement would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the new storage tank as well increased height near residential houses),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Cultural resources (potential short-term impact due to installation in existing location),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity), and
- Public health (positive impact to system service and increased reliability in situations where fire flow may be required).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Section 4.1.2.2.1.

8.2.2.3 No Improvements

Since there would be no action taken to improve the current system, there would be no environmental impacts due to new construction. This improvement can be avoided in the near-term by increasing sources capacity and pumping directly to the system. However, at some point in the future, additional storage will likely be necessary if the District continues to grow.

9.2.3. Booster

9.2.3.1. Replace and Upsize (Greenferry, Highland, Snowshoe/Tanglewood, Bella Mid-Level [in conjunction with reservoir upgrade at Bella])

The primary environmental impacts associated with replacing and upsizing the existing booster pumps is associated with temporary disturbance due to replacement. There is also the possibility that a new pump house or pump house expansion would have to be built to house the upsized/new booster pumps. The improvement would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the new pump house),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (improved overall system efficiency), and
- Public health (positive impact to system service and reliability in the long-term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Sections 4.1.3.1. and Section 4.1.3.3.

9.2.3.2. Individual Booster Stations

The primary environmental impacts associated with implementing individual boosters is associated with temporary disturbance to connect the boosters to each user’s service. The improvement would impact the following existing environmental conditions:

- Physical aspects (minor short-term impact due to excavation for the new booster pump),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),

- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (minor long-term impact due to the District supplying power to each individual booster), and
- Public health (positive impact to system service and reliability in the long-term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Section 4.1.3.1.2.

9.2.3.3. GREENFERRY BOOSTER STATION BYPASS

The primary environmental impacts associated with this improvement consist of trench excavation for the approximate 50 lineal feet of new waterline. The installation of the improvement would impact the following existing environmental conditions:

- Physical Aspects (short-term impact for the waterline installation),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water Quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (minor positive impact to energy consumption required by pumping due to reduced system losses), and
- Public health (positive impact to system service and reliability in the long-term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Section 4.1.3.2.

9.2.3.4. NO IMPROVEMENTS

Since there would be no action taken to improve the current system, there would be no environmental impacts due to new construction. This improvement can be avoided in the near-term by increasing source capacity and pumping directly to the system. However, at some point in the future, additional booster capacity will likely be necessary if the District continues to grow. This is especially true if the growth occurs in areas above the current system's hydraulic grade line.

9.2.4. *Distribution*

9.2.4.1. *Upsize Transmission Pipe (Greenferry Terraces, Riverview Dr., Greensferry Rd. Well Transmission),*

The primary environmental impacts associated with this improvement consist of trench excavation for approximately 14,000 linear feet of waterline replacement. The installation of the improvement would impact the following existing environmental conditions:

- Physical Aspects (short-term impact for the waterline installation),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water Quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs)
- Floodplains and wetlands (potential long-term impact due to encroachment on the shoreline, to be mitigated through appropriate BMPs)
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (minor positive impact to energy consumption required by pumping due to reduced system losses), and
- Public health (positive impact to system service and fire flow capabilities in the long term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Sections 4.1.4.1.-4.1.4.5.

9.2.4.2. *Crystal Bay Upgrades*

The primary environmental impacts associated with this improvement consist of trench excavation for approximately 2,825 linear feet of new waterline. The installation of the improvement would impact the following existing environmental conditions:

- Physical Aspects (short-term impact for the waterline installation),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water Quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs)
- Floodplains and wetlands (potential long-term impact due to encroachment on the shoreline, to be mitigated through appropriate BMPs)
- Flora and fauna (minor short-term impact due to construction activity),

- Air quality (minor short-term impact due to construction activity),
- Energy (minor positive impact to energy consumption required by pumping due to reduced system losses), and
- Public health (positive impact to system service and fire flow capabilities in the long term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect or cumulative impacts.

The improvement option associated with these environmental impacts can be found in Section 4.1.4.6.

9.2.4.3. NO IMPROVEMENTS

Since there would be no action taken to improve the current system, there would be no environmental impacts from new construction. However, the current transmission line is not capable of handling the size of water flows the source upgrades being considered will produce. This could result in pipe breaks and/or over pressurization of service connections so it is impractical to improve the source capacity without upsizing required pipe sections.

9.2.5. ALTERNATIVE COMPARISON

An additional comparison of the improvements has been included in Appendix I-11. This comparison highlights the major impacts anticipated for each alternative discussed above.

9.2.6. REFERENCES

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