Stevensville, Montana

Preliminary Engineering Report

Water System

Ravalli County, Montana
June 8, 2021

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Executive Summary

Provide a summary of why the study was done and briefly describe the alternatives considered, the preferred alternative, the estimated total cost, the net cost per user based on proposed funding plan, and any other pertinent conclusions.

Considering the planning period of 2020-2040 and the influence of population growth on existing infrastructure for the Town of Stevensville, it has been determined that implementing additional water storage, replacing key distribution mains, and upgrading SCADA will increase the efficiency, security, and dependability of the existing drinking water system. Existing rate programs and leak remediation efforts have prepared the town well to implement these recommendations. This report can also serve to assist the application process for newly available ARPA funding.

1 Project Planning

1.1 Introduction

The Town of Stevensville (Town) completed a comprehensive Water System Improvements Preliminary Engineering Report (PER) Update in 2009. A phased approach to water system improvements was outlined in the 2009 PER, including metering, a new well field, decommissioning of the Water Treatment Facility, and distribution system improvements. The purpose of this document is to update the 2009 PER with a focus on the Phase IV Storage System Upgrades. Phase IV of the approach consists of storage system improvements and was previously deferred due to a lack of reliable metering and leakage data. This data has recently been better quantified and consequently it is the intent of the Town to proceed with Phase IV of the project.

This report follows the 2019 Uniform Application for Montana Public Facility Projects, 12th Edition, which includes the *Uniform Preliminary Engineering Report for Montana Public Facility Projects* outline provided by the State of Montana. Guidance language provided in the outline will be presented at the beginning of each pertinent section in ***bold italics***. Additional sections have been added to this report as necessary to provide information or clarity on specific items related to the Stevensville water system. All 11 x 17 figures are included at the conclusion of the chapter for easier viewing. This outline of the final compiled report is organized as follows;

Executive Summary

Chapter 1 – Project Planning

Chapter 2 – Existing Facilities

Chapter 3 – Need for Project

Chapter 4 – Alternatives Considered

Chapter 5 – Selection of an Alternative

Chapter 6 – Proposed Project (Recommended Alternative)

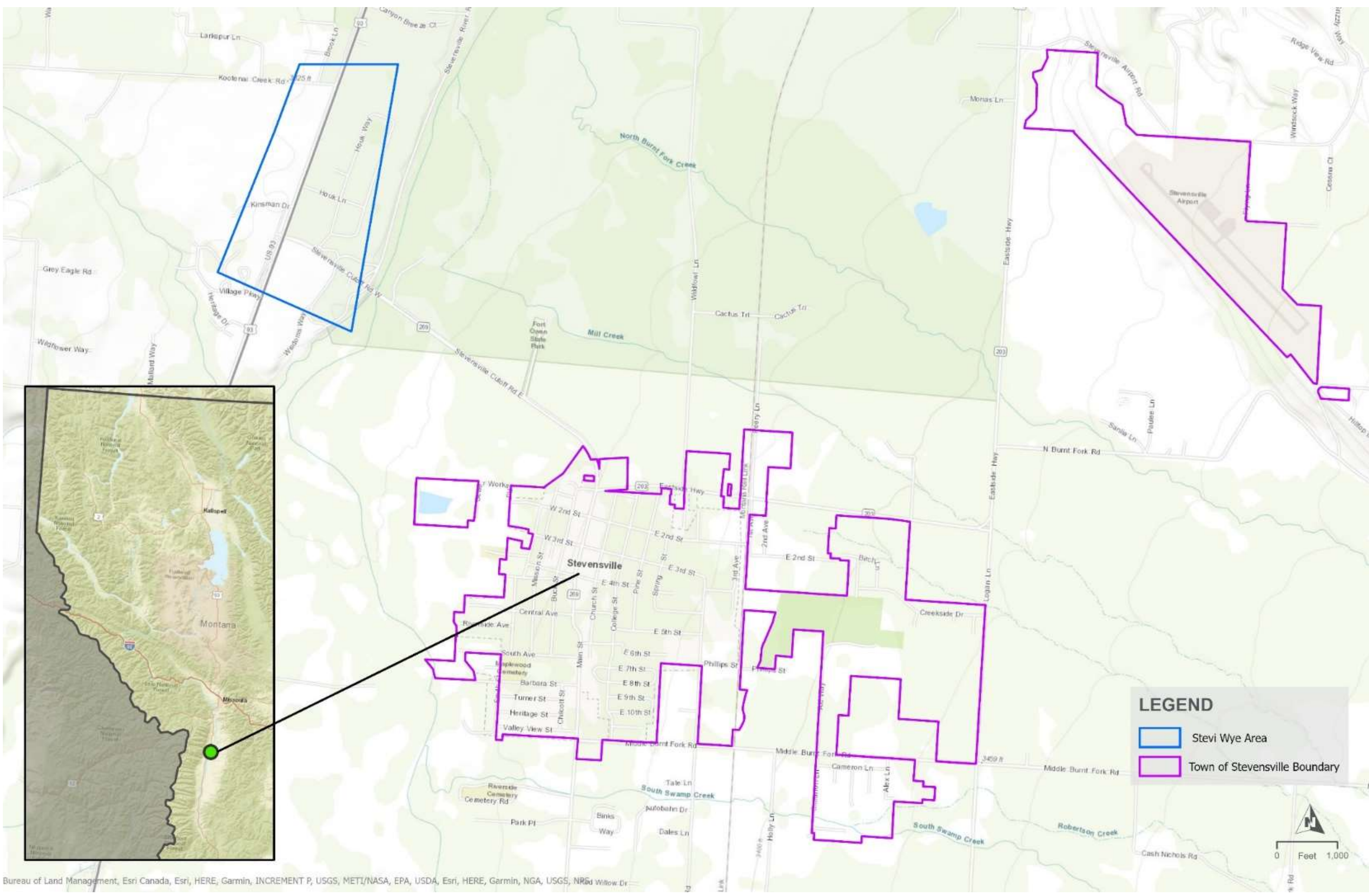
Chapter 7 – Conclusions and Recommendations

1.2 Location

Provide scale maps and photos of the project planning area and any other existing service areas including legal and natural boundaries and a topo map of the service area.

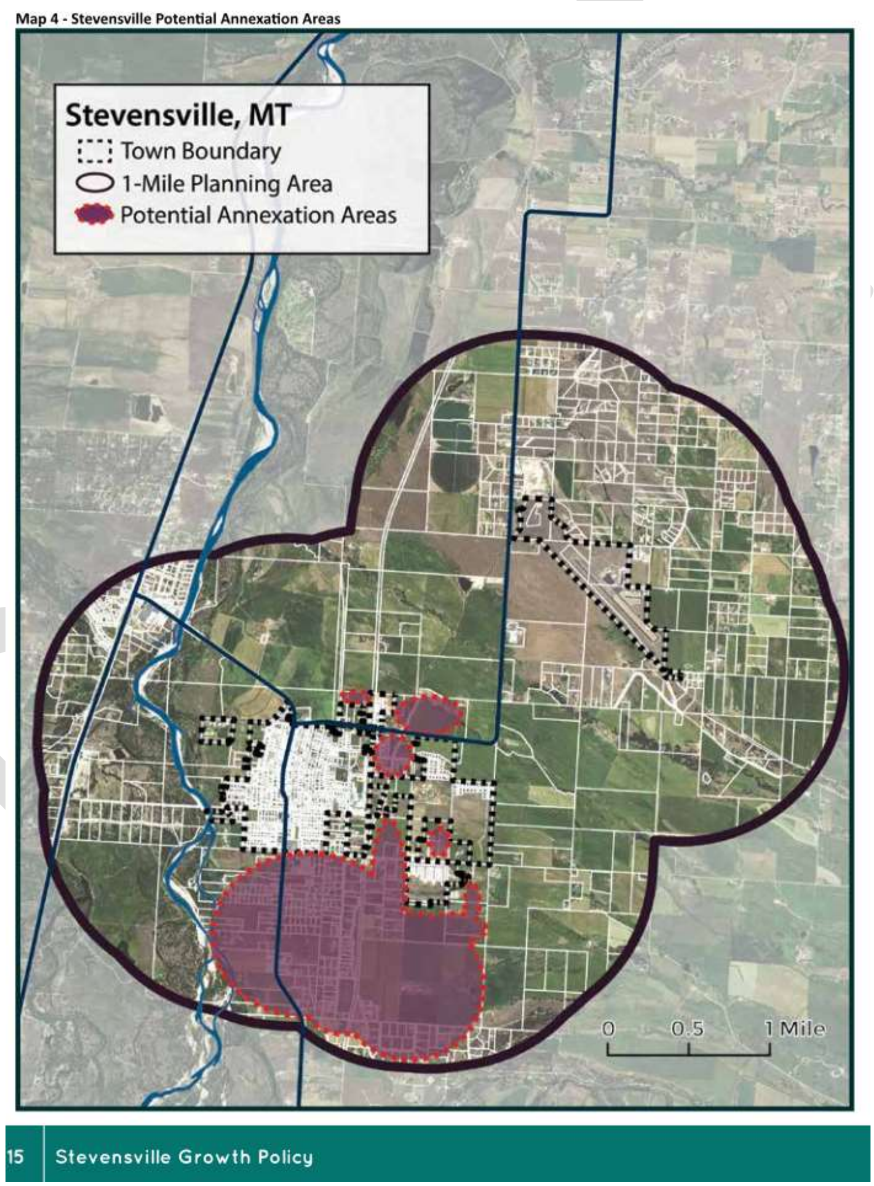
The Town of Stevensville is located in the Bitterroot Valley, in the northern portion of Ravalli County, approximately 29 miles south of the City of Missoula in western Montana. The Town is situated on a valley plain bounded on the west by the Bitterroot Mountains and on the east by the Sapphire Mountains. After Hamilton, it is the second largest of 10 communities within Ravalli County. The Town is situated on the east side of the Bitterroot River and east of US Highway 93. The Town is located at 46.5095° N, 114.0962° W (Figure 1-1).

Figure 1-1. Location of Stevensville, MT



The planning area for this study encompasses the present Town limits and unincorporated county areas to the northeast, east, south, and the "Wye" area to the west across the Bitterroot River. The planning area includes those areas east and south of the existing Town Limits where growth is occurring now and is expected to continue during the planning period and where there is sufficient land to support that growth. The planning area also includes the 1-mile planning area that encompasses the Wye area and potential annexation areas highlighted in Map 4 in the 2016 Stevensville Growth Policy, included below as Figure 1-2. Appendix A includes a study done by HDR in 2019 that explored the feasibility and cost for the town to annex the Wye area.

Figure 1-2. 2016 Growth Policy Planning Areas



1.3 Environmental Resources Present

Maps, photos, or narrative descriptions of environmental resources present in the planning area that affect design. Past review information can be used here.

As part of the 2009 PER, information on the environmental resources present in the planning area were collected, and anticipated impacts to the resources were summarized in the *Uniform Environmental Checklist* (UEC), included as Appendix C. This information was taken into account for the Water System PER Project's UEC. In addition, a narrative summary of the proposed projects was submitted to local, regional, state and federal agencies for comments on the project. This information was used to determine if any environmental resources will be impacted by the project. Potential impacts, along with any mitigation measures where pertinent, are discussed in the following subsections. A copy of the updated, project-specific UEC, accompanying narrative and agency comments received are included in Appendix C.

Historical and Archeological Resources

Saint Mary's Mission, located at the end of 4th Street in the Town of Stevensville, was the first Catholic mission in the northwest and the first permanent white settlement in Montana. The mission was established in 1841 by Father Pierre DeSmet, who came to the Bitterroot Valley in response to requests for "Black Robes" by various Native American tribes of present-day Montana and Idaho. The mission complex includes the chapel/residence, Father Anthony Ravalli's log house and pharmacy, Chief Victor's cabin and the Native American burial plot. All buildings have been restored to the 1880 era and are furnished with items built by Father Ravalli, Montana's first medical doctor. Chief Victor's cabin is restored as an Indian museum. Nearby DeSmet Park was dedicated in 1991 to commemorate the 150th anniversary of the establishment of St. Mary's Mission.

Also included in the complex is the Stevensville Museum. This facility features the early growth and development of the Bitterroot Valley with displays of artifacts, pictures and information panels regarding the history of the American Indian population (the Salish Indians), the Lewis and Clark Corps of Discovery expedition through the valley in 1805-1806, the arrival of Father DeSmet in 1841, the establishment of the earliest mission in what is now Montana, the development of Fort Owen as one of the earliest trading posts and the history of Stevensville itself.

The historic Catholic mission complex and Fort Owen will not be impacted by the activities associated with the subject project. The response from the State's Historic Preservation Officer (SHPO) to the Environmental Checklist regarding this PER is included in Appendix C. It indicates a low likelihood of significant impact to both archaeological and historical resources for the proposed projects since virtually all actions will be conducted in previously disturbed areas.

Fish, Wildlife and Endangered Species

During the preparation of the UEC, the database of the *Montana Natural Heritage Program* was researched for the presence of sensitive animal, fish or plant species within the planning area. No conflicts relative to the proposed projects were noted.

The response received from the US Fish and Wildlife Service, USDI indicated that there are three (3) threatened species that may occur in the Planning Area, namely, the Canada Lynx, the Bull Trout and the Bald Eagle. In addition, the Gray Wolf, considered to be a nonessential experimental species introduced into the area, and the Yellow-billed Cuckoo, a candidate threatened species, may also occur in the area. The response indicated that, considering the nature, scope and location of the project, this agency does not anticipate adverse impacts to any federally listed threatened, endangered, candidate or proposed species or critical habitat.

Agricultural Land

The planning area includes many agricultural parcels. The principal agriculture activities conducted within the planning area are the raising and pasturing of livestock, primarily cattle and horses, and hay cropping on irrigated lands. The upcoming upgrade and expansion of the Town of Stevensville's water system will permit nearby agricultural lands to be developed as residential or commercial use. Overall, higher density development on lands provided with municipal level facilities will require less of the available land area and will ultimately serve to reduce impacts on agricultural lands throughout the general area.

The improvements proposed by this PER are replacements or upgrades to existing facilities and do not directly impact agricultural lands or uses.

Surface Waters, Floodplains and Wetlands

The improvements proposed by this PER do not impact any surface waters, floodplains or wetlands. All work will be conducted away from surface waters, outside of the 100-year flood zone and away from area wetlands.

Groundwater

Groundwater under the Planning Area is known to be plentiful and generally of good quality. The near surface waters are seasonal and supported by summer irrigation of integral and surrounding pasture lands and hayfields.

Water quality testing of Stevensville's municipal drinking water supply both from the infiltration gallery and from the wells had not indicated any persistent or recurring water quality issues.

1.4 Population Trends

US Census or other population data for the service are for at least the past two decades if available. Base population growth around concentrated growth areas for project growth period.

Historical population growth is shown in Table 1-1. Stevensville grew rapidly in the 1990’s at a rate of 2.7% annually, slowing to just over 1% annually in the 2000’s. The Stevensville 2020 population is approximately 2,182 people (931 households with 2.3 people per household, see footnote in table below).

Table 1-1. Historical Population Growth

Year	Stevensville Population	Increase Over Period
1990	1,221	-
2000	1,553	27.2% (2.7% annually)
2010	1,809	11.8% (1.1% annually)
2020	2,182[1]	17.1% (1.7% annually)

[1]U.S. Census Bureau (2019). *American Community Survey 5-year estimates*. Retrieved from *Census Reporter Profile page for Stevensville, MT* http://censusreporter.org/profiles/16000US3071200-stevensville-mt/. These estimates have a margin of error which is why the total population estimate doesn’t match the number of households multiplied by the persons per household precisely.

B

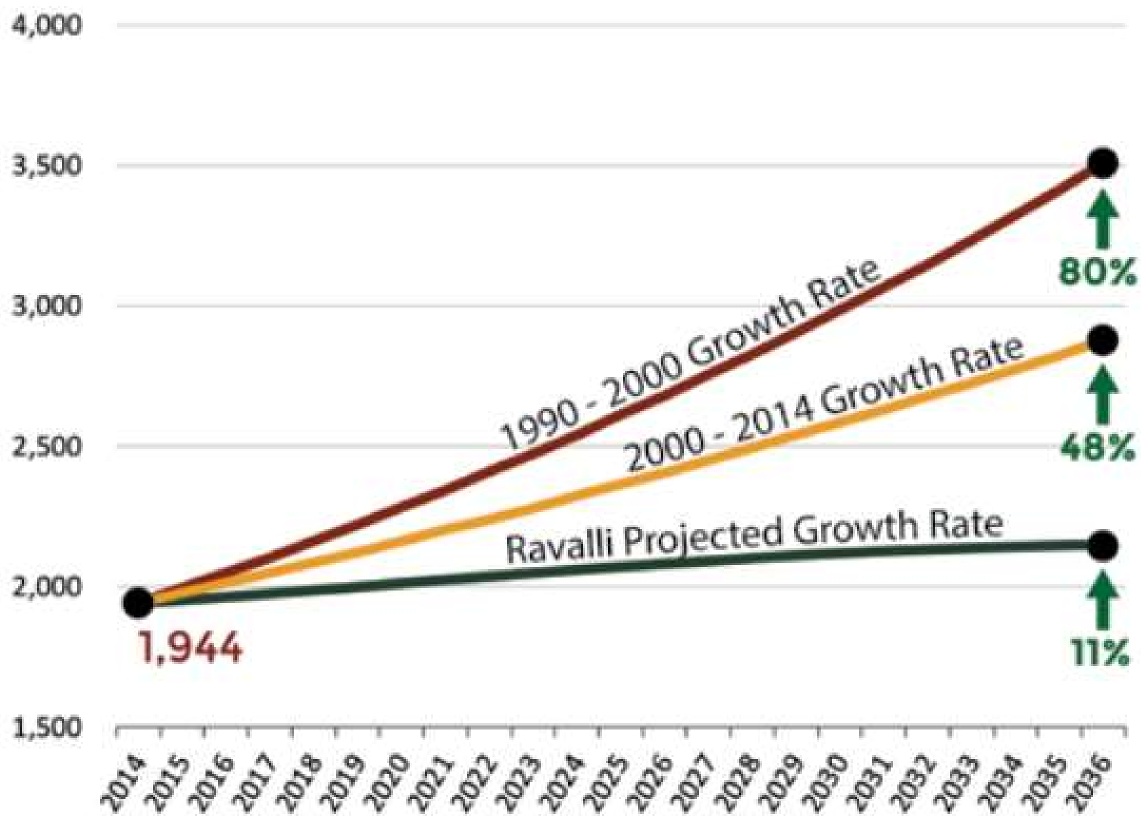
Towns in Ravalli County experienced a 27% growth rate over the decade from 1990 to 2000, and 20% for 2000 to 2010. Similar to the Town of Stevensville, Ravalli County as a whole showed an increase from 2000 to 2010 of 11.5% growth.

1.4.1 Population Projections

The Town’s 2016 Growth Policy Update offers population projections as described below.

> *As depicted in Figure 1-3, the State of Montana’s Census and Economic Information Center (CEIC) provides county level population projections, produced by Regional Economic Models, Inc. In the absence of local level projections provided by CEIC, three scenarios were created, projecting Stevensville’s population 20 years into the future. One projects Stevensville’s future population using Ravalli County growth rates (provided by CEIC); one projection applies Stevensville’s average annual growth rate between 1990 and 2000 (2.72%), and the final projection applies Stevensville’s average annual growth rate between 2000 and 2014 (1.8%).*
>
> *The Ravalli County growth rate, projects Stevensville’s total population increasing by 11% between 2014 and 2036 – the smallest increase of all projections. The other two projections show more significant growth. The 1990-2000 growth projection estimates Stevensville’s population to increase by 80% over the next 20 years, while the use of recent growth rates (2000-2014) estimates Stevensville’s population to increase by 48%. For this PER update, a range of population growth projections were completed as shown in Table 1-2 and 1-3 below.*

Figure 1-3. Growth Policy Population Projections



Source: Montana Census and Economic Information Center, as presented in the 2016 Growth Policy

Table 1-2. Population Growth Sources and Comparison

	Population (# of people)				Annual Growth Rates (% growth per year)			
Source	1990	2000	2010	2020	1990-2000 10-yr Base	2000-2010 10-yr Base	1990-2010 20-yr Base	Source Growth Rate
MT.gov Rate	-	-	-	2,048	-	-	-	-
HDR Water Rights Report for Lolo, MT	-	-	-	-	3.29%	3.29%	2.46%	2.47%
HDR Water Rights Report for Hamilton, MT	-	-	-	-	2.64%	2.64%	2.06%	3.0%
2016 Growth Policy	1,221	1,553	1,809	-	2.72%	2.72%	2.72%	2.11%
2012 HDR Wastewater PER for Town	1,221	1,553	1,809	-	2.72%	2.72%	2.72%	1.10%
US Census Data	1,288	1,665	1,832	2,025	2.93%	2.93%	2.72%	-
2009 PCI Water PER for Town	1,221	1,553	-	-	3.7%	3.7%	2.72%	2.38%
ACS 2018 Survey	1,288	1,665	1,832	2,193	2.93%	2.93%	2.72%	-
Averages	**1,248**	**1,598**	**1,821**	**2,089**	**2.99%**	**1.57%**	**2.59%**	**2.21%**

Table 1-3. Population Growth Rate Comparison

Year	Average Annual Growth Rate		
(YYYY)	1%	2.18%	3.0%
2020	2,182	2,182	2,182
2030	2,410	2,707	2,932
2040	2,661	3,359	3,941

Since Stevensville has seen 2.18% growth, on average, over the last decade, this population growth rate was chosen to base water demands on. This matches up well with the middle range population projection from the 2016 Growth Policy Update (the 2000-2014 growth rate), and the average of the various sources examined in Table 1-2. Growth trends indicate future growth of the Town is expected to be primarily towards the east and south where there is available suitable land for development.

1.5 Community Engagement

Describe the utility's approach used to engage the community in the project planning process.

The Town of Stevensville holds regular city council meetings to discuss public or private projects and provides citizens with information regarding proposed and completed public or private development or infrastructure projects online at, townofstevensville.com. Resources to educate the community or communicate with the utility are readily available on the website as well.

This PER and the recommended projects will be presented to the public by the Town of Stevensville upon completion of the draft and final versions of the PER.

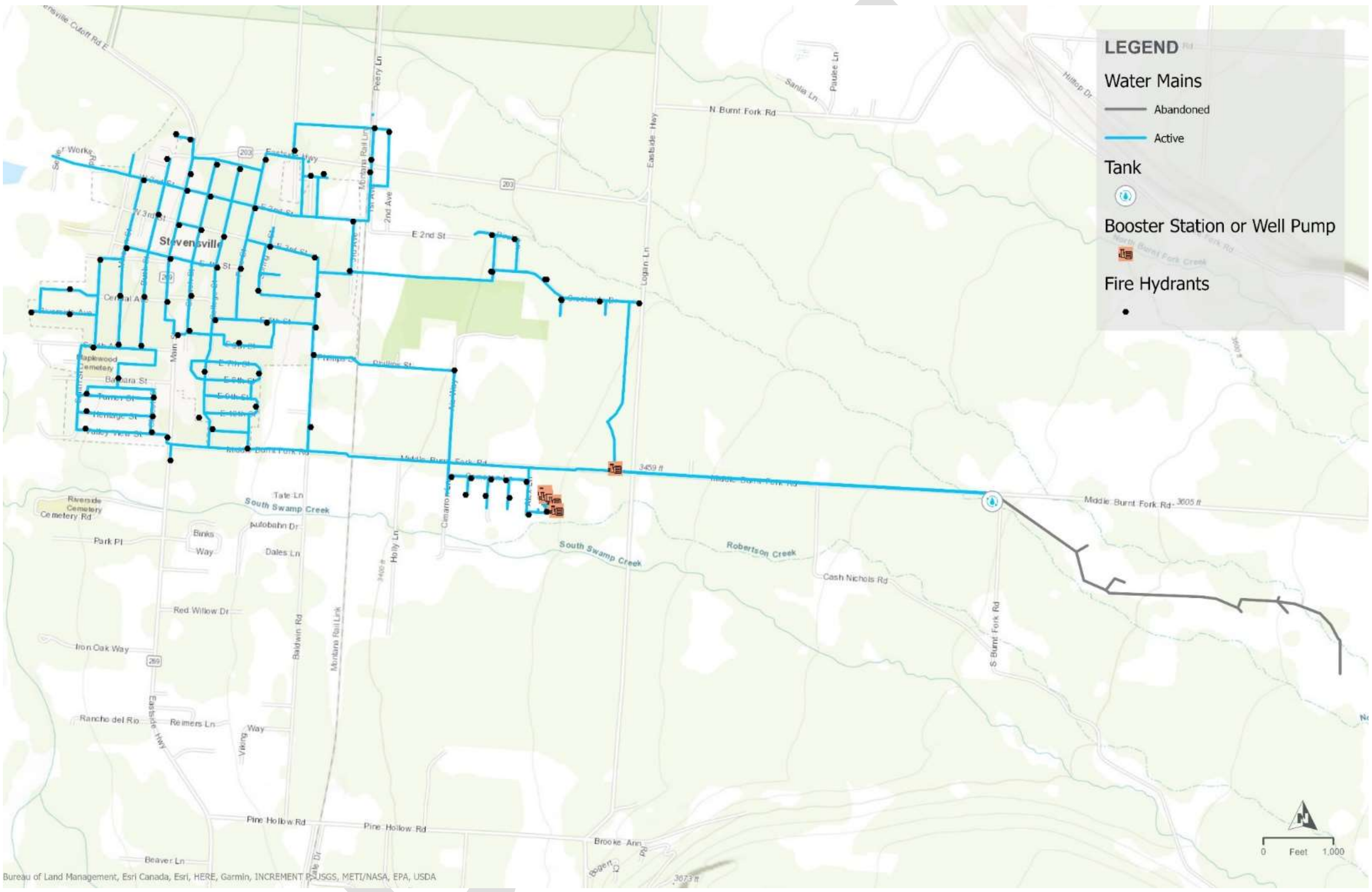
2 Existing Facilities

2.1 Location Map

Provide a map and a schematic process layout of all existing facilities. Identify facilities no longer in use or abandoned. Include photos of existing facilities.

The water system map is included as Figure 2-1.

Figure 2-1. Existing System



2.2 History

Indicate when major system components were constructed, renovated, expanded or removed from service. Discuss any failures and their cause. History of applicable violations.

The following historical information regarding the water system was taken from the Stevensville, Montana 2016 Growth Policy Update prepared by Land Solutions, LLC and Professional Consultants, Inc.

The Town of Stevensville's original water supply was constructed in 1909 with over 6.2 miles of 4", 6" and 8" wooden water pipe and a small concrete reservoir located between Mill Creek and North Swamp Creek. The Town appropriated five cubic feet per second (CFS) from North Swamp Creek that fall, and the $20,035 construction cost was paid with a voter approved bond. Water rates were set in December 1909 at $1.00 per residence and $1.50 for restaurants and saloons per month. Livery barns and hotels were charged $3.00. Although the wooden pipe is no longer in use, sections of the 8" main still remain under Middle Burnt Fork Road.

In the 1930s, an infiltration system was constructed that gathers shallow groundwater from below the surface of the fields between Mill and North Swamp Creeks. Initially, a total of 8,134 linear feet of drainage pipe was installed generally parallel to North Swamp Creek with the intent of capturing and routing subsurface flow down to the municipal reservoir. Originally the raw water collected from the subsurface infiltration system was delivered to a large concrete storage tank at the water treatment plant site, and then piped to Town in an 8" wooden pipe. The wooden main was abandoned in about 1936 when the cast iron pipe was installed.

In the 2000's, Stevensville's water system was upgraded from a shallow infiltration gallery and surface water treatment to deep groundwater wells.

With Stevensville's water system improvement projects completed in the late 2000's, the Town transitioned from the shallow groundwater infiltration gallery, surface water treatment plant and shallow wells in Town to a consolidated well field with deep well groundwater sources. The recommended upgrades in the 2009 PER were implemented except for additional storage, which this PER explores. The upgrades included a variety of water main interconnections and an upgrade to a 10" PVC pipe to connect the water tank to the system. A map of the recommended and implemented changes from the 2009 report are depicted in Appendix D.

2.3 Condition of Existing Facilities

Describe present condition, suitability for continued use, adequacy of current facilities, conveyance and storage capability. Describe capacity, compliance, and overall energy consumption.

Today the system includes five wells, one 430,000 gallon concrete storage tank, three Pressure Reducing Valves (PRVs), 5.6 miles of watermain, 90 fire hydrants, and approximately 814 connections. Table 2-1 below summarizes water system information.

Table 2-1. Existing Facility Characteristics

System Component	Metric	Value	Notes
Approximate Connections	Meters	814	2020 value
	Customers Served	2,035	Assuming 2.5 persons per connection.
Wells	Well 1 Flow	175 gpm	GWIC Well #: 243996
	Well 5 Flow	550 gpm	GWIC Well #: 272191
	Well 6 Flow	585 gpm	GWIC Well #: 272196
	Well 7 Flow	270 gpm	GWIC Well #: 244440
	Well 8 Flow	185 gpm	GWIC Well #: 272197
Tank	Diameter	110 feet	-
	Max Water Depth	6 feet	Bottom of tank at 3,542.50’
	Volume	430,000 gallons	5% allocated to dead storage.
Other Components	Fire Hydrants	90 Hydrants	-
	PRVs	3 valves	Assumed 60 psi setting.
	Miles of Water Mains	5.6 miles	Does not include service piping.

Storage

The system is served by a single, 430,000 gallon concrete tank located near the intersection of Middle Burnt Fork Road and South Burnt Fork Road, at elevation 3,542.50 feet. The tank is 110 feet in diameter with a total water depth of 6 feet and passed DEQ inspections in 2004 receiving a baffling factor of 0.2 based on a peak flow of 900 gpm. It is connected to the rest of the water system via 5,400 linear feet of 10-inch PVC main. The Town has identified the need for additional storage per recommendations from the last water PER in 2009.

Supply

Water is supplied by five wells. Well No. 1 is located near the intersection of Main Street and Highway 203 whereas Wells No. 5-8 are located at the new well field near Alex Ln. and Middle Burnt Fork Rd. In April 2021, the Town notified HDR that well 1 is not operating and does not contribute to the water supply and the future use of well 1 is undetermined.

The Town replaced the pumps and motors of well 8 in 2018. In March, 2019, one of the well field pumps failed and HDR conducted a well pump evaluation and found that the well field pumps are affected by sand and it was recommended that a hydrogeologist perform an analysis to determine remediation measures. In response to the completed analysis, wells 5, 6, and 7 received new pumps and motors in 2019 and the well field is now fully operational.

Distribution

The Town's distribution system saw recent upgrades as recommended by the 2009 PER. Since then, further information on the system in regard to leaks, GIS, and modeling has been gathered. All data analysis was conducted using provided GIS data which quantifies certain characteristics for the system, but a large proportion of information is missing. Generally, distribution along and near Main Street and in older residential areas is the oldest. Table 2-2 summarizes pipe material types and quantity, Table 2-4 shows an estimation of water distribution age, Table 2-3 summarizes the most recent water meter data from 2015.

Table 2-2. Water Distribution Characteristics

Diameter (in.)	PVC (ft.)	DIP (ft.)	CIP (ft.)	Unknown (ft.)	Totals (mi.)	% Diameter
2	-	3	-	343	**0.07**	**1.2%**
4	189	2	3,792	226	**0.80**	**14.1%**
6	3,648	10	5,145	442	**1.75**	**31.0%**
8	4,513	6	735	98	**1.01**	**17.9%**
10	3,655	0	158	14	**0.72**	**12.8%**
12	5,003	1	8	0	**0.95**	**16.8%**
16	1,915	-	-	-	**0.36**	**6.4%**
Totals (mi.)	**3.58**	**0.004**	**1.86**	**0.21**	**5.66**	
% Material	**63.4%**	**0.1%**	**32.9%**	**3.8%**		

Table 2-4. Estimated Pipe Age

Age	% Length of System
<10	13%
10-20	18%
20-30	7%
30-40	3%
>40	20%
Unknown	39%

Table 2-3. Water Meter Connections and Data

Water Line/Meter Size	Connections	EDU Multiplier	2015 EDUs
3/4 inch	742	1	739
1-inch	43	1.79	73.39
1.5-inch	19	4	80
2-inch	3	7.14	21.42
3-inch	0	16	0
4-inch	0	28.57	0

Leakage

The Town of Stevensville has made a concerted effort to install water meters; in 2009 an estimated 69% of the system was metered with significant improvements made since. Table 2-5 shows the monthly results of this comparison from January 2016 to June 2018.

Table 2-5. Water Leak Data

Month	Metered Water (gal)	Produced Water (gal)	Produced vs. Metered (gal)	% of Non-Revenue for Water
Jan-16	3,925,870	10,461,000	6,535,130	62%
Feb-16	3,627,980	9,819,000	6,191,020	63%
Mar-16	4,094,780	10,141,000	6,046,220	60%
May-16	8,318,530	16,893,000	8,574,470	51%
Jun-16	16,456,200	25,919,000	9,462,800	37%
Jul-16	16,339,740	27,163,000	10,823,260	40%
Aug-16	18,040,810	26,403,000	8,362,190	32%
Sep-16	10,414,330	18,965,000	8,550,670	45%
Oct-16	5,382,270	13,124,000	7,741,730	59%
Nov-16	4,270,330	11,210,000	6,939,670	62%
Dec-16	3,805,010	12,486,000	8,680,990	70%
Jan-17	4,743,450	13,595,000	8,851,550	65%
Feb-17	3,647,772	12,079,000	8,431,228	70%
Mar-17	3,854,500	12,389,000	8,534,500	69%
Apr-17	4,052,170	11,924,000	7,871,830	66%
May-17	8,982,400	18,671,000	9,688,600	52%
Jun-17	13,616,950	22,702,000	9,085,050	40%
Jul-17	19,949,680	33,724,000	13,774,320	41%
Aug-17	23,788,000	33,177,000	9,389,000	28%
Sep-17	12,089,550	22,652,000	10,562,450	47%
Oct-17	8,361,880	15,273,000	6,911,120	45%
Nov-17	4,484,640	12,558,000	8,073,360	64%
Dec-17	4,059,260	13,323,000	9,263,740	70%
Jan-18	4,031,750	13,773,000	9,741,250	71%
Feb-18	4,052,470	11,586,000	7,533,530	65%
Mar-18	3,592,660	13,636,000	10,043,340	74%
Apr-18	3,953,210	13,944,000	9,990,790	72%
May-18	9,147,650	19,745,000	10,597,350	54%
Jun-18	10,426,840	22,557,000	12,130,160	54%

An increase in metering water has improved the Town's understanding of water use and loss. In 2019, an analysis was conducted to estimate water losses. The metered water used was compared to the water produced. The Town's operations staff recently isolated the 110 foot diameter concrete water tank and monitored the surface elevation to determine if the tank was leaking. The surface elevation dropped 0.3 feet (21,327 gallons) over a 3 hour and 43 minute time period which equates to a leak of 96 gallons per minute.

In an effort to locate leaks, a leak detection survey for the Town of Stevensville was conducted in September 2018, by American Leak Detection. The leak survey tested 155 areas and found 11 leaks including six service line leaks, two irrigation line leaks, one curb stop leak and two main leaks.

Compliance and Quality

A sanitation survey in October, 2019 found no deficiencies in the system and the current water source has met federal and state regulations since 2017. Water quality reports from 2017-2019 and well logs can be found in Appendix __.

2.4 Financial Status of any Existing Facilities

Info regarding current rate schedules, annual O&M cost, other CIP, and tabulation of users by monthly usage categories for the most recent typical fiscal year. Provide status of existing debts and required reserve accounts.

The Town of Stevensville has been preparing for their future upgrade needs in recent years including scheduling four annual rate increases adopted in 2015 and completing wastewater and water capital improvement plans. Current user rates and estimated connections from 2015 can be found below in Table 3-1. A usage charge of $1.85 per 1,000 gallons applies to water use that exceeds the usage allowance for each meter size.

Table 2-6. Current Water Rates

Water Line/Meter Size	Monthly Rate	Connections	EDU Multiplier	2015 EDUs	Usage Allowance
¾-inch	$14.75	742	1	739	3,000 gallons
1-inch	$26.40	43	1.79	73.39	5,370 gallons
1.5-inch	$59.00	19	4	80	12,000 gallons
2-inch	$105.31	3	7.14	21.42	21,420 gallons
3-inch	$236.00	0	16	0	48,000 gallons
4-inch	$421.41	0	28.57	0	85,710 gallons

Source: Resolution 378

The Montana Department of Commerce target water rate for this community is $37.73 per month. For ¾ inch connections, the Town will be below the target rate by a factor of 2.57. Additionally, Stevensville's Median Household Income (MHI) is $32,337, making their water bill about 0.5 percent of their median household income. Adoption of the rate increase program, and associated rate variance program, shows the Town has been proactive in preparing for their upcoming needs for water infrastructure while accommodating citizens who require lower rates.

The rate increases have allowed the Town of Stevensville to operate with a healthy cash balance for water upgrades. There was approximately $1,600,000 cash on hand, at the end of fiscal year 2020. Financial analysis of the water utility determined that if funding is acquired as described above, the entire Phase IV Water Storage Improvements Project could be completed and a healthy cash balance could be maintained without further rate increases. In addition, the Town could complete the other water improvement projects scheduled in the Town's capital improvement plan.

2.5 Water, Energy, or Waste Audits

Discuss water, energy, and/or waste audits which have been conducted and the main outcomes.

Leak detect efforts and water quality have been previously discussed. No other water, energy, or waste audits have been performed.

3 Need for Project

Describe concerns and include relevant regulations and correspondence from/to federal and state regulatory agencies and include copies of correspondence.

To inform project need, hydraulic analysis of the distribution was conducted using WaterGEMS software and the original distribution model created during the 2009 PER. An updated water model from the 2009 PER was developed in conjunction with this report to include the following updates:

- As-built data and locations for residential development and well locations
- Updated pump curves for booster station and well pumps
- Updated elevation data for new development and Stevi Wye area
- Improved water demand distribution based on water service/parcel location
- Proposed infrastructure for the Wye area

Throughout this section, reference to this model and methods specific to its improvement will be highlighted as reasoning behind each project need.

3.1 Health, Sanitation, and Security

Historical Risks

In the 2009 PER conducted by PCI, health and safety issues regarding the surface water turbidity and treatment plant adequacy were defined but are now assumed to be of no risk to the public because all mentioned entities are not in use or have been abandoned. On 10/2019, annual water quality testing found no deficiencies in the system and the current water source has met federal and state regulations since 2017. Water quality reports from 2017-2019 and well logs can be found in Appendix E.

Distribution

As per the recommendations of the 2009 PER, the Town has increased metered connections and has improved distribution supply, capacity, and leaks. This has helped in reducing the health and safety risks associated with previous capacity and distribution issues. The aforementioned leak detection survey found six service line leaks, two irrigation line leaks, one curb stop leak, and two main leaks. These leaks hinder fire flow capability, put chlorine and orthophosphate into the groundwater, and potentially introduce bacterial contamination into the distribution system. Continued improvement of distribution capacity, metering, and leaks will improve system fire flows and mitigate contamination of the distribution system and groundwater. 2016 fire flow tests included in Appendix F and modeled water system pressures and velocities align with MDEQ Circular 1 requirements for system pressure and velocities. System pressures and velocities were evaluated in the hydraulic model using the updated demand information and met MDEQ Circular 1 recommendations.

Storage

As stated in the 2009 PER and serving as the primary purpose for this report, the existing storage tank is not adequate to meet MDEQ’s current water storage requirements. MDEQ Circular 1 states the following;

Storage facilities must be sufficient, as determined from engineering studies, to supplement source capacity to satisfy all system demands occurring on the maximum day, plus fire flow demands where fire protection is provided.

a. The minimum allowable storage must be equal to the average day demand plus fire flow demand, as defined below, where fire protection is provided.

b. Any volume less than that required under a. above must be accompanied by a Storage Sizing Engineering Analysis, as defined in the glossary. Large non-residential demands must be accompanied by a Storage Sizing Engineering Analysis and may require additional storage to meet system demands.

c. Where fire protection is provided, fire flow demand must satisfy the governing fire protection agency recommendation, or without such a recommendation, the fire code adopted by the State of Montana.

d. Each pressure zone of systems with multiple pressure zones must be analyzed separately and provided with sufficient storage to satisfy the above requirements.

e. Excessive storage capacity should be avoided to prevent water quality deterioration and potential freezing problems.

Due to the Town's efforts, enough data has been compiled to accurately size a water tank to replace or supplement the existing one and meet ISO fire flow and peak demands for the planning period.

This need aligns with Goal #4.3 in the 2016 Growth Policy: *Water Storage Capacity is Increased*. The action item associated with this goal is to "Identify a preferred location for a new water storage tank or reservoir and apply for grant funding to construct new water storage facility."

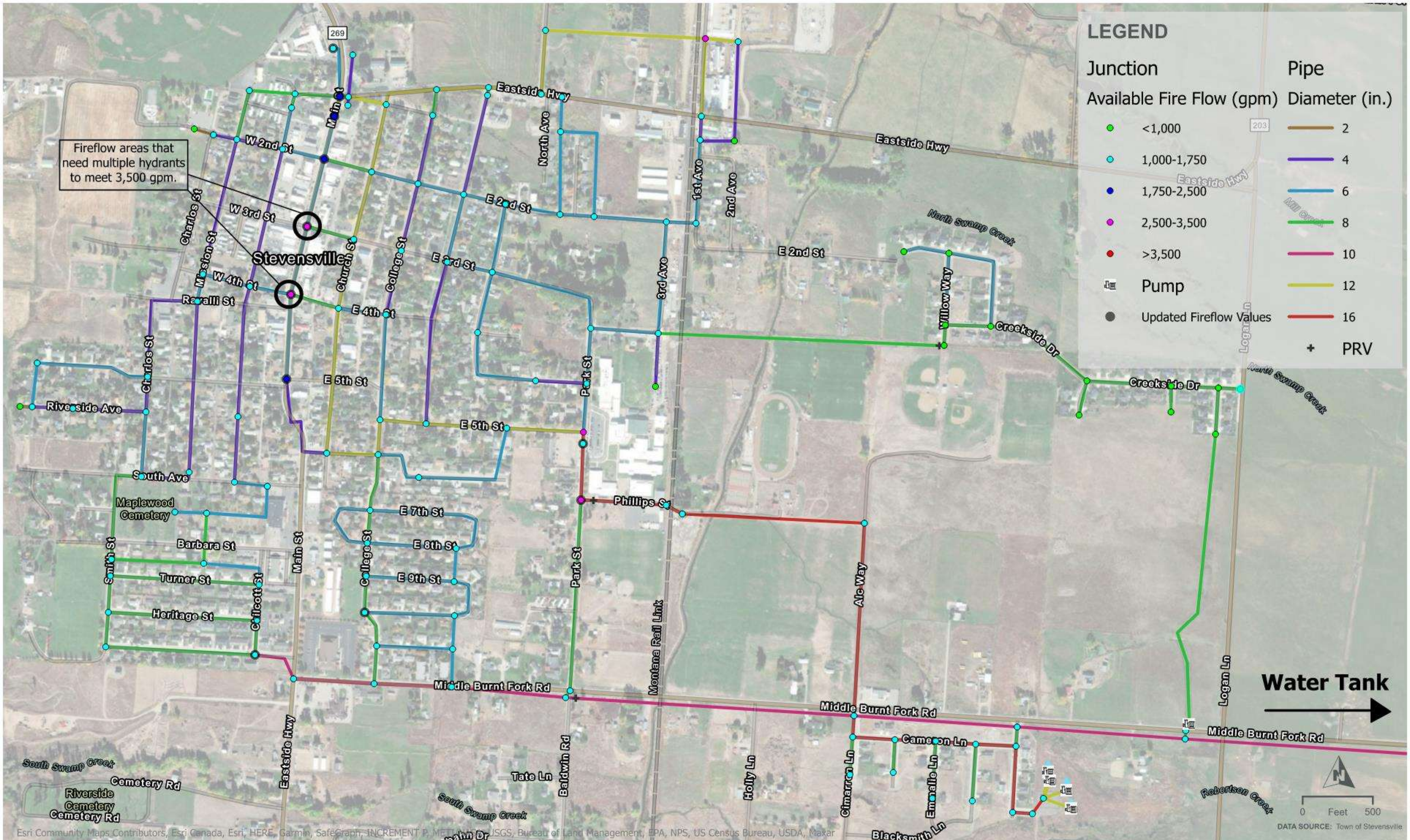
Supply

As previously mentioned, a new well field has been installed to increase water supply to the public with recent pump repairs and well analysis to improve operation and longevity. The system has reported no recent water quality issues and has been in compliance since 2017 after the minor violations mentioned in section 3.5.

Fire Flow

Needed fire flow (NFF) requirements were recently informed via correspondence with the town on 4/1/2021 and can be found in Appendix G. The updated NFF of 3,500 gpm for areas along Main Street were also designated by CSO in the 2009 PER (see Appendix H). The updated model was run to determine available fireflow under 2020 and 2040 average day demand (ADD). Available fire flow met updated NFF values while conforming to MDEQ Circular 1 pressure requirements in all cases except for the same problem areas along Main Street which would need to multiple hydrants to meet the required flow as depicted in Figure 3-1 below.

Figure 3-1. Areas with Inadequate NFF Values under 2020 ADD and 2040 ADD



CURRENT WATER SYSTEM PROPERTIES AND AVAILABLE FIREFLOW UNDER 2020 AVERAGE DAY DEMAND (ADD)
TOWN OF STEVENSVILLE WATER PER

3.2 Aging Infrastructure

Describe the concerns and indicate those with the greatest impact. Describe water loss, inflow, infiltration, treatment or storage needs, management, adequacy, inefficient designs, and other problems. Describe any safety concerns.

Historical Risks

In the 2009 PER conducted by PCI, health and safety issues regarding the 8" cast iron main were defined but are now assumed to be of no risk to the public because it has been abandoned.

Distribution

As summarized in Table 2-4, a large portion of the system has an unknown age or age greater than 40 years. Efforts to fix leaks and replace aging distribution system components have reduced issues resulting from aging infrastructure. Further monitoring, metering, and leak repair will continue to improve these issues.

Storage

Recently, the Town found the tank to be leaking at a rate of 96 gpm. The tank is about 50 years old having received a lid in 1979. The last 2004 inspection deemed the tank as safe but fixing leaks or replacing the tank would save a significant amount of water and improve system capacity.

Supply

As it has aged, Well No. 1 has had issues with sand, decreasing capacity, and growth potential. Its future use is undetermined.

Fire Flow

Distribution system upgrades installed per recommendations by the 2009 PER have improved fireflow capacity. Calculated available fire flow from the updated water model reflect that the designated 3,500 gpm fireflow required along Main Street cannot be met. The designated 3,500 gpm fireflow was determined in 1996 and could be re-evaluated by a qualified agency. The 6-inch water main on Main Street could be upsized to a 12-inch water main to replace aging infrastructure and potentially improve fire flow.

3.3 Reasonable Growth

Describe the reasonable growth capacity that is necessary to meet needs during the planning period. Facilities proposed to be constructed to meet future growth needs should generally be supported by additional revenues. Consideration should be given to designing for phased capacity increases. Provide number of new customers committed to this project.

Historical Risks

In the 2009 PER, population growth projections and increased water demand and fireflow requirements prompted the recommendation for increased storage capacity. This report and analysis build on the 2009 analysis with updated population projection data and its effect on water demand, storage, and the distribution system in general.

Distribution

In the 2009 model, demand was applied evenly across all nodes in the system, which would potentially misrepresent flow in areas of higher or lower demand. New development has increased water demand and the extent of the distribution system. Development and demand changes have been incorporated into the updated model. The additional distribution needed to serve the Wye area was also added to the model per guidance from the 2019 annexation study included in Appendix A.

Water demand at each node in the model was updated to include leak demand and better represent areas with potentially higher or lower water demand. This was done by quantifying demand for nodes based on the number of parcels, or representative service connections, they were surrounded and multiplying that by a gallons per parcel factor.

Storage

Using monthly water production data (July 2015-June 2018) and population data per the analysis in section 2.4, an estimation of projected water demand was calculated to determine additional water supply and storage needs. Table 3-1 below summarizes key findings, use in gallons per capita per day (gpcd), and leak data in million gallons per day (MGD).

Table 3-1. Key Population Growth and Water Use Values

Metric	Values		
Projected Annual Growth Rate	2.18%		
Avg. Daily Unaccounted for Water	0.3 MGD		
Water Use Designation	**Residential**	**Commercial**	**Total**
Average Day Demand (ADD)	114 gpcd	34 gpcd	148 gpcd
Max Day Demand (MDD)	250 gpcd	47 gpcd	297 gpcd

Source: Water Meter Use Data from the Town and Population Growth Data per section 2.4

Supply

The new well field provides adequate supply for projected water demand through 2040. Though Well No. 1 currently serves as a supplementary source, a replacement well near chlorine and orthophosphate infrastructure could benefit supply and capacity in the long term. Replacing Well No. 1 could improve capacity and supply and decrease contamination risks. Generally increasing supply could supplement storage in efforts to meet fire flow demands. Table 3-2 highlights projected water demand over time and its influence on supply accounting for the well with the largest flow out of service (firm capacity) per MDEQ Circular 1 requirements.

Table 3-2. Projected Water Use and Supply

Year (YYYY)	Population (# of people)	ADD (MGD)	MDD (MGD)	Unaccounted for Water (MGD)	Firm Capacity (MGD)	Remaining Supply under ADD (MGD)	Remaining Supply under MDD (MGD)
2020	2,182	0.32	0.65	0.3	1.70	1.08	0.75
2021	2,230	0.33	0.66	0.3	1.70	1.07	0.74
2022	2,279	0.34	0.68	0.3	1.70	1.06	0.72
2023	2,328	0.34	0.69	0.3	1.70	1.05	0.71
2024	2,379	0.35	0.71	0.3	1.70	1.05	0.69
2025	2,431	0.36	0.72	0.3	1.70	1.04	0.68
2026	2,484	0.37	0.74	0.3	1.70	1.03	0.66
2027	2,538	0.38	0.76	0.3	1.70	1.02	0.64
2028	2,593	0.38	0.77	0.3	1.70	1.02	0.63
2029	2,650	0.39	0.79	0.3	1.70	1.01	0.61
2030	2,708	0.40	0.81	0.3	1.70	1.00	0.59
2031	2,767	0.41	0.82	0.3	1.70	0.99	0.58
2032	2,827	0.42	0.84	0.3	1.70	0.98	0.56
2033	2,889	0.43	0.86	0.3	1.70	0.97	0.54
2034	2,952	0.44	0.88	0.3	1.70	0.96	0.52
2035	3,016	0.45	0.90	0.3	1.70	0.95	0.50
2036	3,082	0.46	0.92	0.3	1.70	0.94	0.48
2037	3,149	0.47	0.94	0.3	1.70	0.93	0.46
2038	3,217	0.48	0.96	0.3	1.70	0.92	0.44
2039	3,288	0.49	0.98	0.3	1.70	0.91	0.42
2040	3,359	0.50	1.00	0.3	1.70	0.90	0.40

Source: Water Meter Use Data from the Town and Population Growth Data per section 2.4

Fire Flow

Current NFF values and projected growth indicate a need for increased water storage to meet MDD and fire flow requirements for the 3-hour fire flow time and emergency storage required per MDEQ Circular 1 for 3,500 gpm. Figure 3-2 depicts typical water storage allocations recommended per MDEQ Circular 1.

Figure 3-2. Typical Storage Allocations

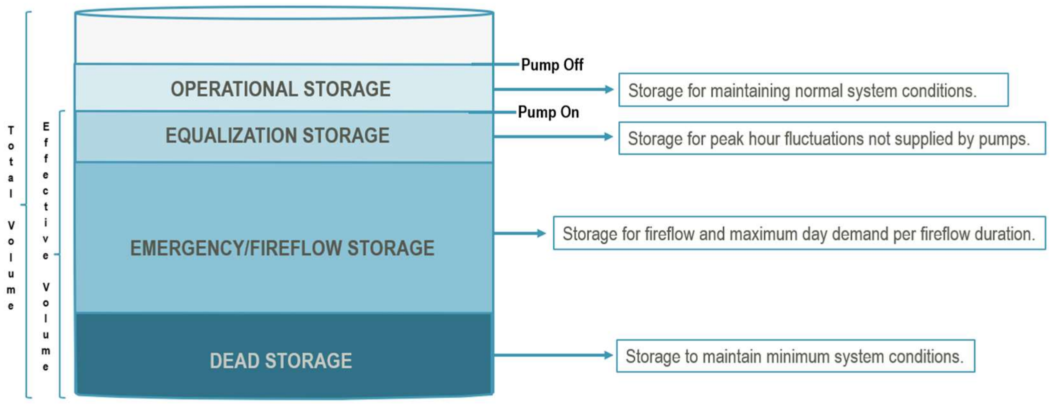


Table __ below summarizes the changes in emergency storage required through 2040 for a 3-hour, 3,500 gpm NFF. Table 3-3 summarizes total storage needed if the current tank is used to supplement storage or if a new tank/s is implemented.

Table 3-3. Emergency Storage Balance through 2040

Year (YYYY)	NFF (GPM)	Run Time (Hours)	Total NFF Volume (Gallons)	MDD (Gallons)	Unaccounted for Water (Gallons)	Firm Well Capacity (MGD)[2]	Emergency Storage Needed (Gallons)	Current Emergency Storage (Gallons)[1]	Additional Storage Needed (Gallons)
2020	3,500	3	630,000	81,183	37,124	212,400	535,907	301,000	234,907
2025	3,500	3	630,000	90,448	37,124	212,400	545,171	301,000	244,171
2030	3,500	3	630,000	100,754	37,124	212,400	555,477	301,000	254,477
2035	3,500	3	630,000	112,213	37,124	212,400	566,937	301,000	265,937
2040	3,500	3	630,000	124,975	37,124	212,400	**579,698**	301,000	**278,698**

[1]Assumes current 430,000-gallon uses 5% and 25% of storage for operational and equalization storage respectively
[2]Firm well capacity assumes largest pump is out of service per MDEQ Circular 1 recommendations

Table 3-4. Approximate Emergency and Proposed Tank Storage Volumes

Metric	Supplemental Storage (Gallons)	New Storage (Gallons)
Additional Emergency Storage Needed	278,698	579,700
Assumed Equalization/Operational Volume (25%)	125,000	250,000
Dead Storage (5%)	25,000	50,000
Proposed Tank Volume	**500,000**	**1,000,000**

4 Alternatives Considered

4.1 Water Storage

Per section 4.3 above, water tank storage alternatives are listed below in Table 5-1.

Table 4-1. Water Tank Alternatives

Tank Alternative	Tank Type	Location	Size (gallons)
1	Rehab Existing Tank	Current Location	430,000
	Additional Storage	Next to Existing Tank	500,000
2	Rehab Existing Tank	Current Location	430,000
	Additional Storage	Wye Area	500,000
3	Rehab Existing Tank	Current Location	430,000
	Additional Storage	Airport	500,000
4	Rehab Existing Tank	Current Location	430,000
	Additional Storage	Elevated Tank	500,000
5	New Tank	Current Location	500,000
	New Tank	Wye Area	500,000
6	New Tank	Current Location	500,000
	New Tank	Airport	500,000
7	New Tank	Current Location	500,000
	New Tank	Elevated Tank	500,000
8	New Tank	Current Location	1,000,000
9	New Tank	Wye Area	1,000,000
10	New Tank	Airport	1,000,000
11	New Tank	Elevated Tank	1,000,000

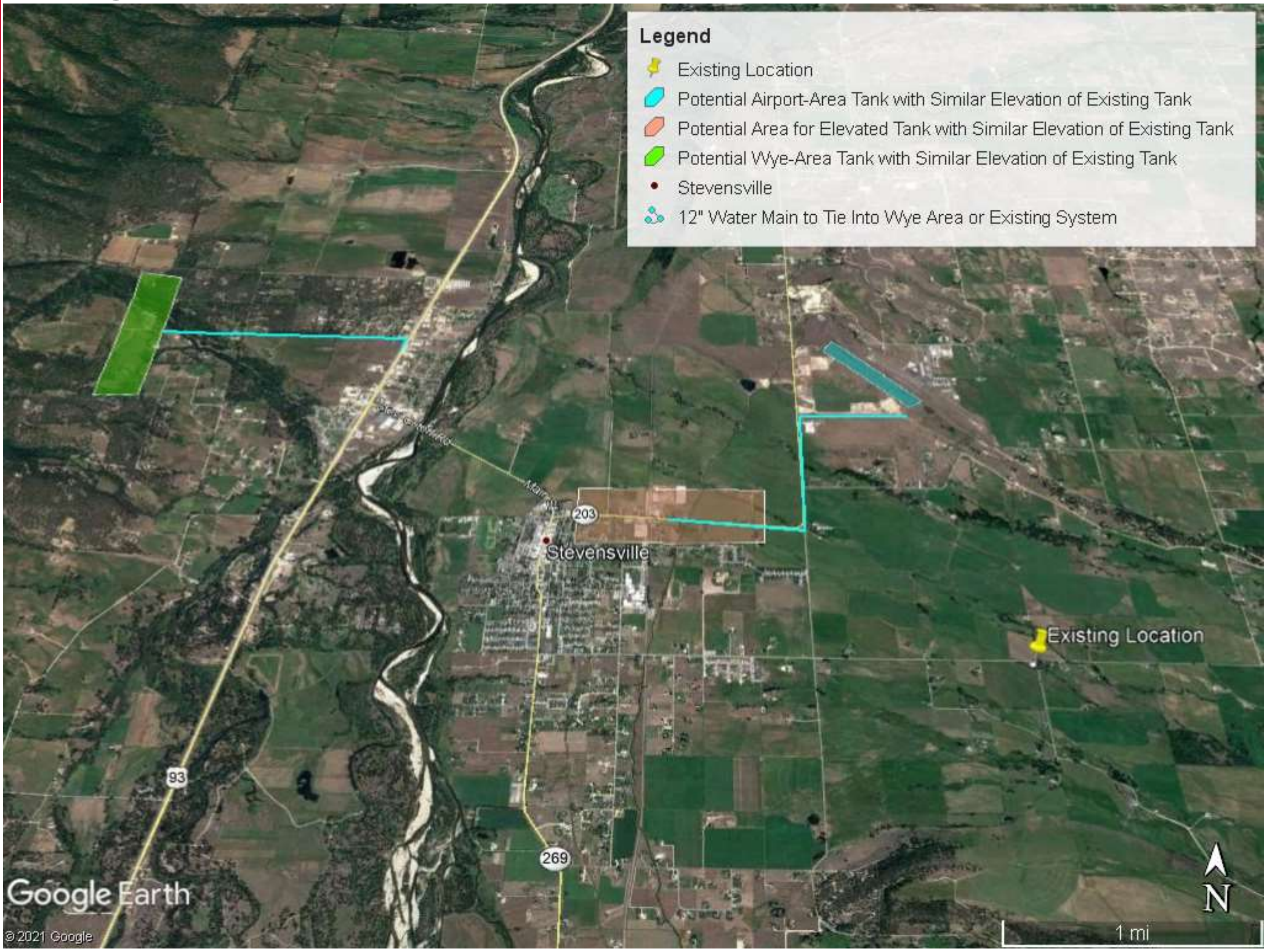
4.1.1 Design Criteria

For water storage alternatives considered, water surface elevations for existing or alternate locations for existing or new water tanks should match existing conditions or be re-calibrated to maintain appropriate operation. Before new tank implementation, it is recommended that a thorough hydraulic analysis is conducted to ensure appropriate water surface elevations are estimated especially in the case of new tank locations. An in depth tank site study is recommended to identify tank locations that have appropriate geotechnical and hydraulic characteristics.

4.1.2 Map

Figure 4-1 below depicts areas with similar elevations to the existing water tank that could contain a new water tank. These depicted areas are rough estimates and a tank site study would be required before tank implementation.

Figure 4-1. Potential Areas for a Water Tank



4.1.3 Environmental Impacts

A new water storage tank and associated distribution could disturb areas of undeveloped land but, generally, environmental impacts of water tanks are negligible. The tank site study previously mentioned would be required to investigate environmental impacts and required permitting.

4.1.4 Land Requirements

Water storage tanks require relatively small amounts of land, but associated distribution could require additional right-of-way (ROW) acquisition. A more in depth tank site study would better define land and ROW requirements.

4.1.5 Potential Construction Problems

Potential construction problems with a new tank would likely be influenced by tank location. The condition of the current tank could require more complex rehabilitation methods if the condition is poor.

4.1.6 Sustainability Considerations

Water and Energy Efficiency

Rehabilitating or replacing the existing tank would improve water efficiency by fixing the current leak from the tank. For new tank alternatives, modeling water tank levels and their relationship to pumping intervals could be used to improve pumping time and frequency, therefore improving energy efficiency.

Green Infrastructure

Further tank site examination and tank design could highlight opportunities for implementing green infrastructure.

4.1.7 Cost Estimates

See section 6.5 for a cost estimate for water storage based on the recommended alternative.

4.2 Water Distribution

Significant improvements have been made to the distribution system as recommended by the 2009 PER and due to leak remediation efforts. Further water leak analysis and repair is recommended to improve the water distribution system. Prioritizing the oldest and smaller-diameter pipes could improve the distribution system in a more efficient way since many large diameter improvements have been made recently per the 2009 PER recommendations.

It is recommended that the 6-inch main along Main Street be upsized to a 12-inch water main in order to improve fireflow in the inadequate NFF area and potentially fix unknown leaks in the older pipe.

Distribution associated with the Wye Area can be found in the Annexation Report and Medical Facility report in Appendices __ and __. 12-inch distribution would be associated with a new tank site but would require further analysis before implementation.

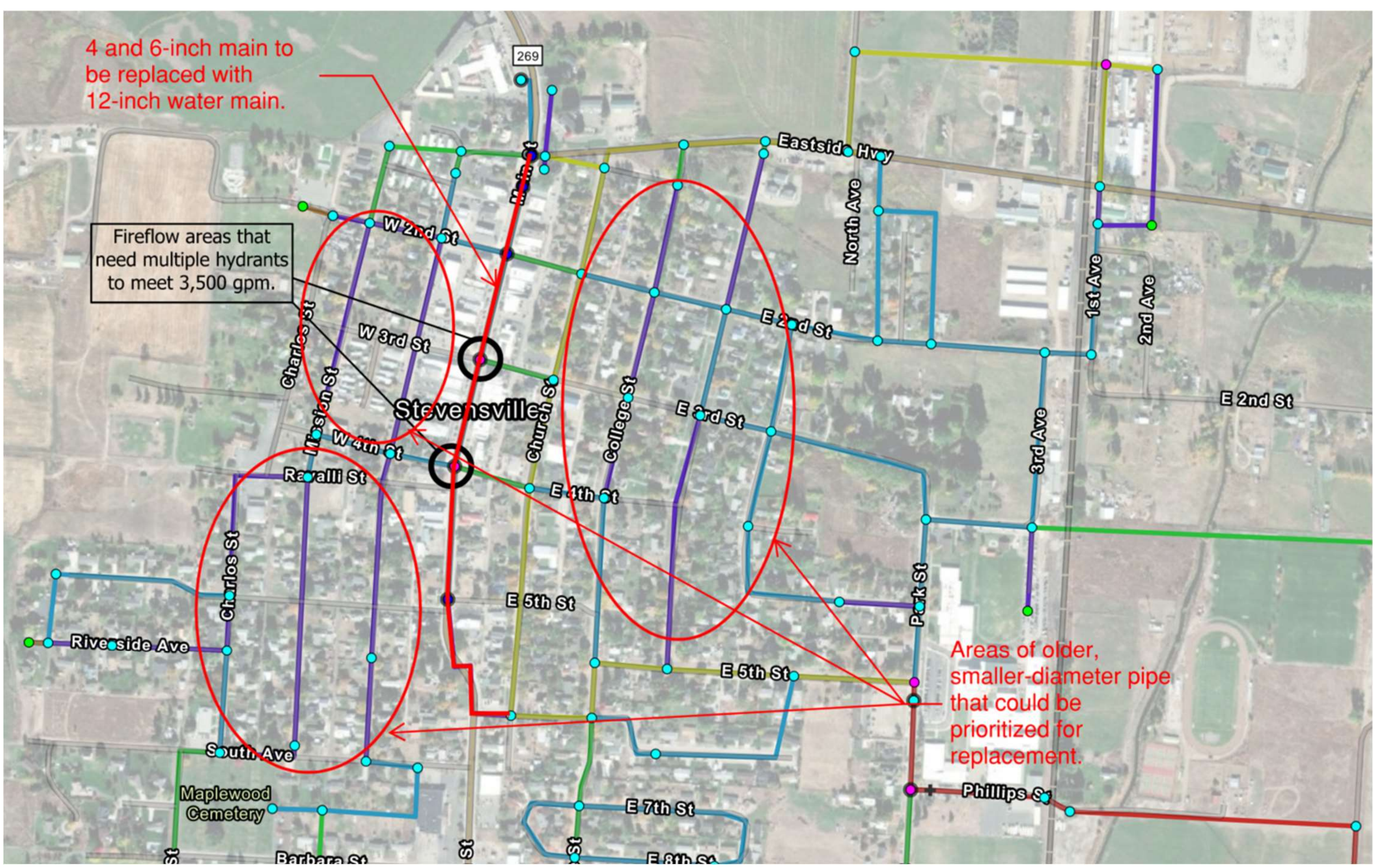
4.2.1 Design Criteria

All distribution system changes should be modeled to confirm that changes allow the system to meet distribution system requirements per MDEQ Circular 1.

4.2.2 Map

Figure 4-2 below depicts the 4 and 6-inch main to be replaced with 12-inch main as well as the smaller-diameter, older water mains that could be prioritized.

Figure 4-2. Potential Distribution System Improvements



4.2.3 Environmental Impacts

Replacing existing distribution lines would likely not have large environmental impacts whereas new distribution lines for a new tank site or Wye area expansion could have environmental impacts by disturbing undeveloped land.

4.2.4 Land Requirements

Replacing existing distribution lines would likely not have additional land requirements whereas new distribution lines for a new tank site or Wye area expansion could require acquisition of additional ROW.

4.2.5 Potential Construction Problems

Dewatering during replacement or construction of existing or new water mains would likely be required. Other potential construction problems could arise based on site-specific geotechnical variations.

4.2.6 Sustainability Considerations

Water and Energy Efficiency

Replacing existing distribution mains could improve leaks, therefore improving water efficiency. Low-friction material for new or replacement water mains could improve system flow compared to high-friction materials allowing for a potential in energy savings. During new or replacement distribution design prioritizing leaking pipes would improve water efficiency quicker.

Green Infrastructure

Green infrastructure options for water implementation could be investigated further during the design process

4.2.7 Cost Estimates

Appendix A highlights costs of Wye area distribution requirements. See section 6.5 for a cost estimate for distribution system cost based on the recommended alternatives for the existing system.

4.3 SCADA

Upgrading current SCADA infrastructure related to drinking water to match the SCADA used for the town's wastewater infrastructure is recommended as it would improve overall water operations and control integration.

4.3.1 Design Criteria

Further investigation into the existing water and wastewater SCADA design metrics and controls would inform the requirements for transitioning the system onto one primary control platform.

5 Selection of an Alternative

Further feedback from the town is being taken into account before a water storage alternative is selected. A tank site study could affect water storage alternative selection as well.

It is recommended that the town replace the 4 and 6-inch water main on Main Street mentioned in this report with a 12-inch main to increase fire flow and potentially improve leaks.

SCADA upgrades for the water system to match the wastewater SCADA platform is recommended.

5.1 Life Cycle Cost Analysis

For water storage alternatives, capital costs are typically the highest costs associated. Routine inspections on water storage tanks is typically required and other operation and maintenance activities may be required periodically.

For water distribution alternatives, capital costs are typically the highest costs associated. Distribution system improvements may benefit from regular valve exercising or other maintenance programs but are generally a low-maintenance component of the system.

5.2 Non-monetary Factors

Acquiring town feedback in regard to preferred water storage tank sites and social impacts associated with the tank alternative and other alternative impacts is necessary to determine the selected alternative.

6 Proposed Project

6.1 Preliminary Project Design

6.1.1 Storage

As mentioned in section 4.1, a tank site study is recommended to determine appropriate tank siting and final water storage alternatives and their associated design metrics.

6.1.2 Distribution Layout

As mentioned in section 4.2, a tank site study and further town feedback regarding the Wye area development would inform design for new distribution system layout. Replacing existing water distribution with new, larger-diameter water main would likely re-use existing pipeline alignments and ROW.

6.2 Project Schedule

A preliminary project schedule can be found in Table 6-1 below. Generally, the schedule accommodates new funding sources and feasible construction times for the area.

Table 6-1. Potential Proposed Project Schedule

Time of Year	Event
Summer 2021	Tank Siting Study, SCADA analysis, and distribution system recommendations.
Fall 2021	Tank Pre-Design, SCADA design, and distribution system preliminary design.
Winter 2021	Final Design
Spring-Fall 2022	Construction

6.3 Permit Requirements

Permit requirements regarding water storage and distribution will likely be determined by tank location which would be determined by the aforementioned tank siting study.

6.4 Sustainability Considerations

See sections 4.1 and 4.2 in regard to water storage and distribution system sustainability considerations.

6.5 Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

The tank siting study would inform a more detailed cost estimate for the chosen location(s) and alternative but an estimate for a 1,000,000-gallon water tank has been provided below in Table 6-2 for context.

Table 6-2. Potential 1 MG Tank Cost

Item	Qty.	Unit	Unit Price ($)	Total ($)
Division # 1 - Special Conditions				
Land Purchase, Site Prep, and Permits	1	LS	265,000	265,000
Division # 2 – Site Work/Tank				
Concrete	880	CY	600	528,000
Reinforced Steel	66	SY	2,200	145,200
Engineered Gravel Fill	1,150	SY	30	34,500
Waterproofing	660	SY	150	99,000
	Subtotal Construction			$ 1,071,700
	Contingency		20%	214,340
	Engineering		20%	214,340
	Total Estimated Cost			**$ 1,500,400**

Table 6-3 below provides a cost opinion for replacing the 4 and 6-inch water main along Main Street.

Table 6-3. Cost Opinion for Distribution Improvements

Item	Qty.	Unit	Unit Price ($)	Total ($)
Division # 1 - Special Conditions				
General Conditions, Mobilization, and Permits	1	LS	43,700	43,700
Division # 2 - Site Work				
12" Water Main	2,900	LF	70	203,000
12" Isolation Valve	6	EA	4,000	23,200
Fire Hydrants	6	EA	7,200	43,200
Water Service Connection	30	EA	1,800	54,000
Asphalt Resurfacing	700	YD^2	95	66,500
Water System Tie-In	2	LS	6,000	12,000
	Subtotal Construction			$ 445,600
	Contingency		20%	89,120
	Engineering		20%	89,120
	Total Estimated Cost			**$ 623,900**

Table 6-4 below provides a cost opinion for upgrading SCADA infrastructure so the water system matches the wastewater system SCADA.

Table 6-4. Key Population Growth and Water Use Values

Item	Qty.	Unit	Unit Price ($)	Total ($)
Head End Software/Upgrades/Communications				
Engineering and Programming	1	LS	45,000	45,000
Construction	1	LS	25,000	25,000
Software	1	LS	50,000	50,000
Well Field				
Engineering and Programming	1	LS	48,000	48,000
Construction	1	LS	46,000	46,000
Generators and ATS	1	LS	17,000	17,000
Tank Improvements				
Engineering and Programming	1	LS	14,000	48,000
Construction	1	LS	20,000	46,000
			Total Estimated Cost	**$ 265,000**

6.6 Annual Operating Budget

6.6.1 Income

As mentioned in section 2.4, the town has saved the appropriate funds for this project per advisement from the 2009 PER. Recently, funding has become available through the American Rescue Plan Act (ARPA) and could provide additional funding for the water tank and distribution system improvements. Table 6-5 and Figure 6-1 below depict and summarize the potential available funding from ARPA to supplement current town funds.

Figure 6-1. ARPA Funding Structure

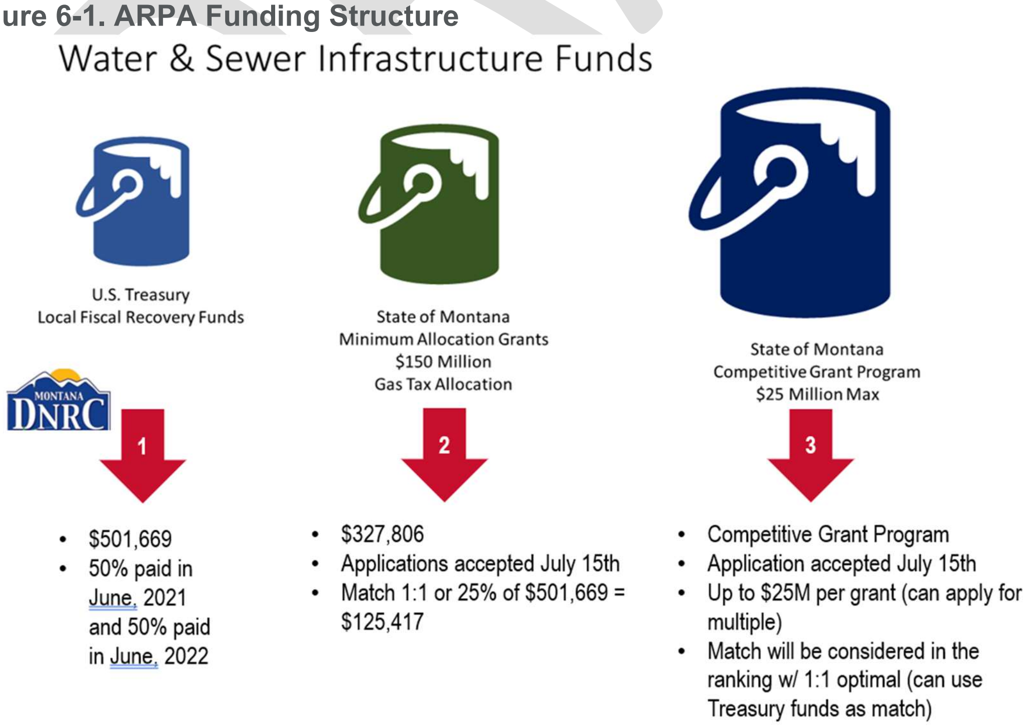


Table 6-5. ARPA Funding Scenarios

ARPA Funding Scenario	Value
House Bill	$327,806
Treasury	$501,669
Town Funds	$1,600,000
Potential Competitive Grant	$1,976,252
Total Potential Funds	**$4,405,727**

7 Conclusions and Recommendations

Considering the planning period of 2020-2040 and the influence of population growth on existing infrastructure for the Town of Stevensville, it has been determined that implementing additional water storage, replacing key distribution mains, and upgrading SCADA will increase the efficiency, security, and dependability of the existing drinking water system. Existing rate programs and leak remediation efforts have prepared the town well to implement these recommendations. This report can also serve to assist the application process for newly available ARPA funding.