Analysis of Alternatives
for
Wolf Creek Property Owners Assn
State ID# 11476H

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PROJECT NUMBER
250912

Prepared for:

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Wolf Creek Water Main Replacement
Analysis of Alternatives Report

1.0 System Description

The Wolf Creek Property Owners Assn. water system (ODW # 11476H) is an existing Group A water system located in Section 31, Township 35, Range 21 East, W.M. just west of Winthrop, Washington in Okanogan County. The water system is currently approved for 79 connections and serves 61 connections.

The system contact information is as follows:

Water System Name:	Wolf Creek Property Owners Assn
WSDOH ID Number:	11476H
Name of Owner:	Wolf Creek Property Owners Assn
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SMA Primary Contact:	Doug Hale
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The water system is currently comprised of a two drilled wells, which feed a 30,000-gallon reservoir located up the hill. The system is split into three zones: a gravity zone fed by the reservoir, and two booster zones each pressurized by a single booster pump located in a booster station adjacent to the reservoir. The gravity fed zone is located north of the reservoir toward State Route 20, while the pressurized zones are located to the west and south of the reservoir. Of the 61 existing connections served by the water system, 7 are currently served by the upper pressure zones. All connections served by the water system are single family residential connections with a typical lot size of approximately 2 acres.

2.0 Project Description

Over the past decade, numerous leaks have developed. Water Use efficiency reports within the past five years show that a system leakage over 50%. In an attempt to reduce leakage, the water system began replacing the portion of the transmission and distribution system between the pumphouse and the Green Meadows subdivision. The community wishes to address other potential leaks in the transmission and distribution systems.

3.0 Review of System

The following are an analysis of different components within the water system.

3.1 Source Pumps

The existing source pumps are controlled via float switches in the reservoir. The system currently alternates between source pumps on each call for water from the reservoir. Well #2 has a capacity of 55 gpm while Well #3 has a capacity of 60 gpm. Water rights limit the withdrawal from the ground water aquifer to 60 gpm. Additional water rights will be needed if the system wishes to place the system on lead lag controls.

The last well pump replacement for Well #2 appears have been completed in 2016. Well #3 appears to be the original source pump installed in 2008. Typically, submersible source pumps have an expected life of about 20 years when pumping to a reservoir. The community should be aware that the Well #3 pump may be near the end of life. However, submersible pumps pumping to a reservoir often last approximately 30 years.

3.2 Transmission line

The transmission line between the Cottonwood Meadows community and Aspen Ln. is the most recent installation of the water system. The transmission line was originally installed in 2008. The significant leaks that developed since the original installation between the Cottonwood Meadows community and Aspen Ln. were unexpected and suggest the original installation was not completed properly. In 2024, the community again replaced the portion of the transmission line between Cottonwood Meadows community and Aspen Ln. This replacement seems to have repaired a majority of the system leakage at that time.

While the most recent repair has addressed most of the leakage, it has been confirmed another leak is present in the transmission line between Well #2 and Well #3.

3.3 Chlorine Treatment

The existing chlorine treatment is located in the booster station near the reservoir. Chlorine is injected into the transmission water prior to the reservoir. The treatment appears to be functioning as intended.

3.4 Reservoir

The reservoir is a buried 30,000-gallon concrete reservoir. Some small leaks have been reported. Historic maps show the reservoir elevation to be 2,070 feet. However, USGS topographic maps show the reservoir elevation to be less than 2,020 feet. The lower elevation explains the low-pressure complaints received from the south Green Meadows community (see Section 4.0). It is likely, at some point, a "2" was misinterpreted as a "7" and has been carried down from map to map.

The existing reservoir appears to be undersized according to current Washington State standby storage design practices. It should be noted plans have been made to upgrade the reservoir. Standby storage is typically used for reliability purposes. Reliability is a community choice.

3.5 Booster Station

Two pressure zones are each served by a single booster pump within the pumphouse. If one of the pumps were to go offline, a valve could be opened to connect the two pressure zones until the booster pump is repaired or replaced. Historically, the pumps were two different sizes. However, the smaller booster pump is planned to be replaced with a 7.5 hp booster to match the larger booster pump. The existing booster pumps are significantly oversized for the two pressure zones. Additionally, the system may improve reliability by combining both pressure zones and using both booster pumps to supply water to a newly combined pressure zone. Two 2 hp pumps should be able to support all connections in the upper pressure zone. The design for the booster station should be completed alongside the upgrade to increase pressure to the southern portion of the Green Meadows Community (See Section 4.0). The booster pumps themselves seem to be in good condition and should be replaced with smaller boosters upon the end of useful life. However, we recommend completing the engineering design now so when the pumps are replaced in an "emergency" the correct pumps can be installed.

3.6 Distribution system

The distribution system is the current concern of the community. The system has developed leaks in recent years that have caused the system to far exceed the maximum 10% leak threshold established by the Department of Health. Department of Health

notified the system that leakage should be reduced by 2017; however, this was not accomplished. Further action by the Department of Health has not yet been taken.

The system is comprised mostly of four-inch PVC mains. PVC is expected to last anywhere between 50 and 100+ years depending on when it was installed. More recent installations are expected to last longer.

The community has continued to develop since the distribution system was installed. According to maps provided, water mains that originally supported the southernmost portion of the Green Meadows community were placed in the middle of a then vacant lot. Satellite imagery shows the lot has since been developed and water mains may now be located under the existing buildings. This will make these sections incredibly difficult (if not impossible) to repair. It has been suggested that existing maps showing the location of the distribution system may be inaccurate and need to be updated to show the actual path.

System leaks throughout the distribution system have increased over recent years, suggesting the distribution system is nearing the end of life. However, based on leak data recorded by the system, a majority of the leaks appear to occur near the corners of the system. Leaks at pt near the corners suggests inadequate thrust blocks were installed allowing the corners of the distribution system to move over time.

Most of the historical leak repairs have occurred in the Cottonwood Meadows community with few leak repairs being recorded at higher elevations within the Green Meadows loop. Recorded leak repairs tend to be located within 100 feet of distribution corners and where two sections of pipe come together. The community has noted that the loop servicing the Cottonwood Meadows community currently does not have leaks.

Leaks running along the side of the pipe making it more difficult to detect. Therefore, it is not impossible that similar leaks to those repaired in the Cottonwood Meadows community have occurred elsewhere undetected. The water main serving the Green Meadows community, is the largest and has seen the fewest repairs. It is likely that leakage is occurring somewhere on this main.

3.7 Pressure Reducing Station

The Cottonwood Loop is served by a pressure reducing valve (PRV) which reduces the pressure to 60 PSI. A PRV requires regular maintenance. The screen upstream of the PRV (if there is one) should be cleaned every one to five years. The PRV itself should be rebuilt every five to ten years. However, some water systems just run the PRVs until they fail. Not rebuilding the PRV will severely shorten the life of the PRV.

4.0 Hydraulic Analysis

A hydraulic model of the system was created to determine theoretical pressures throughout the system. Reports of both high pressures and low pressures from the community warranted a closer look at system pressures.

Upper Green Meadows and Virginia Hills are each served by a booster pump which ensure connections served within the pressure zone receive adequate pressures.

The gravity pressure zone is fed directly from the reservoir. Large elevation changes throughout the system lead to areas in which portions of the community experience high pressure and other parts of the community experience low pressure.

The highest pressure throughout the community is just below 70 psi. This is within the range of 40 psi – 80 psi in which most customers find acceptable.

A pressure reducing valve currently reduces pressure in the Cottonwood Community to 60 psi. Without the pressure reducing valve, some connections would experience pressures in excess of 100 psi.

The model showed areas in the Green Meadows community may experience pressures below 30 psi during times of high demand. The Department of Health requires all connection be provided a minimum of 30 psi. However, most modern fixtures are designed to function best between 40 psi and 60 psi. The pressure in this area will need to be increased to meet the standards put forth by the Washington State Department of Health. A line from the upper pressure zone can be run down the hill to provide pressure for this area. Alternatively, the abandoned booster station in the vault along the Green Meadows loop could be reactivated until replacement of the Distribution System within the Green Meadows community is replaced.

5.0 Distribution Leak Repair Options

The distribution system is in need of repair. The community has opted to not increase the main sizes to support fire flow. Therefore, fire flow will not be considered. Technologies exist that could be used to repair leaks in the distribution system and/or improve the strength of the mains such as sleeving or relining the interior of the mains which were brought up by the community. However, these technologies will not address the underlying issues that exist.

Sleeving water mains is a technology, typically used with ductile iron pipe, to improve the structural integrity of water mains. A sleeve can be placed around the main (typically welded). This will prevent leaks from pitted or cracked piping. Leaks throughout the system have been noted to happen at joints suggesting pipe movement or a failure of seals. Sleeving the piping will not address these types of failures.

In some cases, trenchless repair can be used to save on costs associated with trenching and excavation. The downside to trenchless repair/replacement is it is more difficult to visually inspect the quality of work. Two main trenchless methods are used to replace/repair water mains, epoxy lining the existing mains and pipe bursting.

Recoating the interior of the mains with an epoxy liner would use the existing strength of the mains to provide initial structural support. A technician would use a mesh sleeve saturated with epoxy to line the interior of the water main. The liner would also allow epoxy to fill any cracks that may have developed across the distribution system. Once the liner has hardened the technician will then need to go through and cut out all branches. If the original mains were not installed correctly, this method is likely to fail over time. The costs associated with trenching at Wolf Creek are likely to be similar to relining the mains with an epoxy mesh. Therefore, epoxy lining will not be considered as a water main repair option.

Pipe bursting threads a new main through the existing pipe by breaking apart the existing main as it goes. Pipe bursting is best used for short runs on brittle mains. Longer runs require larger equipment. Pipe bursting really shines in areas where trenching would require the demolition and replacement of infrastructure such as sidewalks and paved roads. The cost of pipe bursting would likely be significantly more expensive than a trenched replacement. Therefore, pipe bursting will not be considered as a replacement option.

Excavation and replacement will cost less and will allow for visual inspection of the infrastructure. Therefore, the following options are under consideration by the community:

- Replace the Entire Distribution System
- Replace most troublesome sections
- Replace Thrust Blocks
- Repair as Needed

The community has also asked that a cost estimate be prepared to be able to compare the various options. It should be noted the community has had a difficult time enlisting contractors to complete work on the distribution system. The quotes that the system has shared with Northwest Water Systems far exceed costs for similar work in other areas. The cost estimates presented are based on other projects Northwest Water Systems has been involved in throughout the state, but also considering quotes associated with past Wolf Creek projects. While cost estimates may be used to compare, they should not be considered quotes.

Submittal to the State Department of Health is not expected. Therefore, engineering costs and fees associated with project submittal to the State Department of Health are not included.

5.1 Replace the Distribution System

The system is approximately 40 years old. PVC installed in the late 70's to early 80's has an expected life between 50 to 100 years, depending on when it was installed and who the manufacturer was. PVC prior to the mid 1970's tends to become brittle over time and is expected to have a typical life between 40-60 years. PVC manufacturers implemented major advances in their products through the mid 80's.

Replacing the entire system will allow the system to take advantage of newer technology available to distribution systems and oversee the installation to ensure correct materials and methods are used, conforming to industry standards. Replacing the distribution system will reduce foreseeable repair costs as new distribution systems have little leakage. Since leaks are unlikely to develop in new, correctly installed distribution mains, replacing the distribution system would also allow the system to install any desired upgrades to the mains.

There are portions of the distribution system that may be currently inaccessible as distribution maps show the mains lie underneath buildings. Community members have shared that these utility maps are likely incorrect. Replacing the distribution system would provide the opportunity to install infrastructure where it is more accessible, remove some of the easements through private property and provide an opportunity to create an accurate water system utility map.

Replacing the distribution system comes with the highest upfront cost and will be a lengthy process. A planned water outage should last at most a few hours. If the community chose, bottled water could be made available during an outage. However, it is typical to expect customers to maintain a few gallons of water on hand for an outage event. It should be noted that replacement of the distribution system can be done in phases to minimize the number of people out of water at any given time.

5.1.1 Arguments For

- "Guaranteed fix"
- Gain advantage of newer technology
- Limit reliance on easements through property boundaries.
- Easy to install troubleshooting
- Mostly planned, short interruptions

5.1.2 Arguments Against

- Most expensive upfront cost

5.1.3 Approximate Costs

Most of the costs associated with replacement of the distribution system are accumulated by labor. The material costs associated with the replacement are relatively small in comparison.

Component	Cost per Unit	Units	Total Cost
2" DR 11 HDPE	$2.20/ft.	5,100	$11,300
4" DR 11 HDPE	$5.40/ft.	11,300	$61,000
4" Gate Valve	$700	17	$11,900
6" DR 11 HDPE	$10.00/ft.	700	$7,000
4" DR11 HDPE*	$5.40/ft.	3,900	21,100
Service Laterals	$1,000/connection	79	$79,000
Blowoff	$1,500	9	$13,500
Air-vac	$1,500	5	$7,500
Source Meters	$150	2	$300
Monitoring Meters 2" °	$150	5	$750
Monitoring Meters 3" °	$1,500	4	$6,000
Service Meters	$150	79	$11,900
Misc Fittings	$5,500	1	$5,500
Dirt Removal	$25/yd^3	32	$800
Concrete	$200/ yd^3	32	$5,200
Labor and Trenching	$130/ft	17,100**	$2,223,000
Equipment Rental	$1,000+$250/day	171	$43,800
Water Samples	$55	17	$800
		Subtotal	$2,510,400
		Contingency (20%)	$502,100
		Total	**$3,012,500**

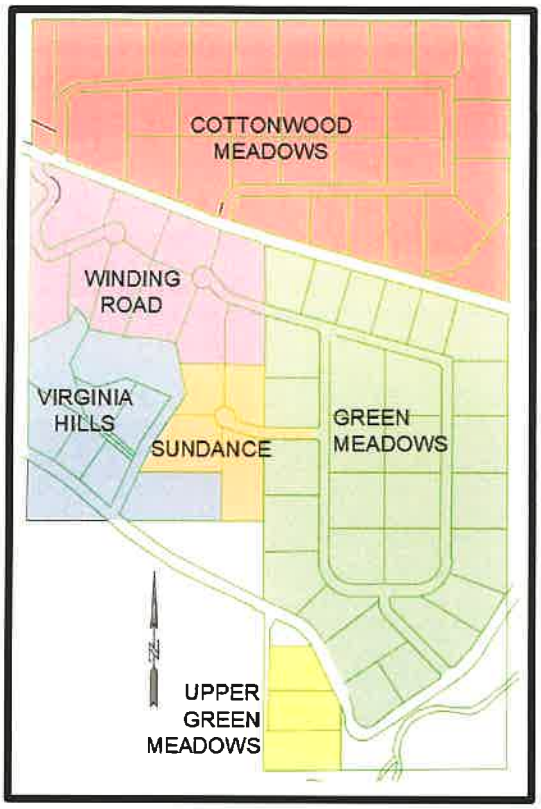
*Transmission Line to reservoir from Well #2 and Well #3

**Assumes transmission line is completed alongside distribution system in same trench.

° Optional community requested component

5.2 Replace Over Time

Instead of replacing the whole distribution system, the community could replace just the sections experiencing the highest leaks. By only replacing a portion of the distribution system, the community will not be replacing infrastructure that may have significant useful life left. However, as other sections deteriorate further, leak repairs will begin to increase. While this option will spread the costs associated with replacement over several years, the overall cost will likely be higher than a full replacement.



Zones Referenced for Partial System Replacement

5.2.1 Arguments For

- Not replacing sections that do not seem to leak
- "Guaranteed fix" for Troublesome Section
- Gain advantage of newer technology
- Mostly planned, short interruptions
- Spread replacement of system out over time
- Lower upfront cost than total replacement

5.2.2 Arguments Against

- Expensive upfront costs
- Unexpected interruptions for remainder of system
- Rest of system will likely experience occasional leaks as it continues to age

5.2.3 Approximate Costs

Most of the costs associated with replacement of the distribution system are accumulated by labor. The material costs associated with the replacement are relatively small in comparison.

Cottonwood Meadows

Component	Cost per Unit	Units	Total Cost
4" DR 11 HDPE	$5.40/ft.	5,900	$31,900
4" Gate Valve	$700	5	$3,500
Service Laterals	$1,000/connection	30	$30,000
Blowoff	$1,500	1	$1,500
Service Meters	$150	30	$4,500
Monitoring Meter 3"[O]	$1,500	1	$1,500
Air-vac	$1,500	1	$1,500
Misc Fittings	$1,000	1	$1,000
Dirt Removal	$25/$yd^3$	9	$225
Concrete	$200/ yd^3	9	$1,800
Labor and Trenching	$130/ft	5,900	$767,000
Equipment Rental	$1,000+$250/day	53	$14,250
Water Samples	$55	2	$110
		Subtotal	$858,800
		Contingency (20%)	$171,800
		Total	**$1,030,600**

[O] Optional community requested component

Green Meadows

Component	Cost per Unit	Units	Total Cost
2" DR11 HDPE	$2.20/ft.	1,700	$3,800
4" DR 11 HDPE	$5.40/ft.	3,800	$20,600
6" DR 11 HDPE	$10.00/ft.	700	$7,000
4" Gate Valve	$700	7	$4,900
Service Laterals	$1,000/connection	26	$26,000
Blowoff	$1,500	3	$4,500
Monitoring Meters 2" [O]	$150	1	$150
Monitoring Meter 3" [O]	$1,500	2	$1,500
Service Meters	$150	26	$3,900
Air-vac	$1,500	2	$3,000
Misc Fittings	$2,000	1	$2,000
Dirt Removal	$25/$yd^3$	11	$275
Concrete	$200/ yd^3	11	$2,200
Labor and Trenching	$130/ft	6,200	$806,000
Equipment Rental	$1,000+$250/day	68	$18,000
Water Samples	$55	5	$275
		Subtotal	$904,100
		Contingency (20%)	$180,900
		Total	**$1,085,000**

[O] Optional community requested component

Sundance Ln.

Component	Cost per Unit	Units	Total Cost
2" DR 11 HDPE	$2.20/ft.	500	$1,100
Service Laterals	$1,000/connection	4	$4,000
Blowoff	$1,500	1	$1,500
Service Meters	$150	4	$600
Monitoring Meters 2" [O]	$150	1	$150
Misc Fittings	$500	1	$500
Dirt Removal	$25/yd^3	1	$25
Concrete	$200/ yd^3	1	$200
Labor and Trenching	$130/ft	500	$65,000
Equipment Rental	$1,000+$250/day	5	$2,300
Water Samples	$55	1	$55
		Subtotal	$75,500
		Contingency (20%)	$15,100
		Total	**$90,600**

[O] Optional community requested component

Winding Road

Component	Cost per Unit	Units	Total Cost
2" DR11 HDPE	$2.20	900	$2,000
4" DR 11 HDPE	$5.40/ft.	400	$2,200
4" Gate Valve	$700	1	$700
Service Laterals	$1,000/connection	9	$9,000
Blowoff	$1,500	1	$1,500
Monitoring Meters 2" [O]	$150	1	$150
Service Meters	$150	9	$1,400
Air-vac	$1,500	1	$1,500
Misc Fittings	$500	1	$500
Dirt Removal	$25/yd^3	3	$75
Concrete	$200/ yd^3	3	$600
Labor and Trenching	$130/ft	1,300	$169,000
Equipment Rental	$1,000+$250/day	13	$4,300
Water Samples	$55	2	$110
		Subtotal	$193,100
		Contingency (20%)	$38,600
		Total	**$231,700**

[O] Optional community requested component

Virginia Hills (ridge)

Component	Cost per Unit	Units	Total Cost
2" DR11 HDPE	$2.20	1,400	$3,080
4" DR 11 HDPE	$5.40/ft.	1,200	$6,500
4" Gate Valve	$700	3	$2,100
Service Laterals	$1,000/connection	7	$7,000
Blowoff	$1,500	2	$3,000
Monitoring Meters 2" [O]	$150	1	$150
Service Meters	$150	7	$1,100
Air-vac	$1,500	1	$1,500
Misc Fittings	$1,000	1	$1,000
Dirt Removal	$25/yd^3	6	$150
Concrete	$200/ yd^3	6	$1,200
Labor and Trenching	$130/ft	2,600	$338,000
Equipment Rental	$1,000+$250/day	26	$7,500
Water Samples	$55	1	$55
		Subtotal	$372,400
		Contingency (20%)	$74,500
		Total	**$446,900**

[O] Optional community requested component

Upper Green Meadows

Component	Cost per Unit	Units	Total Cost
2" DR 11 HDPE	$2.20/ft.	600	$1,320
4" Gate Valve	$700	1	$700
Service Laterals	$1,000/connection	3	$3,000
Blowoff	$1,500	1	$1,500
Monitoring Meters 2" [O]	$150	1	$150
Service Meters	$150	3	$450
Misc Fittings	$500	1	$500
Dirt Removal	$25/yd^3	2	$50
Concrete	$200/ yd^3	2	$400
Labor and Trenching	$130/ft	600	$78,000
Equipment Rental	$1,000+$250/day	6	$2,500
Water Samples	$55	1	$55
		Subtotal	$88,700
		Contingency (20%)	$17,700
		Total	**$106,400**

[O] Optional community requested component

Transmission line

Component	Cost per Unit	Units	Total Cost
4" DR 11 HDPE	$5.40/ft.	3,900	$21,100
4" Gate Valve	$700	5	$2,800
Source Meter	$150	2	$300
Monitoring Meter 3"[O]	$1,500	1	$1,500
Misc Fittings	$1,000	1	$1,000
Dirt Removal	$25/yd^3	5	$125
Concrete	$200/ yd^3	5	$1,000
Labor and Trenching	$130/ft	3,900*	$338,000
Equipment Rental	$1,000+$250/day	39*	$8,500
Water Samples	$55	1	$55
		Subtotal	$374,400
		Contingency (20%)	$74,900
		Total	**$449,300**

*Assumes transmission line done as separate project

[O] Optional community requested component

5.2.4 Approximate Cost Summary

The following table provides an overview of the costs associated with the replacement of various sections of the Wolf Creek water system. The table assumes all projects are done separately. Some costs may be able to be reduced by combining various projects.

Cottonwood Meadows	$1,030,600
Green Meadows	$1,085,000
Sundance Ln.	$90,600
Winding Road	$231,700
Virginia Hills	$446,900
Upper Green Meadows	$106,400
Transmission Line	$449,300
Total	**$3,440,500**

5.3 Replace the Water System's Thrust Blocks

Based on information provided by the community, most leaks appear to be near the corners of the water system. This suggests the system may not have been installed correctly allowing shifts in the corners of the distribution system over time. However, it would be expected most of the movement would have occurred within the first 20 years. By depressurizing the system and installing proper thrust blocks, the system may be able to prevent further movement and reduce the frequency of leaks.

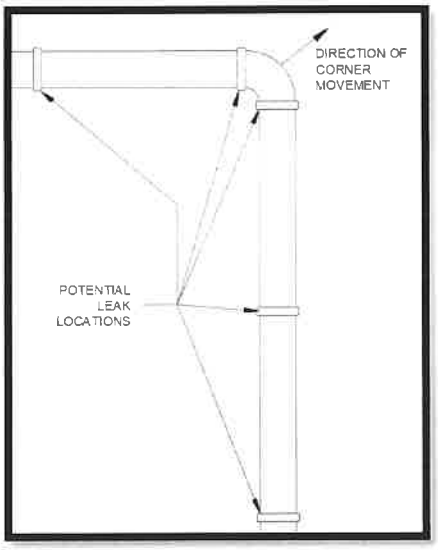


Illustration of potential leak formation from corner movement

Replacing the thrust blocks will ensure further movement of the distribution system is minimized. This will reduce future leaks caused by the movement of mains near the distribution system's corners.

It should be noted that this is not a "guaranteed fix". If the installation of new thrust blocks does not reduce the number of leaks, the distribution system may need to be completely replaced. Additionally, while existing leaks may be caused by movement, the system is approximately 40 years old. New thrust blocks will not address leakage caused by cracked pipes, worn gaskets, or other age-related leaks.

5.3.1 Arguments For

- Less expensive
- May significantly prolong the life of distribution system

5.3.2 Arguments Against

- May be a waste of time and money
- Not a guaranteed fix
- Will not address age of existing infrastructure
- Customers out of water while thrust block is replaced.

5.3.3 Costs

Component	Cost per Unit	Units	Total Cost
Concrete	$200/ yd^3	11	$2,200
Labor	$200/hr.	200	$40,000
Dirt Removal	$25/yd^3	11	$300
Equipment	$1,000+$250/day	25	$7,300
Water Samples	$55	11	$600
		Subtotal	$50,400
		Contingency (20%)	$10,080
		Total	**$60,480**

5.4 Repair as Needed

The last option is to be reactive and repair leaks as they develop. Several major leaks have been repaired in the past five years. While the system continues to have some leakage, the leak repairs seem to have addressed a majority of the leak issues.

Repairing a single leak, while expensive, is not as expensive as replacing the entire distribution system. The community may decide that the current financial impact of repairing leaks as they develop is less than the financial impact of replacing the distribution system.

Repairing as needed will do nothing to address the concern voiced by members of the community regarding the frequency of leaks. As the distribution system continues to age, leaks will likely become more frequent and the cost to repair leaks on an annual basis will continue to increase. Eventually the cost to replace the system will "pay for itself". Repairing leaks as they develop may just be delaying the reality that the system may be at the end of life and should be replaced.

5.4.1 Argument For

- Maximize use of existing system
- Unchanged financial impact
- Will address only what is needed

5.4.2 Arguments Against

- Financial impact will increase over time
- Will not address existing distribution system concerns
- May just be delaying the inevitable
- Outages unplanned and variable in duration

5.4.3 Costs

Component	Cost per Unit	Units	Total Cost
Leak Detection	$3,000	1	$3,000
4" DR 11 HDPE	$5.40/ft.	20	$110
Water Samples	$60	1	$60
Misc Fittings	$290	1	$290
Dirt Removal	$25/ yd^3	4	$100
Labor	$200/hr.	13	$2,600
Dirt Removal	$25/$yd^3$	4	$100
Equipment	$1,000+$250/day	1	$1,250
		Subtotal	$7,510
		Contingency (20%)	$1,510
		Total	**$9,020**
		Leaks per year	**2**
		Cost per year	**$18,040**

5.5 Option Summary

The community has three options to address the leakage throughout the transmission and distribution systems. Replacing the distribution system will ensure the leakage will be reduced, but has the highest upfront cost. Continuing to repair as needed will have the lowest upfront cost, but will do nothing to reduce the frequency of leaks long term. The following table provides an overview of the costs associated with each method

	Replace Distribution System	Replace Over Time	Replace Thrust Blocks	Repair as Needed*
Reduce Annual number of Leaks?	Yes	Yes	Maybe	No
Approximate Cost				
Materials	$241,950	$246,700	$2,200	$300
Labor	$2,223,000	$2,561,000	$40,000	$2,600
Leak Detection				$3,000
Water Samples	$800	$800	$600	$60
Equipment Rental	$43,800	$57,350	$7,300	$1,250
Dirt Removal	$800	$1,000	$300	$100
Subtotal	$2,510,400	$2,867,000	$50,400	$7,510
Contingency (20%)	$502,100	$573,500	$10,080	$1,510
Total	**$3,012,500**	**$3,440,500**	**$60,480**	**$9,020**
Timeframe	**75 years**	**75 years**	**15 years**	**0.5 years**
Cost per year	**$39,492**	**$45,874**	**$4,032**	**$18,040**

*Cost per repair

It should be noted that the costs to replace over time may be reduced by combining the replacement multiple sections. Other costs associated with potential leaks in other sections are not factored into the cost projection.

6.0 Recommendations

Northwest Water Systems recommends that the distribution and transmission system be replaced within the next 15 years. While this option may have a high up front cost, it is guaranteed to address issues brought up by the community and reduce the costs associated with leak repair and detection. Based on data provided by the community, the current annual savings by not repairing leaks will not cover the annual cost to replace the system. However, other factors need to be considered. Every time a leak occurs, there is a potential for the distribution system to become contaminated. This may lead to increased monitoring and operational costs. Furthermore, unplanned outages can have a detrimental impact on the community and affect the perceived reliability of the water system. Another factor to consider is the people who live in the community. The community currently has individuals who can provide historical context for the water system and have a vested interest in maintaining the water system to a high standard. While the current community may be willing to replace the system when needed, there is no guarantee that the community of the future will share the commitment to water system standards displayed by the current. When the time comes to replace the distribution system, the community may decide other items are a higher priority.

Alternatively, the system could replace the transmission and distribution systems over time as sections begin to fail. This will spread out the cost to replace the distribution system and potentially allow portions of the existing system to continue providing service for more than 15 years. If the community chooses to delay the full replacement of the water system, it is highly recommended that an accurate map of the transmission and distribution system be developed. The community has noted that the existing maps do not properly represent locations of existing mains. These maps should be updated while the knowledge and expertise still exists within the community.

If the community chose, Northwest Water Systems would fully support an attempt to replace the distribution system's thrust blocks with the understanding that pursuing this option is not a guaranteed fix, and may just be "throwing away" money. If this method is chosen it is recommended that an exploratory excavation within each community be completed to determine if proper thrust blocks were installed. Each exploratory excavation would cost approximately $6,000.

The distribution system is not currently catastrophically failing and can be maintained until replacement is deemed necessary. Until the distribution system is repaired and/or replaced, the water system will need to continue to repair leaks as needed. While this will maintain the status quo, the average annual costs associated with leak detection and

repair will continue to increase as the system ages. The system was installed in the late 70's and it is possible the system is nearing the end of life.

Good records of all leaks and repairs should be kept. At a minimum records should include:

- Date Leak Was Detected
- Pictures of the Leak
- Pictures of the Repair
- Date Leak Was Repaired
- Who Did the Repair
- Location of the Leak
- Cause of Leak (Gasket Failure, Burst Pipe, Digging Accident, etc.)
- Size of Leak (GPM)

Members of the community has expressed interest in adding monitoring meters throughout the system. Monitoring zones can be used to narrow down where leaks are occurring. Monitoring meters could be installed prior to full or partial replacement to help identify which sections are in the greatest need of replacement. While monitoring meters may be incredibly helpful in certain situations, they are an optional upgrade that can be completed if the community chooses.

Additionally, the low pressure along the southernmost portion of Green Meadow community needs to be addressed. Northwest Water Systems strongly recommends Installing a distribution line from the upper pressure zone in the booster station down Left Wolf Creek Rd upon the replacement of that section of distribution line. In the interim, a booster pump could be placed in the vault below the booster station. The community has noted that a booster pump historically resided within the vault. Vaults are typically considered confined spaces. Confined spaces, in most cases, increase the costs associated with maintenance, repair, and replacement.

An analysis on the leak in the transmission line between Well #2 and Well #3 should be conducted to determine if the costs associated with the production of the lost water, and potential for contamination, the leak to become worse, or the potential for the leak to have adverse effects on other infrastructure outweighs the costs associated with repairing the leak.

7.0 Other Recommendations

There are items outside the scope of this project that may improve the longevity of water system components. These are recommendations Northwest Water Systems suggest the community consider for future projects.

7.1 Chlorination

Chlorine injection currently occurs in the booster station just before the water enters the reservoir. It is recommended that chlorination be moved to the pumphouse to allow for additional contact time prior to the first service.

7.2 Upgrade Pumphouse

The community has expressed an interest in upgrading the source pumps controls to VFDs. Excessive starting and stopping is the primary cause of premature pump failure for the submersible pump motor. Long run times provided by storage will prevent excess starting and stopping. Outside of providing the operator more control and the ability to record additional data, upgrading the pump controls are unlikely to provide much benefit.

Soft start controls require the pump motor to be a three-phase motor. If the existing pumps are single phase and the community decided to upgrade the pump controls, this upgrade should wait until the pump motors need to be replaced. Typically, soft start controls are less expensive than VFD controls; however, a VFD controller can be used as a "glorified" soft start.

7.3 Booster Station Upgrades

The booster station currently supports two pressure zones with a single booster pump for each zone. Two 2 hp pumps will likely be able to support both pressure zones and provide additional flow for the southern portion of the Green Meadows community. The current 5 hp and 7½ hp booster pumps are likely oversized which will likely lead to reduced pump life from excessive starts and stops.

The boosters are on VFD which will theoretically reduce energy consumption; however, not only does ramping down reduce energy cost it also reduces efficiency. By switching the existing booster pumps out for smaller booster pumps, the pumphouse will likely reduce energy costs, and prolong pump life.

It is recommended that a booster station design be completed now so when the existing pumps fail, the correct booster pumps can be installed. When the community decides to upgrade the booster pump station, it should also install a distribution line to the southern part of the Green Meadows community.

7.4 Water rights

Well 2 has a capacity of 55 gpm and Well 3 has a capacity of 60 gpm. On the WFI these have been combined into a single well field with a capacity of 115 gpm. Water rights show the system is allowed an instantaneous withdraw rate up to 60 gpm. If the community wishes to exercise the full capacity of the sources, a change to the water rights to increase the allowed instantaneous withdrawal will be needed.

8.0 Financial Options

Many projects associated with water systems require large amounts of capital to complete. Multiple financial options are available to communities that wish to complete:

- Community Financial Reserves
- USDA Loan
- DWSRF Loan
- Community Development Block Grant (CDBG)
- Department of Commerce Programs

Low interest loans can be competitive and there is a chance Wolf Creek will not be able to acquire funding through these low interest loans. These loans have become even more competitive as government infrastructure spending has been reduced.

Government funding is typically not available for past projects. Projects associated with government funding also typically have higher costs. Care should be taken to ensure additional costs associated with grants or low interest loans do not outweigh the benefits provided.

8.1 Community Financial Reserves

Customers of a water system should be charged water rates that can then be used for projects to replace and/or upgrade the water system. Using community reserves minimizes the "red tape" associated with other financing options available. However, this means the community needs to be charging appropriate rates and not allocating funds collected through water service to other community projects. Water rates should be evaluated at minimum every five years or after every major project to ensure the system maintains financial viability.

8.2 USDA Loan

The USDA Rural Development loan has multiple programs associated with water system development. The program normally provides loans at low interest rates and may have principle forgiveness depending on fund availability and whether the water system meets low income and other conditions. Unlike the DWSRF programs, the USDA Rural Development Loans do not require the system to have an approved planning document. Loan repayment can typically be spread out up to a 40 year period depending on the project. Applications for these loans require the owner of the system (in this case the HOA) to provide historical financial information such as tax documentation to show the owner has the financial capacity to repay the loan.

USDA loans are not competitive and have interest rates comparable to a typical 30 year fixed home loan.

8.3 Drinking Water State Revolving Fund (DWSRF) Loan

The Drinking Water State Revolving Fund (DWSRF) has multiple programs associated with water system development. The program normally provides loans at low interest rates and may have principle forgiveness depending on fund availability and whether the water system meets low income and other conditions. Most DWSRF programs require the system to have an approved planning document listing the project to qualify for consideration. These loans are typically for the life of the project up to 20 years with a 2% initial fee and up to 1.5% interest dependent on population being served. DWSRF also offers loans for engineering and planning documents. These loans are subject to the 2% loan fee and are typically repaid over a 10 year period. No forgiveness is offered on planning document loans.

Construction loans are competitive and like the USDA loans require the HOA to be registered inside the Federal Government's system as approved lenders. The system will likely be required to keep a portion of the value of the total loan in reserve. Additionally, contractors are required to be paid at the prevailing wage (typically higher than typical work). Contractors must also follow strict oversite and inspection procedures. Other studies such as

When deciding who is granted DWSRF funding, distribution replacement projects typically rank the lowest. Therefore, DWSRF funding will likely not be available for Wolf Creek.

8.4 Community Development Block Grants CBDG

Community Development Block Grants (CBDG) are available for infrastructure projects which primarily benefit low and moderate income persons. The program is supported by the Department of Housing and Urban Development. The HOA is not eligible to apply directly but may be sponsored by the county. The program does not have a regular drinking water specific grant/program.

8.5 Department of Commerce Programs

The Department of Commerce may have some programs to provide financial assistance for community growth and planning. Grants may be available for projects connecting infrastructure to low or moderate income housing. Programs targeting drinking water are unlikely within the next two to three years with the Washington State budget shortages.

9.0 Conclusion

Excessive leakage throughout the water system suggests the water mains were either not installed correctly or are nearing the end of life. It is recommended that the distribution and older transmission mains be replaced within the next 15 years.

It is recommended the community start at least with replacement of the section(s) that have the highest leakage, and have engineering completed for the entire system. Having the engineering completed will ensure future/continued replacements compliment the initial phases.

Low pressure issues near the southern portion of the Green Meadows community needs to be addressed. A main from the upper pressure zone could be used to increase the pressure in this area.

Many options are available to fund water system projects the Wolf Creek community wishes to pursue. If the community wishes to acquire government funding, the community will be required to meet the requirements of the associated program.

10.0 Report Preparation

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