WATER MASTER PLAN

NORWOOD WATER COMMISSION

NOVEMBER 2020

Prepared by

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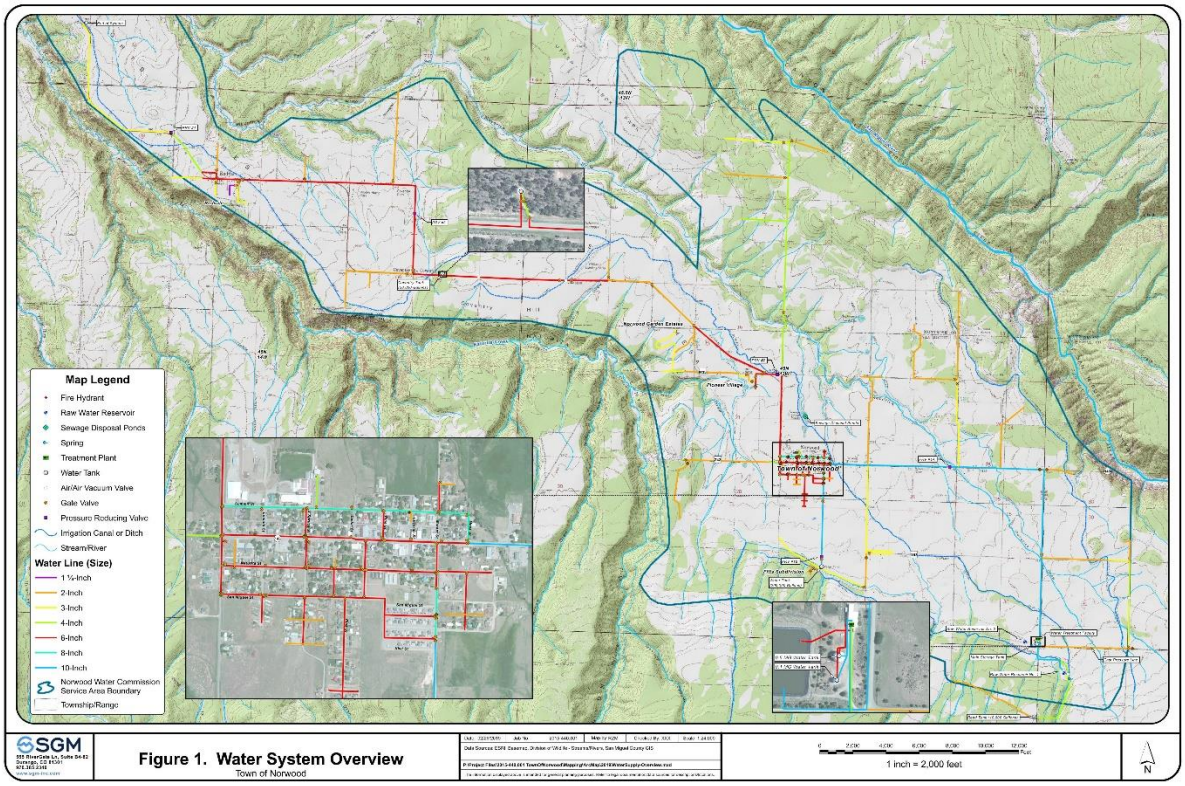
1.0 Introduction

The Norwood Water Commission (NWC) is a rural water system located on Wrights Mesa, approximately 30 miles NW of Telluride. The NWC is both in San Miguel County and Montrose Counties. The NWC serves a very large service area that includes the Town of Norwood and Redvale and the rural parts of Wrights Mesa in San Miguel County and Montrose County. The areas outside of the Norwood Town Boundary are very rural with a very low-density agricultural land use. Figure 1-1 shows the service area for the NWC.

Figure 1-1 Water System Overview



See end of Section for full size figure.

The NWC principle water supply is from Gurley Reservoir which supplies irrigation and municipal water to Wrights Mesa. Gurley water is only available to the NWC during the irrigation season, from April to November, because of legal and physical constraints. Water use during the non-irrigation season comes from NWC Reservoirs 1 and 2 which are filled from Gurley Reservoir in November. During the drought of 2018 water levels dropped significantly in Gurley Reservoir and in the NWC reservoirs. If a similar drought would have occurred in 2019, or in any two consecutive drought years, reservoirs levels would have continued to drop to a level that would not supply adequate drinking water to the entire service area without water restrictions. The NWC water supply is vulnerable to droughts which have been increasing both in frequency and intensity. Therefore, the NWC would like to consider a second reliable and redundant source of water for existing and future water demands.

The NWC water pipeline distribution and transmission grid consists of pipe diameters that range from 2" to 10". The distribution system is located between the WTP near the east end of the service area then west to the end of the service area, approximately 16 miles away. The grid traverses through six different pressure zones. Distribution lines are undersized and are not adequately looped resulting in low pressures, water quality issues, and lack of fire flows.

The NWC has had significant failure of the 10" water transmission line segment from the WTP to the Town of Norwood. This is the only feed line to the entire service area and when taken off-line disrupts water service to a significant portion of the service area.

Tap demands throughout the service area remains high. The low flow and low pressures at the extremities of the distribution grid make is difficult to add taps without negatively impacting service to other customers.

1.1 Purpose

The purpose of this master plan is to update the Norwood Water Commission master planning efforts for current and future physical infrastructure. This includes water supply, treatment, storage, transmission, and distribution infrastructure. This plan update will provide recommendations for updating the water system for current conditions and future growth.

This plan will create a GIS map and data base of the water system to be used as a tool for managing infrastructure. All of the NWC legacy data of record drawings, design and construction drawings, legacy system blue prints etc. will be converted into the digital GIS mapping.

This plan update will perform a hydraulic model of the grid. The model will be used to predict pipe hydraulics under different demand scenarios. Demand scenarios will include average day, maximum day and peak hour flow conditions. Fire flows can then be added to each demand scenario to understand available fire flow. The scenarios will also consider impacts to hydraulics and water delivery based upon future growth conditions.

Finally, the NWC would like to understand the feasibility and permitting issues for a new water supply known as the San Miguel River water diversion. This will require a new intake on the San Miguel River, a pump station and transmission line to the WTP. This will serve as a second redundant source of year-round water. The decreed location of the diversion is near the confluence of the San Miguel River and Beaver Creek.

1.2 History

The NWC consolidated the service for the Town of Norwood and the rural areas of Wrights Mesa in San Miguel and Montrose County into the NWC. Historically the rural water service was provided by the San Miguel Water Conservancy District. To eliminate the administrative complexity of ownership and operation by two entities The NWC was created in 1993. The Town of Norwood owns all the infrastructure for the in-town and out-of-town infrastructure. The NWC operates and maintains the entire system. Service Fees are paid to the NWC. The entire system for the Town and the NWC, including supply, treatment and distribution operates as one water system.

1.3 Executive Summary

1. This master plan updates the water planning for the NWC and updates the findings of master plans prepared by Westwater Engineering (WE). The original Master Plan for the water distribution system was prepared by WE in 1994. A raw water feasibility report was prepared by WE in 1995. A Master Plan update was prepared by WE in 2006. Portions of recommendations from past master plans have been implemented. Other recommendations have not been accomplished. This master plan updates the planning based upon current conditions.
2. This plan has prepared a systemwide GIS map of the entire NWC service area. The mapping includes supply, WTP location, storage tanks, transmission and distribution lines. One 24" by 30" map has been prepared for 20-mile-long service area. The location of service line taps has been shown on the mapping based upon the customer addresses. The addresses were georeferenced on the mapping. Over time we recommend that the NWC slowly over an annual cycle improve the mapping to include GPS locations of key infrastructure and the insertion of smart data and all legacy data. We have found that other similarly sized water providers have used GIS mapping as a great tool to manage all the functions of the water service infrastructure. We recommend that the NWC use a cloud-based system that allows a certain number of NWC staff access with laptops, iPads and iPhones.

3. A hydraulic model of the water distribution and storage system was prepared. System hydraulic parameters are determined based upon demand scenarios including average day, maximum day, peak hour and fire flow demands. Hydraulic parameters included pipeline velocity, dynamic pressures, and available flows. The model clearly shows that fire flows are not available in the rural areas outside of the Town of Norwood. The model shows undersized mains based upon velocities above regulatory and industry standards. The end of the many dead-end mains in the rural distribution area have low pressures during peak demand scenarios. These lines will limit further taps and should be increased in size or looped in the future. The model can be used to show the impacts on existing flows, pressures and velocities on current customers due to new taps. We recommend that the model be used when these tap requests come to the Commission.

   The model shows that water age is very long and will negatively impact chlorine residuals. We recommend that further water quality investigations continue to determine if chlorination in the distribution system or storage tanks can keep residuals above the minimum 0.2 mg/l requirement. The model will also assist improvements necessary to allow lower water age, tank turnover and compliance with the (DPR).

4. Recommendations of the priorities for water transmission and distribution lines include the implementation of a new 10-inch line from the WTP to the 200,000-gallon Blue Tanks and then to the west end of the Town of Norwood grid. This will allow for a redundant supply loop to the entire NWC supply. The line will also allow the second priority of replacing the existing 10-inch transmission line from the WTP to the Town. This line has “run to failure” and has reached useful life. Numerous other distribution line improvements are recommended for increase line size, looping and aging infrastructure.

5. The WTP has enough capacity for the next 20 years but shortly thereafter will require expansion. The plant has difficulty with meeting the Disinfection By-Product Precursor Rule (DBP) regulatory requirement and the minimum chlorine residual at the same time. We recommend a more focused engineering study to resolve this issue. We recommend the recycling of backwash water through the WTP. This will require some small-scale process equipment before the water is recycled.

6. The Master Plan included an asset management assessment of the condition of aging infrastructure. An inventory of all system components with date installed, useful lifetime and projected year of replacement was prepared. A financial assessment determined the amount of funds that need to be set aside on an annual basis to replace the infrastructure when it fails. Current service fees do not pay for the replacement of aging infrastructure. We recommend that service fees increase slowly over time to establish a fund to pay for aging infrastructure.

7. We recommend that the NWC proceed with the planning and financing plans for a second supply from the San Miguel River. Grants and loans are available through State and Federal agencies to help fund new supply projects.

End of System
PRESSURE ZONE 5
3-In
PRV #4
4-In
2-In
Redvale
PRESSURE ZONE 4
PRV #3
Future PRV Priority
Detail D
PRESSURE ZONE 3
45N 14W
Coventry Tank 120,000 Gallons (See Detail D)
45.5N 13W
San Miguel River
Norwood Garden Estates
Naturita Creek
MONTROSE COUNTY
SAN MIGUEL COUNTY
45N 13W
PRV #2
W35
Pioneer Village
PS
Booster Pump
Sewage Disposal Ponds
Z42
TOWN OF NORWOOD (See Detail A)
PRV #1A
PRESSURE ZONE 2
Y43
PRESSURE ZONE 1
Fitts Subdivision
Water Tank (200,000 Gallons)
Altitude Valve
Future PRV Priority
Raw Water Reservoir No. 2
Water Treatment Facility (See Detail B)
Main Storage Tank
East Pressure Line
Raw Water Reservoir No. 1 (See Detail C)
Reed Tank (10,000 Gallons)
145

Detail A
Summit St
Juniper St
S Shafer St
Cedar St
Pine St
Locust St
Maple St
West St
Naturita St
San Miguel St
Elm St
Kiwi St
0 500 1,000 Feet

Detail B
Intake Tower & Pump Sump
WTP
0.5 MG Water Tank
0.1 MG Water Tank
Raw Water Reservoir No. 2
4" Pumpline
10" Raw Water Diversion Pipe
6" Intake Line (From Reservoir No. 1)
County Road 45Y
2" PVC
0 100 200 Feet

Detail C
4-In Reed Mesa Pump Line
10-In Raw Water Line
Raw Water Reservoir No. 1
Gardner Spring
0 250 500 Feet

Map Legend

- Norwood Water Commission Service Area Boundary (Approx.)
- County Boundary
- Township/Range
- Fire Hydrant
- Altitude Valve
- Booster Pump
- Raw Water Reservoir
- Sewage Disposal Ponds
- Spring
- Treatment Plant
- Water Tank
- Future PRV Priority
- Pressure Zone Boundary

Future Priorities

- Priority #1 (10-inch)
- Priority #2 (10-inch)
- Priority #3 (10-inch)
- Other Priorities (8-inch)

Valves

- Air/Air Vacuum Valve
- Gate Valve
- Pressure Reducing Valve

Water Line (Size)

- 1 ¼-Inch
- 2-Inch
- 3-Inch
- 4-Inch
- 6-Inch
- 8-Inch
- 10-Inch

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Figure 1.1

Water System Overview Future Priorities

Town of Norwood

Date: 1/31/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:17,953

Data Sources: ESRI, CDW, San Miguel County GIS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2020\WaterSupply-Overview-

0 5,000 10,000 Feet

1 inch = 1,496 feet

N

2.0 Existing Water System Infrastructure

This section provides a broad overview of the components of the NWC water system. More detailed descriptions of the individual system components are contained in Chapter 4.

2.1 Mapping of Existing System

Historically, mapping for the NWC was based on archived hard copy blueprints. 60 years of this legacy data was transferred by SGM into an electronic GIS mapping system of the entire service area. The GIS mapping can be used to embed all NWC legacy data including, photographs, water usage data, lot information, hydrant and valve numbering systems, other shallow and deep utilities, final plats, maintenance records etc. Figure 1-1 shows the entire system at a 1"=2000 feet scale. This map will be referenced throughout the report.

2.2 Water Rights Summary

A summary of water rights owned by the NWC is shown in table 2-1. The location of water rights is shown in Figure 2-1.

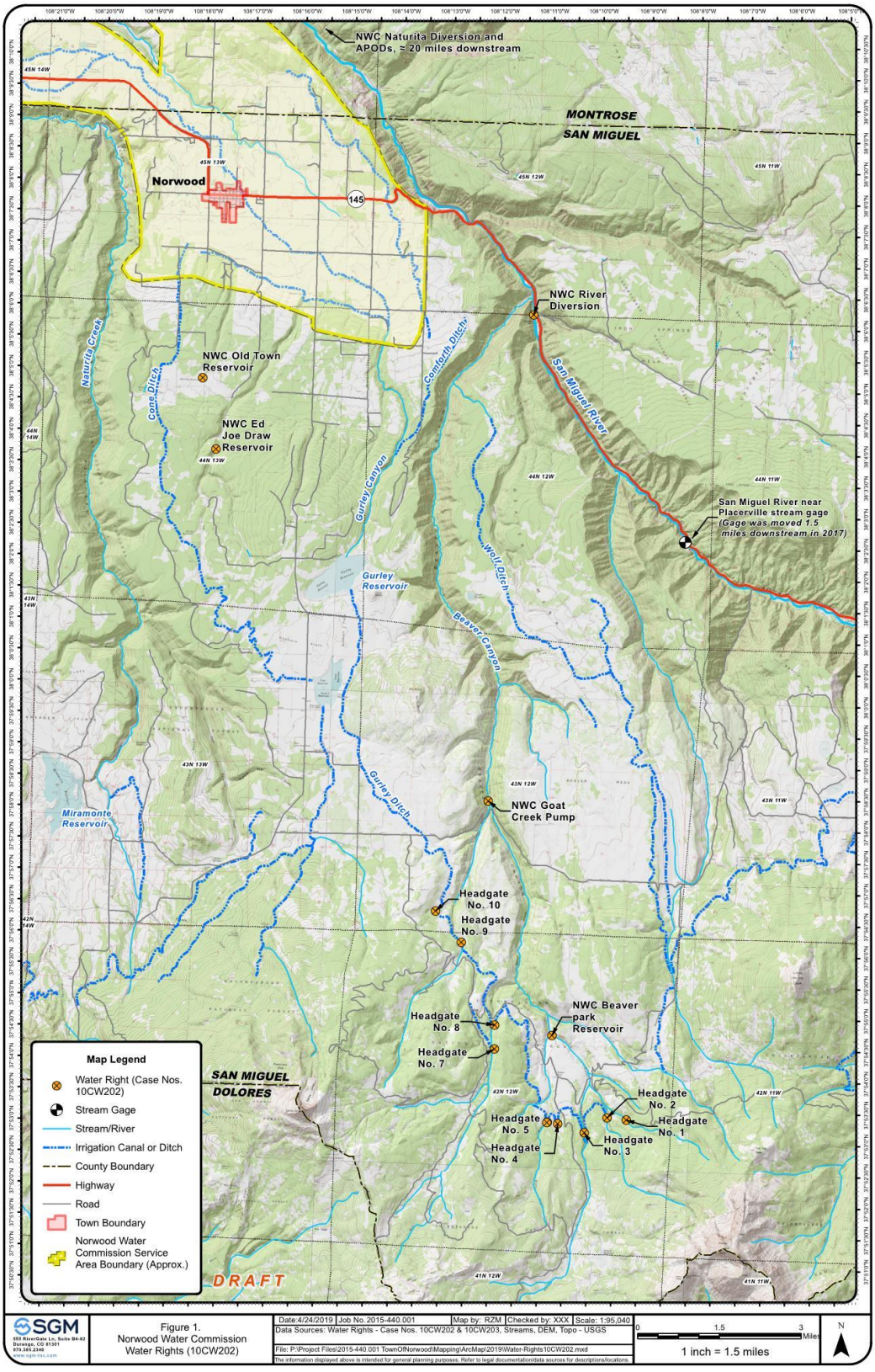
Table 2-1 Norwood Water Commission Water Rights

Table 2-1 Norwood Water Commission Water Rights

	Name	Amount	Use	Source	Adjudication Date	Appropriation Date
Town of Norwood	Priority 214	0.25 c.f.s.	M	Maverick Draw	10/16/1933	10/21/1926
	Town of Norwood Pipeline	0.50 c.f.s.	M	Maverick Draw	7/10/1952	6/1/1935
	Town of Norwood Pipeline	0.25 c.f.s.	M	Maverick Draw	7/10/1952	6/1/1948
	Town of Norwood Infiltration Pipeline	0.57 c.f.s.	M	Maverick Draw, various springs and seeps	1/16/1967	6/10/1962
	Norwood Infiltration Pipeline	0.18 c.f.s.	M		1/16/1967	6/10/1962
	Gardner Springs	0.25 c.f.s.	D/S	Maverick Draw, various springs and seeps	1/16/1967	11/13/1950
	Gardner Springs	0.50 c.f.s.	I/S		1/16/1967	11/1/1960
Norwood Water Commission	Norwood Nelson Ditch	10 c.f.s.	M	McCulloch CK	12/31/1991	7/24/1991
	NWC River Diversion	5.0 c.f.s., conditional	M	San Miguel R.	12/31/1994	11/1/1994
	NWC Gurley Diversion	5.0 c.f.s., conditional	M	Beaver Creek	12/31/1994	11/__ /1994
	NWC Reservoirs Nos. 1, 2, 3, & 4	#1: 18.4 af	M	Gurley Reservoir, Gardner Springs, Priority 214, Infiltration Pipeline, and Town of Norwood Pipeline	12/31/2001	12/1/1994
		#2: 91 af				
		#3: 91 af				
		#4: 33 af conditional				

	Name	Amount	Use	Comments
Reservoir Shares/Agreements	Farmers Water Development Company Shares (Owned)	119 shares	I	Certificate
				716 (1)
				717 (50)
				721 (60)
				723 (6)
				727 (2)
	Farmers Water Development Company Shares (Contract)	300 a.f. minimum	D	

Figure 2-1 Location of Water Rights



See end of Section for full size.

2.3 Water Distribution and Transmission System

The water distribution system for the NWC is characterized by the combination of the municipal water grid found in the Town of Norwood and the rural water grid found in the areas outside of the Norwood Town boundaries. The Town of Norwood grid provides for minimal fire flows with fire hydrants while the rural system does not provide fire flow. The rural system is made up of small diameter mains often installed without the traditional looped grid system. The rural pipe system often consists of dead-end mains and long distances between taps.

Water from the WTP is pumped to two above ground water tanks located on the WTP site. Water from these tanks provides water to the entire service area. The first segment of the pipe from the WTP to the Town of Norwood consists of a 10" main. From the Town of Norwood to Redvale, the transmission main is a 6" line. Distribution lines branch off the main. In the rural areas, the branch distribution lines are in county road ROW's and consist of 2", 3" and 4" mains. In the Town of Norwood, the distribution lines are typically 4", 6", and 8" lines installed in alleys and street ROW's.

The transmission main from just east of the WTP to the very west end west of Redvale extends over 16 miles. This long length and the intermediate storage tanks result on very long water age. The long water age causes very low chlorine residuals.

The long linear transmission main from the WTP to the Town of Norwood and west to Redvale lacks adequate looping and therefore does not have adequate redundancy. Line leaks and pipe failures results in water outages which can impact significant sections of the entire system rather than simple line isolation impacting small areas more typical of a municipal system.

2.3.1 *Summary of Pipe Qualities*

The quantity of pipes and the approximate year they were installed is shown in Table 2-2. Table 2-3 summarizes the number of valves in the system.

Table 2-2 Town of Norwood Water Distribution System

Table 2-2 Town of Norwood Water Distribution System				
Year	Pipe Size (inches)	Material		Grand Total
		PVC	DIP	
1977	1	1,200.24	0	1,200.24
	2	91,821.87	0	91,821.87
	3	48,973.31	0	48,973.31
	4	30,260.33	0	30,260.33
	6	71,254.63	335.7	71,590.33
	8	4,044.69	0	4,044.69
	10	25,756.25	0	25,756.25
1996	3	1,528.64	0	1,528.64
	6	712.89	0	712.89
	10	6,534.22	0	6,534.22
	24	306.52	0	306.52
GRAND TOTAL		282,393.59	335.7	282,729.29

Table 2-3 Town of Norwood Water Distribution System

Table 2-3 Town of Norwood Water Distribution System		
Valve Inventory		
Type	**Size** (inches)	**Quantity**
Air	3	1
	4	1
	6	2
	10	2
TOTAL		**6**
Gate	1	1
	2	23
	3	10
	4	5
	6	88
	8	5
	10	5
TOTAL		**137**
PRV	4	1
	6	2
	10	1
TOTAL		**4**
Fire Hydrant[2]	N/A	22
VALVES TOTAL		**147**

2.3.2 *Pressure Zones*

The NWC water system has six pressure zones as shown in Figure 1-1. The extent of the pressure zones are shown by a pressure contour on the upper and lower pressure limits of the zone. Each zone is identified as pressure zone 1 through zone 6. Pressure reducing valves are also numbered 1 through 4. Five of the pressure zones are created by the elevation drop and corresponding static pressure increase starting at the WTP. Pressure zone 1 is located at the WTP. Pressure zones two through five follow the main transmission line from the WTP to west of Redvale.

The sixth pressure zone is a small zone above the WTP that serves a small number of taps by pumping from the WTP storage tanks to the Reed Tank. The 10,000-gallon Reed tank provides the static pressure to this pressure zone.

The pressure zones are created by pressure reducing valves (PRV) that generally operate with a 135-psi pressure on the upstream side of the PRV to a 50 psi on the downstream side of the PRV. The PRV's are located on the main transmission line from the WTP to west of Redvale.

The Town of Norwood is located in pressure zone 2A, A main 10" transmission line is connected from the Town of Norwood distribution grid and runs to the south to the 200,000 Gallon tank, known as the Blue Tank. The overflow of the 200,000 Blue Tank is at or even slightly below the hydraulic grade created and controlled by PRV 1. This Tank also has an altitude valve that was designed to close when water levels in the tank

exceed the overflow elevation. The Tank only has one inlet that serves as an inlet and outlet pipe. The altitude valve is currently not being used. PRV 1 is adjusted to match the overflow elevation of the tank. This tank provides static pressure, flow, and fire flow volume to the Town of Norwood. PRV 1 keeps the water in the tank full most of the time and therefore the tank does not turn over, resulting in long water age and low chlorine residual.

Pressure Zone 3 includes the 120,000-gallon Coventry Tank and is located adjacent to the transmission main and has a pressure sustaining valve that limits the fill rate to the Tank. The Tank serves as a source of peak hour flow to the service area below the Tank. The Tank creates a very small pressure zone 3A in between the Tank and PRV 3.

A summary of the system PRV's is shown in Table 2-4.

Table 2-4 PRV Summary

Table 2-4 PRV Summary

PRV Station	PRV	Size	Elevation	Setting	HGL	Notes
PRV #1	A	6	7,039	1	7,041	Normally Closed
	B	4	7,039	85	7,235	
PRV #2	A	6	6,946	55	7,073	
	B	2	6,946	1	6,948	Normally Closed
PRV #3	A	4	6,600	40	6,692	
	B	2	6,600	35	6,681	
PRV #4	A	4	6,372	55	6,499	
	B	2	6,372	1	6,374	Normally Closed

2.3.3 *Pipe Materials*

According to the NWC operators, most of the pipe in the water system is class pvc pipe. The class pipe rating varies depending upon pressure. When most of the pipe was installed in 1977, the use of class pipe was common. The current standard for the use of PVC pipe for potable water distribution pipe is C900 PVC pipe as specified in AWWA standard C900-16. C900 pipe is manufactured to a higher standard and has a longer lifetime rating than class pipe. C900 PVC pipe is only manufactured down to a 4-inch size.

2.4 Source of Supply

The main water supply for the NWC is through Gurley Reservoir. A second smaller supply is through Gardiner Springs which is considered seepage from Gurley Reservoir. More details of each supply are described in Sections 2.4.1 and 2.4.2. Figure 2.1 shows the location of Gurley Reservoir relative to the NWC service area and the Town of Norwood.

2.4.1 *Gurley Reservoir*

The NWC has contract water in Gurley Reservoir to provide water to the potable water system. The NWC has a contract with the Farmers Water Development Company (FWDC) for 300 AF of annual raw water for domestic use. Gurley Reservoir is located approximately 15 miles south of Norwood and is filled through the Gurley Ditch (Naturita Canal). Water in the Gurley Ditch comes from a drainage area of approximately 28,602 acres at the base of Lone Cone Peak. The average yield of Gurley Reservoir is 18,597 AF, although the capacity is 12,000 AF. Ten head-gates on smaller tributaries that are tributary to Beaver Creek and Beaver Canyon divert water to the Gurley Ditch. See Figure 2-1

Water is released from Gurley Reservoir to Gurley Canyon. Water from the canyon is diverted to the South Lateral Ditch which then diverted into NWC Reservoir 1 and Reservoir 2. Water from the South Lateral ditch can also be directed directly into the WTP.

At the time this Master Plan was prepared, the state engineers' office restricted the use of storage volume of Gurley Reservoir due to dam deficiencies. The FWDC is working to correct those deficiencies.

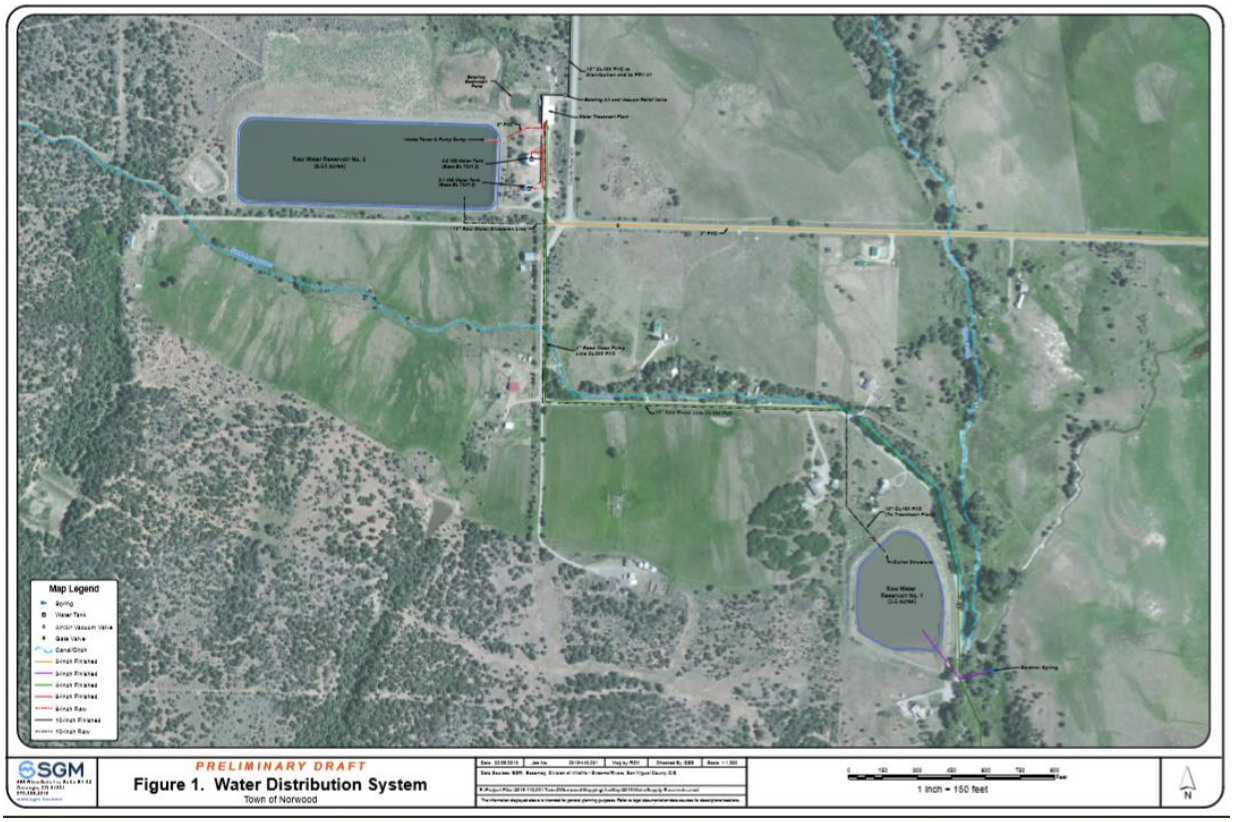
2.4.2 *Gardener Springs*

The Gardner Spring and pipeline is located just upstream of Reservoir 1. The spring supply is decreed for 0.5 cfs. The system consists of a spring box and collection system. The spring is decreed for year-round use. Water from the spring is directed into reservoir 1. Water from Gardiner Springs is not considered reliable during a drought or dry year scenario.

2.5 Raw Water Reservoirs

The NWC has two raw water reservoirs known and Reservoirs 1 and 2. The Gurley Reservoir provides water from April through November. These reservoirs are an important non irrigation or winter supply of water. The location of both reservoirs is shown in Figure 1.1. Figure 2-2 shows the location of both reservoirs adjacent to the WTP.

Figure 2-2 Water Distribution System



See end of Section for full size figure.

2.5.1 *Reservoir 1*

Raw Water Reservoir 1 was constructed in 1978 and was originally designed with a capacity of 10,000,000 gallons (30 AF). Physical conditions encountered during construction and administrative actions subsequent

to construction have resulted in a capacity much less than the 10,000,000 gallons. A photograph of Reservoir 1 is shown in figure 2.3.

Figure 2-3 Reservoir 1

2.5.2 *Reservoir 2*

Reservoir 2, with a capacity of 30,000,000 gallons is located immediately west and adjacent to the WTP. A photograph of Reservoir 2 is shown in Figure 2.4 (92 AF)

Figure 2-4 Reservoir 2

2.6 Water Treatment

The NWC and the Town of Norwood share the same Water Treatment Plant (WTP) The plant was constructed incrementally over a 30-year history with the latest improvements completed in 2001.

2.6.1 *Capacity*

The WTP has a capacity of 0.56 MGD. Current average daily flows for the last 10 years are approximately 35% of plant capacity. Table 2.5 shows the plant production records since 2010 for average annual flow.

Table 2-5 Plant Production Records

Table 2-5 Plant Production Records					
Year	Million Gallons per year	Ave Annual Daily Flow gal/day	Ave Annual Daily Flow MG/day	Ave Annual Daily Flow gpm	% of Plant Capacity
2010	74.7	204,658	0.205	142	36.55%
2011	67.2	184,110	0.184	128	32.88%
2012	69.9	191,507	0.192	133	34.20%
2013	65.2	178,630	0.179	124	31.90%
2014	69.5	190,411	0.19	132	34.00%
2015	60.5	165,753	0.166	115	29.60%
2016	65	178,082	0.178	124	31.80%
2017	70	191,781	0.192	133	34.25%
2018	61.19	167,644	0.168	116	29.94%

2.6.2 *Processes*

The WTP is a conventional treatment plant with coagulation, flocculation, sedimentation with tube settlers and mixed media filters. Chloramines are added in lieu of chlorine as a disinfectant, in order to stay in compliance with the DBP rule.

2.6.3 *Age and Condition*

The most recent improvements at the WTP were in 2001. The condition of the WTP is good. Mechanical and electrical components of the plant have a useful life of 15 to 20 years. Concrete and building components have a useful life in excess of 50 years. Steel tanks and process equipment have a useful life of 30 to 40 years.

2.7 Finished Water Storage

The NWC system wide storage begins with the 0.5 MG and 0.1 MG tanks located at the WTP. Three additional tanks are located in lower pressure zones and serve as flow for specific zones.

The largest component of determining adequate storage volume is fire flow storage. Because the NWC does not provide fire flows to areas outside of the Norwood Town limits, fire flow storage volume requirements do not apply to system wide storage. The 200,000 gallon “Blue Tank” can provide between 1,000-1,500 gpm for two hours fire flow to the Town of Norwood. This range of flows is on the lower end of requirements as based upon the Uniform Fire Code for municipal and commercial land uses. The UFC requirements are specific to building size, proximity to other buildings and building materials. Additional storage is available from the 0.6 MG of storage at the WTP.

The 10,000 Reed Tank only provides operational storage requirements for that upper pressure zone. The Coventry tank operates to provide volume for Redvale and west of Redvale.

A summary of all tanks is shown in Table 2.6

Table 2-6 Summary of All Tanks

Table 2-6 Summary of All Tanks						
Tank	Base Elevation (ft)	Diameter (ft)	Height (ft)	Overflow Elv. (ft)	Capacity (gallons)	Control Scheme
0.5MG WTP Tank	7,342	53	30	7,372	495,068	
0.1 MG WTP Tank	7,342	28	30	7,372	138,175	
Coventry Tank	6,767	26	30	6,797	119,141	
Blue Water Tank	7,174	34	30	7,204	203,737	
Reed Tank	7,608	NA	NA	NA	10,000	

2.7.1 *Tanks at WPT Site - 0.5 MG and 0.1 MG*

The two tanks located at the WTP total 0.6 MG of volume. The typical volume requirements for municipal water providers is based upon three components including fire flow volume, operational storage and emergency storage. The rural areas of the NWC are not provided with fire flows from the potable water system. There are no fire hydrants in the rural areas.

The 200,000 Blue tank provides minimal fire flows to the Town of Norwood. Therefore, the volume requirements for volume at the WTP would consist of operational storage and emergency storage. Emergency storage would include 24 hours of average daily flow. For the years 2010 through 2019 that volume would be approximately 200,000 gallons, Operational storage would be four hours of peak hour flow less the flow provided by the WTP. Peak hour flow for the NWC is projected to be slightly lower than industry standards because of the rural nature of the service area. According to NWC staff outside irrigation is limited. A typical ratio of peak hour (PHF) to average day (ADF) is 4.5. For the NWC we are assuming a ratio of 3. The average daily flow for the peak month of June is 199 gpm. That would result in a current PHF of 3 times ADF of 199 gpm or 597 gpm for a total operational requirement of 143,000 gallons. The total requirement of emergency storage and operational storage for current usage is 343,333 gallons compared to the actual storage of 0.6 MG. A photograph of the 0.5 and 0.1 MG tanks are shown in Figure 2.5.

Figure 2-5 0.5 and 0.1 MG Tanks

2.7.2 *0.2 MG Blue Tank*

The 200,000 Blue Tank provides peak hour flow, fire flow and operational storage to Norwood. The 0.6 MG volume of water at the WTP can provide operational storage and emergency storage to Norwood. The Blue Tank provides minimal fire storage to Norwood of between 1000-1500 gpm.

The Blue Tank does have some hydraulic and operational limitations. The overflow elevation for the tank is controlled by PRV 1. Flow to Norwood is in part from the 0.1 MG and 0.5 MG tanks at the WTP and from the Blue tank. Based upon the hydraulic modeling the water level in the Blue tank does not fluctuate or turn over and thus has significant water age. Chlorine residuals are influenced by water age. The longer the age, the less the chlorine residuals. CDPHE requires a minimum residual of 0.2 mg/l. A photograph of this tank is shown in Figure 2.6

Figure 2-6 200,000 Gallon Blue Tank

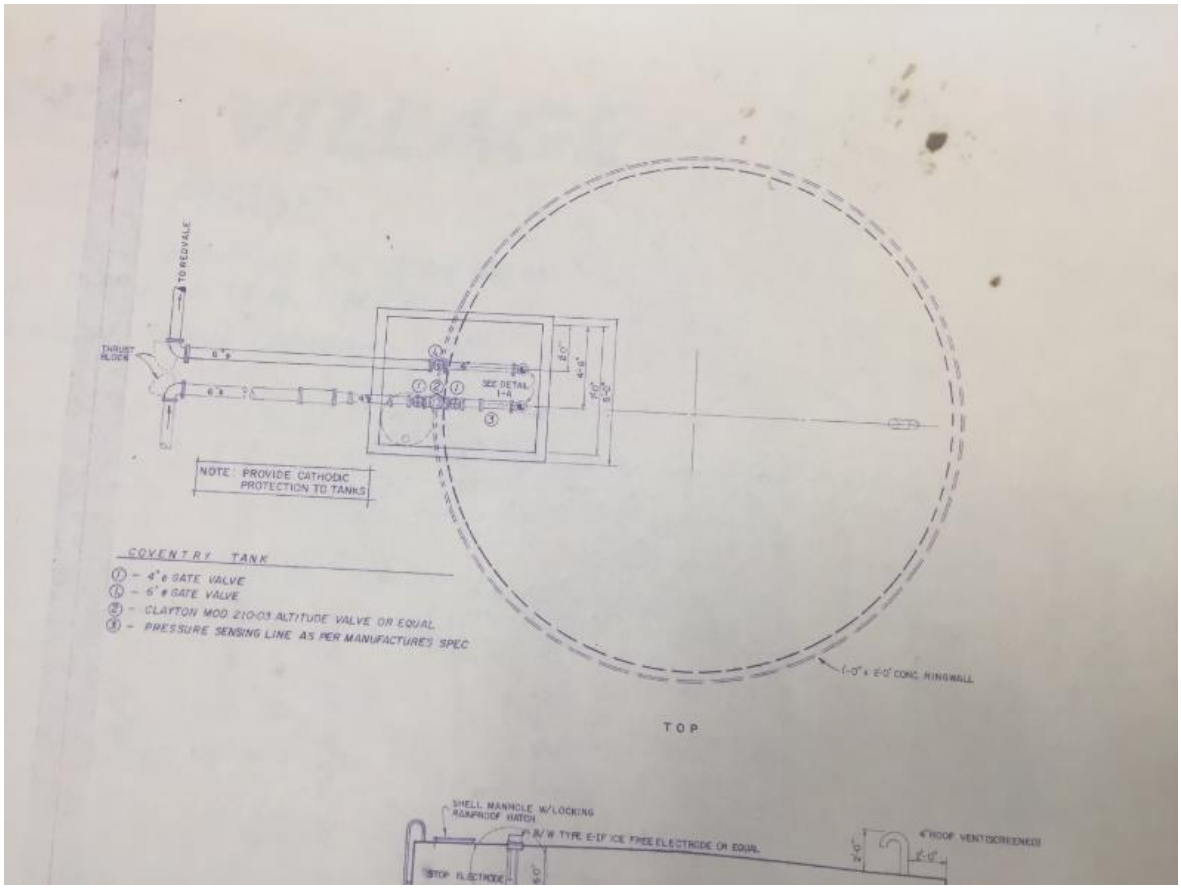
2.7.3 *Reed Tank - 10,000 Gallons*

The 10,000-gallon Reed Tank only provides minimal emergency and operational storage and not fire storage.

2.7.4 *Coventry Tank – 120,000 Gallons*

The Coventry Tank provides a break in pressure to atmospheric pressure and serves a very small area between Pressure zone 3 and zone 3a. The tank's purpose seems to be to limit the flow through the transmission line from Norwood to the Coventry tank, so that the demand below the tanks comes from the volume of the tank. This lowers the flow and velocity in the transmission main upstream of the tank. The flow in the tank is controlled by a pressure sustaining valve. The valve opens when the level of the tank drops. The valve when open then modulates to keep a pre-determined pressure upstream of the valve. This keeps pressures upstream from falling below required system pressure while the tank is filling. This mode of operation for a tank is very rare in municipal water systems. A schematic of the Coventry Tank yard piping is shown in Figure 2.7.

Figure 2-7 Coventry Tank Piping



2.8 Raw Water System (Norwood)

In 2018 the Town of Norwood installed a town-wide raw water system. The system used water rights consisting of 119 AF of rights owned by the NWC out of the South lateral Ditch, (from Gurley Reservoir) to fill a new reservoir adjacent to the 200,000-gallon Blue Tank. The reservoir acts as the hydraulic grade for the raw water system and provides pressures similar to the potable water system.

The raw water distribution grid consists of a 10-inch line from the reservoir to the Town tied into a grid of 8-inch, 6 inch and 4-inch distribution lines. Service taps serve individual properties. Customers are required to purchase taps by paying tap fees. It is planned for the raw water system to be expanded in future phases throughout Town and then into the adjoining rural areas in the NWC service area. A large benefit of the raw water system is that it takes demand away from the potable water system storage, transmission and storage facilities and thus freeing up capacity for future growth. The raw water system limits the amount of chlorinated water applied to outside landscaping. A photograph of the Raw Water Reservoir before it was filled is shown in Figure 2.8.

Figure 2-8 Raw Water Reservoir before filling

NWC Naturita Diversion and APODs, ≈ 20 miles downstream

MONTROSE

SAN MIGUEL

Norwood

145

NWC River Diversion

NWC Old Town Reservoir

NWC Ed Joe Draw Reservoir

Naturita Creek

Cone Ditch

Comforth Ditch

San Miguel River

Gurley Canyon

Gurley Reservoir

Wolf Ditch

Beaver Canyon

San Miguel River near Placerville stream gage (Gage was moved 1.5 miles downstream in 2017)

Miramonte Reservoir

Gurley Ditch

NWC Goat Creek Pump

Headgate No. 10

Headgate No. 9

Headgate No. 8

Headgate No. 7

NWC Beaverpark Reservoir

Headgate No. 5

Headgate No. 4

Headgate No. 2

Headgate No. 1

Headgate No. 3

SAN MIGUEL

DOLORES

45N 14W

45N 13W

45N 12W

45N 11W

44N 14W

44N 13W

44N 12W

44N 11W

43N 14W

43N 13W

43N 12W

43N 11W

42N 14W

42N 12W

42N 11W

41N 12W

41N 11W

Map Legend

- Water Right (Case Nos. 10CW202)
- Stream Gage
- Stream/River
- Irrigation Canal or Ditch
- County Boundary
- Highway
- Road
- Town Boundary
- Norwood Water Commission Service Area Boundary (Approx.)

SGM
555 RiverGate Ln, Suite B4-82
Durango, CO 81301
970.385.2340
www.sgm-inc.com

Figure 2-1

Norwood Water Commission
Water Rights (10CW202)

Date:4/24/2019 | Job No. 2015-440.001 | Map by: RZM | Checked by: XXX | Scale: 1:95,040

Data Sources: Water Rights - Case Nos. 10CW202 & 10CW203, Streams, DEM, Topo - USGS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2019\Water-Rights10CW202.mxd

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 1.5 3 Miles

1 inch = 1.5 miles

N

SGM

Figure 2-2 **Water Distribution System**

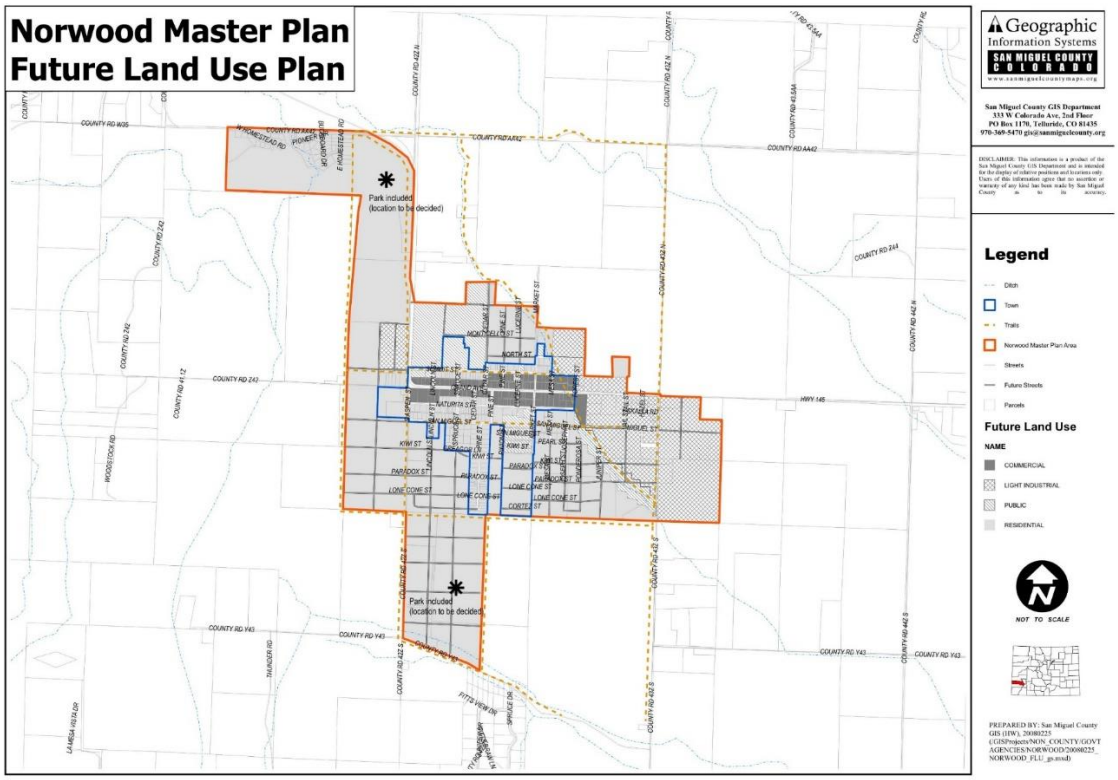
Town of Norwood

3.0 Existing and Future Water Demands

Currently the NWC serves approximately 800 taps. Approximately 370 of these taps are within the Town Boundary. Based upon conversations with Town Staff, the majority of future growth within the NWC will be concentrated in the two more dense areas of the NWC service area including the Town of Norwood and Redvale.

The Norwood Master Plan for Future Land Use Plan is shown in Figure 3-1. Future Land Use for commercial, Light Industrial, public, and residential are shown. Because the Town of Norwood has municipal level services for water, fire flow and centralized sewer services it is appropriate to plan for much of the growth to occur in the Norwood Master Plan Area. Norwood will experience growth from affordable housing needs from the Telluride area. Broadband services are currently being upgraded and will attract individual and businesses that can conduct business anywhere but prefer to live in Norwood Service area.

Figure 3-1 Norwood Master Plan Future Land Use Plan



See end of Section for full size.

The Colorado State Demographer has projected growth in all counties in Colorado. Table 3.1 shows both historical and projected growth for San Miguel County. Historically San Miguel County growth in the years between 2010 and 2020 was at an annual rate of 1.6% from the State Demographer. Planning for a long-term water supply should consider a higher growth rate to ensure adequate potable water is available. For the purposes of this master plan a 2% growth rate is used within the Town of Norwood, Redvale and the rural area.

Table 3-1 San Miguel Population Projections

Table 3-1 San Miguel Population Projections

Year	Population	% Increase over 5-Year Period	% Annual Increase
2010	7,356		
2015	7,840	6.58%	1.32%
2020	8,551	9.07%	1.81%
2025	9,534	11.50%	2.30%

Future water demand in the Town of Norwood must take into consideration the impact of the recently installed Raw Water System. The Raw Water System will decrease demand from the potable system, starting in 2019. Future water demands from the potable system are shown in Table 3-3. This table is based upon a 2% growth rate. The summertime demands were reduced based upon the number of taps in 2019 that tied into the raw water system infrastructure.

Water infrastructure is typically planned for a 20-year projection which in this case is the year 2040.

Table 3-2 Existing and Projected WTP Water Demands by Month

Table 3-2 Existing and Projected WTP Water Demands by Month

Month	2020 gpd	2040 gpd
Jan	183,008	271,940
Feb	165,094	245,321
Mar	162,674	241,724
Apr	164,594	244,578
May	176,230	261,868
Jun	279,732	415,667
Jul	242,905	360,943
Aug	232,737	345,836
Sept	195,684	290,776
Oct	186,397	276,976
Nov	178,602	265,393
Dec	166,063	246,760
Average Annual Day	194,477	288,982
Average Day Non-Irrigation	172,833	256,820
Max Day	345,665	513,640
Peak Hour Day	518,498	770,460

Average Annual Demand AF	218	324

3.1 Flow Records from WTP

The water demand for average day, maximum day and peak hour flows are shown in table 3-4 for the years 2016 through 2018. The year 2018 demand is less than the previous two years. 2018 was a record drought year resulting in water restrictions.

Table 3-3 Flow Records from WTP for 2016-2018

3-3 Flow Records from WTP for 2016-2018			
Average Daily Flow			
Month	**2016** gal/day	**2017** gal/day	**2018** gal/day
Jan	148,387	174,194	154,839
Feb	157,143	157,143	153,571
Mar	135,484	154,839	154,839
Apr	130,000	156,667	166,667
May	164,516	167,742	222,581
Jun	273,333	286,667	223,333
Jul	232,258	251,613	158,065
Aug	200,000	241,935	177,419
Sept	196,667	206,667	160,000
Oct	174,194	177,419	158,065
Nov	166,667	170,000	133,333
Dec	167,742	158,065	145,161
ADD	178,866	191,913	167,323
MDD	357,732	383,825	334,645
PHD	536,598	575,737	501,968

For hydraulic modeling, water usage was considered from the years 2001 through 2009 summarized in table 3-5 for gross water flow purposes in the pipelines.

Table 3-4 Summary of Water Demand used for Hydraulic Model

3-4 Summary of Water Demand Used for Hydraulic Model					
Demand	**Demand[1]** (gpm)	**Multiplier**	**Demand** (gpd/tap)	**Current Demand[2]** (gpm)	**Current Demand** (gpd)
AFD	111	0.8	217	118	170,183
ADD	133	1	262	143	205,382
PMD	201	1.5	394	214	308,836
MDD	267	2	524	285	410,765
PHD	400	3	786	428	616,147

1. Estimated using 2001 - 2009 Production Data
2. Estimated using 2001 - 2009 Unit demand numbers, assumes 784 active taps.
Multiplier = Demand/ADD
AFD: Average Fall Demand [Average demand for October and November]
ADD: Average Day Demand [Average Annual Demand, calculated by dividing annual production by 365]
PMD: Peak Monthly Demand [Maximum Water Produced in a Given Month/Number of Days in Month]
MDD: Maximum Day Demand [Multiplier assumed based on previous project experience, is somewhat conservative]
PHD: Peak Hourly Demand [Multiplier assumed based on previous project experience, is somewhat conservative]
The WTP capacity is 560,000 gpd.

3.2 Future Water Supply Needs

Based upon the 2% growth and a 20-year planning period the ADD required in the year 2040 is 286,073 gpd. The MDD required in the year 2040 is 508,653 which compares to the WTP capacity of 560,000 gpd. The capacity of WTP's are based upon meeting MDD demands. Expansion plans for a WTP addition or new plant should begin at least 5-10 years prior to reaching plant capacity. It is not advisable to allow demands to reach WTP capacity due to the variability of raw water quality and ever-changing regulatory requirements. Thus, the NWC should begin planning and financing plans in the 2030's. Trends in water demand will change and should be monitored closely. Regulatory changes within the 20-year planning cycle will also require WTP modifications and additions.

From a water rights perspective the average annual water demand is projected to be higher than the 300 AF supply from Gurley Reservoir, in the early 1930's. Water supply planning should begin immediately to use other water rights or to find new water sources and water rights, because water court cases can take many years to obtain a final decree in water court. Table 3.2 summarizes projected water demand for the 20-year planning period.

Norwood Master Plan
Future Land Use Plan

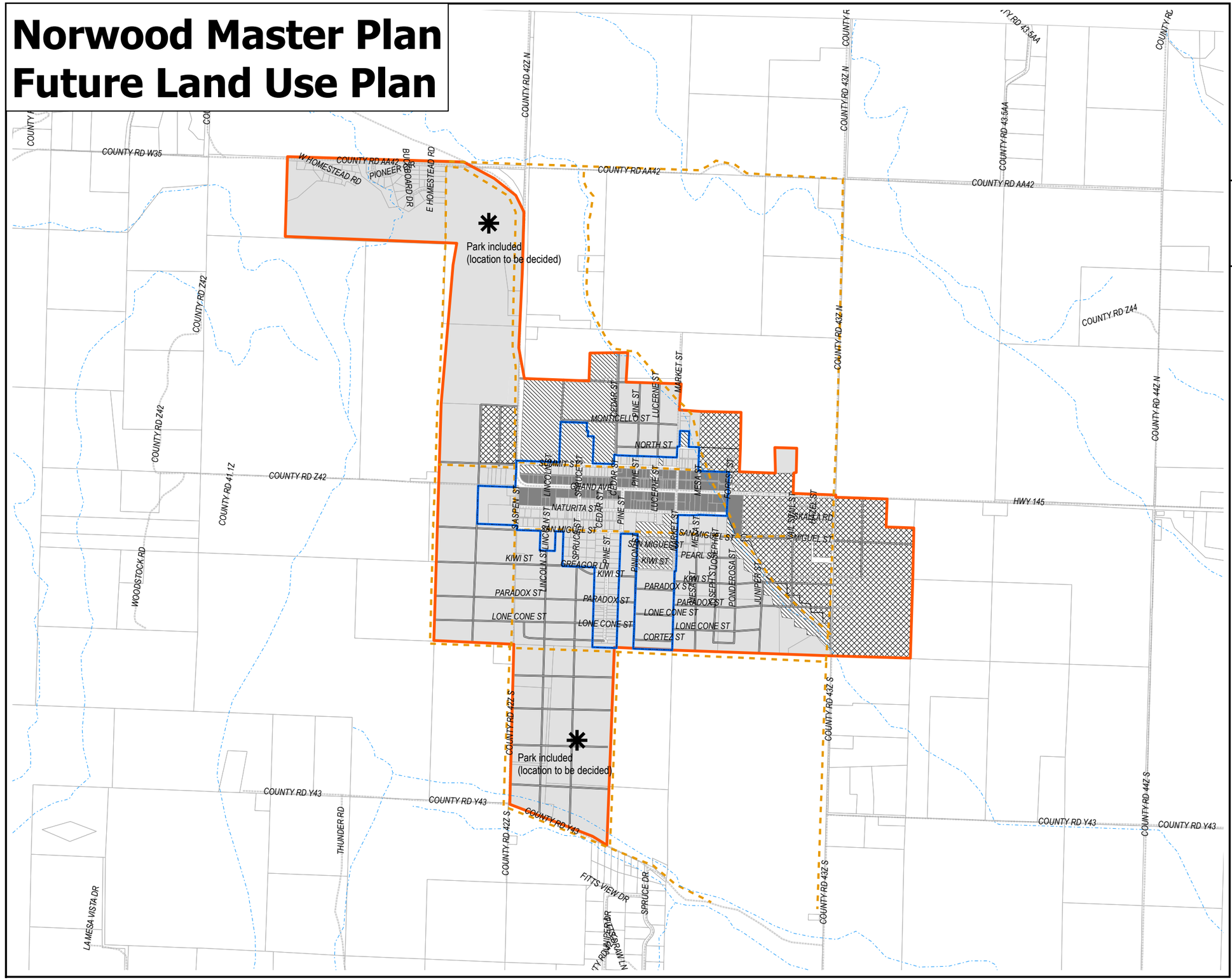


Figure 3-1

Geographic Information Systems
SAN MIGUEL COUNTY COLORADO
www.sanmiguelcountymaps.org

San Miguel County GIS Department
333 W Colorado Ave, 2nd Floor
PO Box 1170, Telluride, CO 81435
970-369-5470 gis@sanmiguelcounty.org

Figure 3-1

Legend

- Ditch
- Town
- Trails
- Norwood Master Plan Area
- Streets
- Future Streets
- Parcels

Future Land Use

NAME

- COMMERCIAL
- LIGHT INDUSTRIAL
- PUBLIC
- RESIDENTIAL

NOT TO SCALE

PREPARED BY: San Miguel County GIS (HW), 20080225 (/GISProjects/NON_COUNTY/GOVT AGENCIES/NORWOOD/20080225_ NORWOOD_FLU_gs.mxd)

4.0 Water Distribution System

4.1 Description

Figure 1-1 is a GIS map of the NWC water distribution system. Information on the existing distribution system is discussed in Section 2.3. The map was compiled from numerous blueprints of water system components, subdivisions, developments, construction drawings, and record drawings. This map is at a 2000 scale. At this scale the entire large rural system can be shown on one 24" by 36" drawing. The pipeline network is overlaid onto a Google earth drawing that shows land features, roads, drainages, and other land features.

Water from Gurley Reservoir is diverted into the South lateral ditch which then diverts water into Raw Water Reservoir 1 and 2. There are two finished water ground steel water tanks that provide water to the grid of transmission and distribution mains and sets the hydraulic grade for the water system.

Water from the WTP tanks is pumped to a small upper pressure zone to the Reed Tank (10,000 gallons), that supplies pressure to a small amount of lots above the WTP.

One 10-inch transmission main is fed from the two WTP tanks to supply the majority of the water to the NWC. This transmission main serves rural sections of the NWC through long dead-end small diameter distribution mains. The main then ties into the Town of Norwood internal distribution line grid. A 6-inch diameter main leaves the Town of Norwood Grid and extends along HWY 145 west to Redvale. From Redvale a 4-inch line extends west to the end of the NWC system.

The elevation from the WTP to the end of the system west of Redvale has a continuous drop in elevation. There are five pressure zones between the WTP and the end of the system west of Redvale. Two of the pressure zones have ground storage water tanks, one above the Town of Norwood (200,000 gallons) and one in between Norwood and Redvale called the Coventry tank (120,000 gallons)

Numerous small diameter distribution lines serve rural areas in the service area. Most of these lines are dead end lines without looping. The rural small diameter grid is not meant to provide fire flows. Most of the service area outside of Norwood and Redvale is single family remote taps. Several small denser developments including Pioneer Village, Norwood Garden Estates, Fitts Subdivision and others are served by the system.

The NWC water system is unique and characterized as a rural non-urban water system. The criteria for pressures, maximum day flow, fire flow, and water age that governs most municipal and special district systems in western Colorado, often do not apply to small rural water providers. The biggest difference between the NWC system and other water provides is the lack of fire flow capabilities outside of the Norwood system.

Other unique aspects of the NWC include the large service area which results in very long water detention times between the WTP and the remote dead ends of the grid. This can result in problems with maintaining chlorine residual levels. Long dead-end mains also result in stagnant water concerns.

The NWC supplies water to the Town of Norwood. The Town water system grid is more typical of small municipal water systems with larger main sizes, looping and the ability to provide short term fire flows.

The five pressure zones require added infrastructure in PRV vaults and additional water storage facilities. Four of the five pressure zone have individual tanks that supply system pressure. The locations of the pressure zones in some cases has created a challenge in line looping. Often looping from one dead end to an adjoining loop requires lines from two different pressure zones, which requires an additional pressure reducing valve.

4.2 Hydraulic Model

In order to analyze the hydraulics in the NWC water grid, including flow, velocity, fire flow capability, water age, and residual pressures, the water grid from the GIS mapping was used to create a hydraulic model. The input into the model included the grid of water distribution lines, water transmission mains, PRV's, water tanks and tap locations. The modeling software from Innovyze "InfoWater" was used with Esri ArcGIS to allow for the combination of hydraulic and GIS capabilities.

4.2.1 *Tap Locations*

Tap locations were based upon customer addresses from customer lists. The addresses for each customer were geo-referenced into the NWC GIS map to show the exact location of each tap and are shown in Figure 4.1 and Appendix E. Not all addresses (53) could be accounted for with a physical map and will need to be updated with additional research, however enough addresses are accounted for to accurately depict the location of the water demand on the system. In the future these addresses should be verified by NWC staff and cross referenced to location of actual water service lines and meter pits. These locations can be more accurately located in the future through GPS coordinates. We highly recommend that this task be budgeted for in subsequent years because location of service lines requires accurate locations.

4.2.2 *Water Demands*

After tap locations, system demands are aggregated to the location of taps by assigning demands to the nearest nodes in the system by using the following methodology. Demand/tap numbers were calculated using historic tap numbers and WTP production data. Values were calculated using production data from 2001 – 2009. Water production during this period is higher than the more recent WTP production records. The current number of taps is assumed to be 784. A summary of the demand per tap is shown in Table 3-4.

- ERWSD's Vail water system ("full-time" residential accounts): 216 gpd/SFE
- Town of Avon: 211 gpd/SFE
- Edwards: 245 gpd/SFE
- Cordillera: 201 gpd/SFE
- Town of Granby (North Service Area – historical town footprint): 226 gpd/SFE
- Town of Crested Butte: 245 gpd/SFE
- Town of Fairplay 245 gpd/SFE

After the steps of entering the pipe network system and tap locations into the GIS mapping and hydraulic model, and entering the demand scenarios, the model then determines system hydraulic conditions based upon multiple demand scenarios. The demand scenarios used for the NWC model included average day demand, peak hour demand, fire flow conditions, and the fill cycle of the Coventry Tank. Output from the model includes pipeline velocity, dynamic pressures, and fire flow availability. The results of the model are then shown graphically on the GIS mapping through color variation. The modeling results for these existing conditions are shown graphically in Appendix A and B. This analysis is for current demand conditions. Future demand will be discussed in Section 4.5

The results of the model are summarized in the following section.

4.3 Hydraulic Model Summary Current conditions.

Current demand conditions were modeled to determine the state of the existing water system.

4.3.1 *Pressure*

The most common scenario used to determine adequacy of system pressure is peak hour demand (PHD) or when the system demands put the most strain on the system.

Overall system pressures are adequate in most of the pipe networks with current demand. 35 psi is the CDPHE design criteria for minimum pressure at PHD. The model shows that dynamic pressure less than 35 psi are shown at the ends of dead-end small diameter mains in pressure zones 1 and 2 for the northern most pipes in the network. Pressure in the Town of Norwood is adequate. Many areas in all pressure zone in the rural areas have pressures in the 35-55 psi range. If significant growth occurs in the rural areas, improvements will need to be made in line sizes and looping. It will be important for the NWC to consider impact to system pressure with each new tap so that these new increased demands do not drop system pressure below the CDPHE criteria of 35 psi.

If the significant growth occurs in the Town of Norwood service area, system pressures will be adequate. Alternatively, if significant growth occurs in the rural areas outside of Norwood, system upgrades will be required.

Likewise, if Redvale is considered a target for future growth system pressure appear adequate for moderate growth.

Pressures along the main transmission line from the WTP to the end of the system near the Highway corridor also are much better than the end of the long dead-end lines.

4.3.2 *Fire Flow*

Available fire flow is extremely low in the rural areas of the NWC pipe network. In most cases the available fire flow is less than 100 gpm. 500 gpm is considered the absolute minimum for single family structures based upon the Uniform Fire Code criteria.

Some of the higher density developments outside of the Town of Norwood including Pioneer Village, Norwood Garden Estates, and Fitts Subdivision exhibit very low fires flows even though they may have more suburban density.

Fire flows within the Town of Norwood are higher because of the grid and looped lines of the pipe network and proximity to the 200,000-gallon water tank. Available fires flows are still considered low based upon Uniform Fire Code standards. Fire flows along the Highway in the main business district are higher at 500-1000 gpm but well below uniform fire flow standards. Approving commercial land use outside of this area would not comply with the Uniform Fire Code or the Uniform Building Code standards.

4.3.3 *Velocity in Pipes*

Appendix A and B Figures show the water velocity under several different flow demands. Pipeline velocity is used in part to determine if pipe diameter is adequate. It can also show weak points like dead end mains, lack of looping and over capacity demand in small diameter pipes. The upper limit of pipeline velocity is considered 5 fps. Velocities above 5 fps are an indication of undersized pipes, high demand, excessive head-loss and the potential for water hammer and pressure transients.

Under the peak hour demand scenario, velocities are well below the 5 fps criteria both in the Town of Norwood and in the NWC rural areas.

When the Coventry Tanks are being filled significant sections of the main transmission main between Norwood and the Coventry Tank are in the range of 2.5 to 5 fps. The majority of this line is not looped and is a 6-inch pipe which is considered much smaller than required for a main spine transmission main that provides water to everything west of Norwood. If significant growth occurs west of Norwood this line will have to be replaced in the future or pressure zones will have to be reconfigured with water storage tanks that supply peak hour flows. Line looping of the pipe network can also lower pipe velocity.

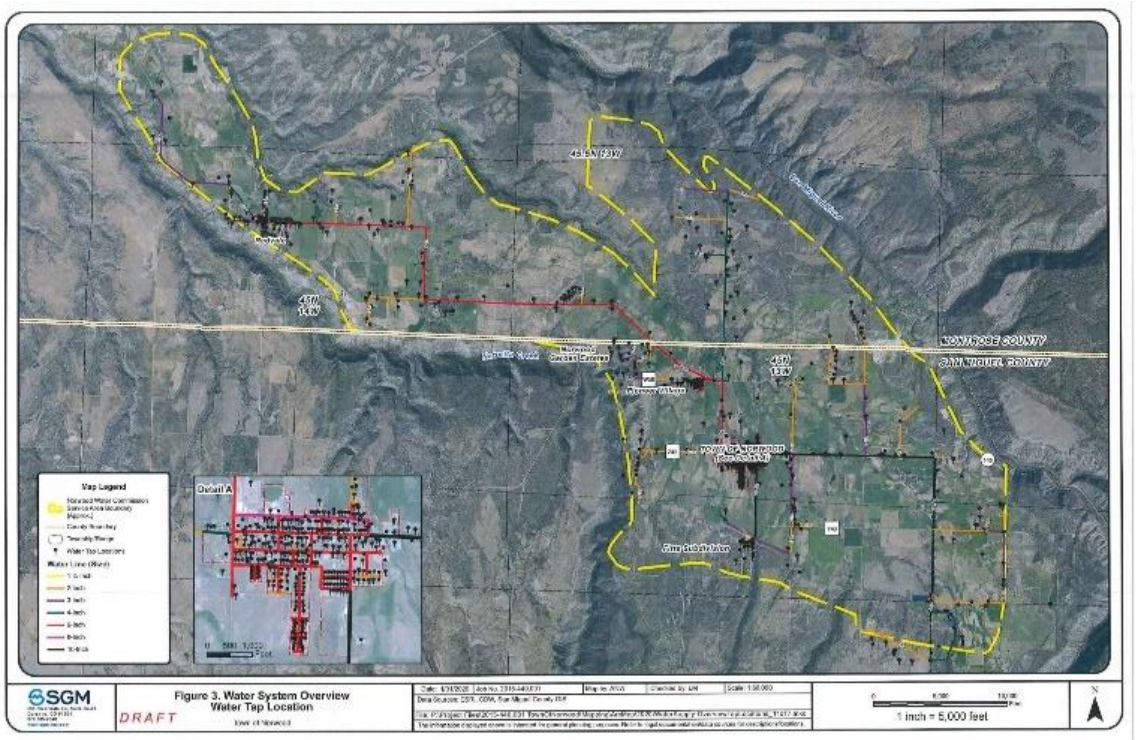
4.3.4 *Dead Ends*

The NWC transmission and distribution grid of one 15-mile-long transmission main with approximately ten branch dead-end distribution mains results in hydraulic, water service outages, and water quality deficiencies.

Water repairs on one transmission main or a dead-end line will result in water disruption for significant sections of the NWC grid. Only small areas will have service disruption if lines are looped and have adequate valves. Dead-end mains result in water stagnation, long water age and low chlorine residuals.

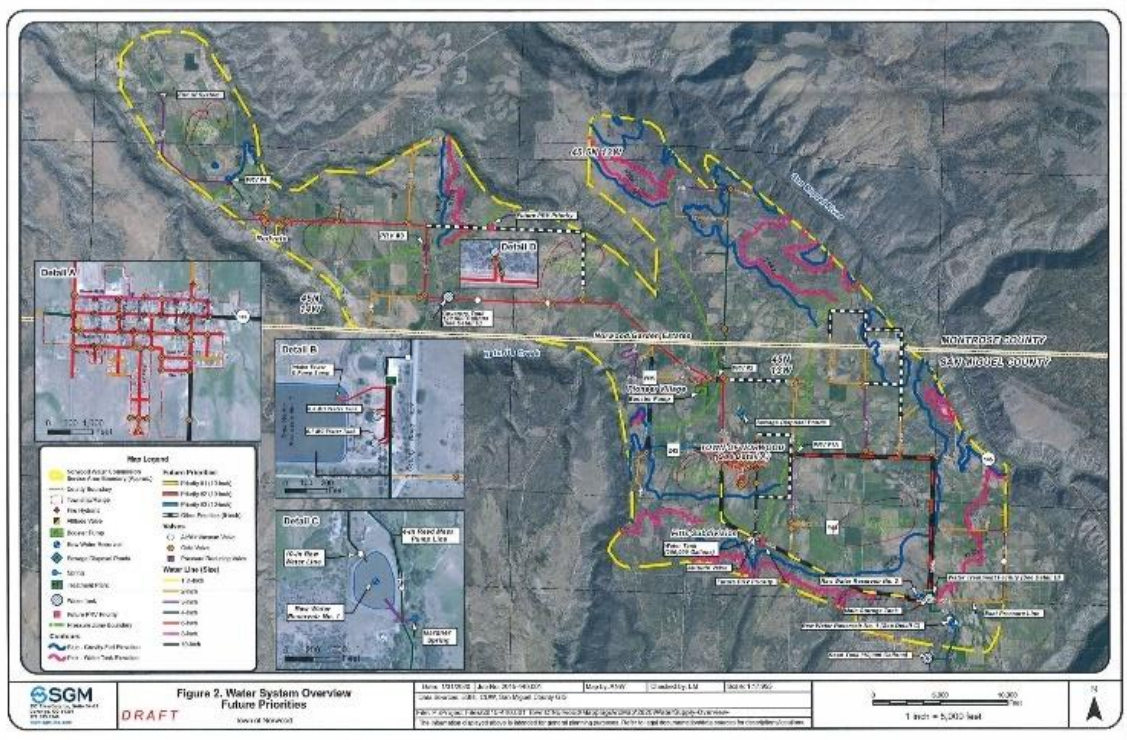
We recommend that dead-end mains be eliminated in the future by installing loops to other dead-end lines. Figure 4.2 shows recommended line looping.

Figure 4-1 Water Tap Location



See end of Section for full size figure.

Figure 4-2 Water System Overview Future Priorities



See end of Section for full size figure.

4.3.5 *Water Quality Issues*

Because of the large service area from east to west, the end of the pipe network is extremely long which results in very long detention times between the WTP and a tap. This long detention time can dissipate chlorine residual. Further, the DBP treatment issue at the WTP can work against higher residuals that leave the plant. The combination of chlorine and organics from raw water storage can cause DBP. Chloramines are used by the WTP as an alternative to gaseous chlorine as the primary disinfectant. The addition of Chloramines (ammonia) with long detention time can also cause nitrification to occur in the pipelines.

The pressure reducing valve between Pressure zone 1 and 2 also had the added function to control the level of water in the 200,000-gallon tank. The PRV is maintained to just allow the 200,000 tank to fill without spilling out the overflow. This operation does not allow the tank to cycle properly leading to aging stagnant water. This can be resolved by several methods that will be discussed in more detail in later section

4.3.6 *Pressure Zones*

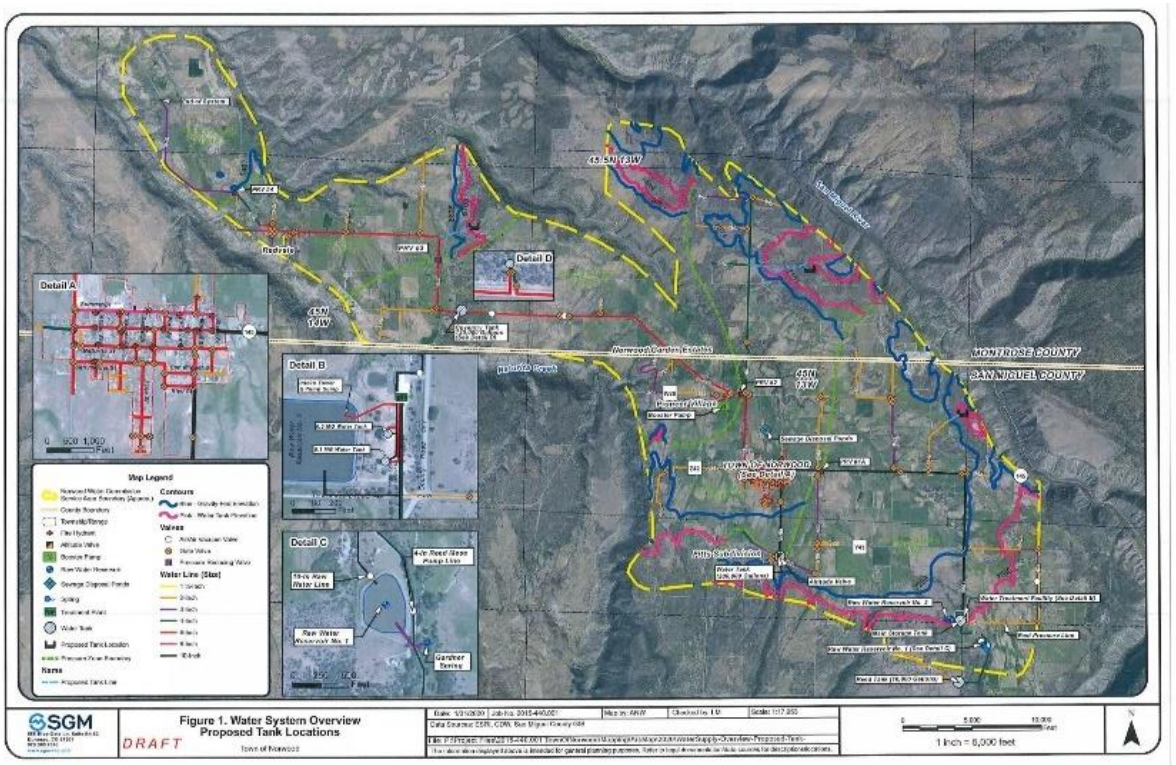
The five pressure zones have created difficulty in looping dead end lines because in some cases logical looping would require a connection between two pressure zones which requires additional PRV's.

4.4 Recommendations

This section will discuss future recommendations based in part from the Hydraulic modeling. These recommendations are shown graphically in Figure 4.3. As rural lines are replaced, upgraded or extended the size of lines should be increased to allow increased flows without excessive headloss and loss of pressures.

- Install SCADA system on PRV #1 to allow 200,000-gallon tank to cycle
- Limit the flow when filling the Coventry Tank
- Replace existing 10" transmission main from WTP to Norwood.
- Create a looped transmission line from WTP to 200,000-gallon tank
- Loop between the 200,000-gallon tank and the west end of Norwood
- Loop around Pioneer village
- Increase size of 6-inch transmission main from Norwood and Redvale over time with new main or parallel main
- Eliminate dead end mains by looping distribution lines. The size of these lines will require additional modeling so that the hydraulics, water age and chlorine residual issues are balanced.
- Prepare a valving plan for the distribution and transmission line operation. Determine proper spacing between valves and at tees and crosses to that lines can be shut down for maintenance without disrupting service to large service areas.

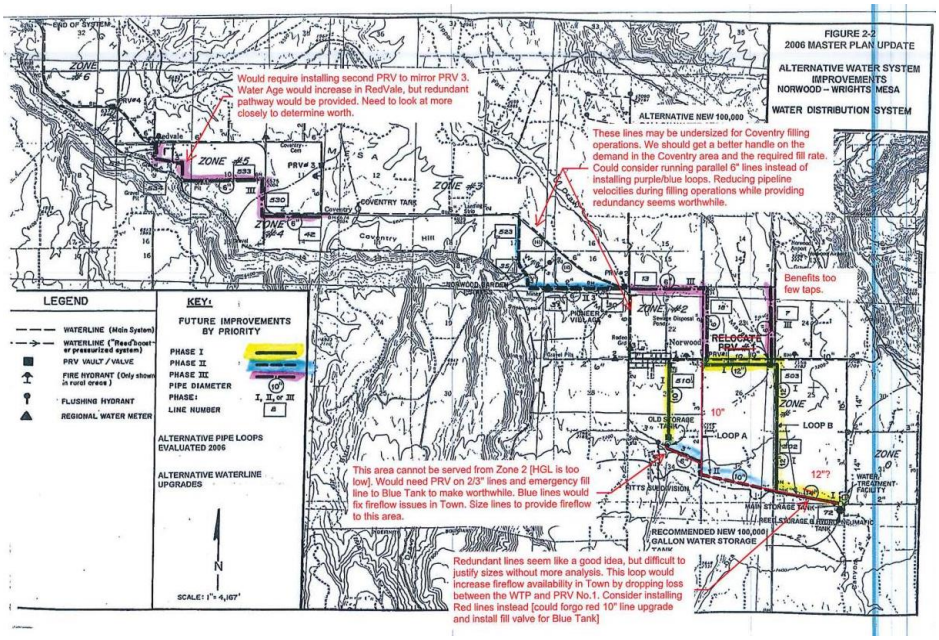
Figure 4-3 Water System Overview Proposed Tank Locations



See end of Section for full size figure.

The Westwater master planning update report prepared in June 2006 recommended similar system improvements and is shown in Figure 4.4

Figure 4-4 2006 Master Plan Update



See end of Section for full size figure.

4.5 Water distribution system future conditions

As the Norwood Water Commission grows through taps in the rural areas or in the Town of Norwood, flows will increase which will result in higher head loss and lower pressures. In the absence of specific development plans and land use plans in San Miguel and Montrose County specific distribution and storage improvements that focus on meeting future growth is not possible. We recommend that over time the NWC work with the two counties in a proactive manner to identify growth areas so that the proper planning, research and hydraulic modeling allows for adequate water system infrastructure.

Several distribution/transmission line projects are recommended. The 10-inch transmission line from the WTP to the Town has reached its useful life. In order to replace this line, we recommend that a redundant 10-inch line be extended from the WTP west to the 200,000-gallon tank and then north to the west side of the Town of Norwood distribution system. According to NWC staff an easement across private property exists to all this line in between the WTP and the Blue Tank. Once this line is installed, we recommend that the existing 10-inch line be replaced in its approximate same alignment. See figure 4-2.

4.6 Cost estimates for Priority Water Transmission and Distribution Line projects.

Section 4.4 outlines recommendations for future water transmission and distribution line projects. This section will provide engineers estimates (EOPC) for the priority projects for those projects that have a defined scope. The locations of these priority projects are shown in Figure 2 “Water System Overview Future Priorities. Those projects and the EOPC are as follows:

Priority 1
Create a looped 10” transmission line from WTP to 200,000-gallon tank
$ 2,204,286

Priority 1A
10” transmission line loop between the 200,000-gallon tank and the west end of Norwood
$ 1,455,580

Priority 2
Replace Existing 10” Transmission line from WTP to Norwood
$ 3,589,045

Priority 3
Create a looped 10” Transmission line from Norwood around Pioneer Village and Norwood Garden Estates
$ 2,314,620

Detailed estimates (EOPC) for these priority can be found in Appendix F

45.5N 13W

San Miguel River

Redvale

45N 14W

Naturita Creek

Norwood Garden Estates

MONTROSE COUNTY

SAN MIGUEL COUNTY

45N 13W

W35

Pioneer Village

Z42

TOWN OF NORWOOD (See Detail A)

145

Y43

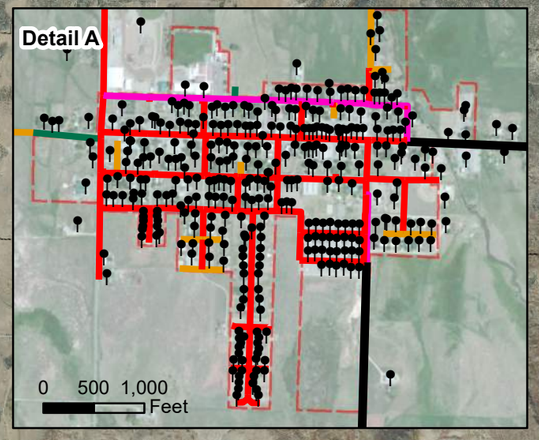
Fitts Subdivision

Map Legend

- Norwood Water Commission Service Area Boundary (Approx.)
- County Boundary
- Township/Range
- Water Tap Locations

Water Line (Size)

- 1 ¼-Inch
- 2-Inch
- 3-Inch
- 4-Inch
- 6-Inch
- 8-Inch
- 10-Inch



SGM
555 RiverGate Ln, Suite B4-82
Durango, CO 81301
970.385.2340
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Figure 4-1
Water Tap Location
Town of Norwood

Date: 1/31/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:60,000

Data Sources: ESRI, CDW, San Miguel County GIS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2020\WaterSupply-OverviewTapLocations_11x17.mxd

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 5,000 10,000 Feet

1 inch = 5,000 feet

N

End of System
PRESSURE ZONE 5
PRV #4
Redvale
PRESSURE ZONE 4
PRV #3
Future PRV Priority
Detail D
PRESSURE ZONE 3
45N 14W
Coventry Tank 120,000 Gallons (See Detail D)
45.5N 13W
San Miguel River
Norwood Garden Estates
Naturita Creek
MONTROSE COUNTY
SAN MIGUEL COUNTY
45N 13W
PRV #2
W35
Pioneer Village
Booster Pump
PS
Sewage Disposal Ponds
Z42
TOWN OF NORWOOD (See Detail A)
PRV #1A
PRESSURE ZONE 2
Y43
PRESSURE ZONE 1
Fitts Subdivision
Water Tank (200,000 Gallons)
Altitude Valve
Future PRV Priority
Raw Water Reservoir No. 2
Water Treatment Facility (See Detail B)
Main Storage Tank
East Pressure Line
Raw Water Reservoir No. 1 (See Detail C)
Reed Tank (10,000 Gallons)
145

Detail A
Summit St
Juniper St
S Cedar St
Cedar St
Pine St
Locust St
Maple St
West St
Naturita St
San Miguel St
Kiwi St
Elm St
0 500 1,000 Feet

Detail B
Intake Tower & Pump Sump
WTP
0.5 MG Water Tank
0.1 MG Water Tank
Raw Water Reservoir No. 2
4" Pumpline
6" Intake Line (From Reservoir No. 1)
10" Raw Water Diversion Pipe
2" PVC
County Road 45Y
0 100 200 Feet

Detail C
4-In Reed Mesa Pump Line
10-In Raw Water Line
Raw Water Reservoir No. 1
Gardner Spring
0 250 500 Feet

Map Legend

- Norwood Water Commission Service Area Boundary (Approx.)
- County Boundary
- Township/Range
- Fire Hydrant
- Altitude Valve
- Booster Pump
- Raw Water Reservoir
- Sewage Disposal Ponds
- Spring
- Treatment Plant
- Water Tank
- Future PRV Priority
- Pressure Zone Boundary

Future Priorities
- Priority #1 (10-inch)
- Priority #2 (10-inch)
- Priority #3 (10-inch)
- Other Priorities (8-inch)

Valves
- Air/Air Vacuum Valve
- Gate Valve
- Pressure Reducing Valve

Water Line (Size)
- 1 ¼-Inch
- 2-Inch
- 3-Inch
- 4-Inch
- 6-Inch
- 8-Inch
- 10-Inch

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Figure 4-2
Future Priorities
Town of Norwood

Date: 1/31/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:17,953

Data Sources: ESRI, CDW, San Miguel County GIS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2020\WaterSupply-Overview-

0 5,000 10,000 Feet

1 inch = 1,496 feet

N

End of System
PRESSURE ZONE 5
3-in
6407
PRV #4
4-in
2-in
Redvale
PRESSURE ZONE 4
2-in
PRV #3
6635
6703
3-in
45N 14W
Detail D
Coventry Tank 120,000 Gallons (See Detail D)
PRESSURE ZONE 3
45.5N 13W
7049
6981
3-in
2-in
7074
4-in
7142
San Miguel River
Norwood Garden Estates
Naturita Creek
MONTROSE COUNTY
SAN MIGUEL COUNTY
45N 13W
3-in
2-in
6-in
3-in
W35
2-in
PRV #2
Pioneer Village
PS
Booster Pump
Sewage Disposal Ponds
6-in
3-in
2-in
Z42
2-in
TOWN OF NORWOOD (See Detail A)
PRV #1A
PRESSURE ZONE 2
2-in
145
6-in
10-in
3-in
2-in
Y43
PRESSURE ZONE 1
Fitts Subdivision
Water Tank (200,000 Gallons)
10-in
Altitude Valve
7266
7360
Raw Water Reservoir No. 2
Water Treatment Facility (See Detail B)
Main Storage Tank
East Pressure Line
Raw Water Reservoir No. 1 (See Detail C)
Reed Tank (10,000 Gallons)

Detail A
Summit St
Lincoln St
S Spruce St
Cedar St
Pine St
Alucrne St
Maple St
Mesa St
145
Naturita St
San Miguel St
San Miguel St
Pine St
Kiwi St
0 500 1,000 Feet

Detail B
Intake Tower & Pump Sump
WTP
0.5 MG Water Tank
0.1 MG Water Tank
Raw Water Reservoir No. 2
4" Pumpline
10" Intake Line (From Reservoir No. 1)
10" Raw Water Diversion Pipe
2" PVC
County Road 45Y
0 100 200 Feet

Detail C
4-In Reed Mesa Pump Line
10-In Raw Water Line
Raw Water Reservoir No. 1
Gardner Spring
0 250 500 Feet

Map Legend

- Norwood Water Commission Service Area Boundary (Approx.)
- County Boundary
- Township/Range
- Fire Hydrant
- Altitude Valve
- Booster Pump
- Raw Water Reservoir
- Sewage Disposal Ponds
- Spring
- Treatment Plant
- Water Tank
- Proposed Tank Location
- Pressure Zone Boundary

Name

- Proposed Tank Line

Contours

- Blue - Gravity-Fed Elevation
- Pink - Water Tank Elevation

Valves

- Air/Air Vacuum Valve
- Gate Valve
- Pressure Reducing Valve

Water Line (Size)

- 1 ¼-Inch
- 2-Inch
- 3-Inch
- 4-Inch
- 6-Inch
- 8-Inch
- 10-Inch

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Figure 4-3
Proposed Tank Locations
Town of Norwood

Date: 1/31/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:17,953

Data Sources: ESRI, CDW, San Miguel County GIS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2020\WaterSupply-Overview-Proposed-Tank-

0 5,000 10,000 Feet
1 inch = 5,000 feet

N

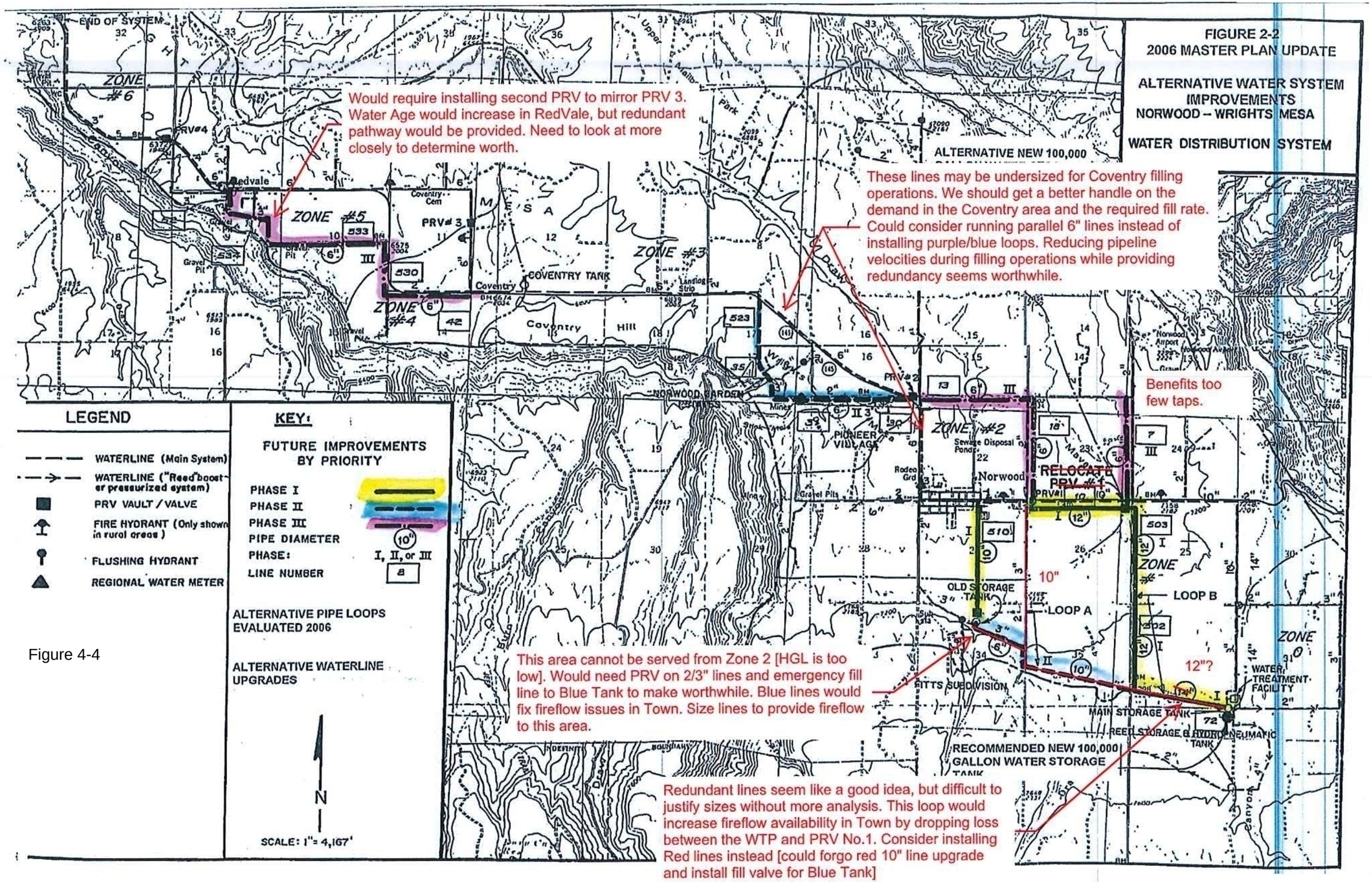


FIGURE 2-2
2006 MASTER PLAN UPDATE
ALTERNATIVE WATER SYSTEM IMPROVEMENTS
NORWOOD – WRIGHTS MESA
WATER DISTRIBUTION SYSTEM
Would require installing second PRV to mirror PRV 3. Water Age would increase in RedVale, but redundant pathway would be provided. Need to look at more closely to determine worth.
These lines may be undersized for Coventry filling operations. We should get a better handle on the demand in the Coventry area and the required fill rate. Could consider running parallel 6" lines instead of installing purple/blue loops. Reducing pipeline velocities during filling operations while providing redundancy seems worthwhile.
Benefits too few taps.
This area cannot be served from Zone 2 [HGL is too low]. Would need PRV on 2/3" lines and emergency fill line to Blue Tank to make worthwhile. Blue lines would fix fireflow issues in Town. Size lines to provide fireflow to this area.
Redundant lines seem like a good idea, but difficult to justify sizes without more analysis. This loop would increase fireflow availability in Town by dropping loss between the WTP and PRV No.1. Consider installing Red lines instead [could forgo red 10" line upgrade and install fill valve for Blue Tank]
ALTERNATIVE NEW 100,000
RECOMMENDED NEW 100,000 GALLON WATER STORAGE TANK
RELOCATE PRV #1
ZONE #6
ZONE #5
ZONE #4
ZONE #3
ZONE #2
ZONE
LOOP A
LOOP B
COVENTRY TANK
OLD STORAGE TANK
MAIN STORAGE TANK
REED STORAGE & HYDRO-PNEUMATIC TANK
WATER TREATMENT FACILITY
PIONEER VILLAGE
NORWOOD GARDENS
FITTS SUBDIVISION
Redvale
Coventry
Coventry Hill
Norwood
Norwood Airport
Sewage Disposal Ponds
Rodeo Grd
Gravel Pits
Landing Strip
Coventry Cem
PRV#1
PRV#2
PRV#3
PRV#4
10"
12"?
LEGEND
WATERLINE (Main System)
WATERLINE ("Reed booster pressurized system)
PRV VAULT / VALVE
FIRE HYDRANT (Only shown in rural areas)
FLUSHING HYDRANT
REGIONAL WATER METER
KEY:
FUTURE IMPROVEMENTS BY PRIORITY
PHASE I
PHASE II
PHASE III
PIPE DIAMETER
PHASE:
LINE NUMBER
I, II, or III
ALTERNATIVE PIPE LOOPS EVALUATED 2006
ALTERNATIVE WATERLINE UPGRADES
N
SCALE: 1"= 4,167'

Figure 4-4

5.0 Water Supply, Treatment and Storage

This section will discuss the regulatory compliance and capacity issues for the water supply, treatment and storage for existing and future conditions.

Based upon a 2% growth rate and a 20-year planning horizon the number of taps will grow from 800 to over 1200 Taps or EQR's in the year 2040. Demographic projects rarely are consistent year to year and scenario planning should consider other growth scenarios. Using a 3% growth rate the number of taps in 2040 would be approximately 1500 taps or EQR's. Average daily flows in the peak month of June would increase from 279,000 gpd to 415,667 gpd with a 2% growth rate to 505,000 gpd for a 3% growth rate.

A summary of a comparison of water demand metrics for the years 2020 and 2040 are shown in table 5.1.

Table 5-1 Water Demands for the years 2020 and 2040

5-1 Water Demands for the years 2020 and 2040		
Month	**2020** gpd	**2040** gpd
Jan	183,008	271,940
Feb	165,094	245,321
Mar	162,674	241,724
Apr	164,594	244,578
May	176,230	261,868
Jun	279,732	415,667
Jul	242,905	360,943
Aug	232,737	345,836
Sept	195,684	290,776
Oct	186,397	276,976
Nov	178,602	265,393
Dec	166,063	246,760
Average Annual Day	194,477	288,982
Average Day Non-Irrigation	172,833	256,820
Max Day	345,665	513,640
Peak Hour Day	518,498	770,460
Average Annual Demand AF	218	324

5.1 Water Supply Adequacy Statement

The NWC has contract water in Gurley Reservoir to provide 300 AF of raw untreated water on an annual basis for domestic use. The agreement was consummated on April 121, 2005 between the NWC and the Farmers Water Development Commission. The water supply is considered firm. The agreement is perpetual and may only be terminated upon the written agreement of both parties. The reservoir physical supply, however, is subject to and vulnerable to drought conditions based upon the inflow and fill into the reservoir.

Other supplies such as Gardner Springs and Pipeline are not considered a firm physical supply due to drought, dropping levels in Gurley Reservoirs, changing irrigation patterns from flood to sprinkler irrigation. These rights will be subject to administration during the irrigation season.

The current total use of the Gurley supply is approximately 218 AF and will increase with additional taps. Based upon a 2% growth rate it is expected the 300 AF from Gurley will be exceeded in the year 2036 based upon sole reliance on Gurley Reservoir. The adjudication of a new water right, or the change of a water right in a basin like the San Miguel, that is contested with opposition can take years. SGM recommends that the NWC begin to firm up other water rights including the San Miguel River diversion decreed for 5 cfs. (Case No. 94CW244: Diligence Case No. 08CW55)

Another strategy to pursue includes the implementation of a Water Rights Dedication Ordinance. This ordinance will require that future development or annexations dedicate all or a part of the historical agricultural water rights to the commission to offset the consumptive demand of the potable water system. Many factors would have to be considered for an ordinance that would work for the NWC. Other water providers on the West Slope have developed a very robust water supply through these ordinances in lieu of purchase of augmentation water or future water rights. The NWC can go into water court to change the rights from agricultural to domestic rights.

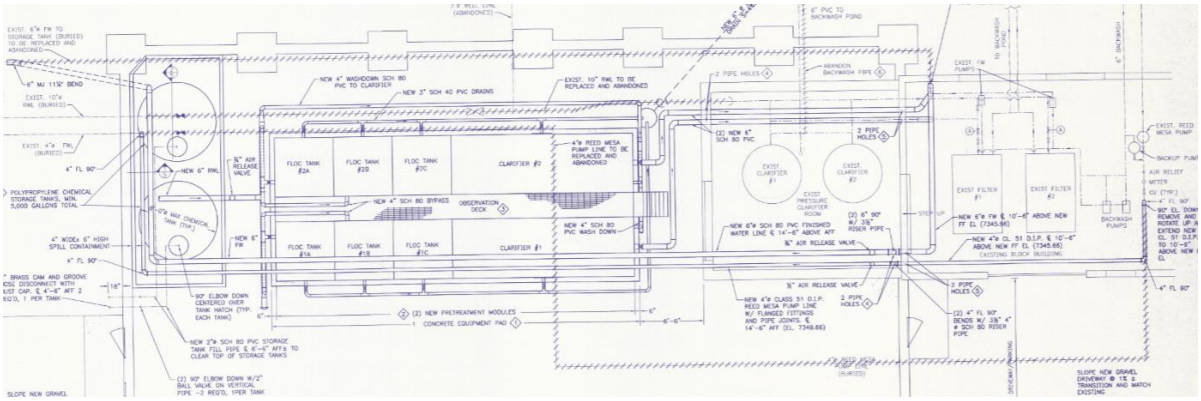
5.2 Water Treatment

The NWC WTP has a capacity of 0.56 MGD. The current average daily flow on an annual basis is approximately 194,000 gpd. Water Treatment plants are required to deliver MDD. The current MDD occurs in June and is projected to be 345,000 gpd. Currently MDD is 62% of the plant capacity. The MDD in the year 2040 is projected at 513,640 gpd which is 92% of capacity. Planning, designing and construction for a new WTP can take up to 5 years. Establishing a fund that is specific to financing the plant can take 10 years or more. SGM recommend that planning or the new WTP begin the early 2030's. Further changes in rate structures should occur at least 10 years prior to begin to finance the construction of the facility, as it is not certain that loan and grant sources will be available at that time.

The plant is a conventional plant with coagulation, flocculation, sedimentation and mixed media filtration. The Plant currently meets all regulatory requirements according to NWC staff. WTP regulatory compliance is based upon the State of Colorado "Design Criteria for Potable Water Systems" and the Water Quality Control Commission "Colorado Primary Drinking Water Regulations". A schematic layout of the Facility is shown in Figure 5.1

According to NWC staff the plant does have challenges meeting these regulations.

Figure 5-1 Schematic Plan View of WTP processes



See end of Section for full size figure.

5.2.1 *Deficiencies*

The water source is a high-quality headwater source, however the long detention times in Gurley Reservoir and Raw Water Reservoirs 1 and 2 result in high organic concentrations and Total Organic Carbon (TOC). The high TOC levels can be attributed to natural water quality from the watershed and from algae blooms in the reservoirs. Disinfection through chlorine combined with elevated organics and TOC can create (DBP) precursors that are the natural organic and inorganic compounds that react with chemical disinfectants in water to form DBP's.

At the same time the NWC must comply with minimum disinfection residuals concentrations in order to meet disinfection requirements in the finished water and in the finished water pipelines. In order to comply with these two competing regulations, chlorine is fed to the water after it leaves the mixed media filter and before it is pumped to the two on site water tanks in order to comply with required detention times. Once the water leaves the tanks ammonia is added in order to form chloramines which are then used in the pipelines to keep bacterial growth eliminated. Chloramines do not dissipate as quickly as free chlorine in the pipelines.

In order to meet the DBP rules total chlorine is kept to a minimum. The Primary Drinking Water Regulations require keeping a minimum chlorine residual of 0.2 mg/l in all pipelines. The combination of a large service area, long transmission lines, dead end lines, and limited taps on certain sections, the water age is very high, and the chlorine residuals fall below the minimum 0.2 mg/l requirement. SGM recommends that an in depth study be undertaken to determine improvements in the WTP processes and chemical feed additions to decrease the formation of DBP's.

Modifications to the raw water reservoirs can be made to reduce the formation of organics, such as aeration and the addition of Carp to keep algae levels lower.

Another deficiency exists in the spent backwash water. When filters and tube settlers are backwashed or flushed, spent backwash water is sent to backwash ponds. If Backwash ponds overflow, they must have a discharge permit in order to protect surface water sources, much like wastewater treatment plants. The WTP does not hold a discharge permit for the backwash ponds and theoretically are non-discharging and rely upon evaporation. The capacity of the backwash ponds to evaporate water is less than the amount of spent backwash water, and thus either a discharge permit must be applied for or other solutions considered. One solution is to recycle the backwash water through the water plant by filtering the backwash water and pumping to one of the raw water reservoirs. Recycling backwash water is common practice. SGM recommends that the NWC research the requirements of a small package filter system and recycle backwash water. This has the added benefit of increasing the water supply available to the WTP.

5.2.2 *Other Regulatory Requirements*

The NWC is required to meet a required inactivation of giardia and viruses as part of the treatment, distribution and storage system. Log removals are required and are based upon treatment type, disinfection levels, contact time, and other parameters. This section will discuss compliance with the Primary Drinking Water Regulations for log removal criteria. The Surface Water Treatment Rule outlines general treatment requirements as stated below:

At a point where the source water is not subject to recontamination and the entry point, the supplier must install and properly operate water treatment processes that reliably achieve at least the following levels of treatment: (I) 99 percent (2-log) removal of Cryptosporidium. (II) 99.9 percent (3-log) treatment, including filtration and disinfection, of Giardia lamblia. (III) 99.99 percent (4-log) treatment, including filtration and disinfection, of viruses.

This removal criteria is met through a combination of the WTP treatment process and the addition and detention time with a disinfectant. CDPHE field staff regularly performs field investigations to verify that log inactivation and disinfection levels are in compliance and are known as Disinfection and Outreach Verification Effort (DOVE) requirements.

SGM has entered the system parameters of water quality, chlorine levels, treatment plant type, and contact time in the 500,000- and 100,000-gallon tanks into a Contact Time (CT) model template and has verified that DOVE requirements are met.

The log removal requirements for Giardia are a three-log removal. The credit for giardia removal for the WTP processes is 2.5 log. The disinfection after the plant was determined to be 1.76 log removal through the contact time in the two tanks. This results in a total log removal credit of 4.3 log removal which is greater than the required 3 log removal.

The log removal requirement for viruses is a 4-log removal. The credit for virus removal for the WTP process is 2 log. The disinfection credit after the plant was determined to be well in excess of the required log removal and therefore is in compliance.

SGM does recommend that the 500,000 tank be retrofitted with baffles in order to prevent short circuiting and to increase the effective CT time.

A final regulatory challenge is keeping a minimum of 0.2 mg/l chlorine residual in the far reaches of the distribution system and in remote storage tanks including the Coventry Tank and the 200,000-gallon Blue tank. SGM recommends using the hydraulic model to determine water age and the dissipation of total chlorine from the chloramines to determine locations of the low free chlorine residuals. Chloramine chemical feed additions to the distribution system or to tanks can added.

5.2.3 *Recommendations Future Expansion, Research, and Capital Projects*

Recommendation on future steps and projects at the WTP are as follows:

- Undertake a study to determine filtration requirements necessary to recycle backwash water back through the WTP. This can be compared with applying for a discharge permit and discharging to an approved location.
- Undertake a study to ensure compliance with the DBP and minimum chlorine residual requirements by considering modifications to the WTP processes, addition to aeration or carp to the raw water reservoirs, and the addition of distribution chloramine chemical feed stations. Implement the following DBP/Chlorine residual study.

  DBP/Chlorine Residual Study

- Review historic DBP and chlorine residual data.
- Review WTP monitoring/performance data. Determine WTP process efficiency by monitoring the following at the WTP effluent [with SGM spectrometer].
  - pH
  - Temperature
  - Total Chlorine
  - Free Chlorine
  - Monochloramine
  - Free Ammonia as N
- If required, sample the following parameters at a number of sites during one day (WTP effluent, Storage Tanks, and PRVs or TCR monitoring points).
  - pH
  - Temperature
  - Total Chlorine
  - Free Chlorine
  - Monochloramine
  - Free Ammonia as N
  - TTHMs
  - HAAs? [likely not]
- Consider measuring TOC removal at the existing WTP.

    - Could also quantify TOC in San Miguel River (or proposed second source)
- If needed, use individual billing records to more accurately distribute demands. Run EPS modeling runs to estimate water age at locations throughout distribution system.
- Develop recommendations for
    - Operational improvements to reduce water age [Control valve recommendations from current master plan]
    - WTP process improvements for chloramine generation
    - Chloramine Boosting in Tanks
    - TTHM stripping in tanks or at the WTP
- Begin planning for a WTP plant expansion when demand exceeds 70% of plant capacity.
- Begin pursuit of the San Miguel River supply project.
- Consider adopting a water rights dedication ordinance.
- Install baffles in the 500,000 tank.
- Work with the SWBRT to ensure that these projects are included in the Colorado Water Plan update as IPP's.

5.3 Water Storage

This section will discuss water storage requirements based on future conditions. As the NWC grows additional storage volume will be required and the location of smaller tanks will be required in the rural section of the service area. Water storage volume requirements are shown in Table 5-2 for existing and future conditions in the year 2040.

The future storage volume based upon fire flow, operational and emergency storage is 554,500 gallons. The existing volume at the WTP is 600,000 gallons. The Coventry and the Blue Tank will provide an additional 320,000 gallons. The required volume is very dependent upon fire flow requirements. It was assumed that the current fire flow requirement for Norwood is 1000 gpm for two hours and the future requirements is for 1500 gpm for two hours. Based upon these assumptions the existing volume is adequate now and for the foreseeable future.

The location of the storage will need to change as the NWC grows. The small diameter dead-end lines in the rural areas of the service area do not provide adequate flow and pressure to accommodate significant number of new taps in the rural areas. In figure 4-3 we have shown the blue line elevations. If development pressures continue in some of the rural areas, specific improvements to line extension, location, sizing, and potential storage facilities can be researched.

Table 5-2 Storage Requirements for years 2020 and 2040

5-2 Storage Requirements for Years 2020 and 2040							
Year	**ADD** gpd	**MDD** gpd	**PHD** gpd	**FF** gallons	**Operation Storage** gallons	**Emergency Storage** gallons	**Total Storage Volume** gallons
2020	194,477	345,665	518,498	12,000	28,805	194,447	235,282
2040	288,982	256,820	770,460	180,000	85,607	288,982	554,589

The Blue Tanks should have additional controls between PRV 1 to allow the tank to turn over and at the same time not lead water out of the overflow. The Coventry Tank pressure sustaining valve should also have additional functionality to allow tank turnover and limits on fill rates.

5.3.1 *Tank Regulatory Deficiencies*

Many CDPHE design criteria requirements have changed since the NWC tanks have been constructed. We recommend that on a biannual basis the tanks be inspected for compliance with the most recent CDPHE requirements. Tanks should continue to be inspected with divers for coating review. Tanks re coating should be based upon exterior and interior coating inspections. Industry standards require tank re coating to occur every 10 to 15 years.

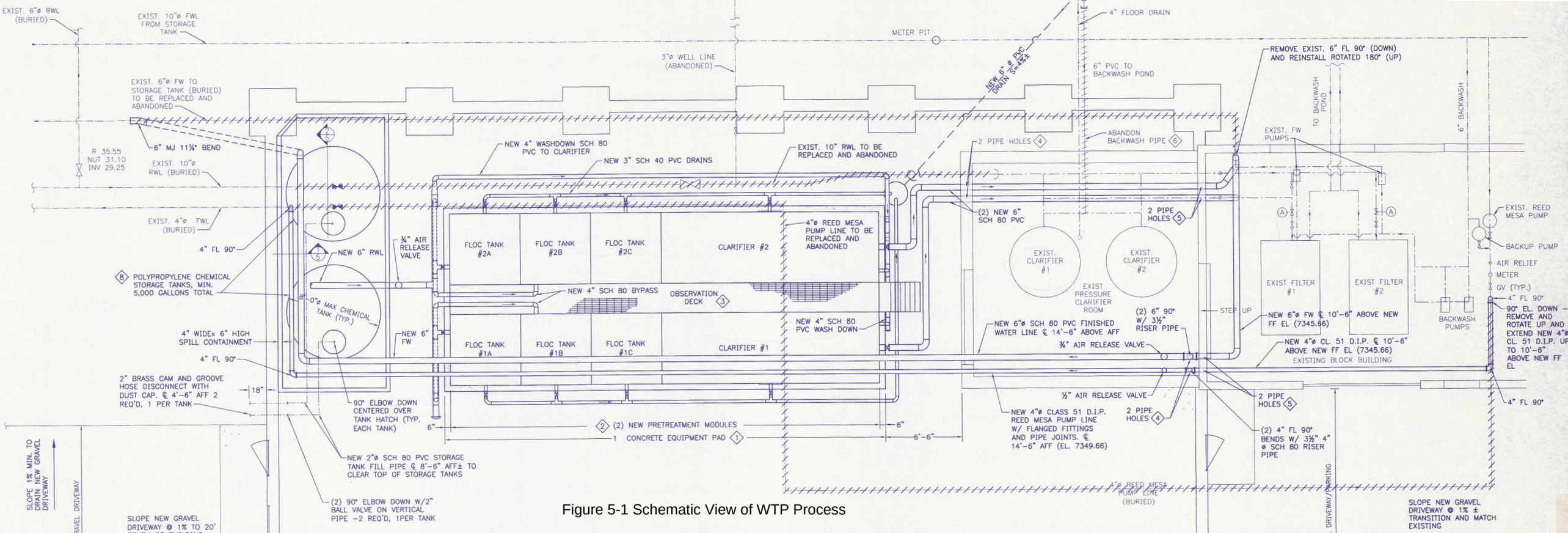


Figure 5-1 Schematic View of WTP Process

6.0 Alternatives for Second Source of Water

This section will discuss a new source of supply for the NWC. The NWC is expected to continue to have growth pressures. Previous sections of this Master Plan have discussed the need for this second source of supply due to growth, vulnerability and limitations to physical and legal supplies.

The NWC water supply from Gurley Reservoir is constrained because water is only available during the irrigation season from April through November. Water during the winter months is provided from two raw water reservoirs filled from Gurley. The capacity of the reservoirs is limited. Gurley Reservoir is vulnerable to droughts, climate change and fires from the tributary watershed.

The 300 AF contract with the FWDC will not supply adequate water for future growth. It is projected that with a 2% growth rate the demand of the NWC will exceed the 300 AF supply sometime between 2035 and 2040. The current use of Gurley Reservoir water is 218 AF.

It is critical that public water providers have multiple and redundant water supplies to insure a safe reliable source of drinking water in case one supply becomes unavailable from physical and legal water curtailment. Further, planning for water supplies must consider long range future water supplies. Water supply planning takes more time than typical infrastructure planning which is 20 years. As one current example the Colorado Statewide Water Plan planning period is up through the year 2050. The planning, financing, and regulatory permitting of water supply planning can take more than 20 years. A significant portion of the San Miguel River Supply is on Federal land which requires National Environmental Policy Act permitting and scoping.

6.1 San Miguel River Supply Water Rights

This section will discuss the physical and legal supply of water available from the San Miguel River intake. It is important to note that even though the decree is for 5 cfs, the actual yield from the intake will be less in most years and not available at all in some months in a dry year. The seniority of the legal water right or the decree is very junior and subject to administrative curtailment certain times of the year from calls from senior water right holders in the San Miguel River basin.

In order to determine the amount of water available it was necessary to evaluate the year-round physical flow in the River at the point of diversion and compare that flow with the senior water rights. This allowed a determination of the amount of firm yield that will be in priority and thus available to divert at the intake. The remainder of this section will discuss the basis for the legal water rights and the following section will discuss the results of that analysis of physical supply available.

The NWC River Diversion was decreed conditionally in water court Case No. 94CW244 to meet the demands of the NWC. Case No. 10CW202 was a use enlargement of the Case No. 94CW244 right; additional direct flow was not requested. This structure is part of an integrated water supply system which includes other diversions and storage in several reservoirs. The NWC River Diversion is decreed for up to 5.0 cubic-feet-per-second (cfs) and the diversion rate is based on the amount of flow in the river, per Case No. 94CW244.

The NWC River Diversion was decreed for new uses and alternate points of diversion in Case No. 10CW202, which is the most recent decree for this structure. Table 6-1 and 6-2 summarizes the water rights information for the structures included in Case No. 10CW202. Figure 6.1 shows the locations of the structures.

Table 6-1 Norwood Water Commission Water Rights Case No 10CW202

6-1 Norwood Water Commission Water Rights Case No 10CW202

Structure Name	Structure Type	Source of Supply	Decreed Case	Adj. Date	App. Date	Admin Number	Decreed Uses [1]	Absolute Amount	Conditional Amount
NWC River Diversion	Diversion	San Miguel River	94CW244	12/31/94	11/1/94	52900 0000	2	0.0 cfs	5.0 cfs [2]
NWC Naturita Pump #1 (at Naturita)	APOO	San Miguel River	10CW202	12/31/94	11/1/94	52900 0000	2	0.0 cfs	5.0 cfs
NWC Naturita Pump #2 (at Naturita)	APOO	San Miguel River	10CW202	12/31/94	11/1/94	52900 0000	2	0.0 cfs	5.0 cfs
NWC Reservoir #1	Reservoir	NWC Naturita Pump #1 (at Naturita) and NWC Naturita Pump #2 (at Naturita)	01CW270	12/31/01	12/1/94	55152 52930	2	0.0 AF	18.4 AF
NWC Reservoir #2	Reservoir		01CW270	12/31/01	12/1/94	55152 52930	2	0.0 AF	91 AF
NWC Reservoir #3	Reservoir		01CW270	12/31/01	12/1/94	55152 52930	2	0.0 AF	91 AF
NWC Reservoir #4	Reservoir		01CW270	12/31/01	12/13/10	55152 52930	2	0.0 AF	33 AF
NWC Beaver Park Reservoir	Reservoir	NWC Goat Creek Pump	10CW202	12/31/10	12/13/10	58786 0000	1,2,4,6,8,A,Q	0.0 AF	2,250 AF
NWC Ed Joe Draw Reservoir	Reservoir	Onstream reservoir on Ed Joe Draw, NWC Goat Creek Pump	10CW202	12/31/10	12/13/10	58786 0000	1,2,4,6,8,A,Q	0.0 AF	2,250 AF
NWC Old Town Reservoir	Reservoir	NWC Goat Creek Pump; NWC River Diversion	10CW202	12/31/10	12/13/10	58786 0000	1,2,4,6,8,A,Q	0.0 AF	183 AF
NWC Goat Creek Pump	Diversion	Beaver Creek; tributaries to San Miguel River	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #1	APOO	East Fork East Beaver Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #2	APOO	East Beaver Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #3	APOO	Beaver Creek; tributaries to San Miguel River	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #4	APOO	East Middle Beaver Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #5	APOO	Main Middle Beaver Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #6	APOO	West Middle Beaver Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #7	APOO	West Beaver Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #8	APOO	Naturita Cattle and Land Company's Ditch	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #9	APOO	Little Beaver Creek a/k/a Goat Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC Goat Creek Pump Headgate #10	APOO	Galloway Creek	10CW202	12/31/10	12/13/10	58786 0000	0,1,2,4,6,8,A,Q	0.0 cfs	175 cfs
NWC River Diversion	Diversion	San Miguel River	10CW202	12/31/10	12/13/10	58786 0000	0,1,3,4,6,8,A,Q	0.0 cfs	5.0 cfs [2]
NWC Naturita Pump #1 (at Naturita)	APOO	San Miguel River	10CW202	12/31/10	12/13/10	58786 0000	0,1,3,4,6,8,A,Q	0.0 cfs	6.0 cfs
NWC Naturita Pump #2 (at Naturita)	APOO	San Miguel River	10CW202	12/31/10	12/13/10	58786 0000	0,1,3,4,6,8,A,Q	0.0 cfs	6.0 cfs

Notes: cfs = cubic feet per second

Footnotes: (1) Use Type Codes: 0 = Storage, 1 = Irrigation, 2 = Municipal, 3 = Commercial, 4 = Industrial, 5 = Recreation, 6 = Fishery, 7 = Fire, 8 = Domestic, 9 = Stock, A = Augmentation, E = Evaporation, Q = Other, W = Wildlife
(2) Diversion rate will be based on the flow of the San Miguel River as described in 94CW244. The annual water diverted pursuant to 94CW244 and the storage decree in Case No. 01CW270, combined will not exceed 723 acre feet.

Table 6-2 Water Rights of Norwood Water Commission River Diversion Case No 10CW202

6-2 Water Rights of Norwood Water Commission River Diversion Case No 10CW202									
Structure Name	Structure Type	Source of Supply	Decreed Case	Adj. Date	App. Date	Admin Number	Decreed Uses (1)	Absolute Amount	Conditional Amount
NWC River Diversion	Diversion	San Miguel River	94CW244	12/31/94	11/1/94	52900 0000	2	0.0 cfs	5.0 cfs (2)
NWC River Diversion	Diversion	San Miguel River	10CW202	12/31/10	12/13/10	58786 0000	0,1,3,4,6,8,A,Q	0.0 cfs	5.0 cfs (2)

Notes:
cfs = cubic feet per second

Footnotes:

(1) Use Type Codes: 0 = Storage, 1 = Irrigation, 2 = Municipal, 3 = Commercial, 4 = Industrial, 5 = Recreation, 6 = Fishery, 7 = Fire, 8 = Domestic, 9 = Stock, A = Augmentation, E = Evaporation, Q = Other, W = Wildlife

(2) Diversion rate will be based on the flow of the San Miguel River in accordance with the following scheduled administered on a year round basis: the maximum diversion rate is 1 cfs when the flow of the San Miguel River is less than 30 cfs;
1.5 cfs when the flow in the San Miguel River is 31 to 60 cfs;
3.5 cfs when the flow of the San Miguel River is 61 to 85 cfs, and
5 cfs when the flow in the San Miguel River is greater than 85 cfs.

A firm yield of no less than 1,000 acre-feet/year is required by NWC for the diversion. The decrees for the NWC River Diversion allow for year-round diversions, if needed, based on the flow in the river. However, it is SGM's understanding that the NWC plans to rely on this structure to primarily meet its winter water demands.

The water court application for the San Miguel Supply in Water Division 4 included stipulations between the NWC and the US BLM in part because the diversion location is located on BLM managed land. A summary of those significant issues in the stipulations are as follows:

San Miguel River Flow cfs	Applicant's Maximum Diversion Rate cfs
<30	1.0
31 to 60	1.5
61 to 85	3.5
>85	5.0

1. "The applicant (NWC) shall monitor and document both the river flow and the diversion rate on an average daily basis when the San Miguel River flow at the Administration Point is 85 cfs or less, and on an average weekly basis when the flow at said Point is more than 85 cfs. "
2. "The annual (calendar year) water diversion volume for San Miguel River water diverted pursuant to the Alternate POD decree and the storage decree, combined ,will not exceed 723 acre-feet. "
3. "Applicant agrees that no more than one pump station will be requested on BLM's land in connection with this project. "
4. "If Applicant requests that its pump station be located on public lands of the United States, Applicant agrees that it shall restrict its request to the following locations on lands administered by the Bureau of Land Management: on the west side of the San Miguel River immediately north of the survey comer for the northwest corner of Tract 37 along the north township line for T44N R12W, New Mexico P.M.

(immediately downstream from the north line of Tract 37 which is presently Canyon Chapel Church Camp property) and south of (upstream from) the Rocky Mountain Natural Gas Pipeline Right of Way."

5. "Applicant agrees that any water pipeline requested on BLM lands in connection with the water rights decreed in this case will be requested to be located parallel to the Rocky Mountain Natural Gas pipeline right of way from the point nearest the Pump Site to the top of Beaver Canyon and that no additional lift will be requested along the portion of pipeline route within BLM lands."

6.2 San Miguel River Supply Physical Supply

SGM evaluated the physical supply of water available at the NWC River Diversion site using flow records from the San Miguel River near Placerville, CO gage (USGS gage no. 09172500) for the period of record, which is from 1943 to 2018. This stream gage is located approximately 6 miles upstream of the point of diversion. Information from the Colorado Division of Water Resource (CDWR) shows that there are no intervening San Miguel River diversions between the NWC River Diversion and this stream gage. The watershed size at the gage is 310 square miles, while the watershed size at the NWC River Diversion site is 349 square miles. Therefore, it was concluded that use of the Placerville gage would provide reasonable and conservative results for this evaluation and no adjustments to flows were made for the relatively small difference in watershed sizes.

Flows were evaluated for dry, average and wet water year conditions based on the average annual flow volume within the following percentiles:

- 25th percentile and below flow years = "dry year",
- 26th to 75th percentile flow = "average year", and
- 75th and above percentile flow = "wet year".

Table 6.3 shows the monthly flows in the San Miguel River at the Placerville gauge for these conditions.

Table 6-3 Monthly Flows of San Miguel River at Placerville Gauge

Table 6-3 Monthly Flows of San Miguel River at Placerville Gauge			
	Gauged Flow [1]		
Month	Dry Year Mean Daily Flow [2] (ofc)	Average Year Mean Daily Flow [2] (ofc)	Wet Year Mean Daily Flow [2] (ofc)
Nov	68.7	86.6	92.8
Dec	59.8	68.1	74.1
Jan	54.8	62.2	66.6
Feb	54.5	63.9	67
Mar	73.9	85.8	84.1
Apr	158.5	240	298
May	341	537	808
Jun	451.9	776.4	1136.3
Jul	191.5	369.2	745.3
Aug	128.8	192.4	316.3
Sept	115.9	136.9	184.4
Oct	91	114.3	126.6

Footnotes:
[1] Data from USOS San Miguel River near Placerville, CO stream gauge between 1943 to 2017
[2] Dry, average, and wet years were determined from annual gauged volumes; dry year (25th percentile and below), average years (25th to 75th percentile), and wet years (78th percentile and above).

The number of months during the period of record that the average monthly flow was within the diversion flow ranges for the NWC River Diversion schedule was determined. Table 6.4 shows the percent of time that the flow in the river was within each diversion flow range for each month. For example, this table shows that 13% of the time in November, the flow in the river was within the range of 31-60 cfs, which would allow for a diversion of 1.5 cfs by the NWC River Diversion.

Table 6-4 Percentage of Months with Flows within Norwood Water Commission River Diversions

Table 6-4 Percentage of Months with Flows within Norwood Water Commission River Diversions [1]													
San Miguel River Flow Condition [2] (cfs)	Total Number of Months in Range	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
<30	0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
31 to 60	124	13%	40%	48%	44%	17%	0%	0%	0%	0%	1%	0%	1%
61 to 85	200	37%	43%	47%	51%	51%	1%	0%	0%	1%	1%	8%	27%
>85	568	48%	15%	4%	3%	31%	99%	100%	100%	99%	97%	92%	71%

[1] Based on monthly averages from San Miguel River near Placerville, CO stream gauge 1943 - 2017
[2] Diversion rate at the NWC River Diversion will be based on the flow of the San Miguel River in accordance with the following schedule administered on a year round basis; the maximum diversion rate is 1 cfs when the flow of the san Miguel River is less than 30 cfs,
1.5 cfs when the flow in the San Miguel River is 31 to 60 cfs,
3.5 cfs when the flow of the San Miguel River is 61 to 85 cfs, and
5 cfs when the flow in the San Miguel River is greater than 85 cfs.

Finally, senior water rights call records for the San Miguel River were obtained to assess the extent that calls from downstream water rights would curtail diversions by the NWC River Diversion. Typically, the Highline Canal and the BCD Ditch are the most senior water rights calling on the river. Call records are provided in Table 6.5. The average start and end dates for calls during dry years (2002, 2003, 2012, and 2013) were used for the dry year analysis and resulted in a call being in effect from July 6 through September 27. The average start and end dates for calls during average years (2004, 2009, 2010, 2011 and 2017) were used for the average year analysis and resulted in a call from August 24 through September 18. It was assumed that the NWC River Diversion would not be able to divert during times of a call. No water rights calls occurred during the wet water year condition.

The Colorado Water Conservation Board (CWCB) has decreed instream flow (ISF) water rights in the San Miguel River at or below the NWC River Diversion. These ISFs were decreed in Case No. 02CW277 that range from 61 to 93 cfs, and in Case No. 11CW129 that range from 80 to 325, depending on the time of the year. Both CWCB's instream flow rights are junior to the NWC River Diversion municipal uses decreed in Case No. 94CW244 and would not have any effect on potential diversions. The CWCB's instream flows decreed in Case No. 02CW277 are senior to NWC River Diversion. Diversions at the NWC River Diversion for uses other than municipal may only be made when the instream flow right, which range from 61 to 93 cfs, is satisfied.

The results of the evaluation are as follows. Table 6-3 shows the average monthly flows in the San Miguel River at the Placerville gage. This table indicates that there is a reasonable amount of flow in the river at this location (and at the point of diversion for the NWC River Diversion), even in a dry year. For example, the lowest flows during a dry water year occur in January and February and are still approximately 55 cfs.

The results of the water availability analysis are provided in Table 6-6 for dry, average and wet water years based on the above assumptions. This table shows that, even in a dry water year with a senior call for most of the summer, there would be 1,990 acre-feet of water that could be diverted. This is almost twice the target yield of 1,000 acre-feet per year needed. Diversions are limited during July through September in a dry year. The available supply in wet and average years is substantially higher.

Conclusions This analysis has shown that ample water exists in the San Miguel River at the point of diversion for the NWC River Diversion to meet the decreed amount for this structure, even in a dry water year.

Table 6-5 Call Records of San Miguel River

Table 6-5 San Miguel River Calls – Water District 60 – 2002 to Present

Date Set	Date Released	Location Structure Name	Most Senior Curtailed Structure Name	Admin No. of Most Senior Curtailed Structure	Priority Amount
2002					
06/20/2002	06/21/2002	Highline Canal	Highline Canal	30604.3007	29.10
06/21/2002	06/27/2002	BCD Ditch	Highline Canal	30604.3007	29.10
06/27/2002	08/25/2002	BCD Ditch	Highline Canal	23681.2153	39.62
08/25/2002	08/28/2002	BCD Ditch	Highline Canal	16588.00000	31.28
08/29/2002	09/08/2002	BCD Ditch	Highline Canal	23681.2153	39.62
09/22/2002	10/31/2002	BCD Ditch	Highline Canal	30604.3007	29.10
2003					
07/15/2003	10/13/2003	Nucla Power Plant Ditch	Highline Canal	23681.2153	39.62
07/22/2003	10/13/2003	BCD Ditch	Highline Canal	23681.2153	39.62
07/23/2002	10/13/2003	Reed Chatfield Alt. Pt.	Highline Canal	23681.2153	39.62
07/28/2003	10/13/2003	Highline Canal	Hardscrabble Ditch	25826.2429	3.90
2004					
08/11/2004	09/05/2004	Highline Canal	Pleasant Valley Ditch	25826.2429	20.00
08/11/2004	09/05/2004	Nucla Power Plant Ditch	Highline Canal	23681.2153	39.62
08/11/2004	09/05/2004	Goulding Ditch	Highline Canal	23681.2153	39.62
08/11/2004	09/05/2004	Reed Chatfield Alt. Pt.	Highline Canal	23681.2153	39.62
08/11/2004	09/05/2004	BCD Ditch	Highline Canal	23681.2153	39.62
2005					
No calls					
2006					
No calls					
2007					
No calls					
2008					
No calls					
2009					
08/06/2009	09/21/2009	Nucla Power Plant Ditch	Highline Canal	23681.2153	39.62
08/06/2009	09/21/2009	Nucla Power Plant Ditch	Highline Canal	23681.2153	39.62
08/11/2009	09/21/2009	Goulding Ditch	Highline Canal	23681.2153	39.62
08/11/2009	09/21/2009	BCD Ditch	Highline Canal	23681.2153	39.62

08/17/2009	09/11/2009	Highline Canal	Goulding Ditch	30604.28777	2.00
09/11/2009	09/21/2009	Highline Canal	Parkway Ditch	25826.24289	2.76
2010					
09/15/2010	09/25/2010	Goulding Ditch	Highline Canal	23681.2153	39.62
09/15/2010	09/25/2010	Highline Canal	Parkway Ditch	25826.24289	2.76
2011					
09/06/2011	09/09/2011	Nucla Power Plant Ditch	Highline Canal	23681.2153	39.62
2012					
07/19/2012	10/08/2012	Highline Canal	Parkway Ditch	30771.0000	1.89
2013					
07/01/2013	07/31/2013	Goulding Ditch	Parkway Ditch	30771.0000	1.89
07/01/2013	07/31/2013	Highline Canal	Parkway Ditch	30771.0000	1.89
07/01/2013	07/31/2013	BCD Ditch	Parkway Ditch	30771.0000	1.89
07/26/2013	07/31/2013	Reed Chatfield Ditch	Parkway Ditch	30771.0000	1.89
2014					
No calls					
2015					
No calls					
2016					
No calls					
2017					
09/5/2017	09/10/2017	BCD Ditch	Highline Canal	28051.00000	10.00
09/10/2017	09/29/2017	BCD Ditch	Highline Canal	30604.30071	29.10
2018					
06/29/2018	07/12/2018	BCD Ditch	Highline Canal	23681.21526	39.62
07/12/2018	07/20/2018	BCD Ditch	Highline Canal	28051.00000	10.00
07/20/2018	10/04/2018	BCD Ditch	Highline Canal	23681.21526	39.62

Source: From the Division 4 Department of Water Resources

Table 6-6 Potential Monthly Yield at the NWC River Diversion

6-6 Potential Monthly Yield at the NWC River Diversion													
Water Year Condition	Number of Days NWC River Diversion is in Priority (1)												Total
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	
Dry	30	31	31	28	31	30	31	30	6	0	3	31	282
Average	30	31	31	28	31	30	31	30	31	24	12	31	340
Wet	30	31	31	28	31	30	31	30	31	31	30	31	365

Water Year Condition	Potential Monthly Yield at NWC River Diversion (AF)(2)												Total
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	
Dry	208	92	92	83	215	298	307	298	60	0	30	307	1,990
Average	298	215	215	194	307	298	307	298	307	238	119	307	3,103
Wet	298	215	215	194	215	298	307	298	307	307	298	307	3,259

(1) Based on San Miguel River call data from the Division 4 Department of Water Resources 2002 to present. The average start and end dates for calls during dry years resulted in a call being in effect from July 6 through September 27. The average start and end dates for calls during average years resulted in a call being effect from August 24 through September 18. No water rights calls occurred during wet water years.
(2) Yield estimated at San Miguel River near Placerville, CO gauge.

The actual decreed location of the water right is located upstream from the confluence of Beaver Creek and the San Miguel and may need a change in location in water court.

6.2.1 *Firm Yield for Physical Supply*

The San Miguel River firm yield during a wet and average year will be able to supply the projected water demand on a monthly basis well beyond the year 2040. In a dry year water will not be available in August and limited water will be available in September. SGM recommends that Gurley Reservoir water would be the primary supply because it allows for gravity flow from Gurley Reservoir to the WTP during the irrigation season. The San Miguel River supply would be used as a backup supply during the irrigation season and the primary supply from November through April. Initially, Reservoir #1 & 2 will have adequate volume for storage over the winter months. Water from the pump station can be pumped directly into the WTP and potentially avoid the organic and TOC elevated concentrations in the raw water.

6.2.2 *Required Infrastructure*

Water from the River must be pumped to the WTP. A potential location of the intake and transmission infrastructure is shown in Figure 6.1. This source will require a river intake, below grade concrete clearwell, above ground control building, electrical MCC panels and control equipment, operating floor for pump, piping and valves and electrical power source. The degreed point of diversion location is upstream of the confluence and may need to be changed through water court.

6.2.2.1 *Intake*

Several types of river intake can be considered. A conventional rock diversion structure known as a Rosgen Structure, inverted V, or vortex weir would be placed in the river along with a conventional turn-out gate with trash rack and measuring device. Water would be directed into a below grade clear well, located below a control building. The rock structure will require Section 404 permitting.

A second intake type would consist of shallow wells that would pump into the clear well or to the WTP.

The elevation of the intake would be approximately 6680 and the hydraulic grade of Reservoir #2 is 7350. The static head or pressure on the pumps would be in excess of 300 psi. With those pressure we would recommend using the wells as a low service Pump and installing vertical line shaft turbine pumps in the clear well as the high service pumps.

The in-channel rock diversion structure would not be required with shallow wells. In order to determine if shallow wells can be installed, test well investigations will be required to determine if water quantity and water quality goals can be met.

6.2.2.2 *Pumps*

The pump capacity will be based upon many different criteria, some of which are not known at this time. Raw Water pumping capacity is considered part of water supply and therefore, should be sized for maximum daily flow. The pumps should be designed to pump directly into the WTP or into Reservoirs 1 and 2.

The current capacity of the WTP is 0.56 MGD or 389 gpm. The total water right decree is 5 cfs or 2244 gpm 3.2 MGD. Ultimately the pumping capacity should be designed for the full decreed amount, however for a first phase we recommend that the pumping capacity match the current WTP capacity. Supply should be based upon multiple pumps so that if one pump is out of service the remaining pumps can provide current maximum daily flow. We recommend a first phase of three pumps each rated for ½ of maximum daily flow or 194 gpm each.

The elevation of the San Miguel pump station location is 6680. The elevation of the WTP is 7350. Accounting for line losses and head requirements at the WTP influent a preliminary TDH will be 720 ft or 312 psi. Pumps rated at 194 gpm at a 720 TDH will have an approximate horsepower requirement of 39 HP.

The high service pumps which will pump from the clearwell to the WTP will require multiple stages and therefore should be vertical in-line turbines. The motors should be provided with variable frequency drives (VFD), which will allow pumping amounts based upon SCADA driven criteria of the WTP demand and at the same time reduce the inrush current demand from the local power source.

Future phases may result in the need for larger pumps.

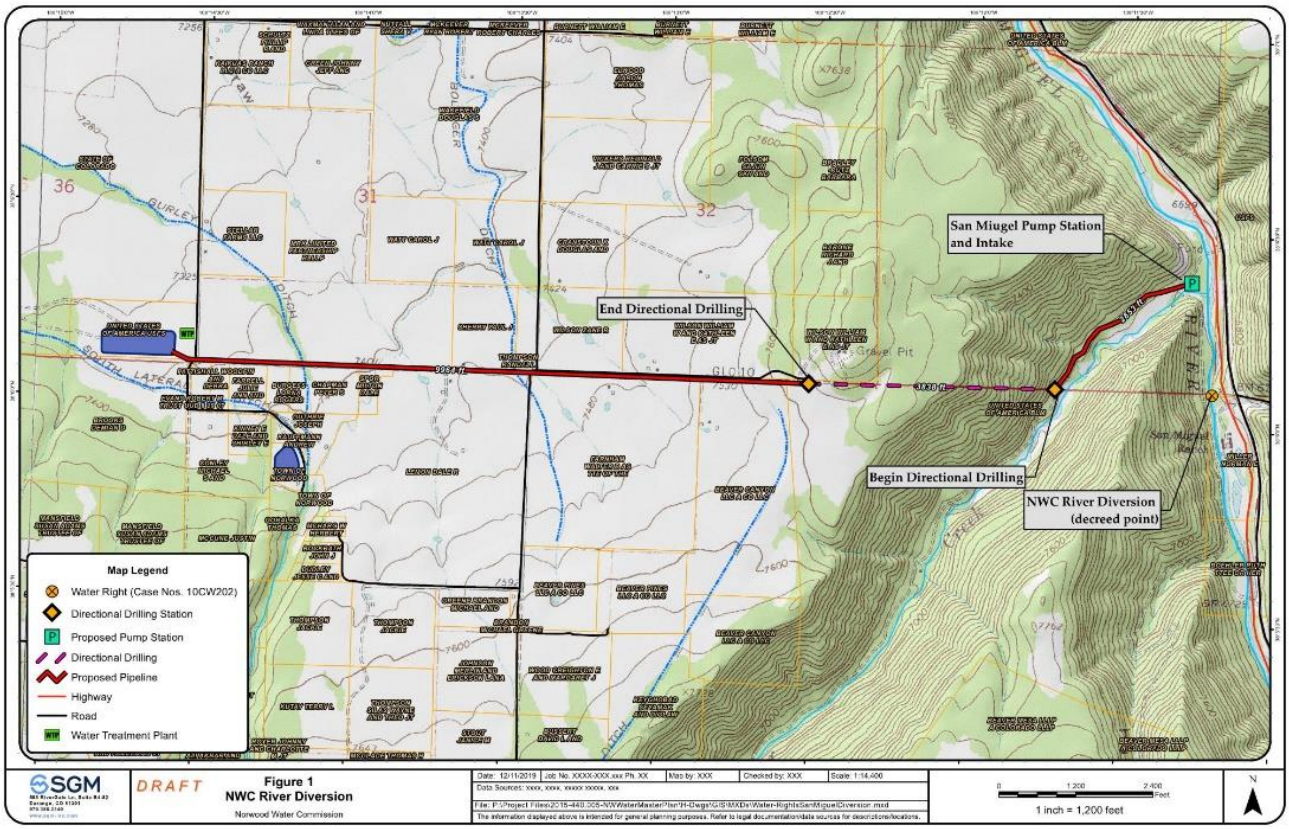
6.2.2.3 *Transmission to WTP*

The raw water transmission line from the pump station to the WTP should be designed for maximum daily flow (MDD) or ultimately based upon the full decreed amount. 5 cfs or 2244 gpm will result in a velocity of 6.37 fps in a 12-inch pipe. Based upon a 12-inch pipe the headloss will be 77 ft., or 33 psi. This 33 psi will add to the static head that already is in excess of 300 psi. We recommend a minimum pipeline diameter of 12 inch. The diameter of the first phase of the transmission line will be a balance between upfront costs versus long term requirements.

The proposed pipeline alignment is shown in Figure 6-1. The first 2853 of pipeline will follow Beaver Creek. An existing gas line has been installed up Beaver Creek and is located in a dirt access road. Because this is a disturbed area already, we recommend that this corridor be used for the transmission line. The alignment will then turn and head west toward the WTP site along an existing county road. As the alignment leaves Beaver Creek it will traverse a very steep rocky outcrop hillside where conventional trenching would be cost prohibited. We recommend that this section of the main should be installed via horizontal directional drilling

(HDD). Once the alignment transitions to the flat upper fence the HDD should end and conventional open cut construction should be used.

Figure 6-1 Location of San Miguel River Intake Schematic



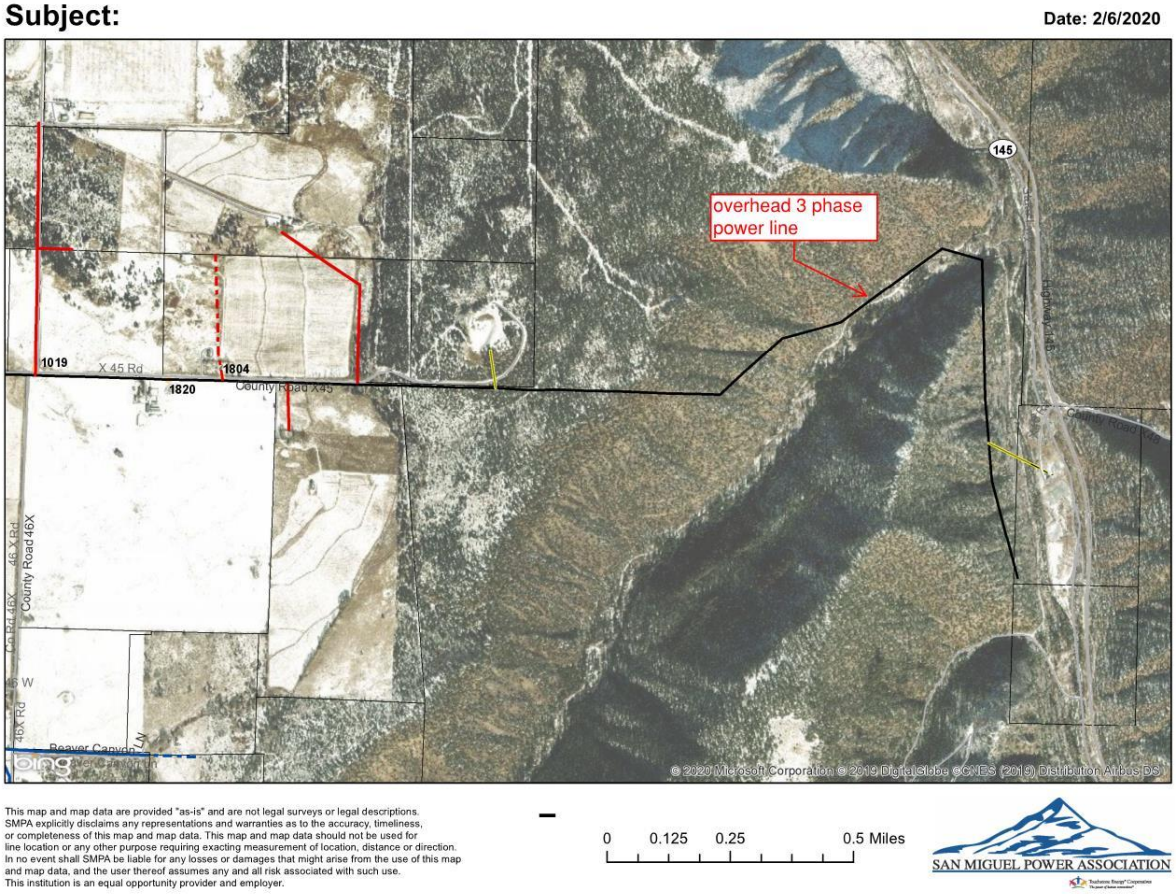
See end of Section for full size figure.

The pipeline alignment for the section along Beaver Creek and up to the upper bench is BLM and will required permitting as discussed in a following section. The alignment on the upper bench will be located in a County Road ROW.

6.2.2.4 *Electric*

San Miguel Power Company has an overhead three phase power line on the west side of Highway 145 and the east side of the San Miguel River. SMPC has been notified of the potential for a pump station in this area. A map of the location of the overhead line and a service cost estimate are shown as figures 6.2 and 6.3.

Figure 6-2 Overhead Power Lines



See end of Section for full size figure.

Figure 6-3 San Miguel Power Estimate

SAN MIGUEL POWER ASSOCIATION

Touchstone Energy® Cooperatives

Estimate of Deposit

Date	12/23/2019	Project ID	46453
Name	SGM, INC	SVO#	142444
Address	LOWER BEAVER CAMPGROUND		

JOB SUMMARY: NEW 3 PHASE 277/480 SECONDARY SERVICE

Project Requirements: INSTALL PRIMARY CABLE FROM EXISTING POLE TO NEW TRANSFORMER. INSTALL SECONDARY CABLE FROM TRANSFORMER TO NEW METER BASE.

Customer Responsibility: All trenching & backfill, install conduit, call for ditch and conduit inspection, state electrical inspection on meter base.

The customer is responsible for being aware of and following SMPA's construction specifications which can be found in the latest version of SMPA's "Construction Handbook."

Estimated Construction Cost		
Labor & Materials		$35,000.00
Facility Reinforcement		$9,600.00
Transformer		$11,600.00
CT Enclosure		$1,125.00
Deposit	N/A	
Connect Fee		$25.00
Total Estimate Due		**$57,350.00**

Estimate prepared by _____Byrd Williams_____, SMPA. (The estimated cost is only valid for 60 days from the date shown above.) Please send or bring deposit payment to your local SMPA office. Your local SMPA office also accepts payment by credit card.

Please be sure to reference the Project ID No. on your payment.

SMPA cannot accept lien waiver checks.

Material will be not be ordered and jobs will not be scheduled until all estimated costs are paid. Scheduling must be coordinated with **KJ JOHNSON at 970-275-3520**. All required permitting and easements must be in place before the job can be scheduled.

A completed Application for Service **MUST** be returned to SMPA before any new metered service is installed.

This is a "good faith" estimate which is used as a deposit applied toward the actual cost of the job. It is not a bid. SMPA line extension policy requires that an applicant pay the actual cost of any line extension or conversion of the existing system. The actual cost will be determined after completion of the job. If the actual cost is less than the deposit, SMPA will refund the difference. If the actual cost is more than the deposit, SMPA will bill the difference. The General Service Connection and Distribution System Line Extension Policy of the Association is available at our offices. The estimate reflects those polices and provision.

Nucla Service Planner
P.O. Box 817
170 W. 10th Ave.
(970) 864-7311
Fax (970) 864-7257

Ridgway Service Planner
P.O. Box 1150
Ridgway, CO 81432
(970) 626-5549
Fax (970) 626-5688

6.2.3 *Environmental Issues*

The location of the proposed pump station and the first section of transmission main are both located on BLM land. The second half of the transmission main on the upper bench of Wrights Mesa should fall within County road ROW.

This section will discuss the environmental permitting required from the BLM and other Federal Agencies. The approximate location of the pump station and transmission line are only at a broad perspective at this time and will be subject to change with further engineering and conversations with the BLM. Figure 6.1 shows the location of the key infrastructure for the San Miguel River Supply.

The location of the pump station and transmission line can be located in previously disturbed areas including the Beaver Creek Campground and a utility road easement that follows the Beaver Creek Drainage. Outside of these disturbed footprints the terrain is undisturbed riparian habitat.

The project would require compliance with the National Environmental Policy Act (NEPA). There are several studies, documents and consultations with various agencies to comply with the NEPA regulations. A large portion of the project is located on lands administered by the Bureau of Land Management (BLM). Under NEPA guidelines established by the federal Council of Environmental Quality (CEQ) the BLM would engage as the "Lead Agency". The BLM, either internally or using a third-party contractor, would produce an environmental assessment (EA) to analyze potential impacts to natural resources as a result of the proposed project. Upon completion of the draft EA, the BLM posts a combined public notice of availability and 30-day comment period. Once the period ends the BLM signs a notice of "Finding of No Significant Impact" (FONSI), posts it on the federal register, and the project is approved.

There are several separate resource studies that are incorporated into the EA. These are described below:

Biological Resources – It will be necessary to verify and document that the project will not adversely affect any federal listed threatened or endangered (T&E) species. A combination of research and field survey is required to ensure compliance with Section 7 of the Endangered Species Act (ESA). Consultation with the United States Fish and Wildlife Service (USFWS) will be required for increased water depletions and Colorado River T&E fish. Furthermore, USFWS consultation is required to ensure the project does not adversely affect nesting or breeding migratory birds.

Cultural Resources – A combination of research and field survey is required to determine the potential presence of artifacts, historical properties or remnants, and other significant cultural resources so that no adverse impacts result from the project. The BLM will consult with the CO-State Historic Preservation Office (SHPO) to ensure compliance with Section 106 of the Historic Preservation Act and the Archaeological Resources Protection Act.

Surface Waters and Wetlands – The United States Army Corps of Engineers (USACE) has jurisdiction over "Waters of the U.S.". Under Section 404 of the Clean Water Act, the USACE ensures that the project has no adverse impacts to jurisdictional waters and aquatic resources. The project will require a field delineation to determine the extent of any project area wetlands and riparian corridors. The USACE issues Section 404 permits through the Nationwide Permits Program. Depending on the extent of wetland impacts the project may require a General Permit and compensatory mitigation.

6.2.4 *Construction and Engineering Costs*

A preliminary reconnaissance level cost estimate is shown as Table 6-6.

This estimate provides a preliminary reconnaissance level cost estimate for the pump station, intake, transmission pipeline and electric. This estimate assumes a conventional river intake with rip rap drop structure and concrete outlet structure. Water from the outlet structure will be directed to a below grade clearwell. Vertical turbine high service pumps will then pump water through a 12-inch transmission line to the WTP. Updated construction costs will evolve as further detailed engineering and permitting occurs.

Table 6-7 Estimate of Probable Construction Costs

6-7 Estimate of Probable Construction Costs				
Description	**Unit Price**	**Unit**	**Approximate Amount**	**Total Price**
General Conditions				
Bonds & Insurance	$15,000	LS	1	$15,000
Project Management - Contractors	$4,000	MO	9	$36,000
Mobilization/Demobilization	$25,000	LS	1	$25,000
Rock River Diversion Structure				
Site Preparation	$4,500	LS	1	$4,500
Rip Rap Materials	$100	Ton	200	$20,000
Rip Rap Labor for Installation	$500	HRS	40	$20,000
Site Prep for River Bank Rip Rap	$5,000	LS	1	$5,000
Erosion Protection	$5,000	LS	1	$5,000
Concrete Turnout Structure				
Excavation	$500	CY	10	$5,000
Concrete Turnout Structure	$1,000	CY	10	$10,000
Trash Rack	$2,500	EA	1	$2,500
Headgate	$4,000	EA	1	$4,000
Measuring Flume	$10,000	EA	1	$10,000
Ultrasonic Sensor & Milltronics Totalizing Meter	$7,000	LS	1	$7,000
Site Work				
Roadway to Access Site	$25,000	LS	1	$25,000
Bridge Over Bear Creek	$25,000	LS	1	$25,000
Primary 3 Phase Electric	$100,000	LS	1	$100,000
Gravel	$200	CY	10	$2,000
Landscaping Erosion Protection	$7,500	LS	1	$7,500
Erosion Protection	$15,000	LS	1	$15,000
Pump Station Building				
Excavation	$25	CY	1000	$25,000
Backfill & Compact Around Foundation	$4,000	LS	1	$4,000
Reinforced Concrete	$650	CY	160	$104,000
Block Building	$300	SF	160	$48,000
Electric	$100,000	LS	1	$100,000
Telemetry Improvement	$15,000	LS	1	$15,000
Pumps	$15,000	EA	3	$45,000
Plant Piping	$10,000	LS	1	$10,000
Transmission Main Pump Building to WTP				
Section in Beaver Creek ROW 6" welded steel	$150	LF	2853	$427,950

Horizontal Directional Drilling 6" flex steel	$300	LF	3838	$1,151,400
Section in Country Road 6" PVC or HDPE	$150	LF	9964	$1,494,600
Valves	$1,000	EA	20	$20,000
Air Release Vaults	$5,000	LS	5	$25,000
Blowoff Valves	$2,500	SF	5	$12,500
Asphalt Replacement	$110	SF	2242	$246,620
Erosion Control	$5,000	LS	1	$5,000
Project Subtotal				**$4,077,570**
Incidentals and Soft Costs				
Contingencies 10%				$407,757
Engineering & Design 10%				$407,757
Construction Management 5%				$203,879
Permitting				$200,000
			Total	**$1,219,393**
			Project Total	**$5,296,963**

6.3 Lone Cone irrigation water supply.

The NWC owns water out of the Cone Ditch and Cone Reservoir. The Cone Ditch runs North from the reservoir to just west of the new raw water reservoir which feeds the Town of Norwood Raw Water system. Water from the Cone supply could supplement the raw irrigation water by piping from the Cone Ditch to the raw water reservoir. This same line could be extended further east to the existing WTP and Reservoirs 1 and 2.

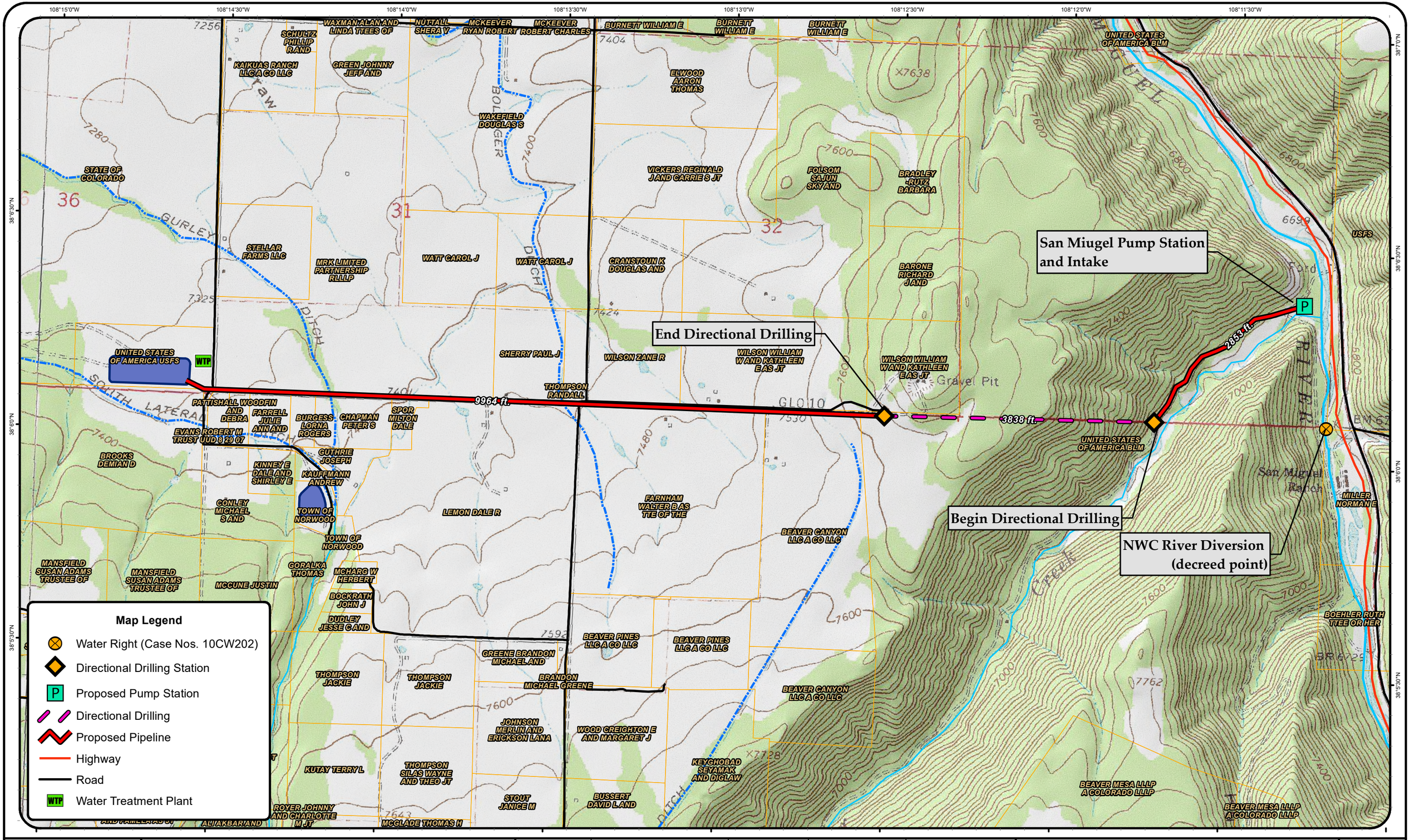


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Figure 6-1
NWC River Diversion
Norwood Water Commission

Date: 12/11/2019	Job No. XXXX-XXX.xxx Ph. XX	Map by: XXX	Checked by: XXX	Scale: 1:14,400

Data Sources: xxxx, xxxx, xxxxx xxxxx, xxx

File: P:\Project Files\2015-440.005-NWWaterMasterPlan\H-Dwgs\GIS\MXDs\Water-RightsSanMiguelDiversion.mxd

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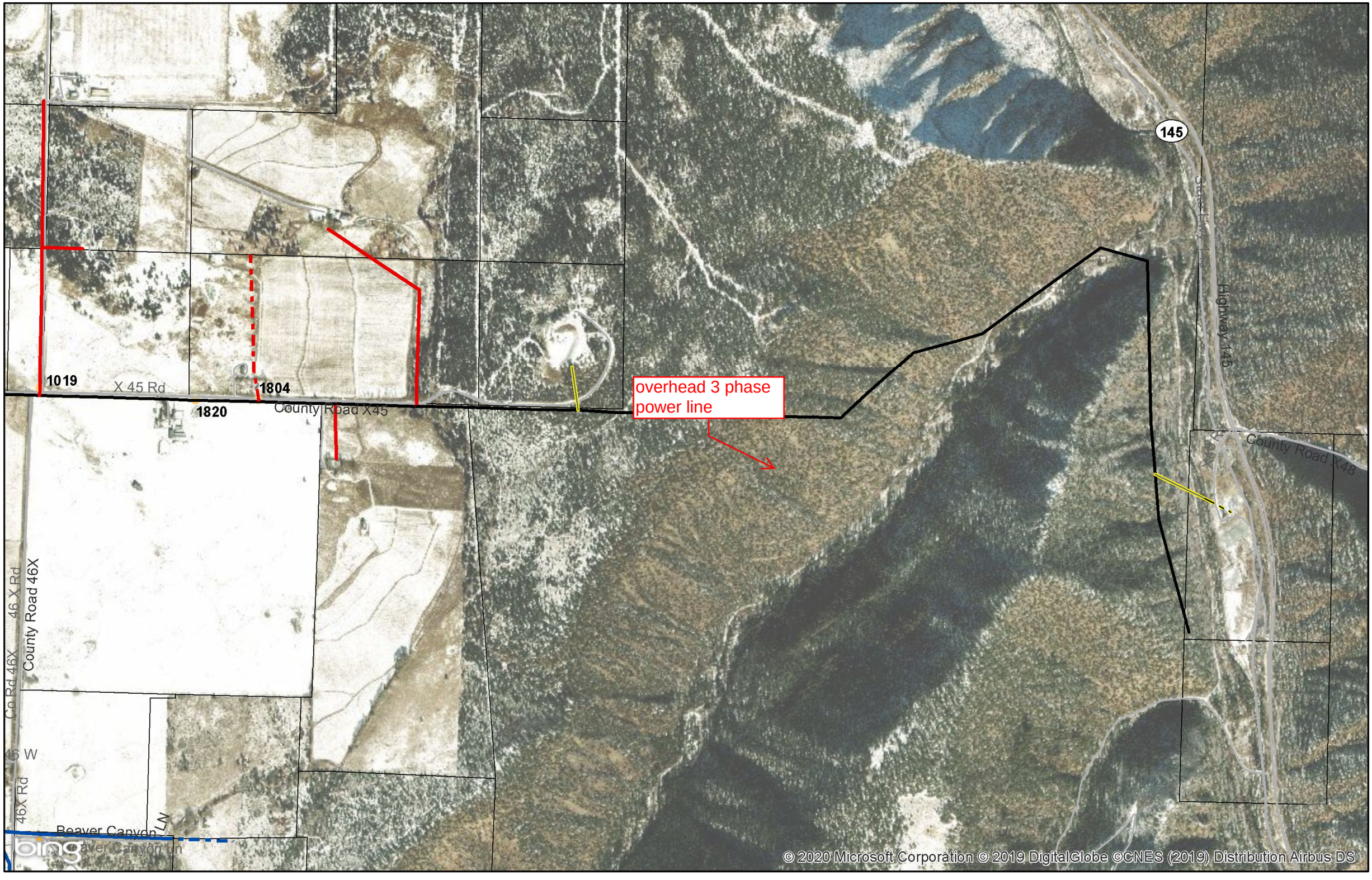
0 1,200 2,400 Feet

1 inch = 1,200 feet

N

Subject:

Date: 2/6/2020



0 0.125 0.25 0.5 Miles

Figure 6-2 Overhead Power Lines

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7.0 Prioritized Capital Improvement Plans

7.1 5 Year Plan

The following items include SGM's recommendations for implementation of a near term Capital Improvement Plan.

- Include the San Miguel River Supply in the 2020 update of Colorado's Water Plan.
- Apply for further funding through the CWCB and SWCD.
- Explore partnership with the San Miguel Conservancy District
- Proceed with Priority 1 water transmission main.
- Once Priority 1 water transmission main is installed proceed with Priority 2
- Prepare a specific engineering analysis for compliance with Disinfection By-Product regulations
- Install the required Chlorine disinfection/Chloramine water distribution system feed to ensure compliance with CDPHE Colorado Primary Drinking Water regulations.
- Install updated SCADA controls for the 200,000 Blue Tank PRV #1 and the Pressure Sustaining Valve for the Coventry Tanks to allow for tank turnover.

8.0 Asset Management for Aging Infrastructure

This section will discuss an asset management approach to managing existing infrastructure. Asset management considers the condition, existing age, expected useful lifetime, future value, expected year of replacement and long-term financial liability of managing a large portfolio of infrastructure.

8.1 Statement of Need

Most municipalities, districts and water providers focus on capacity issues, growth, ever increasing regulatory requirements, customer service, and the shrinking ability of customers to pay the true cost of service. A significant percentage of the assets were installed in the mid to late 20th century. Most of the assets are underground and are out of site and out of mind to the general public. This presents challenges balancing the need to keep customer service fees affordable weighed against the expense of maintaining and replacing aging assets. Traditional state and local funding sources have dried up or are not applicable to the replacement of aging infrastructure.

An asset management approach follows these tasks:

- Inventory of all assets
- Condition assessment of the assets
- Considers the vulnerability of the assets and the criticality of the Asset
- Considers the financial impact of replacement of assets before they fail

8.2 Expected Lifetime

The key attribute in a water system asset management assessment is the industry best management standard of useful lifetime of the water system components. The American Water Works Association (AWWA) and the American Society of Civil Engineers (ASCE) have published tables that provide a range of years of the useful life of Drinking Water System Components. The lifetime of an asset has very different meanings and is considered from many different perspectives. An illustration of the different perspectives is shown in Table 8-1. Table 8-2 published by the ASCE is attached which provides the range of useful lifetime of drinking water system components. These ranges are only guidelines and must be informed by actual subjective criteria. That criteria will include maintenance records, operations team assessments, soil conditions, and construction quality control.

Table 8-1 Asset Life Definitions

The Asset Life family of terms are commonly used when an organization is describing how long their *Asset* is expected to last from a variety of different perspectives.

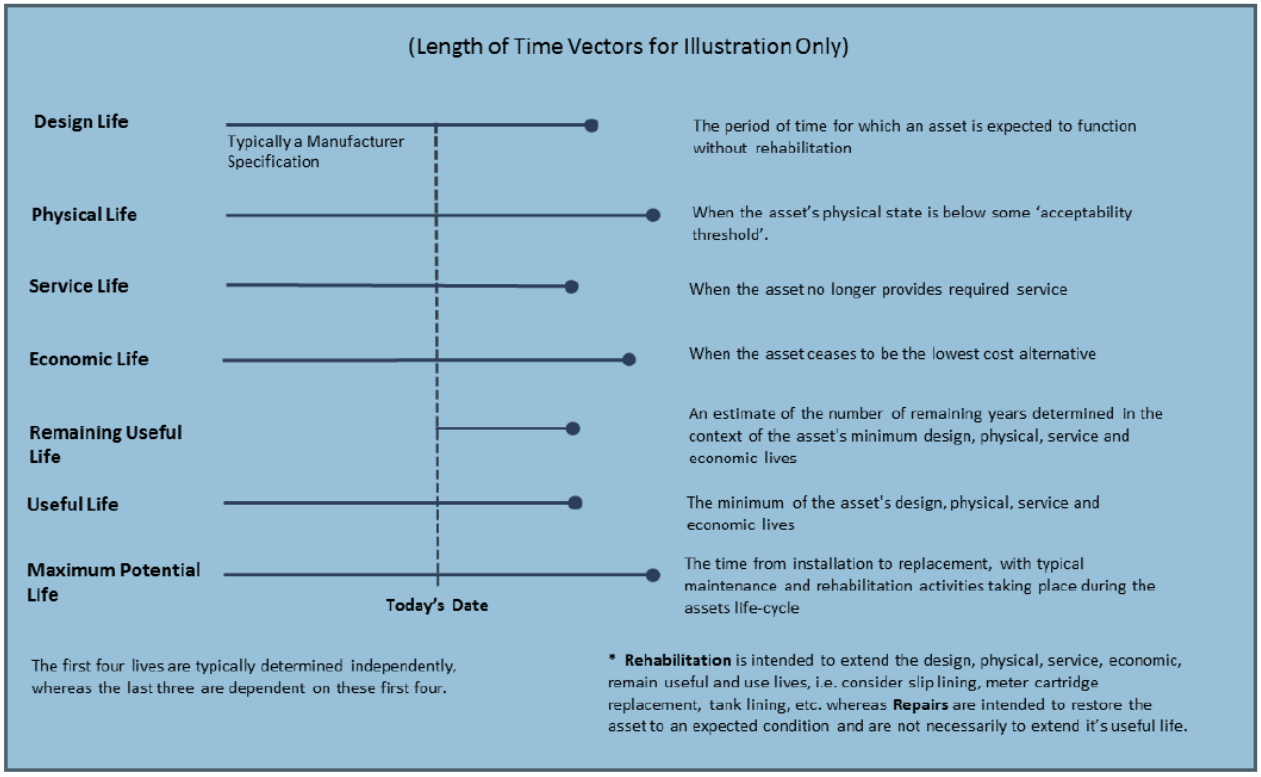


Table 8-2 Asset Useful life

The Useful Lives of Drinking-Water System Components	
COMPONENT	USEFUL LIFE (YEARS)
Reservoirs and dams	50-80
Treatment plants - concrete structures	60-70
Treatment plants - mechanical and electrical	15-25
Trunk mains	65-95
Pumping stations - concrete structures	60-70
Pumping station - mechanical and electrical	25
Distribution	60-95
SOURCE: EPA (2002, table 2-1).	

The Useful Lives of Wastewater System Components	
COMPONENT	USEFUL LIFE (YEARS)
Collections	80-100
Treatment plants - concrete structures	50
Treatment plants - mechanical and electrical	15-25
Force mains	25
Pumping stations - concrete structures	50
Pumping station - mechanical and electrical	15
Interceptors	90-100
SOURCE: EPA (2002, table 2-1).	

8.3 Asset Management Table

SGM prepared an inventory of the assets of the NWC water system components. The inventory was in part based upon the GIS mapping for quanties, and research of construction and as-built drawings to determine the date of installation. Material types were based upon interview with NWC staff. The table is shown in appendix C. The table considers the quantity, unit price, total price in 2020 dollars, useful life, date installed, expected year of replacement, the age in 2020, remaining life, replacement value, depreciated value, inflation factor, future value in the year of replacement, and an annual payment requirement needed to fund the replacement of each asset. The table then summarizes the total value of the assets. For the NWC the total asset value is $19,198,000. The total annual payment required to fund future assets based upon future values is $1,991,000. Another metric to compare to this figure is the recommended funding of 5% of the asset on an annual basis. 5% of the total asset value of $19 million is $960,000. If the NWC would fund 100% of depreciation in an annual year it will be between the range of $0.96 million and $1.9 million. SGM is aware of only one utility in the Western Slope that funds full depreciation. However, the replacement of aging infrastructure is inevitable and an expense that must be considered. Most loan and grant sources are targeted toward new supply, reservoirs and regulatory compliance and not focused on aging infrastructure. We recommend that water providers begin to slowly increase water rates and or implement new sources of revenues like mill levy assessments to begin to fund replacement of aging infrastructure.

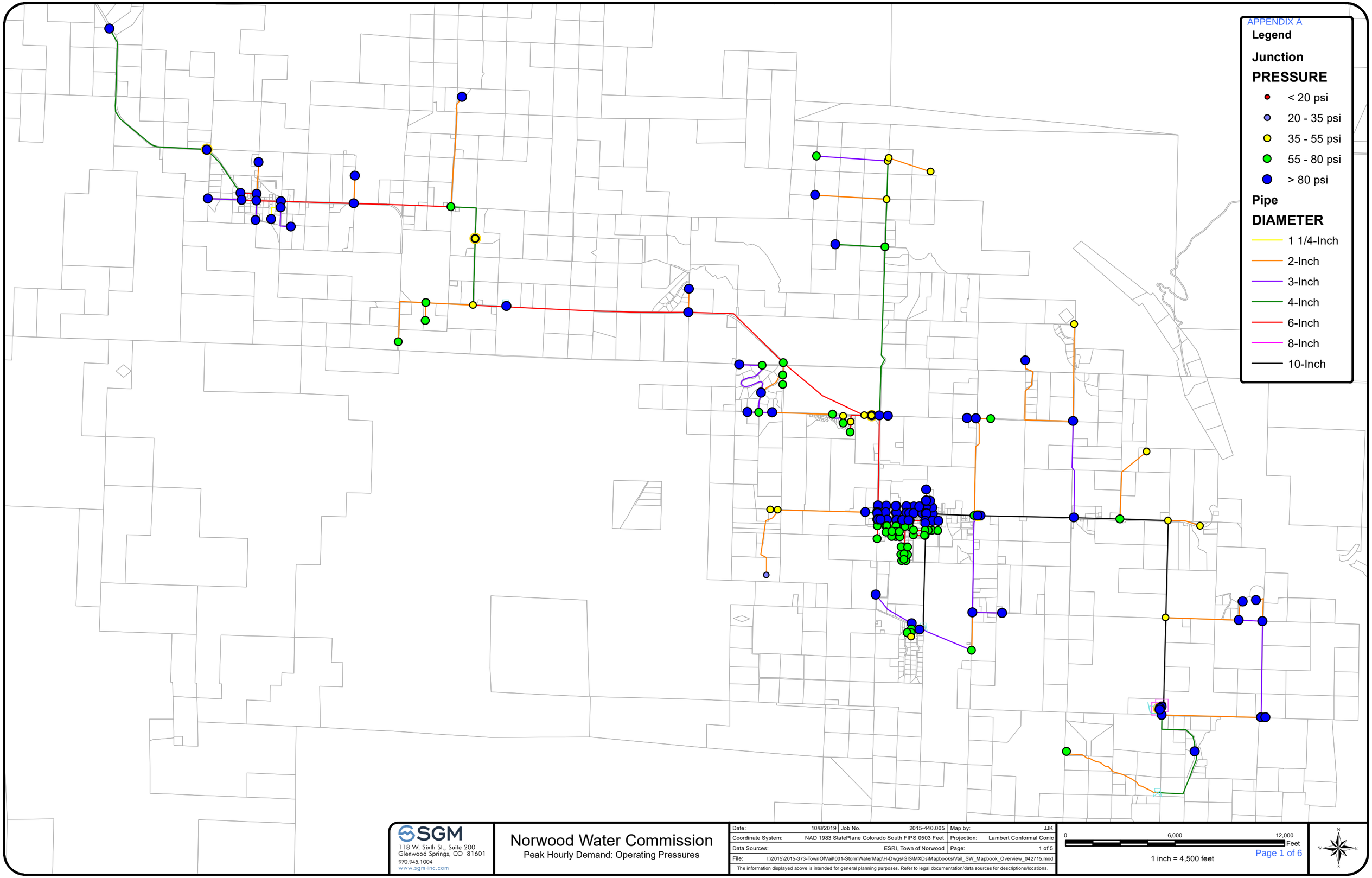
9.0 Financial Issues

The NWC Board should provide feedback on the priority of the capital projects and the amount of aging infrastructure to fund on an annual cycle. The existing rates structure can then be modified to increase the revenue requirement to fund these critical items. The funding sources will include service fees, tap fees and mill levy assessments. It is beyond the scope of this report to undertake a detailed rate study assessment. It is our understanding that the NWC does not have any outstanding debt service related to lines, storage or supply. The NWC does have debt on the Water Treatment Plant.

9.1 Grants and Loan Availability

Tables in appendix D summarize the available loan and grant programs in Colorado. These sources include both State and Federal programs. The attributes include the organization, program name, purpose or use of funds, how to apply, website, and contact information.

Appendix A Results of Modeling of Existing Conditions



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Norwood Water Commission

Peak Hourly Demand: Operating Pressures

Date:	10/8/2019	Job No.	2015-440.005
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet	Map by:	JJK
Data Sources:	ESRI, Town of Norwood	Projection:	Lambert Conformal Conic
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd	Page:	1 of 5

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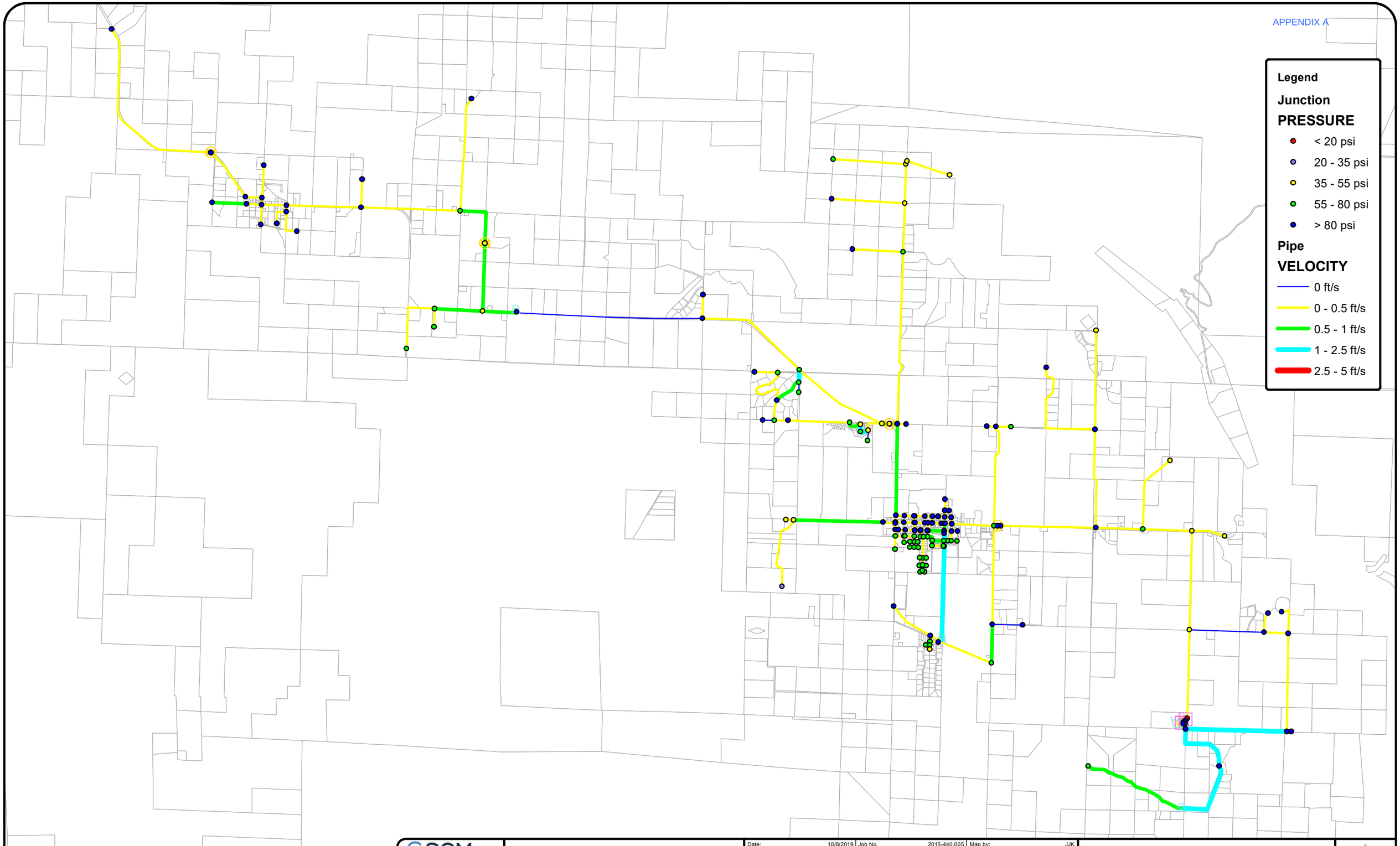
0 6,000 12,000 Feet

1 inch = 4,500 feet



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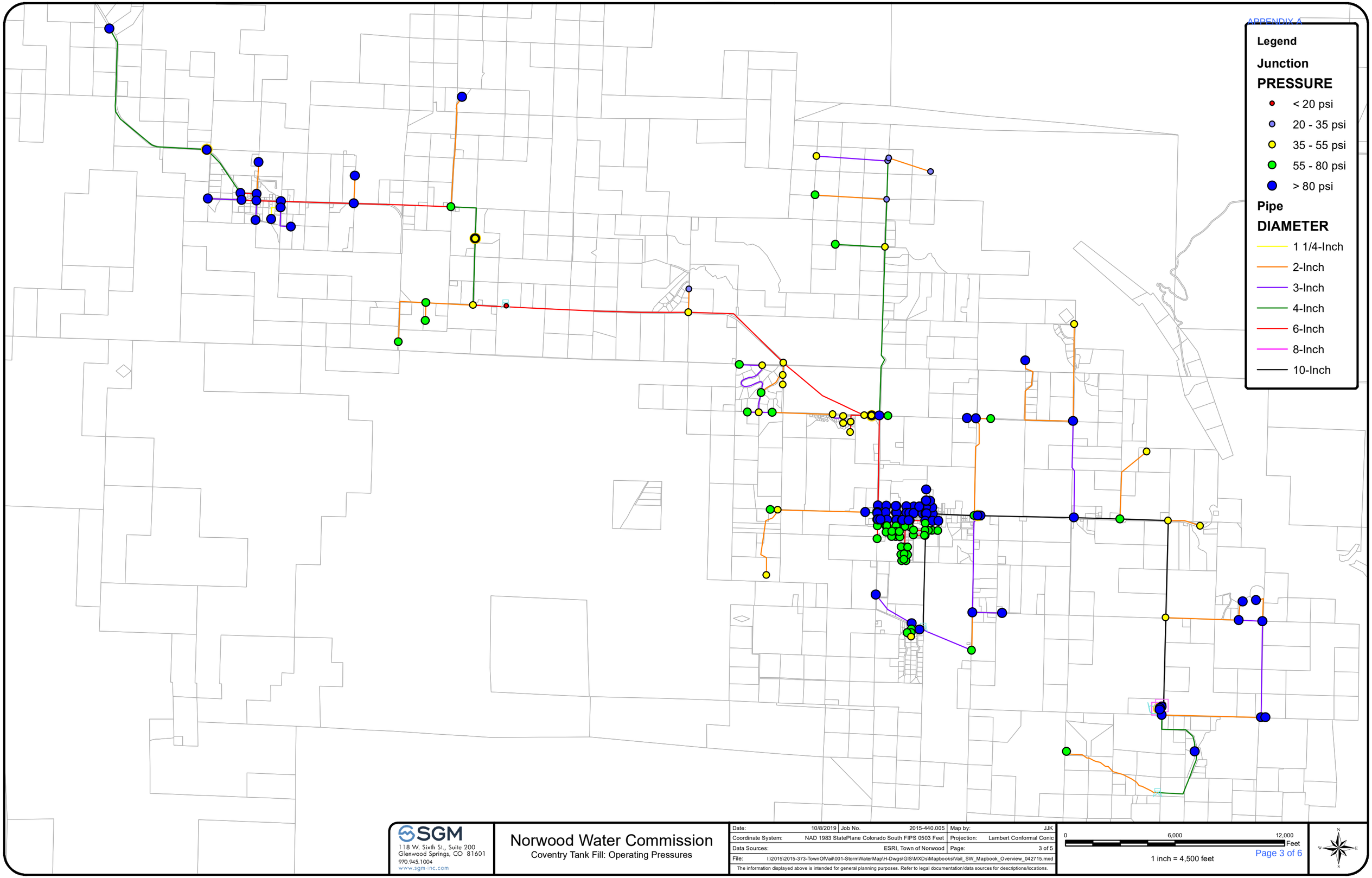
Peak Hourly Demand: Pipe Velocity

Date:	10/8/2019	Job No.	2015-440.005
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet	Map by:	JJK
Data Sources:	ESRI, Town of Norwood	Projection:	Lambert Conformal Conic
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd	Page:	2 of 5

0 6,000 12,000 Feet

1 inch = 4,500 feet



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Coventry Tank Fill: Operating Pressures

Date:	10/8/2019	Job No.	2015-440.005	Map by:	JJK
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet			Projection:	Lambert Conformal Conic
Data Sources:	ESRI, Town of Norwood			Page:	3 of 5
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd				

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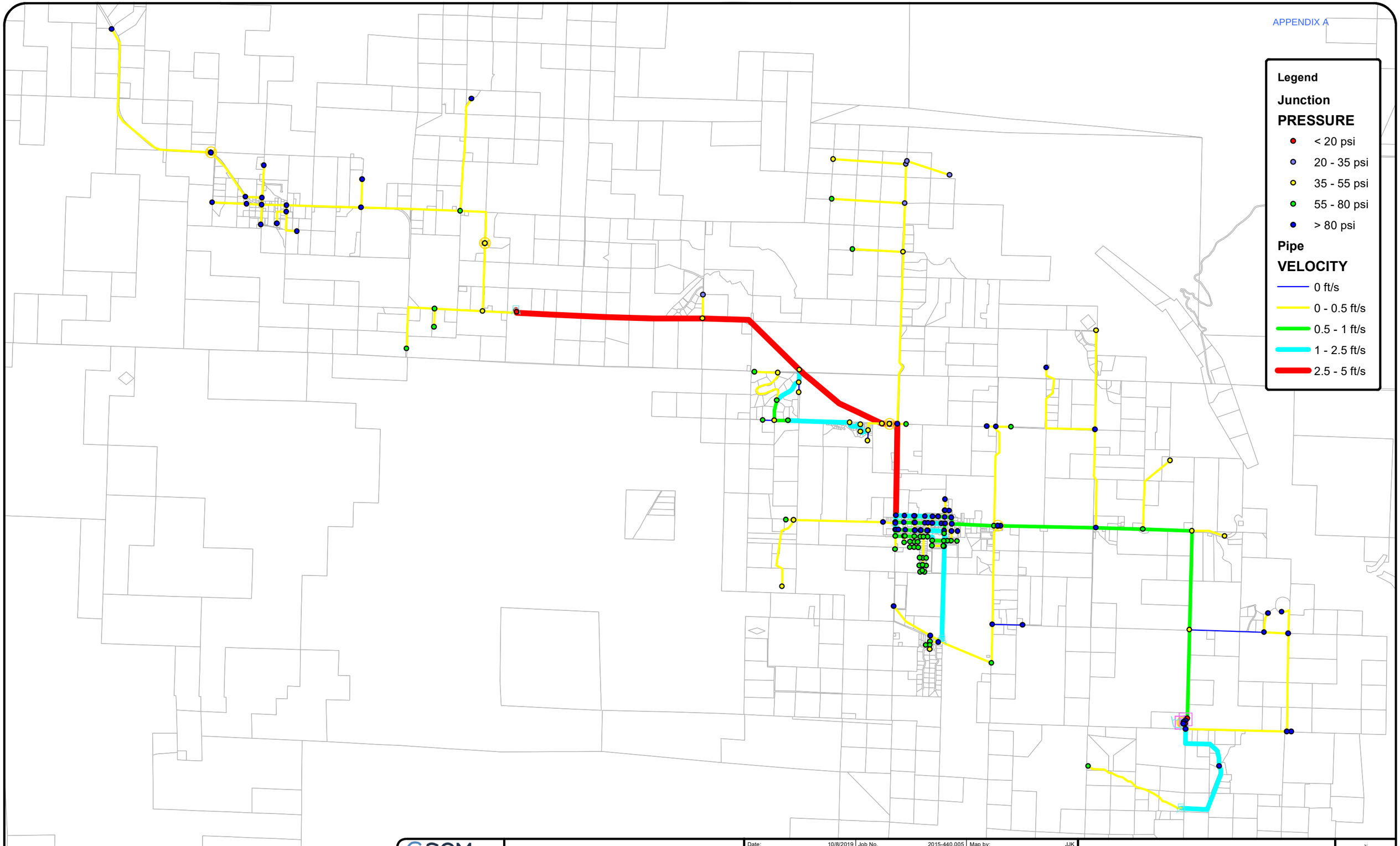
1 inch = 4,500 feet



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Coventry Tank Fill: Pipe Velocity

Date:	10/8/2019	Job No.	2015-440.005
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet	Map by:	JJK
Data Sources:	ESRI, Town of Norwood	Projection:	Lambert Conformal Conic
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd	Page:	4 of 5

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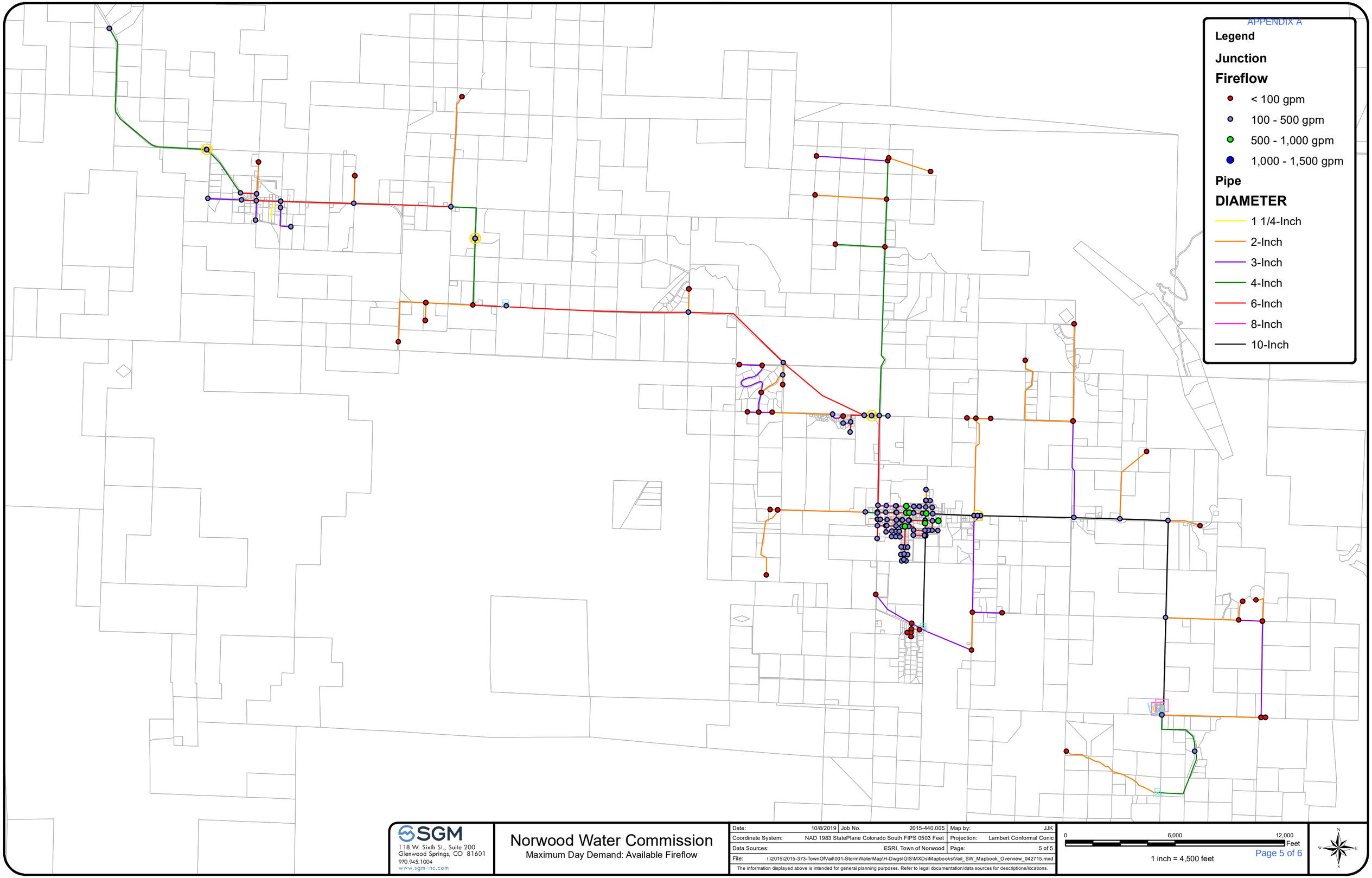
1 inch = 4,500 feet



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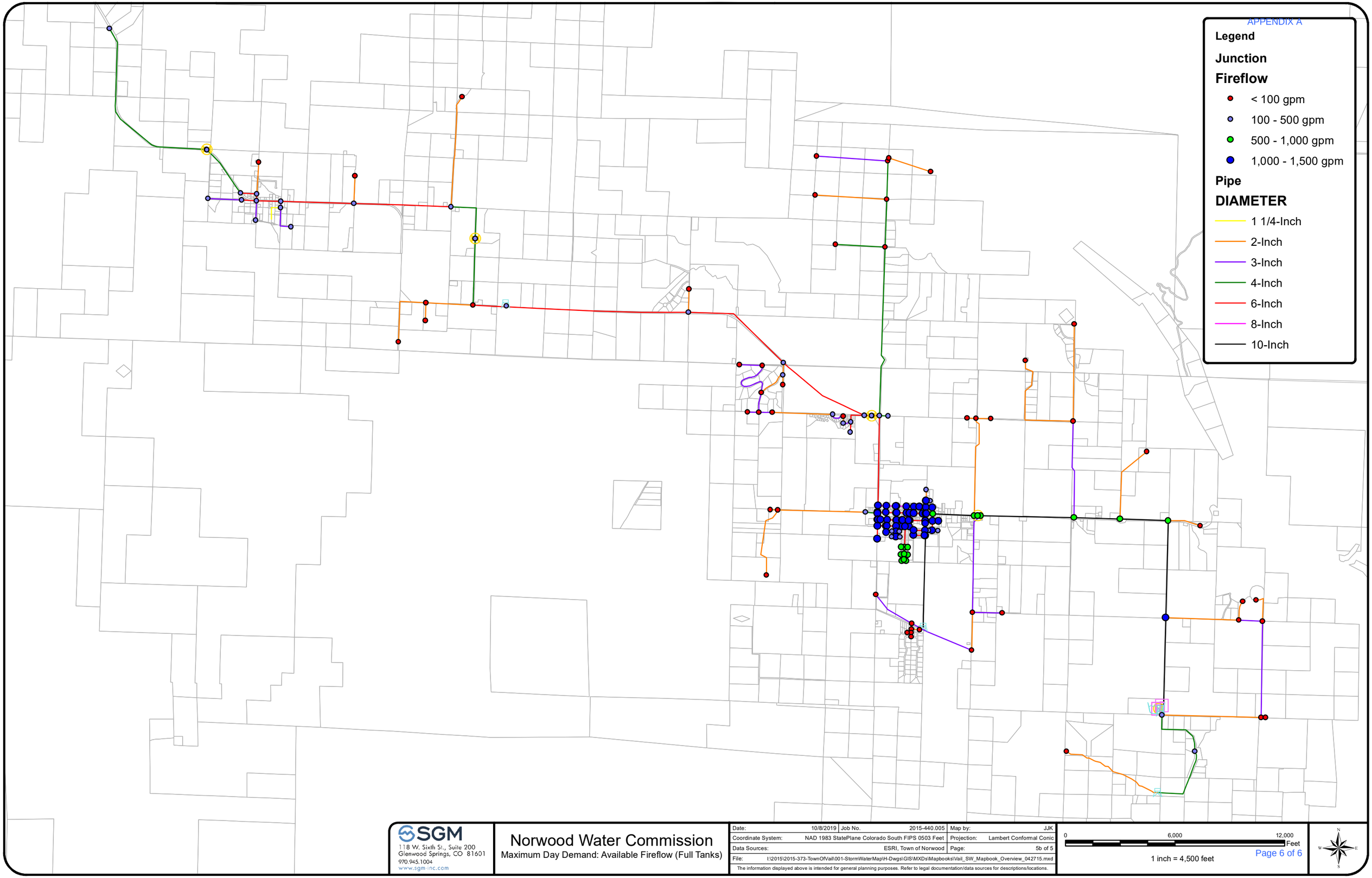
Maximum Day Demand: Available Fireflow

Date:	10/8/2019	Job No.	2015-440.005
Map by:	JJK		
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet	Projection:	Lambert Conformal Conic
Data Sources:	ESRI, Town of Norwood	Page:	5 of 5
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd		

0 6,000 12,000 Feet

1 inch = 4,500 feet



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Maximum Day Demand: Available Fireflow (Full Tanks)

Date:	10/8/2019	Job No.	2015-440.005
Map by:	JJK		
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet	Projection:	Lambert Conformal Conic
Data Sources:	ESRI, Town of Norwood	Page:	5b of 5
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd		

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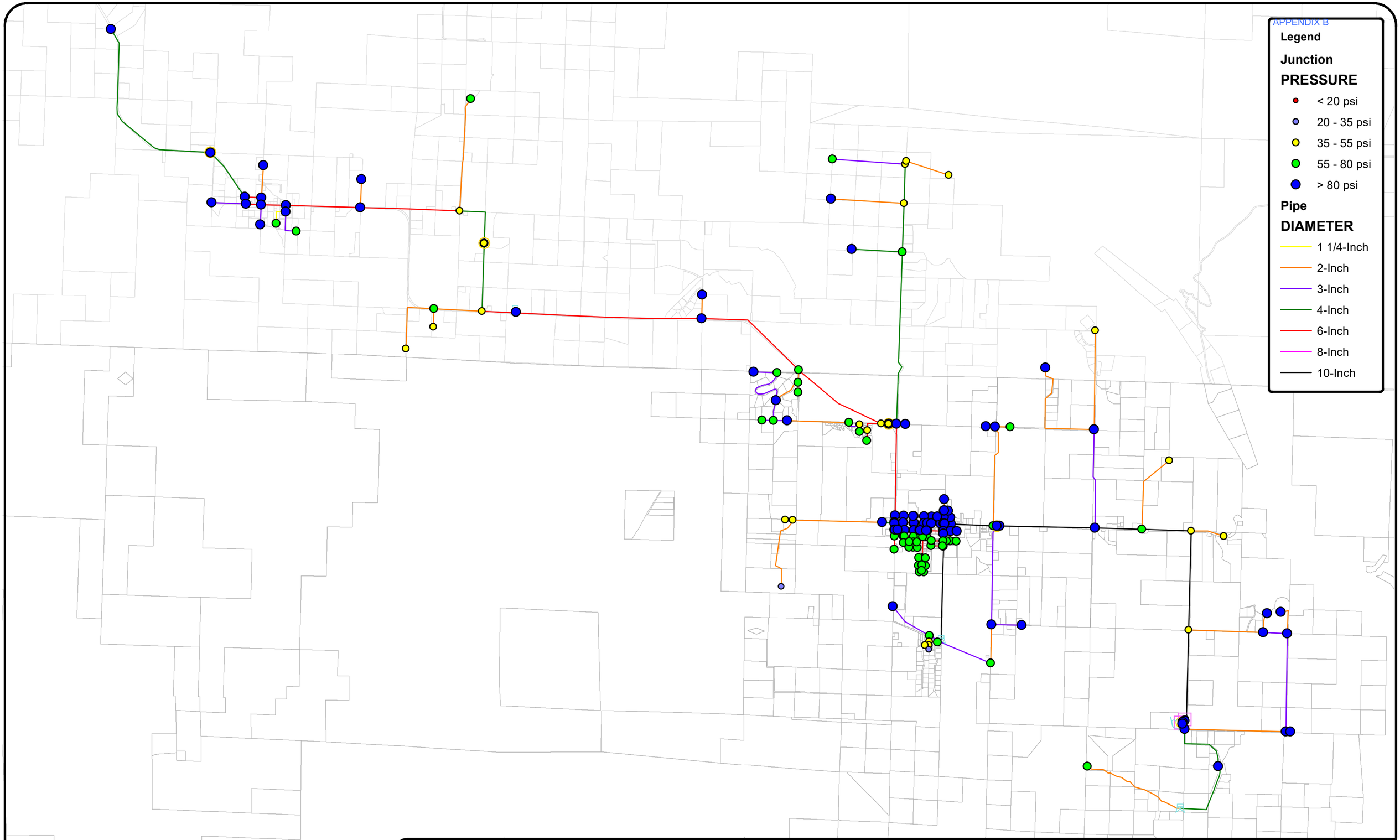
0 6,000 12,000 Feet

1 inch = 4,500 feet

Appendix B Future Modeling Results



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Peak Hourly Demand: System Pressures
Coventry Tank Closed

Date:	1/31/2020	Job No.	2015-440.005	Map by:	JJK
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet			Projection:	Lambert Conformal Conic
Data Sources:	ESRI, Town of Norwood			Page:	1 of 1
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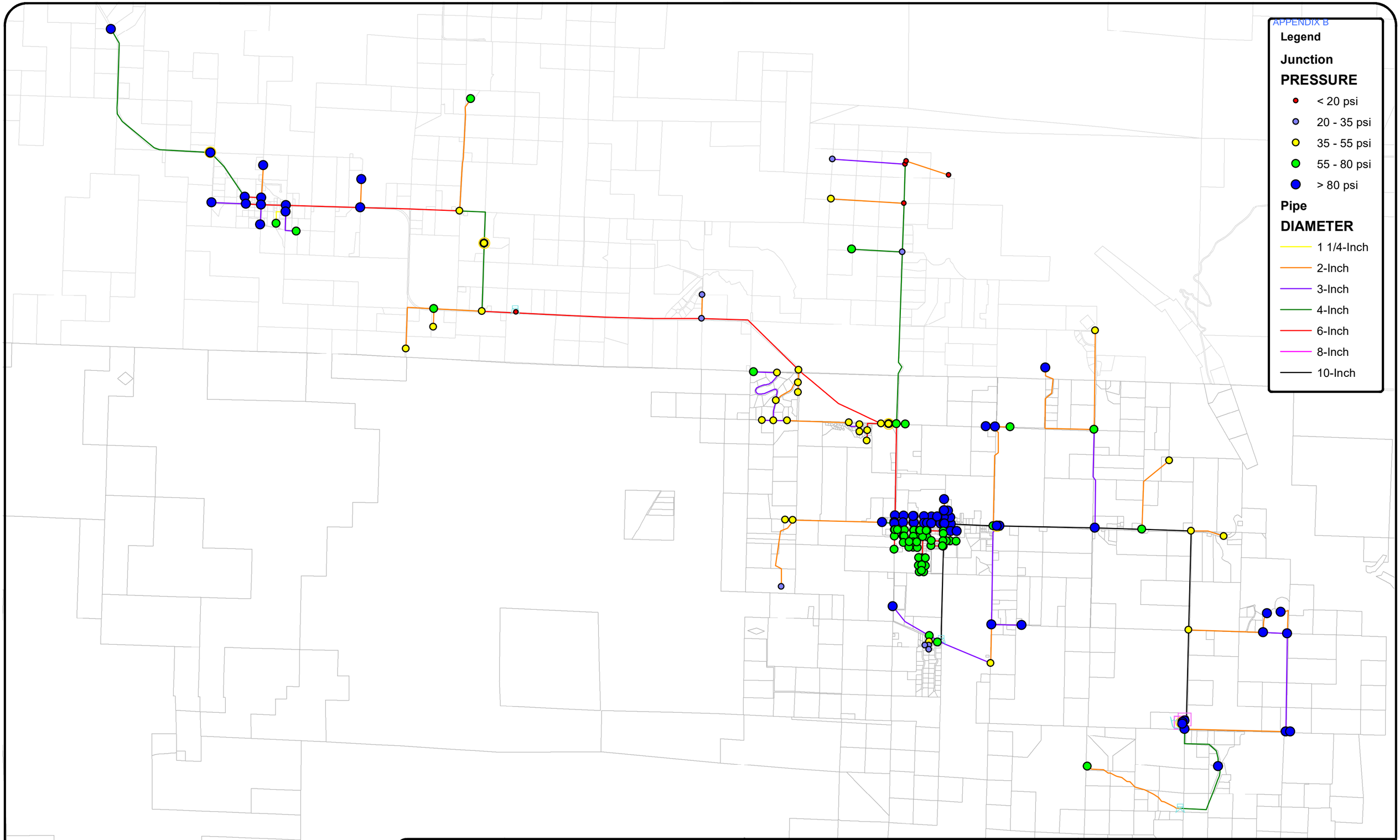

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Peak Hourly Demand: System Pressures
Coventry Tank Open

Date:	1/31/2020	Job No.	2015-440.005	Map by:	JJK
Coordinate System:	NAD 1983 StatePlane Colorado South FIPS 0503 Feet			Projection:	Lambert Conformal Conic
Data Sources:	ESRI, Town of Norwood			Page:	1 of 1
File:	I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd				

0 6,000 12,000 Feet

1 inch = 4,500 feet

Appendix C Asset Inventory and Useful Life

Norwood Water Commissiion
Inventory

Asset family	Asset	Unit	Quantity	Unit Price	Total Price	Useful Life	Year Installed	replacement year	Age YR 2020	remaining life	% of life remaining	replacement Value	depr. value	inflation	remaining useful life	future value factor	future value	annual future value factor	Annual Payment future value	NOTES
Water Source	intake at South Lateral Canal	LS	1	$25,000	$25,000	75	1977	2052	43	32	42.67%	$25,000	$10,666.67	2.50%	32	2.204	55,093.923	0.0208	$1,144.21	
	ditch	LS	1	$25,000	$25,000	75	1977	2052	43	32	42.67%	$25,000	$10,666.67	2.50%	32	2.204	55,093.923	0.0208	$1,144.21	
	Reservoir #1	LS	1	$624,998	$624,998	80	1977	2057	43	37	46.25%	$624,998	$289,061.34	2.50%	37	2.493	1,558,336.703	0.0167	$26,087.96	
	Reservoir # 2	EA	1	$1,500,000	$1,500,000	80	1996	2076	24	56	70.00%	$1,500,000	$1,050,000.00	2.50%	56	3.986	5,978,988.540	0.0084	$50,058.64	Reservoir #2 constructed in 1996
	Reservoir Piping	LS	1	$25,000	$25,000	75	1977	2052	43	32	42.67%	$25,000	$10,666.67	2.50%	32	2.204	55,093.923	0.0208	$1,144.21	New 10" tank outlet water line installed 2009; New 6" tank inlet water line installed 2009
	Misc Raw Water transmission lines 10" CL 16(	LF	3150	$30	$94,500	60	2000	2060	20	40	66.67%	$94,500	$63,000.00	2.50%	40	2.685	253,738.533	0.0148	$3,764.52	Misc. Raw Water transmission lines 10" CL 160 installed in 2000
	Sub total				**$2,294,498**							**$2,294,498**	**$1,434,061**				**$7,956,346**		**$83,344**	
Water Treatment																				New pipes and drains, two new floc/settling units, new 4" clarifier washdown, and two new 2,500 gallon chemical tanks in 2001
	Water treatment plant building	LS	1	$350,000	$350,000	40	2001	2041	19	21	52.50%	$350,000	$183,750.00	2.50%	21	1.680	587,853.648	0.0368	$21,625.56	Existing Bldg expansion in 2001
	Plant piping	LS	1	$100,000	$100,000	50	1996	2046	24	26	52.00%	$100,000	$52,000.00	2.50%	26	1.900	190,029.270	0.0278	$5,276.87	
	concrete clear wells	LS	1	$150,000	$150,000	75	1996	2071	24	51	68.00%	$150,000	$102,000.00	2.50%	51	3.523	528,455.466	0.0099	$5,236.30	
	chlorination/ chloramines	LS	1	$25,000	$25,000	20	2009	2029	11	9	45.00%	$25,000	$11,250.00	2.50%	9	1.249	31,221.574	0.1005	$3,136.42	New chlorination injection system in 2009
	HVAC	LS	1	$50,000	$50,000	20	1996	2016	24	-4	-20.00%	$50,000	-$50,000.00	2.50%	1	1.025	51,250.000	1.0000	$51,250.00	
	Electric	LS	1	$150,000	$150,000	20	2001	2021	19	1	5.00%	$150,000	$7,500.00	2.50%	1	1.025	153,750.000	1.0000	$153,750.00	Minor improvements made in 2001 &2009
	low Service Pumps	EA	3	$15,000	$45,000	15	1996	2011	24	-9	-60.00%	$45,000	-$45,000.00	2.50%	1	1.025	46,125.000	1.0000	$46,125.00	
	meter	LS	1	$15,000	$15,000	15	1996	2011	24	-9	-60.00%	$15,000	-$15,000.00	2.50%	1	1.025	15,375.000	1.0000	$15,375.00	
	Backwash ponds	EA	2	$50,000	$100,000	40	1996	2036	24	16	40.00%	$100,000	$40,000.00	2.50%	16	1.485	148,450.562	0.0516	$7,659.90	
	WTP package units	LS	1	$1,000,000	$1,000,000	30	2003	2033	17	13	43.33%	$1,000,000	$433,333.33	2.50%	13	1.379	1,378,511.045	0.0660	$91,048.27	
	Chem Feed System	LS	1	$50,000	$50,000	15	2009	2024	11	4	26.67%	$50,000	$13,333.33	2.50%	4	1.104	55,190.645	0.2408	$13,290.89	Installed in 1993?; Minor improvements in 2009 - new chemical feed controls; new flowmeter/chemical injection vault
	SCADA system	LS	1	$100,000	$100,000	20	2009	2029	11	9	45.00%	$100,000	$45,000.00	2.50%	9	1.249	124,886.297	0.1005	$12,545.69	
	Sub total				**$2,135,000**							**$2,135,000**	**$778,167**				**$3,311,099**		**$426,320**	
Water Transmission																				
	10" Line from WTP to Norwood	LF	25756.25	$50	$1,287,813	60	1977	2037	43	17	28.33%	$1,287,813	$364,880.21	2.50%	17	1.522	1,959,559.017	0.0479	$93,917.29	
	10" Gate Valves	EA	10	$1,000	$10,000	75	1977	2052	43	32	42.67%	$10,000	$4,266.67	2.50%	32	2.204	22,037.569	0.0208	$457.68	
	PRV station	EA	1	$75,000	$75,000	75	1977	2052	43	32	42.67%	$75,000	$32,000.00	2.50%	32	2.204	165,281.770	0.0208	$3,432.62	PRV Vault #2: New 6" PRV, new 6" gate valve, new manhole; PRV Vault #4: New 4" PRV, new 4" gate valve, new manhole; PRV Vault #1: Install new 10" gate valve, replace PRV, replace existing gate valve
	Air Relief Valves	EA	2	$7,500	$15,000	40	1977	2017	43	-3	-7.50%	$15,000	-$15,000.00	2.50%	1	1.025	15,375.000	1.0000	$15,375.00	
	Sub total				**$1,387,813**							**$1,387,813**	**$386,147**				**$2,162,253**		**$113,183**	
Total water distribution installed in 1977's	10" Waterline	LF	0	$50	$0	60	1977	2037	43	17	28.33%	$0	$0.00	2.50%	17	1.522	0.000	0.0479	$0.00	
	8" Waterline	LF	4045	$45	$182,025	60	1977	2037	43	17	28.33%	$182,025	$51,573.75	2.50%	17	1.522	276,972.564	0.0479	$13,274.68	
	6" waterline	LF	71254	$40	$2,850,160	60	1977	2037	43	17	28.33%	$2,850,160	$807,545.33	2.50%	17	1.522	4,336,855.503	0.0479	$207,855.81	
	4" waterline	LF	30260	$35	$1,059,100	60	1977	2037	43	17	28.33%	$1,059,100	$300,078.33	2.50%	17	1.522	1,611,545.900	0.0479	$77,237.80	
	3" waterline	LF	48973	$35	$1,714,055	60	1977	2037	43	17	28.33%	$1,714,055	$485,648.92	2.50%	17	1.522	2,608,137.389	0.0479	$125,002.21	
	2" and 1-1/4" water line	LF	91821	$35	$3,213,735	60	1977	2037	43	17	28.33%	$3,213,735	$910,558.25	2.50%	17	1.522	4,890,077.863	0.0479	$234,370.53	
	single family service line	EA	400	$2,500	$1,000,000	60	1977	2037	43	17	28.33%	$1,000,000	$283,333.33	2.50%	17	1.522	1,521,618.261	0.0479	$72,927.77	
	10 in valves	EA	0	$0	$0	60	1977	2037	43	17	28.33%	$0	$0.00	2.50%	17	1.522	0.000	0.0479	$0.00	
	8 in valves	EA	10	$800	$8,000	60	1977	2037	43	17	28.33%	$8,000	$2,266.67	2.50%	17	1.522	12,172.946	0.0479	$583.42	
	6 inch valves	EA	90	$600	$54,000	60	1977	2037	43	17	28.33%	$54,000	$15,300.00	2.50%	17	1.522	82,167.386	0.0479	$3,938.10	
	4 inch valves	EA	10	$600	$6,000	60	1977	2037	43	17	28.33%	$6,000	$1,700.00	2.50%	17	1.522	9,129.710	0.0479	$437.57	
	Fire Hydrants	EA	12	$2,500	$30,000	60	1977	2037	43	17	28.33%	$30,000	$8,500.00	2.50%	17	1.522	45,648.548	0.0479	$2,187.83	
	PRV stations	EA	4	$75,000	$300,000	40	1977	2017	43	-3	-7.50%	$300,000	-$300,000.00	2.50%	1	1.025	307,500.000	1.0000	$307,500.00	
	Sub total		**0**		**$10,417,075**							**$10,417,075**	**$2,566,505**				**$15,701,826**		**$1,045,316**	
Total water distribution installed in 1996	10" Waterline	LF	6534	$60	$392,040	60	1996	2056	24	36	60.00%	$392,040	$235,224.00	2.50%	36	2.433	953,651.145	0.0175	$16,642.72	
	8" Waterline	LF	1947.8	$50	$97,390	60	1996	2056	24	36	60.00%	$97,390	$58,434.00	2.50%	36	2.433	236,904.614	0.0175	$4,134.36	
	6" waterline	LF	712	$50	$35,600	60	1996	2056	24	36	60.00%	$35,600	$21,360.00	2.50%	36	2.433	86,598.257	0.0175	$1,511.28	
	4" waterline	LF	0	$50	$0	60	1996	2056	24	36	60.00%	$0	$0.00	2.50%	36	2.433	0.000	0.0175	$0.00	
	3" waterline	LF	1528	$50	$76,400	60	1996	2056	24	36	60.00%	$76,400	$45,840.00	2.50%	36	2.433	185,845.698	0.0175	$3,243.30	
	2" and 1-1/4" water line	LF	0	$50	$0	60	1996	2056	24	36	60.00%	$0	$0.00	2.50%	36	2.433	0.000	0.0175	$0.00	
	single family service line	EA	400	$2,000	$800,000	60	1996	2056	24	36	60.00%	$800,000	$480,000.00	2.50%	36	2.433	1,946,028.253	0.0175	$33,961.26	
	10 in valves	EA	10	$750	$7,500	60	1996	2056	24	36	60.00%	$7,500	$4,500.00	2.50%	36	2.433	18,244.015	0.0175	$318.39	
	8 in valves	EA	5	$600	$3,000	60	1996	2056	24	36	60.00%	$3,000	$1,800.00	2.50%	36	2.433	7,297.606	0.0175	$127.35	
	6 inch valves	EA	2	$600	$1,200	60	1996	2056	24	36	60.00%	$1,200	$720.00	2.50%	36	2.433	2,919.042	0.0175	$50.94	
	4 inch valves	EA	2	$600	$1,200	60	1996	2056	24	36	60.00%	$1,200	$720.00	2.50%	36	2.433	2,919.042	0.0175	$50.94	
	Fire Hydrants	EA	10	$2,500	$25,000	60	1996	2056	24	36	60.00%	$25,000	$15,000.00	2.50%	36	2.433	60,813.383	0.0175	$1,061.29	
	Sub Total				**$1,439,330**							**$1,439,330**	**$863,598**				**$3,501,221**		**$61,102**	
	Total Distribution				**$11,856,405**														**$1,106,418**	
Water Storage																				
	.5 MG tank at WTP	LS	1	$500,000	$500,000	75	2003	2078	14	61	81.33%	$500,000	$406,666.67	2.50%	61	4.510	2,254,892.246	0.0071	$16,061.47	Rehabilited existing tank in 2009 with new interior paint
	.1 MG Tanks at WTP	LS	1	$250,000	$250,000	75	2003	2078	14	61	81.33%	$250,000	$203,333.33	2.50%	61	4.510	1,127,446.123	0.0071	$8,030.74	New tank installed in 2009
	.2 MG Blue Tank	LS	1	$300,000	$300,000	75	1993	2068	24	51	68.00%	$300,000	$204,000.00	2.50%	51	3.523	1,056,910.931	0.0099	$10,472.61	Possible improvements made after 1993 but unknown
	.12 MG Coventry Tank	LS	1	$275,000	$275,000	75	1977	2052	40	35	46.67%	$275,000	$128,333.33	2.50%	35	2.373	652,631.426	0.0182	$11,881.54	
	Yard Piping and appurtenants	LS	4	50000	200000	75	2003	2078	14	61	81.33%	200000	162666.6667	2.50%	61	4.510	901,956.899	0.0071	$6,424.59	Improvements made in 1992 to yard piping
	Sub Total				**$1,525,000**							**$1,525,000**	**$1,105,000**				**$5,993,838**		**$52,871**	
	Total Water System,				**$19,198,715**							**$19,198,715**	**$7,133,477**				**$38,626,582**		**$1,782,135**	Other Notes: New Ammonia Feed System installed in 2009

Norwood Water Commissiion
Inventory

Asset family	Asset	Unit	Quantity	Unit Price	Total Price	Useful Life	Year Installed	replacement year	Age YR 2020	remaining life	% of life remaining	replacement Value	depr. value	Inflation	remaining useful life	future value factor	future value	annual future value factor	Annual Payment future value	NOTES
Water Source	Intake at South Lateral Canal	LS	1	$25,000	$25,000	75	1977	2052	43	32	42.67%	$25,000	$10,666.67	2.50%	32	2.204	55,093.923	0.0208	$1,144.21	
	ditch	LS	1	$25,000	$25,000	75	1977	2052	43	32	42.67%	$25,000	$10,666.67	2.50%	32	2.204	55,093.923	0.0208	$1,144.21	
	Reservoir #1	LS	1	$624,998	$624,998	80	1977	2057	43	37	46.25%	$624,998	$289,061.34	2.50%	37	2.493	1,558,336.703	0.0167	$26,087.96	
	Reservoir # 2	EA	1	$1,500,000	$1,500,000	80	1996	2076	24	56	70.00%	$1,500,000	$1,050,000.00	2.50%	56	3.986	5,978,988.540	0.0084	$50,058.64	Reservoir #2 constructed in 1996
	Reservoir Piping	LS	1	$25,000	$25,000	75	1977	2052	43	32	42.67%	$25,000	$10,666.67	2.50%	32	2.204	55,093.923	0.0208	$1,144.21	New 10" tank outlet water line installed 2009; New 6" tank inlet water line installed 2009
	Misc Raw Water transmission lines 10" CL 16	LF	3150	$30	$94,500	60	2000	2060	20	40	66.67%	$94,500	$63,000.00	2.50%	40	2.685	253,738.533	0.0148	$3,764.52	Misc. Raw Water transmission lines 10" CL 160 installed in 2000
	Sub total				**$2,294,498**							**$2,294,498**	**$1,434,061**				**$7,956,346**		**$83,344**	
Water Treatment																				New pipes and drains, two new floc/settling units, new 4" clarifier washdown, and two new 2,500 gallon chemical tanks in 2001
	Water treatment plant building	LS	1	$350,000	$350,000	40	2001	2041	19	21	52.50%	$350,000	$183,750.00	2.50%	21	1.680	587,853.648	0.0368	$21,625.56	Existing Bldg expansion in 2001
	Plant piping	LS	1	$100,000	$100,000	50	1996	2046	24	26	52.00%	$100,000	$52,000.00	2.50%	26	1.900	190,029.270	0.0278	$5,276.87	
	concrete clear wells	LS	1	$150,000	$150,000	75	1996	2071	24	51	68.00%	$150,000	$102,000.00	2.50%	51	3.523	528,455.466	0.0099	$5,236.30	
	chlorination/ chloramines	LS	1	$25,000	$25,000	20	2009	2029	11	9	45.00%	$25,000	$11,250.00	2.50%	9	1.249	31,221.574	0.1005	$3,136.42	New chlorination injection system in 2009
	HVAC	LS	1	$50,000	$50,000	20	1996	2016	24	-4	-20.00%	$50,000	-$50,000.00	2.50%	1	1.025	51,250.000	1.0000	$51,250.00	
	Electric	LS	1	$150,000	$150,000	20	2001	2021	19	1	5.00%	$150,000	$7,500.00	2.50%	1	1.025	153,750.000	1.0000	$153,750.00	Minor Improvements made in 2001 &2009
	low Service Pumps	EA	3	$15,000	$45,000	15	1996	2011	24	-9	-60.00%	$45,000	-$45,000.00	2.50%	1	1.025	46,125.000	1.0000	$46,125.00	
	meter	LS	1	$15,000	$15,000	15	1996	2011	24	-9	-60.00%	$15,000	-$15,000.00	2.50%	1	1.025	15,375.000	1.0000	$15,375.00	
	Backwash ponds	EA	2	$50,000	$100,000	40	1996	2036	24	16	40.00%	$100,000	$40,000.00	2.50%	16	1.485	148,450.562	0.0516	$7,659.90	
	WTP package units	LS	1	$1,000,000	$1,000,000	30	2003	2033	17	13	43.33%	$1,000,000	$433,333.33	2.50%	13	1.379	1,378,511.045	0.0660	$91,048.27	
	Chem Feed System	LS	1	$50,000	$50,000	15	2009	2024	11	4	26.67%	$50,000	$13,333.33	2.50%	4	1.104	55,190.645	0.2408	$13,290.89	Installed in 19937; Minor improvements in 2009 - new chemical feed controls; new flowmeter/chemical injection vault
	SCADA system	LS	1	$100,000	$100,000	20	2009	2029	11	9	45.00%	$100,000	$45,000.00	2.50%	9	1.249	124,886.297	0.1005	$12,545.69	
	Sub total				**$2,135,000**							**$2,135,000**	**$778,167**				**$3,311,099**		**$426,320**	
Water Transmission																				
	10" Line from WTP to Norwood	LF	25756.25	$50	$1,287,813	60	1977	2037	43	17	28.33%	$1,287,813	$364,880.21	2.50%	17	1.522	1,959,559.017	0.0479	$93,917.29	
	10" Gate Valves	EA	10	$1,000	$10,000	75	1977	2052	43	32	42.67%	$10,000	$4,266.67	2.50%	32	2.204	22,037.569	0.0208	$457.68	
	PRV station	EA	1	$75,000	$75,000	75	1977	2052	43	32	42.67%	$75,000	$32,000.00	2.50%	32	2.204	165,281.770	0.0208	$3,432.62	PRV Vault #2: New 6" PRV, new 6" gate valve, new manhole; PRV Vault #4: New 4" PRV, new 4" gate valve, new manhole; PRV Vault #1: Install new 10" gate valve, replace PRV, replace existing gate valve
	Air Relief Valves	EA	2	$7,500	$15,000	40	1977	2017	43	-3	-7.50%	$15,000	-$15,000.00	2.50%	1	1.025	15,375.000	1.0000	$15,375.00	
	Sub total				**$1,387,813**							**$1,387,813**	**$386,147**				**$2,162,253**		**$113,183**	
Total water distribution installed in 1977's	10" Waterline	LF	0	$50	$0	60	1977	2037	43	17	28.33%	$0	$0.00	2.50%	17	1.522	0.000	0.0479	$0.00	
	8" Waterline	LF	4045	$45	$182,025	60	1977	2037	43	17	28.33%	$182,025	$51,573.75	2.50%	17	1.522	276,972.564	0.0479	$13,274.68	
	6" waterline	LF	71254	$40	$2,850,160	60	1977	2037	43	17	28.33%	$2,850,160	$807,545.33	2.50%	17	1.522	4,336,855.503	0.0479	$207,855.81	
	4" waterline	LF	30260	$35	$1,059,100	60	1977	2037	43	17	28.33%	$1,059,100	$300,078.33	2.50%	17	1.522	1,611,545.900	0.0479	$77,237.80	
	3" waterline	LF	48973	$35	$1,714,055	60	1977	2037	43	17	28.33%	$1,714,055	$485,648.92	2.50%	17	1.522	2,608,137.389	0.0479	$125,002.21	
	2" and 1-1/4" water line	LF	91821	$35	$3,213,735	60	1977	2037	43	17	28.33%	$3,213,735	$910,558.25	2.50%	17	1.522	4,890,077.863	0.0479	$234,370.53	
	single family service line	EA	400	$2,500	$1,000,000	60	1977	2037	43	17	28.33%	$1,000,000	$283,333.33	2.50%	17	1.522	1,521,618.261	0.0479	$72,927.77	
	10 in valves	EA	0	$0	$0	60	1977	2037	43	17	28.33%	$0	$0.00	2.50%	17	1.522	0.000	0.0479	$0.00	
	8 in valves	EA	10	$800	$8,000	60	1977	2037	43	17	28.33%	$8,000	$2,266.67	2.50%	17	1.522	12,172.946	0.0479	$583.42	
	6 inch valves	EA	90	$600	$54,000	60	1977	2037	43	17	28.33%	$54,000	$15,300.00	2.50%	17	1.522	82,167.386	0.0479	$3,938.10	
	4 inch valves	EA	10	$600	$6,000	60	1977	2037	43	17	28.33%	$6,000	$1,700.00	2.50%	17	1.522	9,129.710	0.0479	$437.57	
	Fire Hydrants	EA	12	$2,500	$30,000	60	1977	2037	43	17	28.33%	$30,000	$8,500.00	2.50%	17	1.522	45,648.548	0.0479	$2,187.83	
	PRV stations	EA	4	$75,000	$300,000	40	1977	2017	43	-3	-7.50%	$300,000	-$300,000.00	2.50%	1	1.025	307,500.000	1.0000	$307,500.00	
	Sub total		**0**		**$10,417,075**							**$10,417,075**	**$2,566,505**				**$15,701,826**		**$1,045,316**	
Total water distribution installed in 1996	10" Waterline	LF	6534	$60	$392,040	60	1996	2056	24	36	60.00%	$392,040	$235,224.00	2.50%	36	2.433	953,651.145	0.0175	$16,642.72	
	8" Waterline	LF	1947.8	$50	$97,390	60	1996	2056	24	36	60.00%	$97,390	$58,434.00	2.50%	36	2.433	236,904.614	0.0175	$4,134.36	
	6" waterline	LF	712	$50	$35,600	60	1996	2056	24	36	60.00%	$35,600	$21,360.00	2.50%	36	2.433	86,598.257	0.0175	$1,511.28	
	4" waterline	LF	0	$50	$0	60	1996	2056	24	36	60.00%	$0	$0.00	2.50%	36	2.433	0.000	0.0175	$0.00	
	3" waterline	LF	1528	$50	$76,400	60	1996	2056	24	36	60.00%	$76,400	$45,840.00	2.50%	36	2.433	185,845.698	0.0175	$3,243.30	
	2" and 1-1/4" water line	LF	0	$50	$0	60	1996	2056	24	36	60.00%	$0	$0.00	2.50%	36	2.433	0.000	0.0175	$0.00	
	single family service line	EA	400	$2,000	$800,000	60	1996	2056	24	36	60.00%	$800,000	$480,000.00	2.50%	36	2.433	1,946,028.253	0.0175	$33,961.26	
	10 in valves	EA	10	$750	$7,500	60	1996	2056	24	36	60.00%	$7,500	$4,500.00	2.50%	36	2.433	18,244.015	0.0175	$318.39	
	8 in valves	EA	5	$600	$3,000	60	1996	2056	24	36	60.00%	$3,000	$1,800.00	2.50%	36	2.433	7,297.606	0.0175	$127.35	
	6 inch valves	EA	2	$600	$1,200	60	1996	2056	24	36	60.00%	$1,200	$720.00	2.50%	36	2.433	2,919.042	0.0175	$50.94	
	4 inch valves	EA	2	$600	$1,200	60	1996	2056	24	36	60.00%	$1,200	$720.00	2.50%	36	2.433	2,919.042	0.0175	$50.94	
	Fire Hydrants	EA	10	$2,500	$25,000	60	1996	2056	24	36	60.00%	$25,000	$15,000.00	2.50%	36	2.433	60,813.383	0.0175	$1,061.29	
	Sub Total				**$1,439,330**							**$1,439,330**	**$863,598**				**$3,501,221**		**$61,102**	
	Total Distribution				**$11,856,405**														**$1,106,418**	
Water Storage																				
	.5 MG tank at WTP	LS	1	$500,000	$500,000	75	2003	2078	14	61	81.33%	$500,000	$406,666.67	2.50%	61	4.510	2,254,892.246	0.0071	$16,061.47	Rehabilited existing tank in 2009 with new interior paint
	.1 MG Tanks at WTP	LS	1	$250,000	$250,000	75	2003	2078	14	61	81.33%	$250,000	$203,333.33	2.50%	61	4.510	1,127,446.123	0.0071	$8,030.74	New tank installed in 2009
	.2 MG Blue Tank	LS	1	$300,000	$300,000	75	1993	2068	24	51	68.00%	$300,000	$204,000.00	2.50%	51	3.523	1,056,910.931	0.0099	$10,472.61	Possible improvements made after 1993 but unknown
	.12 MG Coventry Tank	LS	1	$275,000	$275,000	75	1977	2052	40	35	46.67%	$275,000	$128,333.33	2.50%	35	2.373	652,631.426	0.0182	$11,881.54	
	Yard Piping and appurtenants	LS	4	50000	200000	75	2003	2078	14	61	81.33%	200000	162666.6667	2.50%	61	4.510	901,956.899	0.0071	$6,424.59	Improvements made in 1992 to yard piping
	Sub Total				$1,525,000							$1,525,000	$1,105,000				$5,993,838		$52,871	
	Total Water System,				**$19,198,715**							**$19,198,715**	**$7,133,477**				**$38,626,582**		**$1,782,135**	Other Notes: New Ammonia Feed System installed in 2009

Appendix D Loan and Grant sources

COLORADO
Department of Local Affairs
Division of Local Government

AVAILABLE FINANCIAL ASSISTANCE FOR WATER AND WASTEWATER IMPROVEMENTS

AVAILABLE FINANCIAL ASSISTANCE

Colorado Department of Local Affairs
1313 Sherman Street, Room 521 Denver, Colorado 80203 (303) 864-7720
www.dola.colorado.gov

TABLE OF CONTENTS

INTRODUCTION

There are a number of potential sources of funds available to local governments and other community organizations to make needed improvements to water and wastewater systems. This publication details the commonly used sources of funding from federal and state governments for these needs. For answers to specific questions related to these funding sources, please contact the programs directly through the program websites listed at the end of the descriptions of each program, or the Department of Local Affairs Field Representatives listed at the end of the handout.

STATE REVOLVING FUND (WATER AND WASTEWATER INFRASTRUCTURE)

The state revolving fund originated through the Safe Drinking Water Act and the Clean Water Act and is comprised of two separate funds: Water Pollution Control Revolving Fund and the Drinking Water Revolving Fund. The State Revolving Fund also offers some grant assistance. Detailed information for both grants and loans can be found below.

Program Website: https://www.colorado.gov/pacific/cdphe/wq-low-interest-loans

WATER POLLUTION CONTROL REVOLVING FUND (WPCRF)

The Water Pollution Control Revolving Fund provides below-market interest rate loan financing to governmental entities whose projects will correct water quality problems or qualify as eligible pollution control programs. The fund can be used to cover all eligible project costs with terms up to 30 years. The Disadvantaged Community program offers eligible communities loans from the WPCRF with reduced interest rates and access to program grant funding. The fund is jointly administered by the Colorado Division of Local Government, the Water Quality Control Division, and the Colorado Water Resources and Power Development Authority.

DRINKING WATER REVOLVING FUND (DWRF)

The Drinking Water Revolving Fund provides below market interest rate loan financing to governmental entities and private nonprofit water systems. The fund can be used to cover all eligible project costs with terms up to 30 years. The Disadvantaged Community program offers eligible communities reduced interest rates and access to program grant funding. The fund is jointly administered by the Colorado Division of Local Government, the Water Quality Control Division, and the Colorado Water Resources and Power Development Authority.

DWRF AND WPCRF PLANNING GRANTS AND DESIGN/ENGINEERING GRANTS

PLANNING GRANTS

Planning grants are available to assist disadvantaged communities. Eligible systems must have populations under 10,000, qualify as disadvantaged, and must have completed a pre-application meeting with program staff. The planning grant has a 20% match component with awards up to $10,000. Planning grants are for those communities undertaking projects that are identified on the current year's project eligibility list or are being added to the subsequent year's list for either the Drinking Water Revolving Fund or the Water Pollution Control Revolving Fund. This funding may be used to complete required SRF documents such as the Project Needs Assessment (PNA), environmental review, and/or to form an improvement district to advance a system towards securing

project construction funding. There will be only one grant awarded per project. If the entity does not seek construction funding through the State Revolving Fund, they may be required to repay the planning grant or seek a waiver of the repayment requirement from the Colorado Water Resources and Power Development Authority Board.

DESIGN AND ENGINEERING GRANTS

Design and engineering grants are available to assist disadvantaged communities that have an approved SRF Project Needs Assessment, for design and engineering related expenses. The design and engineering grant has a 20% match component. Design and engineering grants are for those disadvantaged communities committed to utilizing a State Revolving Fund loan and can be in an amount up to $300,000 depending on project size and scope. The intent of the design and engineering grant is to help offset the costs of required submittals such as design drawings, design documents, preliminary effluent limits, site application, and plans and specifications. There will be only one grant awarded per project.

COLORADO WATER RESOURCES & POWER DEVELOPMENT AUTHORITY: WATER REVENUE BONDS PROGRAM

The Colorado Water Resources and Power Development Authority was created by the Colorado General Assembly to provide Colorado with a mechanism to finance water and wastewater projects that may not qualify or be interested in the SRF programs. The Authority can assist governmental entities by issuing revenue bonds, up to a maximum of $500 million, and loaning the proceeds to the governmental entity while subsidizing the cost of issuance of up to $250,000 per borrower, per project. Eligible projects include: storage reservoirs, water and wastewater treatment plants, distribution systems, water wells and pumping stations. Construction costs include design, engineering, costs of issuance, financing reserves, interest during construction, site acquisition, planning, environmental documentation, water rights, and mitigation costs.

Program Website: https://www.cwrpda.com/water-revenue-bond-program

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

CDBG is a state administered, federally funded program that funds public facility improvements and infrastructure projects. Grants are provided to "non-entitlement" municipalities and counties for projects, which principally benefit low and moderate-income (LMI) persons. Districts and private entities (such as nonprofit water companies or homeowners associations) are eligible if sponsored by a municipality or county.

Eligible activities include infrastructure, public facilities improvements, and property acquisition and rehabilitation. All activities must meet at least one of three national objectives: benefit to low and moderate income persons, prevention or elimination of slum and blight, or address an urgent need.

Ineligible activities include buildings for the general conduct of government, general government expenses, income payments, operating/maintenance, and repairs. Business loans are also available for improvements on businesses' private property.

Program Contact: Department of Local Affairs Field Team, https://cdola.colorado.gov/regional-managers
Program Website: https://cdola.colorado.gov/community-development-block-grant-cdbg

ENERGY & MINERAL IMPACT ASSISTANCE GRANT/LOAN PROGRAM

The largest distribution of funds by the State Energy and Mineral Impact Assistance Program occurs in the form of discretionary grants for basic infrastructure and community development projects. Loans are available, with a fixed interest rate of 5%, for domestic treated water and sewer projects only.

The purpose of the Energy and Mineral Impact Assistance Program is to assist political subdivisions that are socially and/or economically impacted by the development, processing, or energy conversion of minerals and mineral fuels. Funds come from the state severance tax on energy and mineral production and from a portion of the state's share of royalties paid to the federal government for mining and drilling of minerals and mineral fuels on federally owned land. The program was created by the legislature in 1977.

The department is assisted by a twelve-member Energy and Mineral Impact Assistance Advisory Committee, which meets several times each year, to consider applications for grants and loans. Seven members are appointed by the Governor to four-year terms, while the remaining five are state department executive directors or their designees. Final funding decisions are made by the Department of Local Affairs Executive Director.

Entities eligible to receive grants and loans include municipalities, counties, school districts, special districts and other political subdivisions and state agencies. The kinds of projects that are funded include - but are not limited to - water and sewer improvements, road improvements, construction/improvements to recreation centers, senior centers and other public facilities, fire protection buildings and equipment, and local government planning.

The program includes categorizing grants into Tier I and Tier II and clarifying evaluation criteria, including match requirements.

Program Contact: Department of Local Affairs Field Team, https://cdola.colorado.gov/regional-managers
Program Website: https://cdola.colorado.gov/funding-programs/energy/mineral-impact-assistance-fund-grant-eiaf

CWCB WATER EFFICIENCY GRANT PROGRAM

The Colorado General Assembly under Senate Bill 07-008, expanded a mechanism for the Colorado Water Conservation Board (CWCB) through its Office of Water Conservation and Drought Planning to provide financial assistance to water providers and qualifying agencies in the State of Colorado that are seeking to perform or promote more meaningful water efficiency. The specific uses of the grant monies are as follows: To develop a water efficiency plan; implement the water efficiency programs and measures specified in their water efficiency plans; for public and private agencies, whose primary purpose is to promote the benefits of water resource efficiency, the money may be used to provide education and outreach aimed at demonstrating the benefits of water efficiency; and to develop drought mitigation plans identified as sufficient by the CWCB. Applications will be accepted

throughout the year with awards made to eligible and qualified organizations that meet the requirements of the grant program.

Program Website: https://cwcb.colorado.gov/water-efficiency-grants

CWCB WATER SUPPLY RESERVE FUND

This program provides resources to implement projects and methods for meeting the state's water consumptive and non-consumptive needs. The program can grant money for a broad range of eligible activities including: construction of infrastructure (storage, pipelines, river improvements, etc.), feasibility studies, studies of human and environmental needs, and technical assistance for permitting or environmental compliance. Both statewide and individual basin accounts are established for projects that promote collaboration and cooperation, facilitate water activity implementation, meet water management goals and objectives, and identified water needs, and address issues of statewide value. In 2009, the Water Supply Reserve Account Program was reauthorized in perpetuity by SB 09-106. It is authorized to receive up to $10,000,000 per year from the Severance Tax Trust Fund, subject to available funding.

Program Website: http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Pages/main.aspx

CWCB WATER PROJECT LOAN PROGRAM

The Water Project Loan Program was established in 1971 to provide low interest loans for raw water resource projects. Eligible borrowers have received over $400 million in loans for planning, engineering and construction from the CWCB. Eligible projects involve the collection, storage and transmission of raw water supplies. Examples include new or the rehabilitation of: reservoirs, ditches/canals, pipelines, groundwater wells, water rights purchases, and flood control facilities. A loan feasibility study is required, which must include preliminary engineering by a professional engineer to help select the best alternative and determine project costs. Typical thirty-year loan interest rates range from 2.0% to 3.0% for municipal borrowers, and 1.5% to 2.0% for agricultural borrowers. There is a 1% loan service charge that can be financed into the loan. Applications for loans less than $10 million are accepted throughout the year, and are approved at the bi-monthly CWCB meetings (allow five months for loan approval and loan contracting). Loan requests in excess of $10 million are due August 1st and are considered once a year at the November CWCB meeting, with funds available the following July (if authorized by State Legislature and with executed loan contract).

Program Website: http://cwcb.state.co.us/LoansGrants/water-project-loan-program/Pages/main.aspx

ECONOMIC DEVELOPMENT ADMINISTRATION (EDA) PUBLIC WORKS AND DEVELOPMENT FACILITIES PROGRAM

Federal grants are provided to help distressed communities attract new industry, encourage business expansion, diversify their economies, and generate long-term, private sector jobs. Among the types of projects funded are broadband infrastructure; water and sewer facilities primarily serving industry and commerce; access roads to industrial sites or parks; and business incubator buildings. Proposed projects must be located within an EDA eligible area. Eligibility is based on low per capita income

(PCI) or high unemployment. Eligibility can also be based on various measures of special economic need. Projects must be consistent with an approved Comprehensive Economic Development Strategy (CEDS). An applicant may be a state, political subdivision of a state, Indian tribe, special-purpose unit of government, or public or private nonprofit organization.

Program Website: https://www.eda.gov/resources/economic-development-directory/states/co.htm

USDA RURAL DEVELOPMENT (RD)

Rural Development (RD) awards long term, low interest loans and grants to rural communities (population of 50,000 or less) for construction and replacement of water, wastewater, storm sewer and solid waste facilities. Eligible communities include municipalities, non-profits (such as homeowners associations) and Federally Recognized Tribes. Communities can receive a loan and grant combination, with percentages based median incomes, health hazard elimination and annual debt service charges to keep user costs reasonable.

- **Project planning grants** up to $30,000 are also available for low-income rural communities. The income for the service area cannot exceed 80% of the statewide non-metropolitan median household income and the percentage of grant funds per project is based on population of the service area.
- **The Solid Waste Management Grant Program** can assist rural communities with technical assistance and/or training related to the management and reduction of solid fill to improve water quality. Funds may be used for construction, engineering, interest payments during construction, essential equipment, site acquisition, legal fees, water rights, etc.

Rural Development can work with private lenders with guaranteed loans to provide affordable rates and terms to those communities that qualify borrowers to improve access to clean, reliable water and waste disposal systems for individuals and businesses in rural areas.

Program Website: https://www.rd.usda.gov/contact-us/state-offices/co

NATIONAL RURAL WATER ASSOCIATION (NRWA)

National Rural Water Association's Revolving Loan Program, RLP, established under a grant from USDA Rural Utilities Services, USDA/RUS, may provide financing to eligible utilities for pre-development costs associated with water and wastewater projects and may also be used with existing water/wastewater systems and the short term costs incurred for replacement equipment, small scale extension of services or other small capital projects that are not a part of regular operations and maintenance. Systems applying must be public entities. This includes municipalities, counties, special purpose districts, Native American Tribes and corporations not operated for profit, including cooperatives, with up to 10,000 population and rural areas with no population limits. Loan amounts may not exceed $100,000 or 75% of the total project cost whichever is less. Applicants will be given credit for documented project cost prior to receiving the RLF loan. Loans will be made at the lower of the poverty or market interest rate as published by RUS, with a minimum of 3% at the time of closing. Maximum term of the loan cannot exceed 10 years. Colorado Rural Water Association Circuit Riders will come to applicant communities and will help complete the required paper work.

Program Website: https://nrwa.org/initiatives/revolving-loan-fund/

RURAL COMMUNITY ASSISTANCE CORPORATION LOAN FUND (RCAC)

Rural Community Assistance Corporation's (RCAC) Environmental Infrastructure Loan Program helps create, improve or expand the supply of safe drinking water and waste disposal systems/facilities that serve low and moderate-income communities in the West, including Colorado. RCAC's loan programs provide the early funds small communities need to determine feasibility and pay pre-development costs prior to receiving state and/or federal program funding. RCAC may also provide long-term loans when system improvements are needed and there is a lack of priority for obtaining funds through state or federal programs. Eligible applicants are non-profit organizations, public agencies, and tribal governments. Projects must be located in rural areas with populations of 50,000 or less. Community size is limited to 10,000 for long-term USDA guaranteed loans and short-term loans for which USDA is the long-term lender. Short-term loans for up to three years with an interest rate of 5.50% are available for: Feasibility studies such as preliminary engineering and environmental reports for up to $50,000; predevelopment loans for such items as engineering, legal and bond counsel for up to $250,000; and construction loans for up to $2,000,000 are available. An intermediate term loan of up to 20 years with an interest rate of 5.00% is available for environmental infrastructure loans. Long-term loans for up to $5,000,000 are available so long as the project meets the requirements of the USDA Rural Utilities Service Water and Waste Disposal Guaranteed loan program. The interest rate for these loans is set at the time of loan closing.

Program Website: https://www.rcac.org/environmental/water-wastewater-services/

PRIVATE ACTIVITY BONDS (PAB)

Tax-exempt private activity bond (PAB) allocations are available to municipalities, counties and other issuing authorities. These entities can issue bonds for a project so that it can be financed with a loan with interest exempt from federal income taxation. Privately owned water, sewer, and certain waste disposal facilities are eligible for this funding. Local governments with populations greater than 19,048 receive a direct allocation. Local governments that do not receive a direct allocation, or that need additional allocation, may apply to the Department of Local Affairs for an allocation from the statewide balance.

Program Website: https://www.colorado.gov/pacific/dola/private-activity-bonds

SMALL COMMUNITIY WATER INFRASTRUCUTRE EXCHANGE (SCWIE)

The Small Community Water Infrastructure Exchange (SCWIE) is a network of water funding officials. Under the auspices of the Council of Infrastructure Financing Authorities (CIFA), a group of public and non-profit environmental funding and technical assistance officials have come together to create SCWIE. Although this is not a funding program, they have posted on their website, the names, telephone numbers and e-mail addresses for all the key small community contacts in each state.

Program Website: http://www.scwie.org/

COLORADO ENERGY OFFICE (CEO)

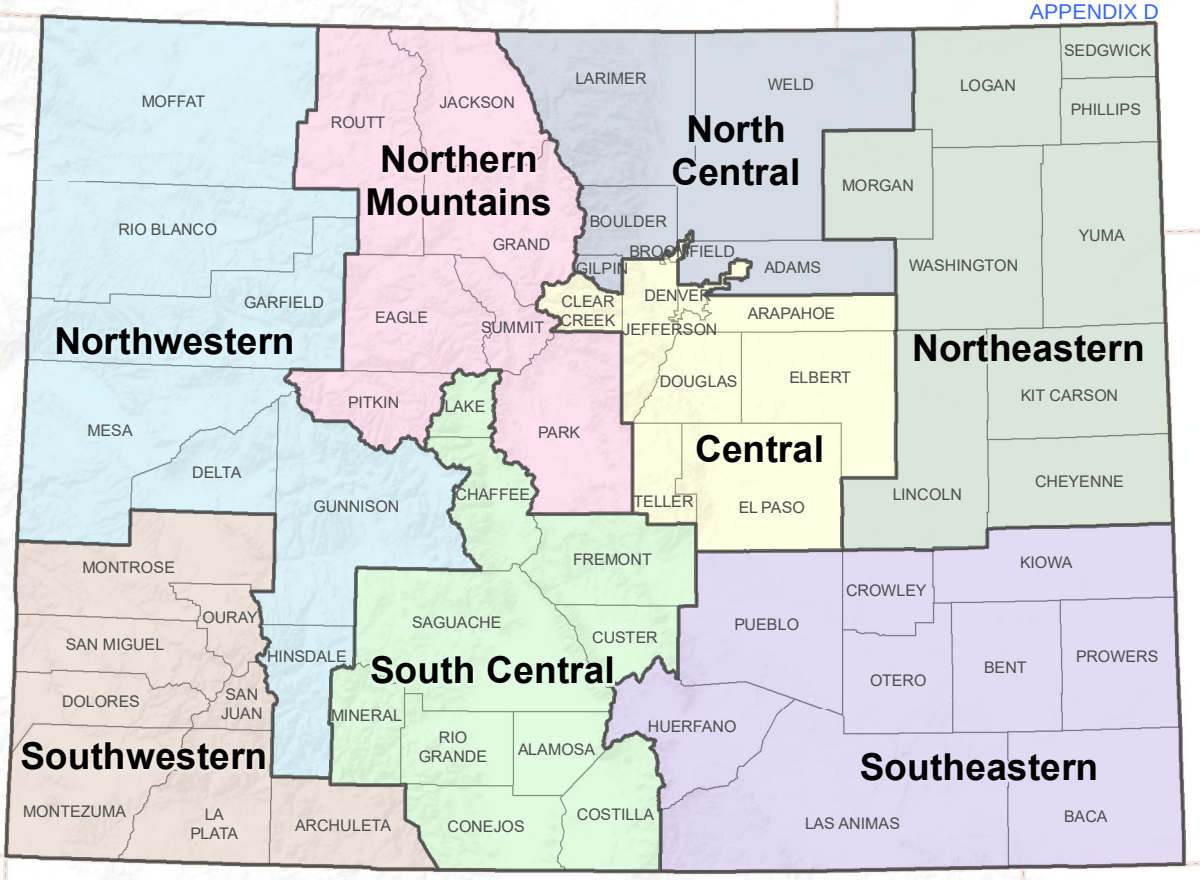
The Colorado Energy Office (CEO) offers an Energy Performance Contracting (EPC) program that helps public jurisdictions to realize annual utility savings through a technical energy audit. While this is not a funding program, the savings are guaranteed as part of the contract and the EPC program

works well with the existing state and federal funding programs for funding the improvements. Facility improvements include indoor lighting fixtures and controls, water efficiency, renewable energy installations, advanced water metering, and much more.

Program website: https://energyoffice.colorado.gov/energy-performance-contracting

REGIONAL MANAGERS and REGIONAL ASSISTANTS

COLORADO
Department of Local Affairs
Division of Local Government



6-5-2020

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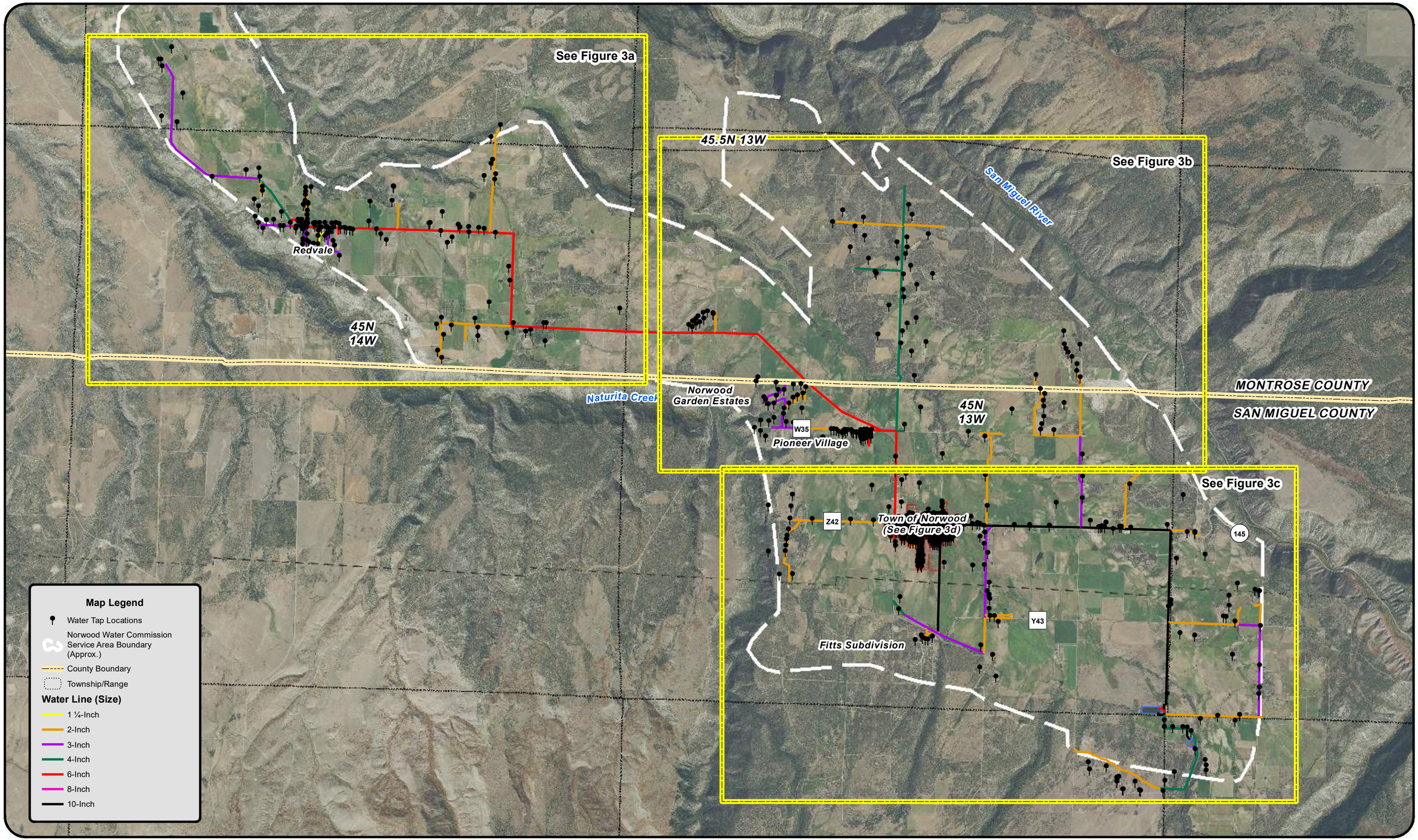
Appendix E Overview of Tap Locations



SGM
555 RiverGate Ln, Suite B4-82
Durango, CO 81301
970.385.2340
www.sgm-inc.com

Figure 3. Water System Overview Water Tap Location

Town of Norwood

Date: 4/30/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:60,000

Data Sources: ESRI, CDW, San Miguel County GIS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2020\Tap Location Maps\WaterSupply-

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 5,000 10,000 Feet

1 inch = 5,000 feet

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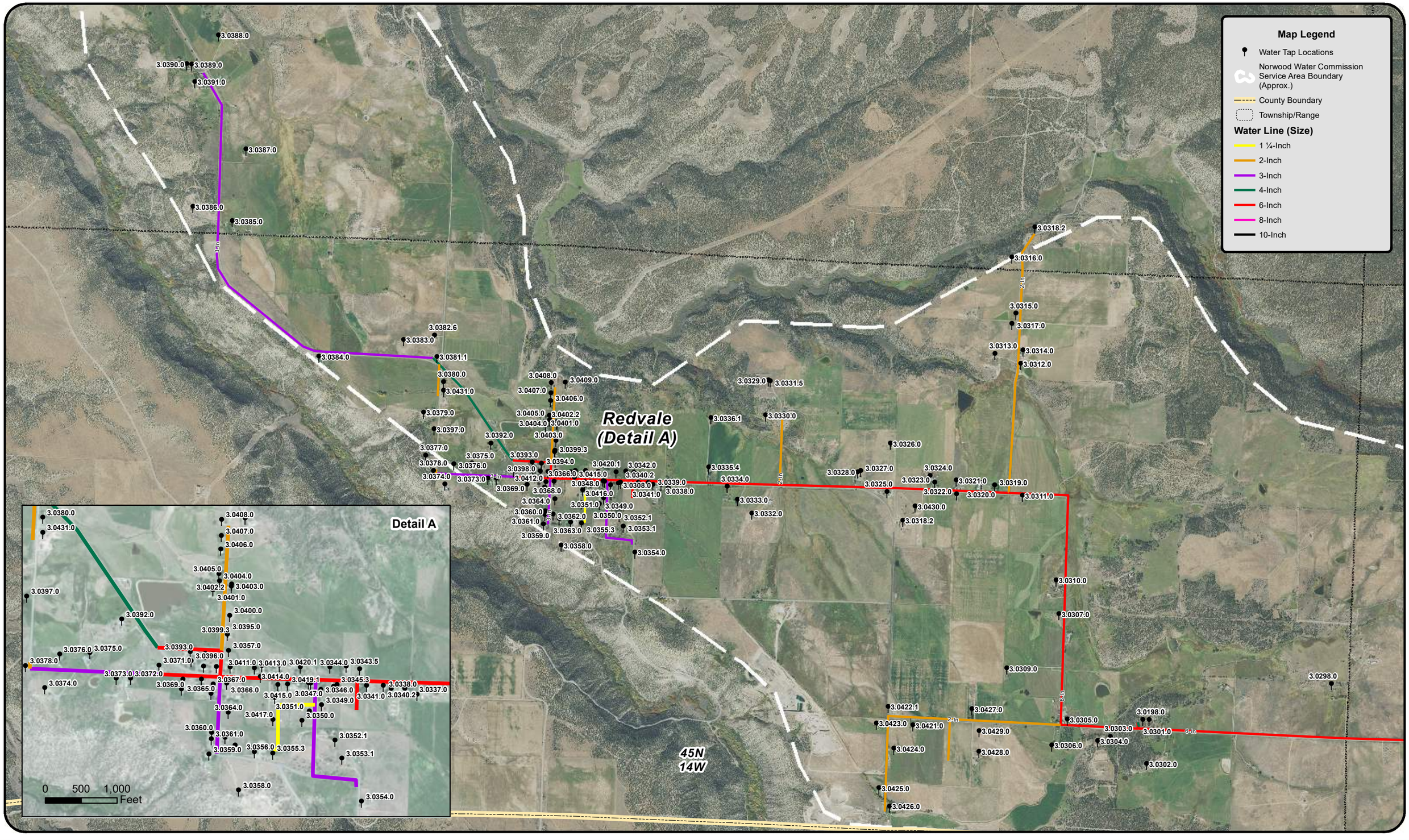

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Figure 3a. Water System Overview
Water Tap Location
Zone 1
Town of Norwood

Date: 4/30/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:24,000

Data Sources: ESRI, CDW, San Miguel County GIS

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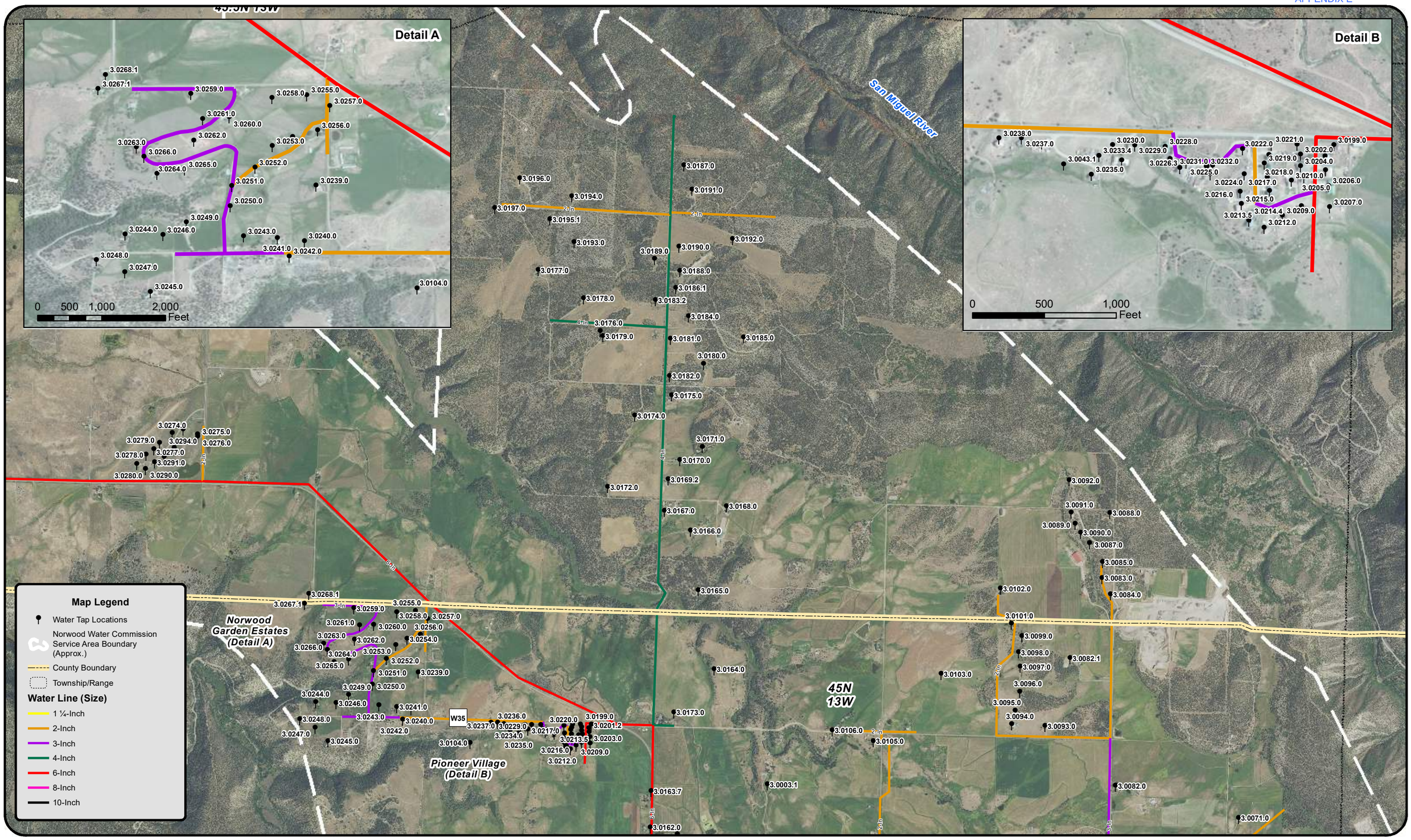

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Durango, CO 81301
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Figure 3b. Water System Overview
Water Tap Location
Zone 2
Town of Norwood

Date: 4/30/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:24,000

Data Sources: ESRI, CDW, San Miguel County GIS

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0 2,000 4,000 Feet

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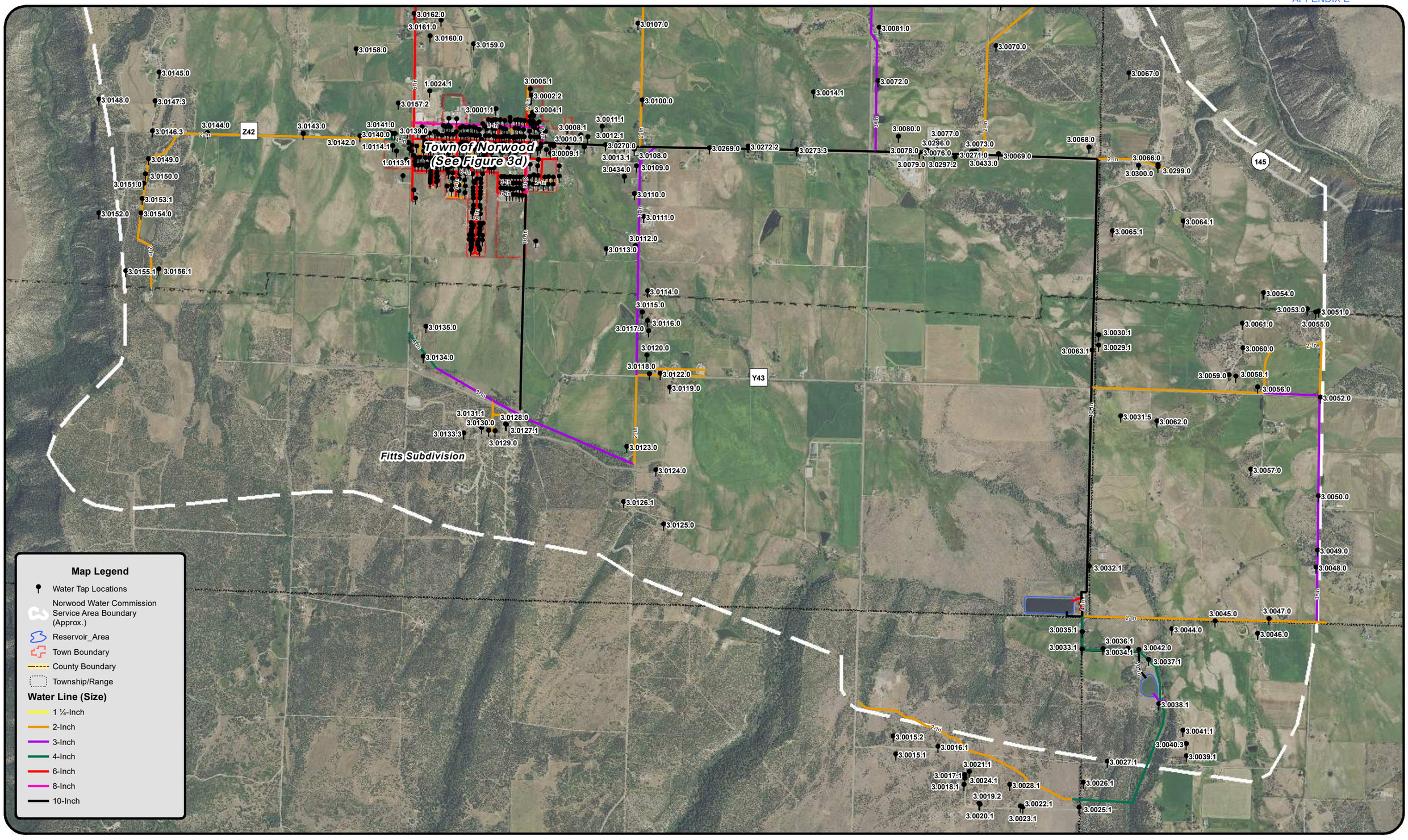

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555 RiverGate Ln, Suite B4-82
Durango, CO 81301
970.385.2340
www.sgm-inc.com

Figure 3c. Water System Overview
Water Tap Location
Zone 3
Town of Norwood

Date: 4/30/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:24,000

Data Sources: ESRI, CDW, San Miguel County GIS

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The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

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1 inch = 2,000 feet

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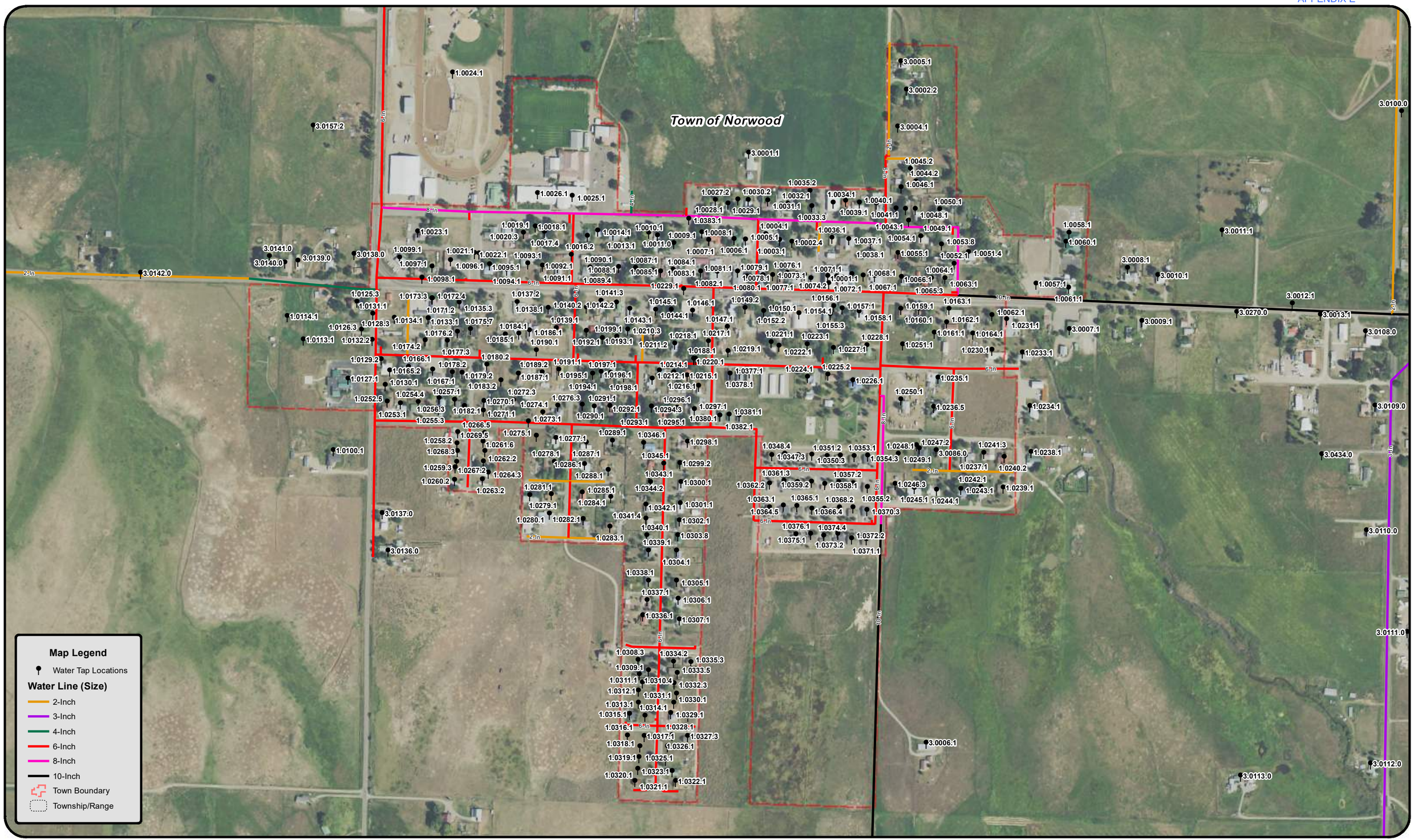

SGM
555 RiverGate Ln, Suite B4-82
Durango, CO 81301
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Figure 3d. Water System Overview
Water Tap Location
Zone 4
Town of Norwood

Date: 4/30/2020	Job No. 2015-440.001	Map by: ANW	Checked by: LM	Scale: 1:5,400

Data Sources: ESRI, CDW, San Miguel County GIS

File: P:\Project Files\2015-440.001 TownOfNorwood\Mapping\ArcMap\2020\Tap Location Maps\WaterSupply-

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 450 900 Feet

1 inch = 450 feet

N

Appendix F Cost Estimates

ENGINEER'S OPINION OF PROBABLE COST (EOPC)

Owner: Norwood Water Commission
Project: Priority #1 10" Water Transmission Main WTP to Blue Tank
Detail:
SGM No.: 2015-440
Date: 1-Oct-20
EOPC Level: Planning
Prepared By: Louis Meyer

Pay Item No.	Item Description	Unit	Quantity	Unit Cost	Estimated Costs	% OF
Base Bid:						
1	Mobilization/Demobilization	LS	1	$ 60,000.00	$ 60,000	3.1%
2	Construction Traffic Control	LS	1	$ 100,000.00	$ 100,000	5.1%
3	Stormwater Management	LS	1	$ 30,000.00	$ 30,000	1.5%
4	10" C-900 Waterline 5-ft cover, Class 6 Aggregate	LF	14,250	$ 120.00	$ 1,710,000	87.3%
5	10" Valves	EA	12	$ 2,500.00	$ 30,000	1.5%
6	10" fittings	EA	5	$ 600.00	$ 3,000	0.2%
7	Connections to existing distribution lines	LF	2	$ 3,500.00	$ 7,000	0.4%
8	Fire Hydrants	EA	4	$ 2,500.00	$ 10,000	0.5%
10	Sawcut and Replace Asphalt	TON	22	$ 200.00	$ 4,320	0.2%
12	Restoration /Seeding	LS	1	$ 5,000.00	$ 5,000	0.3%
					$ -	
					$ -	
				Base Bid Subtotal	**$ 1,959,320**	100.0%

Total Construction Costs	**$ -**	(a)

Additional Construction Costs	Unit	Quantity	Unit Cost	Estimated Costs	% OF	% Range
Construction Administration Services	LS	1	$ 25,000.00	$ 25,000	1.3%	8% - 15% of (a)
Construction Surveying	LS	1	$ 10,000	$ 10,000	0.5%	3% - 7% of (a)
Construction Contingencies	%	5%	$ 97,966	$ 97,966	5.0%	10% - 30% of (a)
			Additional Construction Costs Subtotal	**$ 132,966**	(b)	

Total Construction Project Costs	**$ 132,966**	(c = a+b)

Additional Project Costs	Unit	Quanitity	Unit Cost	Estimated Costs	% OF	% Range
Design Engineering	LS	1	$ 100,000.00	$ 100,000	5.1%	8% - 15% of (a)
Design Surveying, SUE	LS	1	$ 12,000	$ 12,000	0.6%	3% - 7% of (a)
Permitting	LS	1	$ -	$ -	0.0%	10% - 30% of (a)
			Additional Project Costs Subtotal	**$ 112,000**	(d)	

Engineer's Opinion of Probable Costs	**$ 2,204,286**	(e = c +d)

NOTES:

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3. Unit prices and total costs were based on Present Value dollars, assuming project will occur in 2020. Adjustments should be made for years beyond the 2020 calendar year if actual construction occurs in a later year.
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ENGINEER'S OPINION OF PROBABLE COST (EOPC)

Owner: Norwood Water Commission
Project: Priority #1A 10" Water Transmission Main Blue Tank to Norwood
Detail:
SGM No.: 2015-440
Date: 1-Oct-20
EOPC Le Planning
Prepared Louis Meyer

Pay Item No.	Item Description	Unit	Quantity	Unit Cost	Estimated Costs	% OF
Base Bid:						
1	Mobilization/Demobilization	LS	1	$ 60,000.00	$ 60,000	3.1%
2	Construction Traffic Control	LS	1	$ 100,000.00	$ 100,000	5.1%
3	Stormwater Management	LS	1	$ 30,000.00	$ 30,000	1.5%
4	10" C-900 Waterline 5-ft cover, Class 6 Aggregate	LF	6,485	$ 120.00	$ 778,200	39.7%
5	10" Valves	EA	5	$ 2,500.00	$ 12,500	0.6%
6	10" fittings	EA	4	$ 600.00	$ 2,400	0.1%
7	Connections to existing distribution lines	LF	4	$ 3,500.00	$ 14,000	0.7%
8	Fire Hydrants	EA	4	$ 2,500.00	$ 10,000	0.5%
10	Sawcut and Replace Asphalt	Tons	1,350	$ 200.00	$ 270,000	13.8%
12	Restoration /Seeding	LS	1	$ 2,500.00	$ 2,500	0.1%
					$ -	
					$ -	
				Base Bid Subtotal	**$ 1,279,600**	65.3%

Total Construction Costs	**$ -**	(a)

Additional Construction Costs	Unit	Quantity	Unit Cost	Estimated Costs	% OF	% Range
Construction Administration Services	LS	1	$ 15,000.00	$ 15,000	0.8%	8% - 15% of (a)
Construction Surveying	LS	1	$ 10,000	$ 10,000	0.5%	3% - 7% of (a)
Construction Contingencies	%	5%	$ 63,980	$ 63,980	3.3%	10% - 30% of (a)
			Additional Construction Costs Subtotal	**$ 88,980**	(b)	

Total Construction Project Costs	**$ 88,980**	(c = a+b)

Additional Project Costs	Unit	Quanitity	Unit Cost	Estimated Costs	% OF	% Range
Design Engineering	LS	1	$ 75,000.00	$ 75,000	3.8%	8% - 15% of (a)
Design Surveying, SUE	LS	1	$ 12,000	$ 12,000	0.6%	3% - 7% of (a)
Permitting	LS	1	$ -	$ -	0.0%	10% - 30% of (a)
			Additional Project Costs Subtotal	**$ 87,000**	(d)	

Engineer's Opinion of Probable Costs	**$ 1,455,580**	(e = c +d)

NOTES:

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ENGINEER'S OPINION OF PROBABLE COST (EOPC)

Owner: Norwood Water Commission
Project: Priority 2 10" Water Transmission Main Replace existing 10" Mair
Detail:
SGM No.: 2015-440
Date: 1-Oct-20
EOPC Le Planning
Prepared Louis Meyer

Pay Item No.	Item Description	Unit	Quantity	Unit Cost	Estimated Costs	% OF
Base Bid:						
1	Mobilization/Demobilization	LS	1	$ 60,000.00	$ 60,000	3.1%
2	Construction Traffic Control	LS	1	$ 100,000.00	$ 100,000	5.1%
3	Stormwater Management	LS	1	$ 30,000.00	$ 30,000	1.5%
4	10" C-900 Waterline 5-ft cover, Class 6 Aggregate	LF	20,470	$ 120.00	$ 2,456,400	125.4%
5	10" Valves	EA	12	$ 2,500.00	$ 30,000	1.5%
6	10" fittings	EA	20	$ 600.00	$ 12,000	0.6%
7	Connections to existing distribution lines	LF	7	$ 3,500.00	$ 24,500	1.3%
8	Fire Hydrants	EA	4	$ 2,500.00	$ 10,000	0.5%
10	Sawcut and Replace Asphalt	SY	2,250	$ 200.00	$ 450,000	23.0%
12	Restoration /Seeding	LS	1	$ 10,000.00	$ 10,000	0.5%
					$ -	
					$ -	
				Base Bid Subtotal	**$ 3,182,900**	162.4%

Total Construction Costs	**$ -**	(a)

Additional Construction Costs	Unit	Quantity	Unit Cost	Estimated Costs	% OF	% Range
Construction Administration Services	LS	1	$ 50,000.00	$ 50,000	2.6%	8% - 15% of (a)
Construction Surveying	LS	1	$ 25,000	$ 25,000	1.3%	3% - 7% of (a)
Construction Contingencies	%	5%	$ 159,145	$ 159,145	8.1%	10% - 30% of (a)
			Additional Construction Costs Subtotal	**$ 234,145**	(b)	

Total Construction Project Costs	**$ 234,145**	(c = a+b)

Additional Project Costs	Unit	Quanitity	Unit Cost	Estimated Costs	% OF	% Range
Design Engineering	LS	1	$ 150,000.00	$ 150,000	7.7%	8% - 15% of (a)
Design Surveying, SUE	LS	1	$ 12,000	$ 12,000	0.6%	3% - 7% of (a)
Permitting	LS	1	$ 10,000	$ 10,000	0.5%	10% - 30% of (a)
			Additional Project Costs Subtotal	**$ 172,000**	(d)	

Engineer's Opinion of Probable Costs	**$ 3,589,045**	(e = c +d)

NOTES:

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ENGINEER'S OPINION OF PROBABLE COST (EOPC)

Owner: Norwood Water Commission
Project: Priority #3 10" Water Transmission Main Norwood to Norwood Ga
Detail:
SGM No.: 2015-440
Date: 1-Oct-20
EOPC Le Planning
Prepared Louis Meyer

Pay Item No.	Item Description	Unit	Quantity	Unit Cost	Estimated Costs	% OF
Base Bid:						
1	Mobilization/Demobilization	LS	1	$ 60,000.00	$ 60,000	3.1%
2	Construction Traffic Control	LS	1	$ 100,000.00	$ 100,000	5.1%
3	Stormwater Management	LS	1	$ 30,000.00	$ 30,000	1.5%
4	10" C-900 Waterline 5-ft cover, Class 6 Aggregate	LF	12,145	$ 120.00	$ 1,457,400	74.4%
5	10" Valves	EA	10	$ 2,500.00	$ 25,000	1.3%
6	10" fittings	EA	5	$ 600.00	$ 3,000	0.2%
7	Connections to existing distribution lines	LF	4	$ 3,500.00	$ 14,000	0.7%
8	Fire Hydrants	EA	4	$ 2,500.00	$ 10,000	0.5%
10	Sawcut and Replace Asphalt	Ton	1,800	$ 200.00	$ 360,000	18.4%
12	Restoration /Seeding	LS	1	$ 5,000.00	$ 5,000	0.3%
					$ -	
					$ -	
				Base Bid Subtotal	**$ 2,064,400**	105.4%

Total Construction Costs	**$ -**	(a)

Additional Construction Costs	Unit	Quantity	Unit Cost	Estimated Costs	% OF	% Range
Construction Administration Services	LS	1	$ 25,000.00	$ 25,000	1.3%	8% - 15% of (a)
Construction Surveying	LS	1	$ 10,000	$ 10,000	0.5%	3% - 7% of (a)
Construction Contingencies	%	5%	$ 103,220	$ 103,220	5.3%	10% - 30% of (a)
			Additional Construction Costs Subtotal	**$ 138,220**	(b)	

Total Construction Project Costs	**$ 138,220**	(c = a+b)

Additional Project Costs	Unit	Quanitity	Unit Cost	Estimated Costs	% OF	% Range
Design Engineering	LS	1	$ 100,000.00	$ 100,000	5.1%	8% - 15% of (a)
Design Surveying, SUE	LS	1	$ 12,000	$ 12,000	0.6%	3% - 7% of (a)
Permitting	LS	1	$ -	$ -	0.0%	10% - 30% of (a)
			Additional Project Costs Subtotal	**$ 112,000**	(d)	

Engineer's Opinion of Probable Costs	**$ 2,314,620**	(e = c +d)

NOTES:

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