CARROLL COUNTY
WATER SYTEM
IMPROVEMENT STUDY

PRESENTED TO

COUNTY OF CARROLL
OFFICE OF COMMISSIONERS
95 WATER VILLAGE ROAD
OSSIPEE, NEW HAMPSHIRE

DRAFT

DECEMBER 2021

Concord, New Hampshire
UE Job # 2718

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2. Introduction/Purpose of Evaluation

The Carroll County Water System serves the Carroll County Complex and approximately 40 homes in Ossipee Village. According to the New Hampshire Department of Environmental Services (NHDES) One-Stop website, the system has a total of 53 connections and services a population of 258.

The sources of supply include two deep bedrock wells and three dug wells, which are also referred to as springs. The artesian output of two of the dug wells/springs flows by gravity to the third dug well, where water is pumped to a metering and treatment building. The water from dug well W-1 is metered and then chlorine is added before the water flows into an in-ground 200,000-gallon concrete reservoir. The discharge from each bedrock well also flows through the metering and treatment building, is chlorinated, and flows to the reservoir. Water flows by gravity from the reservoir through a 10-inch ductile iron (DI) main to the County Complex, and then onto Ossipee Village via County Farm Road, Route 28 and Route 171, where the size is reduced to 8-inch in the village center. 8-inch and 4-inch diameter branch mains serve other streets in the village.

Water supply capacity has been an issue in the past, and bedrock well #2 (BW #2) was installed in about 2000 to address the issue. However, there have been no other supply improvements for over 20 years. The current condition, supply capacity and water levels of the bedrock wells are unknown. Demands have likely increased slightly over time due to the upgrade or addition of new facilities at the County Complex and the addition of residential connections. There is also potential for increased future water demand in the Village. During recent water quality sampling, there was reportedly air in the discharge from bedrock Well #1 (BW #1), indicating a possible low water level. Nearly all of the water for the system is currently provided by BW #2.

The 10-inch and 8-inch D.I. water mains noted above were installed in 2001/2002. However, a smaller diameter main remains on Old Route 28, which is believed to be 4-inch PVC. In this location, the fire hydrant is connected to the 4-inch main which does not meet current design standards.

Underwood Engineers (UE) was hired to perform an engineering evaluation and study to determine the following:

1. Capacity of existing sources of supply
2. Projected demands and ability of existing supplies to meet those demands
3. Fire flow capability throughout water system
4. Recommendations on
    a. Rehabilitating or improving existing supply sources
    b. Adding a new supply source or sources to meet demands
    c. Distribution system improvements to ensure adequate fire flow
    d. Rate adjustments to help support recommended improvements

History

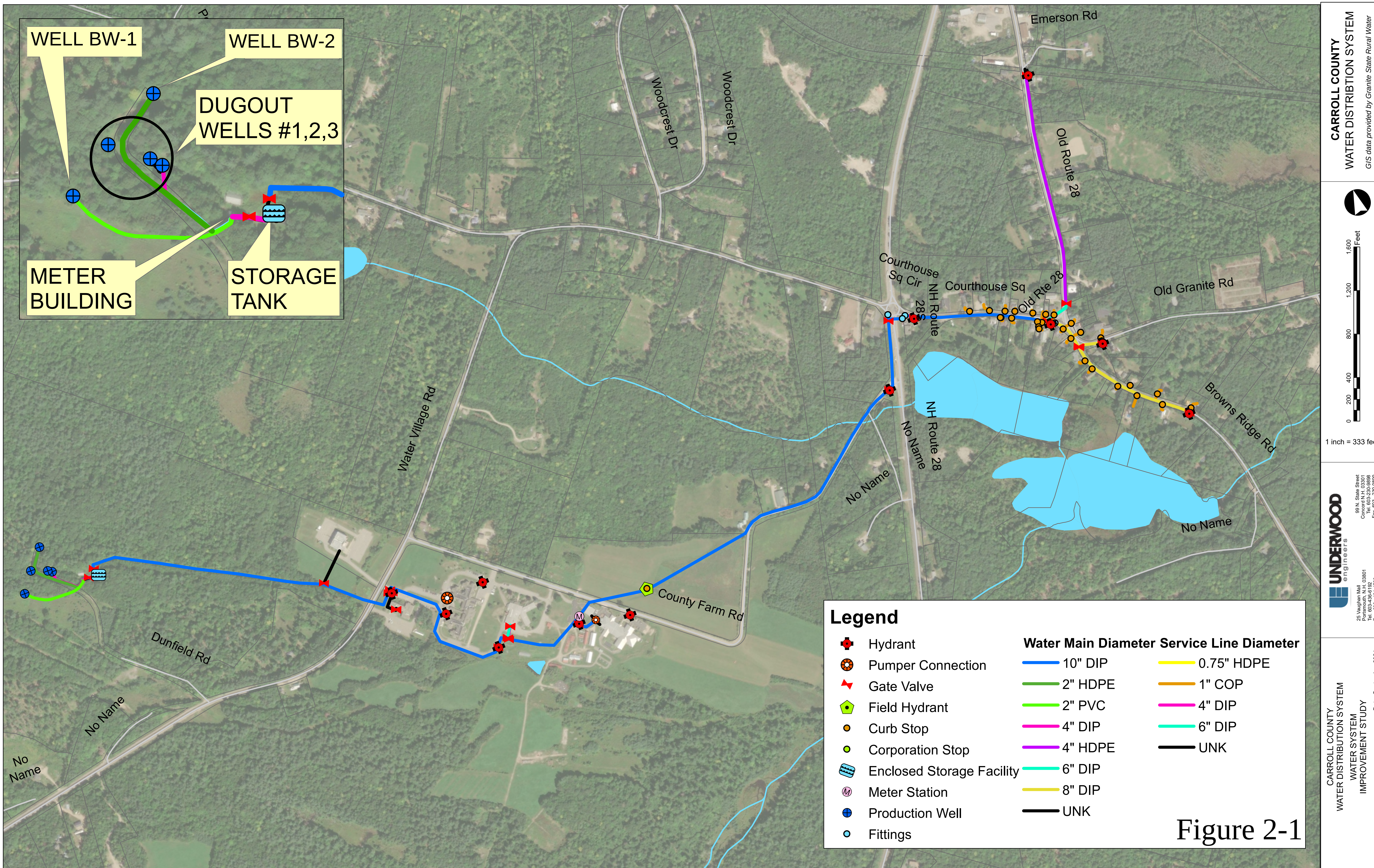
Prior to the 2001 upgrade, the system was reportedly approximately 100 years old and had frequent main breaks, insufficient supply, lacked meters and telemetries, and had antiquated distribution piping and storage facilities. There were reportedly chronic water shortages in the summer months when the wells could not refill the reservoirs.

The existing dug wells/springs (W-1, W-2 & W-3) were installed in 1979 to replace a prior spring system. It is unknown when BW-1 was installed. BW-2 was installed about 2000, and connected to the system during the 2001 upgrade.

The current storge tank was constructed in 1987. An older storage tank with a volume of 90,000 gallons, which was constructed around 1900 and had significant deficiencies, was removed from service sometime after 2000.

Several improvements and additions have been constructed at the County Complex. A new courthouse was added in 2001. A new jail was constructed in 2003 (to replace the old jail), and a new nursing home was constructed in 2010 (to replace the old nursing home). The old nursing home building still exists, but is currently unoccupied. These improvements may have increased usage of the water system slightly, but most improvements were replacements, rather than additions.

A map of the distribution system, as provided by RCAP Solutions, is shown in ***Figure 2-1***.


WELL BW-1
WELL BW-2
DUGOUT WELLS #1,2,3
METER BUILDING
STORAGE TANK
Emerson Rd
Woodcrest Dr
Woodcrest Dr
Old Route 28
Courthouse Sq Cir
NH Route 28
Courthouse Sq
Old Rte 28
Old Granite Rd
Browns Ridge Rd
NH Route 28
No Name
No Name
No Name
Water Village Rd
County Farm Rd
Dunfield Rd
No Name
No Name
Legend
Hydrant
Pumper Connection
Gate Valve
Field Hydrant
Curb Stop
Corporation Stop
Enclosed Storage Facility
Meter Station
Production Well
Fittings
Water Main Diameter
10" DIP
2" HDPE
2" PVC
4" DIP
4" HDPE
6" DIP
8" DIP
UNK
Service Line Diameter
0.75" HDPE
1" COP
4" DIP
6" DIP
UNK
Figure 2-1
CARROLL COUNTY
WATER DISTRIBTION SYSTEM
GIS data provided by Granite State Rural Water Association (GSRWA)
Feet
1 inch = 333 feet
UNDERWOOD engineers
CARROLL COUNTY
WATER DISTRIBUTION SYSTEM
WATER SYSTEM
IMPROVEMENT STUDY
Date: September 2021
Project No. 2718

3. Existing System and Evaluation

3.1 Wells

The Carroll County Water System has 3 water sources, two bedrock wells (BW-1 and BW-2) and a series of 3 dug wells (which are operated as a single source, with W-2 and W-3 flowing by gravity into W-1 where it is pumped to the tank).

It is unknown when BW-1 was installed. A 2018 Sanitary Survey by NHDES indicated Bedrock Well #1 (BRW1-005) was 315 ft deep with an unknown yield. A 1999 Provan & Lorber report indicated that the well was 1,100 ft deep, and estimated the approximate flow from the well at 12 gpm (based on a bucket-test). During the 2001 water system upgrade, an old pump-house was removed, a new pitless adapter was installed, and the pump was lowered from a depth of 300 ft to 500 ft.. The 2001 plans show that the well has a 10-inch diameter well casing, and a 2-inch galvanized drop pipe and has a 5 hp motor. The well is reportedly currently blowing a lot of air when flushing was conducted for sampling, and therefore likely needs further evaluation to identify issues.

BW-2 was installed around 2001 prior to the 2001 construction project. There is conflicting historic information regarding the yield of the well. The 2018 NHDES Sanitary Survey indicates that Bedrock Well #2 (BRW 2-009) has a depth of 1,006 ft and a yield of 29.3 gpm. At the time of our site visit the pump was operating and pumping at about 24 gpm. The NHDES One Stop site indicates that the well was drilled in 2001, has a total depth of 1,006 ft, a depth to bedrock of 150 ft with 172 ft of casing, a static water level of 100 ft and a test yield of 16 gpm (Well ID#187.0489)

Three dug wells make up the third source for the system. According to the 1999 Provan & Lorber report, the wells were considered shallow springs, W-1, W-2 and W-3. W-2 and W-3 originally flowed directly to the tank by gravity, and W-1 was pumped by a 2 Hp submersible pump. During the 2001 upgrade, they were reconfigured, so that W-2 and W-3 flow by gravity into W-1, where it is pumped to the storage tank by a ½ Hp submersible pump. Provan & Lorber indicated that flow measurements from the combined outflow of the wells had a flow rate of about 15 gpm (after a period of moderate to significant precipitation in the fall/early winter of 1998). DES refers to this source as DUG-010 with an unknown yield.

These dug wells were reportedly installed in 1979 to replace an older spring system which had become unproductive. According to DES, the dug wells/springs are reportedly four foot diameter concrete tile construction, and approximately 20 ft deep. The 2001 Provan & Lorber plans show W-1 as 4 ft diameter with 16.5 ft deep concrete well tiles. During the 2001 construction project, a 0.5 Hp pump was reportedly re-set in W-1.

Access to the wells is difficult, via a narrow unmaintained gravel road, with the wells off to the side. The roads to the wells should be improved to allow easier monitoring and maintenance of the wells.

Although shown on the 2001 Provan & Lorber plans, level transducers are not present in the wells. There do not appear to be conduits to the wells either. This make monitoring of the wells difficult, and provides no data for evaluation of the wells operation.

3.2 Pump Station

Building

The 14 ft by 14 ft pump station building was constructed in 2001/2002 in conjunction with distribution improvements. The building houses chorine injection, flow meters for the three source wells, and control equipment. A 1000 gal propane tank supplies a propane heater and 45 KW emergency generator.

The exterior of the wood-frame building is in good condition with no significant damage to the vinyl siding or metal roofing observed. The interior, however, shows significant evidence of moisture damage. Wall and ceiling panels are peeling in multiple places with the worst damage around the chlorine injection pump where a wall patch was added. The system operator indicated that the injection pump had leaked for a prolonged period of time causing chemical to spray onto the wall there. There is also evidence of corrosion damage to the propane heater, electrical wireway and on some panels.

Chlorination System

The chlorination system consists of a 35 gallon storage tank and a wall mounted LMI positive displacement pump. Chlorine is transferred to the storage tank from 30 gallon drums via a drum pump. The system is interlocked to the well pumps to only operate when the wells are operational. Chlorine is injected into the pipeline leaving the meter building and going to the storage tank. A recessed floor area is present for secondary containment of the chemical area.

The chemical feed does not appear to be flow-paced, since the distribution flowmeter is currently inoperable. The operator reports that they manually adjust the pump stroke/speed based on sampling results. They report using 8-10 drums of 12.5% sodium hypochlorite per year. Chlorine residuals are monitored 2-3 times per week at a sample tap at the maintenance building.

Flow meters

The pump station houses three Sensus SRII positive displacement source meters (one for each source), which are manually read and reported to NHDES on a monthly basis. A fourth Sensus SR ECR positive displacement meter, measures the combined flow to the storage tank and is equipped with an electronic reading device, which is connected to the Programmable Logic Controller/Supervisory Control and Data Acquisition PLC/SCADA system. Unfortunately, the flow meter that is attached to the SCADA system does not appear to be functional right now, so there are no flow readings available at SCADA. The SCADA consultant indicated that the Invensys Act Pact box between the flowmeter and PLC does not appear to be lit, so this may be the device that needs to be replaced.

Electrical

The building has an overhead electrical service, and is equipped with an emergency generator and an ASCO Series 165 Automatic Transfer Switch mounted on the exterior of the building. There is significant tree/branch growth around the overhead electrical service, which should be cleared to preserve the reliability of the system.

Control System

The PLC/SCADA system in use is called ProControl, by EOS Research LTD. According to the County's SCADA consultant, the system retains the latest 2,000 data points per input channel, and the logging interval is currently set at 10 minutes. The system does not have an Operator Interface Terminal (OIT), so data may only be reviewed by having EOS Research log into the system remotely, or plug into the PLC at the station. The operator receives daily text notifications of current conditions daily, and is also notified of alarms via text. The operator could log in to view the system data by downloading a free Proview software program and plugging into the PLC at the station. Additional software could be purchased to allow the operator to log in remotely from a computer at the Maintenance facility, or other location, to monitor and retrieve data, and view setpoints.

EOS Research indicated that the existing panel is getting old, but is functional. A new cellular modem was installed in the panel 3-5 years ago, and the panel was evaluated at that time and the components were determined to be in good condition. There is a small area of rust on the exterior of the cabinet. The panel modem is a 3G unit and will need to be upgraded to 4G LTE soon, as Verizon is phasing out 3G service. The panel appears to have limited digital input modules available, but has 4 analog input slots and 4 digital output slots available. The following is a list of signals terminated in the panel:

Table 3-1- PLC termination signals

Discrete Input Devices
Well #1 Run Input
Well #1 Overload
Well BW-1 Run
Well BW-1 Overload
Well BW-2 Run
Well BW-2 Overload
Door Switch
Low Temp
Analog Input Devices
Flow Meter (External power 115V)
Well #1 – Level
Well #BW-1 Level
Well #BW-2 Level
Reservoir #1 Level
Reservoir #2 Level
Discrete Outputs
Well #1 Pump (connect at Motor Starter Start/Stop Contacts)
Well BW-1 Pump (connect at Motor Starter Startr/Stop Contacts)
Well BW-2 Pump (connect at Motor Starter Start/Stop Contacts)
Chemical Metering Pump (115V from Electrical Panel circuit)
Analog Output
Chemical Metering Pump

There is a submersible level transducer in the tank, which transmits tank level to the control panel. High and low level alarms are sent to the operator via cell phone. The tank level transducer was recently replaced.

The system controls have reportedly not been modified in 15 years since they were installed.

a. Well BW-2 pump is set to come on at a tank level of 7.6 ft
b. Well BW-2 pump is set to go off at a tank level of 8.6 ft (There is about 19,000 gallons per ft of depth in the tank, and 19,000 gallons in the typical operational band between pump on and off)
c. If BW-2 pump doesn't provide enough flow and the tank level drops, the other 2 well pumps are called to come on at a tank level of 6.6 ft
d. All pumps will shut off at a tank level of 8.6 ft.
e. Chlorine pump is flow paced

f. The station is equipped with a variety of alarms, including low building temperature, overload on well pumps, low tank level (6.6 ft), etc.
g. The control system has the provision to accept well level, but there are currently no signals provided for this, as the level transducers were not installed.

At the time of our site visit, BW-2 was operating at about 24 gpm. At this rate, the pump will need to run for about 13 hours (with no system demand) to refill the tank to the high level setpoint.

The control system logs information every 10 minutes and has a 2,000 point capacity per input channel. The pump cumulative run time is recorded as well as tank level. The discharge flow from the wells would normally be recorded, but it is currently not functioning, so no data was available. We were able to review tank level data from October 19 through November 2, around the period when the system flushing was conducted.

The PLC panel has spare control wires for Reservoir #2 (removed from service after 2001) coiled inside the panel.

3.3 Storage Tank

Storage for the system is provided by a 200,000 gallon in-ground cast-in-place concrete tank with a pre-stressed hollow core precast concrete roof, covered by a rubber membrane roof with a 30" x 36" aluminum access hatch and ladder. The tank is located near the wells and meter building on a hill behind the complex, and feeds the system by gravity. Static pressures in the system at the complex are about 40-50 psi and in the village about 130-140 psi.

According to the operator, the exterior tank dimensions are 37 ft x 75 ft. The tank has two floor-to-ceiling baffle walls, each with a 5 ft opening. The 1999 Provan and Lorber report says the tank was constructed in 1987 and has a depth of 11 ft.

Underwater Solutions performed an inspection and tank cleaning in May of 2018 and found the tank to be in general good condition, with some concrete repair work needed on the exterior, and minor pipe cleaning/coating needed on the interior. What little sediment was found in the tank was removed during the inspection.

More specifically, the recommendations of the report were as follows:

Tank Exterior

1. The tank inspector recommended removing the expansion rivets and aluminum strips to roll back the rubber membrane and expose the exterior wall surfaces.
2. Power tool clean all surfaces of the exposed exterior walls (approx. 20%) having concrete spall to prepare the substrate and resurface all spalls with concrete repair material to seal the exposed reinforcement steel and prevent further concrete fatigue.
3. Repair cracked and deteriorated exterior corners of the tank, including exposed rebar.
4. Apply an elastomeric sealant having an ANSI/NSF 61 approval throughout the entire joint between the roof and walls to seal the junction and prevent intrusion into the tank.
5. Repair 4” x 2” tear in the roof membrane on the centerline of the easternmost side of the tank by applying sealant over the area.
6. Repair the aluminum strips and expansion rivets securing the roof membrane on the northernmost side of the tank where it has pulled free for approximately 36-inches. Re-attach the rubberm membrane around the perimeter of the tank where removed for concrete repairs.
7. Excavate metal overflow pipe at tank penetration, power tool clean to remove corrosion, coat the pipe and restore partial burial.

Tank Interior

1. Repair three 1/4-inch gaps between the roof and wall junction ranging from 2-inches to 12-inches in length on the eastern side of the tank. Apply an elastomeric sealant having an ANSI/NSF 61 approval throughout the entire joint between the roof and walls to seal the junction and prevent intrusion into the tank.
2. Repair a 20 ft section of joint between the precast concrete roof panels where the foam backing rod material has become dislodged. This is approximately 8 ft from the wall on the westernmost side of the tank.
3. The surfaces of the metal pipes that penetrate the tank wall are not coated and have mild corrosion on all surfaces. Power tool cleaning of the surfaces to remove corrosion and re-coating of the surfaces are recommended.

As previously noted, in the control system discussions, the well pumps are controlled by water level in the storage tank. Tank control levels are included in that section.

3.4 Water Quality/Treatment

Historic water quality is summarized in ***Table 3-2***.

Table 3-2 – Water Quality Summary 2011-2021

Parameter	Units	MCL/SMCL	Concentration Range: Dug Wells Blend (W-1)	Concentration Range: Bedrock Wells Blend (BW-1, BW-2)
Arsenic[1]	mg/L	0.005	ND	ND
Barium	mg/L	2	0.0085 to 0.0163	0.0069 to 0.0089
Chloride	mg/l	250	ND to 41	ND
Chromium	mg/L	0.1	ND	ND
Hardness	mg $CaCO_3$/L		49.8 to 62.8	30.7 to 54.85
Copper[2]	mg/L	1.3	ND to 0.059	
Fluoride	mg/L	4	1.8	1.8
Iron	mg/l	0.3	ND to **0.601**	ND to **1.38**
Lead[2]	mg/L	0.015	ND to 0.002	
Manganese	mg/l	0.05	0.0076 to 0.0433	0.038 to **0.3001**
Nickel	mg/L	0.1	ND to 0.0057	ND
Nitrate (as N)	mg/L	10	ND to 0.05	ND
Nitrite (as N)	mg/L	1	ND	ND
pH	Units	6.5-8.5	8.4 to 8.89	7.67 to 8.41
Sodium	mg/l	100-250	8.63 to 34.1	8.88 to 10.3
Sulfate	mg/l	250	9 to 9.3	8.6 to 9.8
Turbidity	NTU	1	----	----
Zinc	mg/l	5	ND to 0.178	ND to **8.3**
Disinfection Byproducts[3]				
Haloacetic acids (HAA)	ug/l	60	ND to 1.0	
Total trihalomethanes (TTHM)	ug/l	80	ND to 1.2	
PFAS Contaminants[4]				
Perfluorohexane sulfonic acid (PFHxS)	ng/L	18	ND	
Perfluorononanoic acid (PFNA)	ng/L	11	ND	
Perfluorooctane sulfonic acid (PFOS)	ng/L	15	ND	
Perfluorooctanoic acid (PFOA)	ng/L	12	ND	
Radionuclides				
Compliance Gross Alpha	pCi/L	15	5 to 7.49	
Radium 226 + 228	pCi/L	5	0.3 to 3.3	
Radon[5]	pCi/L	2000	----	
Uranium	ug/L	30	1 to 7.9	

Notes:

Disinfection byproducts, lead, and copper samples taken from distribution system. All other data from samples taken from pump station taps.

Red Bold indicates water concentration exceeds MLC or SMCL

1) NHDES MCL of 5 mg/L effective July 2021. Previous MCL = 10 mg/L

2) Copper and lead levels have Action Levels (AL) rather than MCLs. Data shown is 90th percentile of samples collected, which is then compared to AL for compliance

3) HAA and TTHM averages are Running Annual Averages (RAA). MCL standard is based off RAA.

4) NH MCL effective 6/30/2020

5) There is no established MCL for Radon. 2000 pCi/L is an Advisory level set by the State of NH.

Water quality from the wells is in general very good. The pH is average to slightly on the high side, which is not unusual for New Hampshire groundwaters drawn from bedrock aquifers. Typically, slightly higher than average pH water is less corrosive, and therefore desirable.

High iron and manganese in New Hampshire groundwaters are very common. They have historically been considered aesthetic issues, rather than health issues, and therefore evaluated by non-enforceable Secondary Maximum Contaminant Levels (SMCL), as opposed to Maximum Contaminant Levels (MCLs), which are health related enforceable standards. In general, when above SMCL concentrations, iron and manganese can begin to cause customer complaints, such as staining of fixtures and laundry, colored water, taste issues, precipitation and scaling in piping system, etc.

As more research has been conducted in recent years on the health effects of manganese, many states have begun enacting MCLs for manganese due to evidence of neurological effects from elevated concentrations. As of July 1, 2022 the MCL for manganese in New Hampshire will be 0.3 mg/l, matching the federal health advisory concentration, and there will be a public notification requirement for manganese concentrations over a concentration of 0.1 mg/l. This is due to health concerns for infants to even short-term (acute) exposure to concentrations over this concentration. The SMCL, for aesthetic concerns, will remain at 0.05 mg/l.

There was a wide range of iron concentrations reported for all the sources, some which exceed the SMCL. Similarly, there are a wide range of concentrations of manganese, some which exceed the SMCL, and some that may exceed the new MCL of 0.3 mg/l, and the new public notification level of 0.1 mg/l. Most samples had non-detect levels of iron and manganese, however, select samples had exceedances, sometimes significant. Iron and manganese exceeded the SMCLs as follows:

- September 2017 - blend of the bedrock wells
  - Iron 1.38 mg/l
  - Manganese 0.3 mg/l
- October 2015 - dug wells
  - Iron 0.6 mg/l
  - Manganese 0.04 mg/l

Two other samples were close to the manganese SMCL as follows:

- September 2014 - blend of bedrock wells
  - Iron non detect
  - Manganese 0.038 mg/l
- December 2012 - dug wells
  - Iron non detect
  - Manganese 0.04 mg/l

Sampling of public water systems is only required every 3 years, therefore, limited water quality data is available. Additional sampling and monitoring is recommended to better assess and monitor these potential water quality issues.

3.5 Distribution System

A construction project in 2001 replaced the majority of the distribution system, as follows:

- New 2-inch PVC was installed from BW #1 to the new meter building
- A small section of new 2-inch HDPE was installed to connect existing 2-inch HDPE from dug wells #2 (W-2) and #3 (W-3) to dug well #1 (W-1).
- 3-inch PVC was installed between dug well #1 (W-1) and the new meter building
- 2-inch PVC was installed between bedrock Well #2 (BW-2) and the new meter building
- 4-inch DI was installed between the new meter building and the storage tank
- A small section of the 8-inch DI from the storage tank was replaced
- New 10-inch DI was installed from near the storage tank to the Carol County Complex
- New 10-inch was installed throughout the Complex; in front of the Administration building, behind the nursing home, and maintenance building and in front of the new jail
- New 10-inch DI was installed across the field and down County Farm Road and Route 28 to the traffic circle
- New 10-inch DI was installed on Route 171 between the Rte 28 traffic circle and Old Route 28
- New 8-inch DI was installed on Brown's Ridge Rd and a short section of 8-inch to a hydrant on Granite Rd.

The only remaining "older" pipe in the system that was not replaced in 2001 appears to be a 4-inch PVC on Old Route 28. This main should be replaced with an 8-inch ductile iron main to provide proper fire protection in this area.

3.6 Fire Protection

There are a total of 12 hydrants in the system, most of which were installed in 2001. The hydrants in the system are over 20 years old, and the Department of Public Works (DPW) has reported difficulty in finding parts, as well as unacceptable delivery times (weeks to months) when parts are located. Significant difficulties have been experienced with at least one hydrant in front of the old courthouse. Replacement is recommended for all 12 hydrants in the system with a more modern hydrant model with better parts availability. The DPW would like to replace the hydrants with Model B84B American Darling hydrants.

A summary of the existing hydrant locations and color coding/flow capacity was provided by the Ossipee Center Fire Chief in ***Table 3-3***.

Table 3-3 – Fire Department Hydrant Summary

Location/Description	Address	Hydrant Color	Available Flow (gpm)
CCC Administration Building	95 Water Village Road	Light Blue	1,500+
Front Mountain View Community Nursing Home	93 Water Village Road	Green	1,000-1,500
Rear Mountain View Community Nursing Home	93 Water Village Road	Green	1,000-1,500
Side Mountain View Community Nursing Home	93 Water Village Road	Green	1,000-1,500
Barn Yard		Light Blue	1,500+
Front of Jail	50 County Farm Road	Green	1,000-1,500
Okkola	120 County Farm and Route 28	Light Blue	1,500+
by Roundabout	15 Courthouse Square	Light Blue	1,500+
Old Courthouse	20 Courthouse Square	Light Blue	1,500+
Across from Professional Suites	45 Old Granite Road	Light Blue	1,500+
30 Browns Ridge Road	30 Browns Ridge Road	Light Blue	1,500+
Old Route 28 near DOT shed	35 Old Route 28	Orange	500-1,000

The fire chief reports that the last ISO survey was completed in 2017/2018. The basic needed flow was identified as 750 gpm, which is available at all of the hydrants. The highest needed fire flow was 2,500 gpm at the nursing home for 2 hours. The report also noted that fire flows of 3,000 – 3,500 gpm should be obtainable for 3 hours. We believe this is a general statement, and that "obtainable" could mean from off-site sources. The next highest requirements were 1,250 gpm for the administration building, and 1,250 gpm at another commercial building in the village.

Fire Department flushing & testing apparatus

The fire department performs annual flushing of the hydrants, and coordinates with the County DPW staff to ensure the tank is full prior to flushing.

The hydrants in the system appear to be in varying condition. Most of them, with the exception of the one on Old Route 28, were installed in 2001.

Staff reported that all of the hydrants are non-draining with the exception of the one in front of the jail, which is a draining hydrant. The fire department pumps out all of the hydrants at the end of the year, prior to winter conditions.

We conducted flow testing at three of the hydrants when the fire department was flushing them in October. The Fire Department also collected their own readings on each hydrant as they flushed them. They used a Hose Monster pitot attached to a 25 ft length of 2.5-inch fire hose for flushing and flow measurement and also mounted a pressure gage on the opposite side of the hydrant. This setup was switched to a 50 ft hose for hydrants 9 through 12.

UE used an Acron pitot mounted to the hydrant, and pressure gages at the flow hydrant and two residual hydrants upstream.

Fire Department staff were very cautious while flushing the hydrant near the old courthouse, and requested that we arrange our flow tesing so that the hydrant only had to be opened once for flushing. They reported numerous issues with it in the past, with something blowing out 2 years ago, and setting off sprinklers in the courthouse last year.

Results of the flow testing conducted by UE are included in ***Table 3-4***. Our results were consistent with that shown previously by the fire department, with most hydrants having well over 1,000 gpm capacity. Hydrants in the Complex had roughly 1,500 gpm fire flow available at 20 psi, while those in the village were closer to 1,800-2,000 gpm available flow at 20 psi. Static pressures (no flow) in the Complex are typically between 40 and 50 psi, while static pressures in the village are typically 120-130 psi. We assume services in the village are equipped with pressure reducing valves (PRVs), and if not, they should be. PRVs should be installed whenever static pressures exceed 80 psi.

Table 3-4 – Hydrant Testing

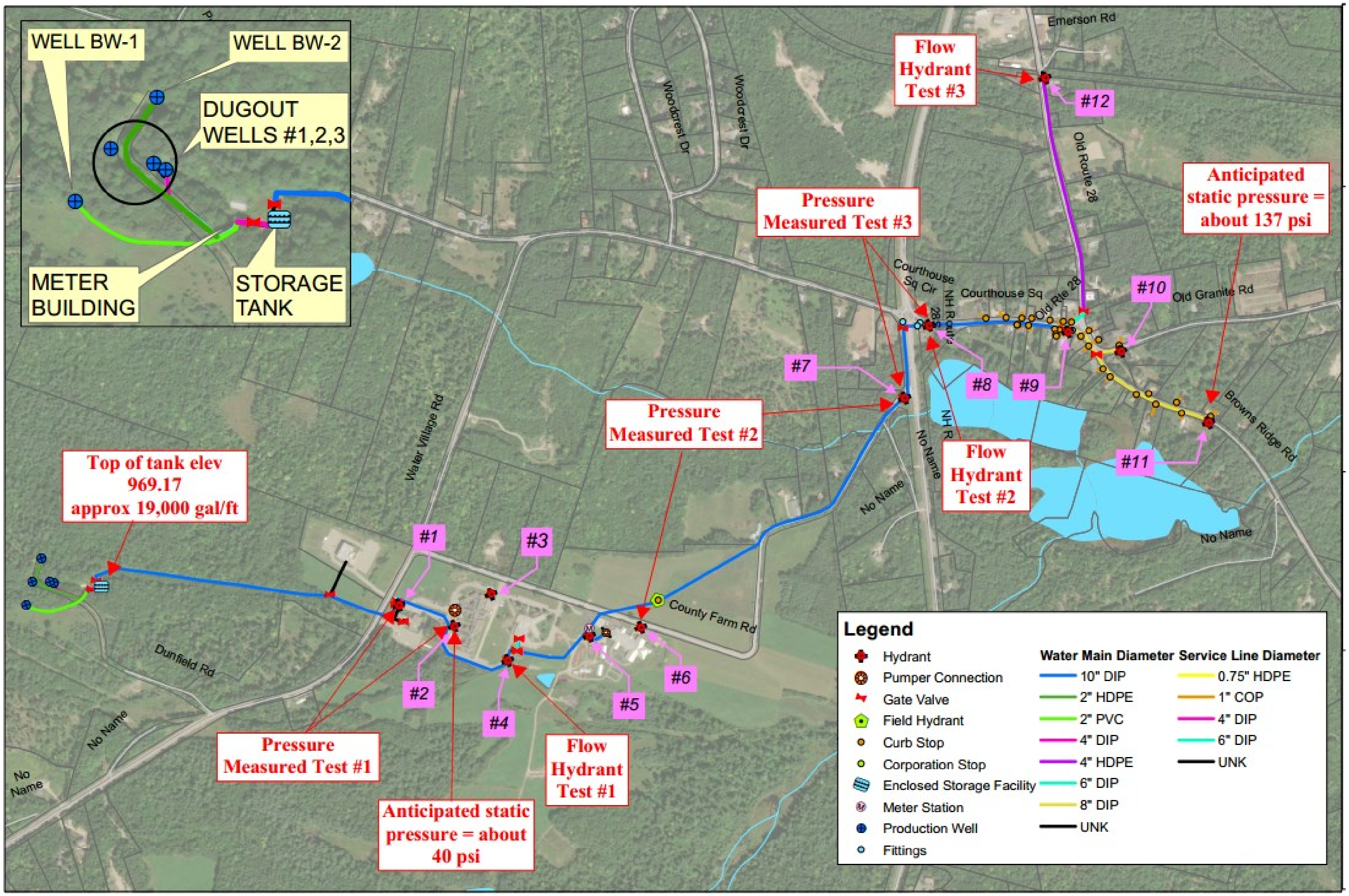
UE Fire Flow Testing, October 2021

UE Hydrant Number	Location/Description	Address	Hydrant Color	Available Flow (gpm) *From FD	Elevation, Ft MSL	Est Static, Ft	Est static, PSI	Actual static from flow testing- UE	UE Flow Tesing	Hydrant Flow during test, gpm	Calculated Available Fire Flow at 20 psi, gpm		Notes
1	CCC Administration Building	95 Water Village Road	Light Blue	1,500+ gpm	867	99.17	42.94	42.50	Gauge hydrant, test #1		1,719		
2	Front Mountain View Community Nursing Home	93 Water Village Road	Green	1,000-1,500 gpm	860	106.17	45.97	44.00	Gauge hydrant, test #1		1,563		
3	Side Mountain View Community Nursing Home (Loading Bay)	93 Water Village Road	Green	1,000-1,500 gpm	850	116.17	50.30	48.00					
4	Rear Mountain View Community Nursing Home	93 Water Village Road	Green	1,000-1,500 gpm	854	112.17	48.57	43.00	Flow hydrant, test #1	803			
5	Barnyard, next to Maintenance		Light Blue	1,500+ gpm	840	126.17	54.63	52.00					
6	Front of Jail	50 County Farm Road	Green	1,000-1,500 gpm	826	140.17	60.69	62.00	Gauge hydrant, test #2		1,437		FD notes: This hydrant is self draining, all others non-draining FD gage read 74 psi after flushing
7	End of County Farm Rd, near Rte 28	120 County Farm and Route 28	Light Blue	1,500+ gpm	662	304.17	131.71	132 130	Gauge hydrant, test #2; Gauge hydrant, test #3		2,080	1,819	
8	Rte 171, near Rte 28 Roundabout	15 Courthouse Square	Light Blue	1,500+ gpm	660	306.17	132.57	132 133	Flow hydrant, test #2, Gauge hydrant, test #3	1,240	2,622	1,601	notified of tank low level alarm while flushing
9	Old Courthouse	20 Courthouse Square	Light Blue	1,500+ gpm	678	288.17	124.78	123.00					FD notes: 2 years ago, issues with something on hydrant "blowing off". Last Year, set off courthouse sprinkler system, this year FD hose lining blew during flushing
10	Across from Professional Suites - Granite Road	45 Old Granite Road	Light Blue	1,500+ gpm	676	290.17	125.64						
11	30 Browns Ridge Road	30 Browns Ridge Road	Light Blue	1,500+ gpm	648	318.17	137.77						
12	Before Emerson Rd, Green roof House - end of line on Old Rte 28	35 Old Route 28	Orange	500-1,000 gpm	640	326.17	141.23	140.00	Flow #3	498	533		

Top of Reservoir = 969.17
Assume full tank = 966.67

Data show is/ or was calcualted using FD fire flow testing done concurrently

Figure 3-1 - Hydrant Flow Testing Map



4. Source Capacity and Demand

4.1 System Demands

Actual system demands are difficult to quantify due to the lack of metering.

- Source meters are present for each of the wells, but they are read and reported to NHDES on a monthly basis.
- The distribution meter measures the total volume of water (from combined sourcs) being sent to the tank, and is connected to the PLC, but the meter is not currently transmitting to the PLC, and therefore data was not available.
- Meters are present at all users in the village, and these meters are read and billed quarterly.
- There are no meters at any of the county facilities, so it has to be assumed that the County Complex use is the total water produced by the wells, less the volume metered in the village, less any other non-metered usage, like hydrant flushing, fire fighting, contractor's use of hydrants, etc. These non-metered uses aren't routinely tracked.

We obtained the village quarterly meter reading/billing and monthly source production reported to NHDES. This data was used to estimate system usage, and compare to NHDES methods for evaluating system usage when precise flow data is lacking.

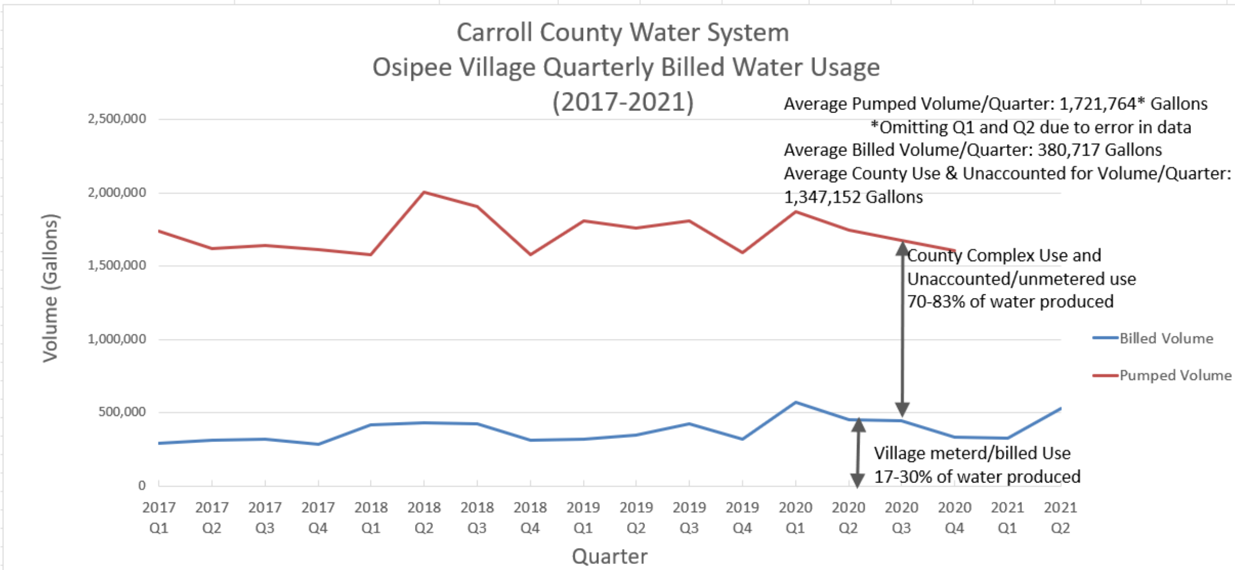
Homes in the village have meters, which are read and billed quarterly, as shown in ***Figure 4-1***. Source water from the wells is also illustrated for comparison. On average, over the period from 2017 through quarter 2 of 2021, metered use in the village ranged from 17% to 30% of the total water produced, with an average of 22% of the water produced being billed to customers in the village over the period. The average daily use over the period, assuming 91 days in a quarter, would be as follows:

Pumped volume =	18,920 gpd
Billed use in village =	4,194 gpd
Remaining use from County Complex =	14,804 gpd

There is one meter listed for the Superior Court at 96 Water Village Road, which is on the Carroll County Complex. This appears to be the only metered building at the County Complex. Typical metered use at this location is about 250 gpd.

Based on the metered data, about ¾ of the water produced is used at the County Complex, and about ¼ is provided to Ossipee Village. Until meters are installed at the County buildings, this can not be verified, nor can unaccounted-for water be evaluated.

Figure 4-1 – Ossipee Village Quarterly Billed Water Usage



4.2 NHDES Standards

The *New Hampshire Code of Administrative Rules*, Part Env-Dw 405 outlines requirements for the design of small community water systems servicing less than 1,000 people. These rules only apply to small community water systems without fire protection. Because the Carroll County system has fire protection, this system technically falls under the requirements of Env-Dw 404, Design Standards for Large Public Water Systems. Because the large system rules do not specifically address the unique requirements of small systems, we will refer to the small system rules for an alternative analysis of source water requirements for the system.

Section Env – Dw 405.10 of the rules addresses design flow for various types of small systems in Table 405-1. This section recommends the following:

- Design flow for a nursing home be based on 125 gallons per day (gpd) per bed,
- Other institutions be based on 135 gpd/bed, and
- Single family homes be based on 150 gpd/bedroom

Average water demand estimates based on NHDES small system rules are as follows:

Ossipee Village

Residences	40 x 3 bedrooms x 150 gpd/br =	18,000 gpd
Businesses	4 x 3 employees x 15 gpd/employee=	180 gpd
		18,180 gpd

Carroll County Complex

County Courthouse	20 employees x 15 gpd/employee =	300 gpd
Administration bldg.	40 employees x 15 gpd/employee =	600 gpd
Nursing Home	103 beds x 125 gpd/bed =	12,900 gpd
Jail	40 inmates x 135 gpd/pp =	5,400 gpd
		18,300 gpd

Design Daily Demand for Carroll County System based on Table 405-1=36,480 gpd

Based on these values, usage by the village and the County Complex would be nearly a 50-50 split. However, based on actual metered (and billed) usage, the village uses between 17% and 30% of the total water produced, with a long term average of 22%. The long term average daily use in the village (based on quarterly data) is about 4,200 gpd.

The NHDES Administrative Rules 405.10 also allow existing systems to determine the design flow using historical water readings, either:

(1) By finding the daily average flow from water meter readings and multiplying the average by a minimum factor of 2 or a maximum factor of 3 depending on the type or frequency of the meter readings; or
(2) By examining 12 months of consecutive daily water meter readings, in which case the water system's design flow shall be based on the highest daily flow noted, without application of a multiplying factor.

The individual source meters for the wells are read monthly and reported to NHDES, so daily metered flow data is not available. Monthly usage from each source was evaluated from Jan 2014 – June 2021, as shown in ***Figures 4-2 & 4-3***.

Figure 4-2 – Carroll County Groundwater Withdrawals Each Source

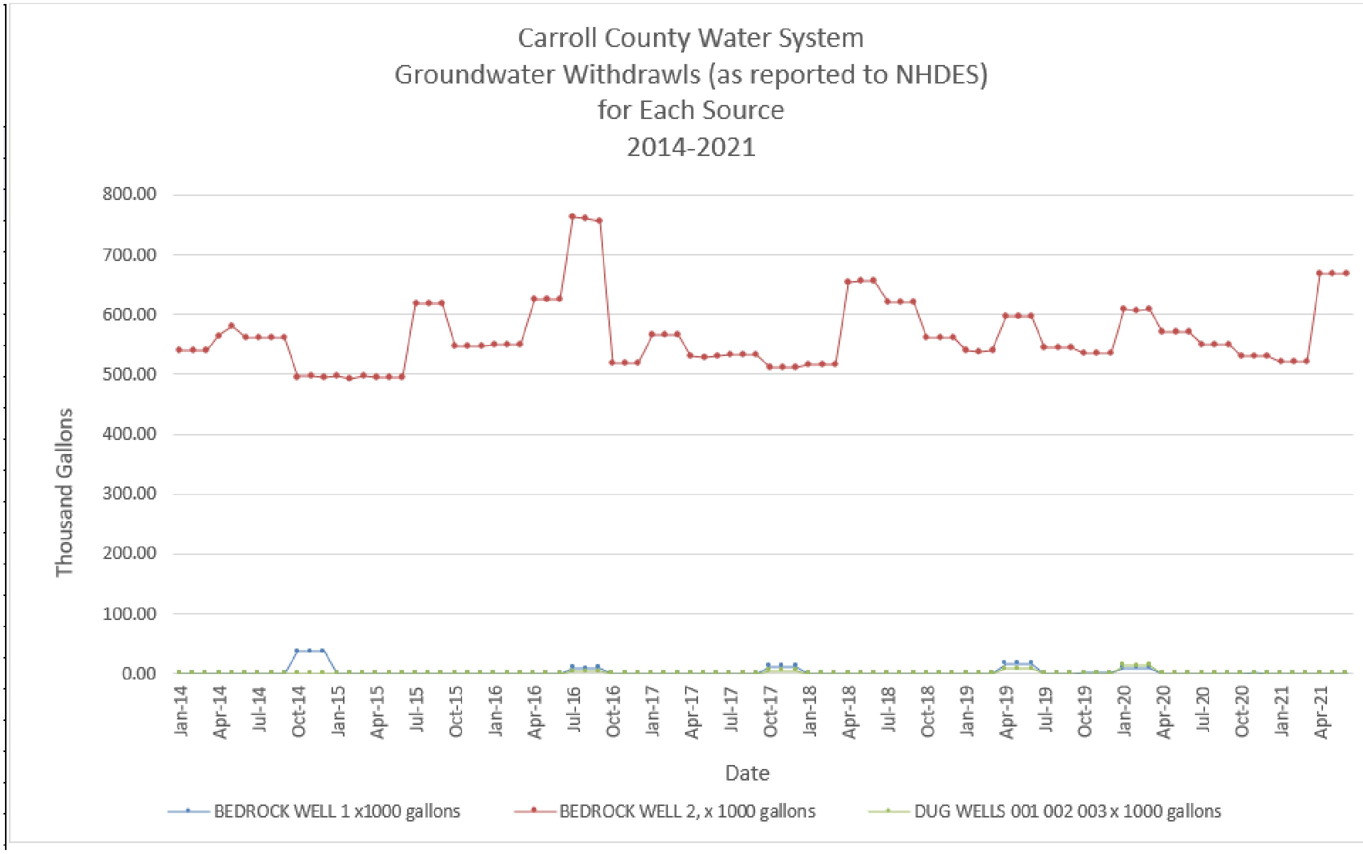
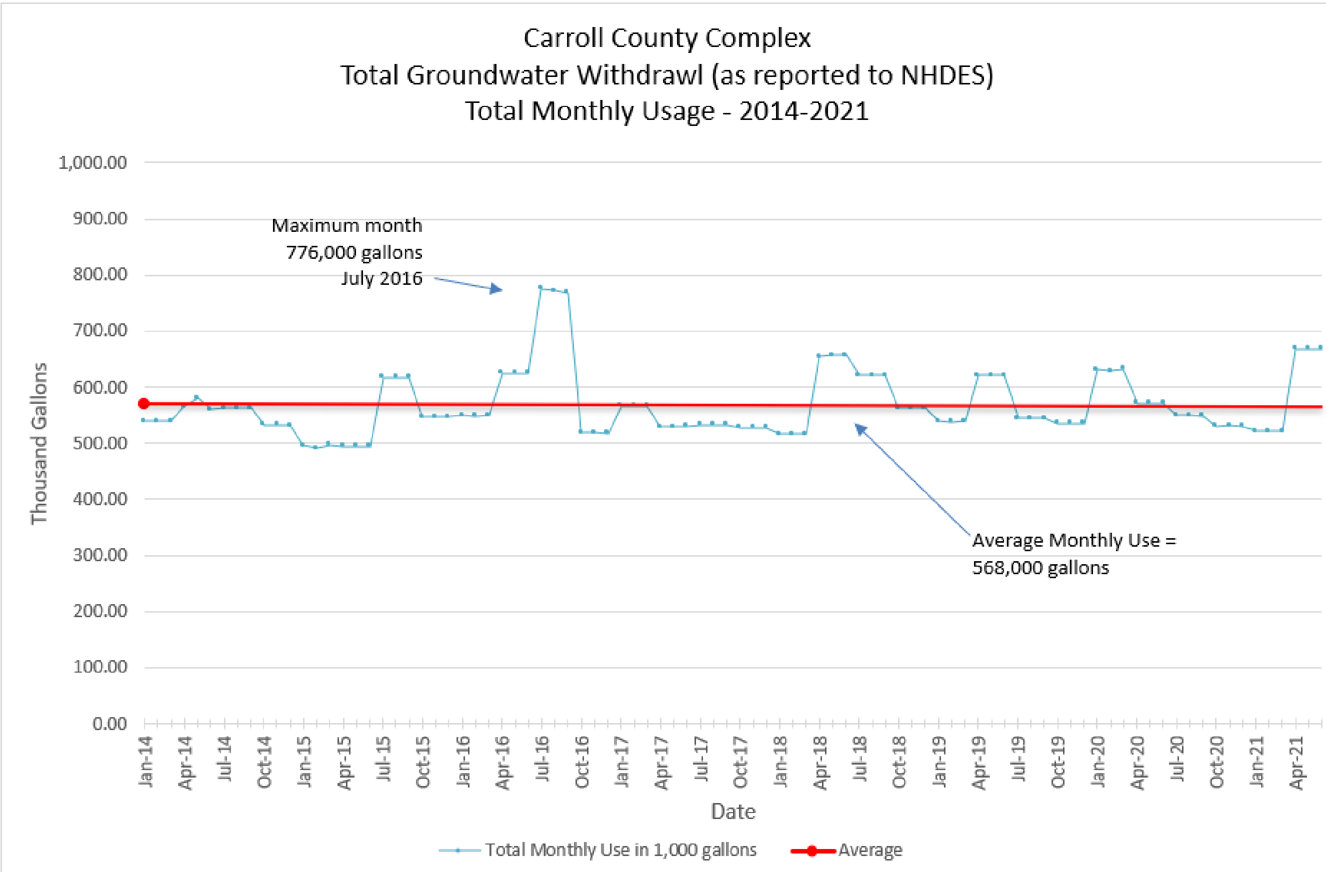


Figure 4-3 – Carroll County Total Groundwater Withdrawals



The average daily use over the entire period was about 19,000 gpd. The maximum monthly use occurred in July 2016 with a monthly use of 776,000 gpd, which would yield a maximum daily flow of 26,000 gpd. The second highest usage was 668,000 gpd in April – May 2021, which would equate to a daily usage of about 22,288 in June 2021. Using these values as maximum daily demand would underestimate this figure, since it is not a measured daily flow, but an average over the month.

Approximate historic average daily use (ADD) 19,000 gpd
Approximate historic maximum daily use (MDD) 26,000 gpd

This would equate to an average historic peaking factor (PF) of about 1.3

Using criteria (1) above, from NHDES Administrative Rules 405.10, the system design flow would be 19,000 gpd x 2 = 38,000 gpd.

Design flow based on NHDES 405.10 = 38,000 gpd

4.3 Pump Run Time

The pump control system is set to turn on BW#2 when the tank is at a level of 7.6 ft and turn it off when it reaches 8.6 ft. The tank has a volume of about 19,000 gallons/ft. If the pumping rate is constant at 24 gpm (the flow observed when we visited in August 2021), we would expect the pump to run for about 13 hours to refill the tank (with no system use).

We looked at a pump cycle over a two day period from August 30 to 31, 2021. Well pump BW#2 came on at 6 am on August 30th and ran for 30 hours, turning off at noon on August 31st. Assuming a pump rate of 24 gpm, this would yield 43,200 gallons pumped over the 30 hour period. Assuming 19,000 gallons went to raising the storage tank level from 7.6 ft to 8.6 ft over a period of 13 hours, the remaining 24,000 gallons would be assumed to be usage over the remaining 18 hour period. For comparison, based on the reported monthly volume pumped from BW#2 during August 2021, the average daily flow over the month was 21,000 gpd. Therefore, based on pump run time, it would appear that the **daily use on this date in August was about 24,000 gallons.**

4.4 Projected Future Demands

Projected demands for the Carroll County system are dependent on two factors: growth of of the County Complex, population increases in the village and system extensions. The New Hampshire Office of Energy and Planning's projected 2040 population for the Town of Ossipee is estimated to increase only 0.96% from the current population. Therefore, barring any planned water main extensions to new areas, or new developments of current property, there is little growth predicted for the village use.

Planned additions to the Carroll County Complex are unknown at this time. An expansion of 50 additional beds was assumed. At 125 gpd/bed this would increase future usage by 6,250 gpd. This results in the following current and projected average day demand flows.

Current Average daily use 19,000 gpd
Future Average daily use 25,250 gpd

4.5 Design Flow

In general, metered data is considered more representative of actual use. In this case, NHDES design standards for design flows, are very close to design flows determined by metered flows:

NHDES Table 405-1 Design Flow:	36,480 gpd
Two (2) times metered daily usage:	38,000 gpd
Maximum day metered usage:	26,000 gpd *
Pump run time August 30, 2021:	24,000 gpd

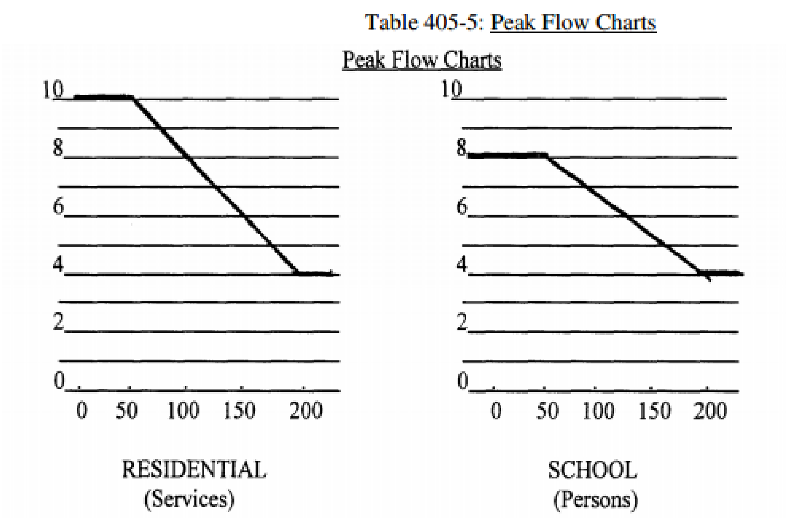
* calculated from maximum monthly water use.

We recommend a **current design flow of 38,000 gpd** be used for the existing Carroll County System. The **future design flow would be 50,500 gpd** (i.e. Future Avg Day x 2).

4.6 Peak Flow

Peak flows are typically calculated by applying a peaking factor to the average daily flow. Typical peaking factors for small systems are between 6 and 10 times the average daily flow. Peaking factors in larger municipal systems may be much lower. Env-Dw 405.19 describes the relationships between peak and design flows using peaking factors in ***Table 4-1 (Env-Dw table 405-5)*** as shown below:

Table 4-1 – Peak Flow Charts



Although there is no information specific to nursing homes and jails, the residential and school peaking factors can give guidance to estimate an appropriate peaking factor for the complex. A residential system with 40 services would have a peaking factor of 10. A school with 130 students would have a peaking factor of about 6. We recommend using a peaking factor of 6, considering the residential village uses a low percentage of the total water from the system.

Current design peak flow:
38,000 gpd design flow = 26 gpm x peaking factor of 6.0 = **158 gpm**

Future design peak flow:
50,500 gpd design flow = 35 gpm x peaking factor of 6.0 = **210 gpm**

This is a short-term flow that might occur during peak water usage. This is a flowrate that any pumps in the distribution system would be designed to meet. Since the entire system is gravity fed, and the distribution system has plenty of capacity, the peak hour flow for the system is not a significant number.

For larger municipal systems, AWWA M32 indicates that peak hour flows are typically between 1.3 and 2.0 times the maximum day demand, and are generally considered to occur for up to 2 hours. The maximum day usage (from historic monthly data) was 26,000 gpd or 18 gpm. Assuming the peak hour flow was 2 times this rate would be a flowrate of 36 gpm, which is much less than the previous estimate using small system criteria. In this case, it is more probable that the County system would behave more like a small community system than a larger municipal system, even though the system provides fire protection.

Therefore, in the absence of real-time flow data, the current estimated peak hour flow based on the small system criteria is believed to be more accurate.

Current Peak hour flowrate = 158 gpm
Future Peak hour flowrate = 210 gpm

4.7 Required Source Capacity

Section Env-Dw 405.12 of the *New Hampshire Code of Administrative Rules* outlines the requirements for source capacity in small community water systems. The minimum total required source capacity for community water systems is at least two (2) times the design flow for the system, based on a 24-hour day. With a current design flow of 38,000 gpd, the required source capacity for the system is 76,000 gpd.

Current Required Source Capacity:	**76,000 gpd**
Future Required Source Capacity:	**101,000 gpd**

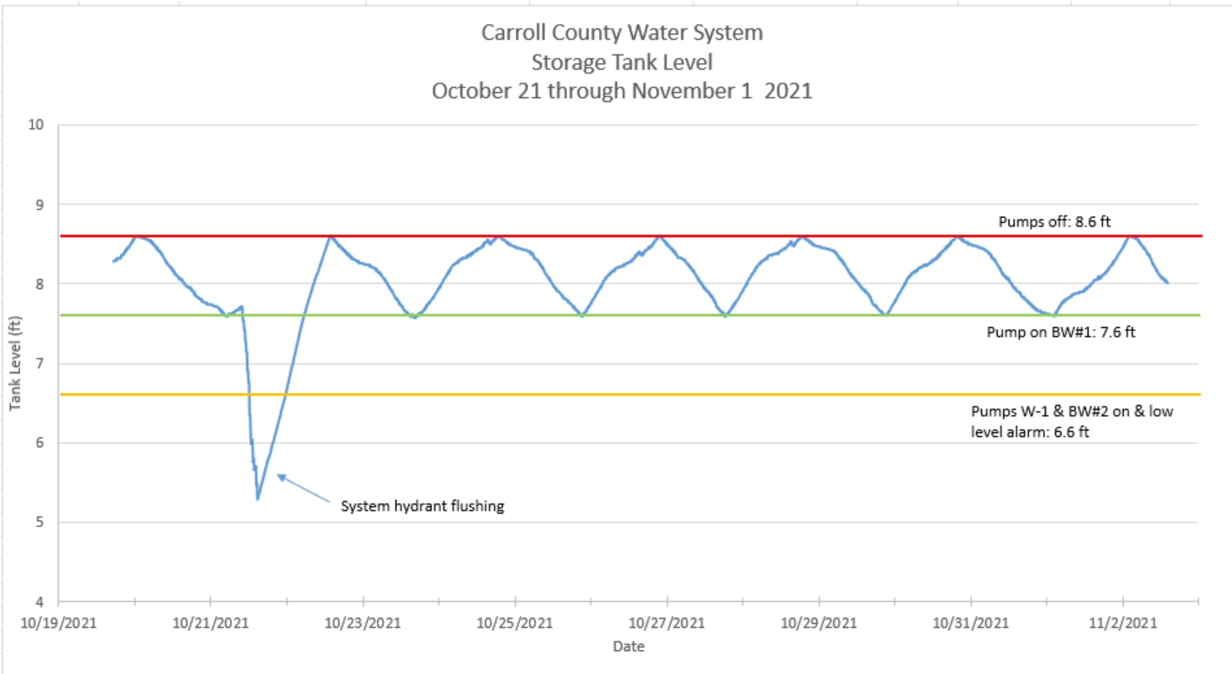
4.8 Existing Source Capacity

The yield of BW#2 was identified as 29 gpm in the 1999 Provan and Lorber Report. The flowmeter was registering about 24 gpm during our site visit in 2001. An assumed yield of 25 gpm was included for the analysis. The dug well (W-1) capacity of 15 gpm was estimated by Provan & Lorber in 1999. NHDES lists the capacity of this source as unknown. Based on an analysis of the storage tank fill after system flushing in October 2021 (see below), we have estimated the possible capacity of BW#1 at 15 gpm. All of these capacities should be field verified to perform the demand/capacity analysis.

Storage tank level analysis

We were able to obtain tank level data from the SCADA system from October 19th through November 2, 2021. Hydrant flushing was conducted during this period on October 21, so the tank level data was analyzed during the period to help evaluate system usage and pumping rates. This information is illustrated in ***Figure 4-4***.

Figure 4-4 – Carroll County Storage Tank Level 2021



On normal days (non-flushing), when BW#2 was called to run, it ran for 22.5 to 26.33 hours, with a tank fill rate of 12.4 to 14 gpm. Since the pump rate is believed to be about 24 gpm, we assume the system usage was about 10 to 11.6 gpm over the 24 hour period. Evaluating the draw cycle of the tank, when the well pumps are not operational, the tank drawdown ranged from 10.5 to 15.5 gpm (15,000-22,300 gpd). These values appear to be consistent with the previous calculations of about 19,000 gpd average daily use for the system.

Flushing

Prior to system flushing on October 21, 2021, the storage tank was filling (BW#2), but not full (level 7.71 ft) when flushing began at about 10 am. The tank reached a low level of 6.6 ft around noon, which would have turned the pumps for W-1 and BW#1 on, and triggered the low level alarm (we received word of the alarm in the field about 12:40 pm). The tank level continued to drop to a low level of 5.29 ft at 2:40 pm, when flushing was completed and the tank began filling again.

The tank did not fill to 8.6 ft to shut the pumps off again until October 22 at 1:30 pm, so all 3 pumps were presumably operational from about noon on October 21, until 1:30 pm on October 22. Using the increase in tank level between midnight and 4 am, and assuming there is no system use during that period, we can estimate the flowrate from the three wells. The tank level rose 0.7 ft over the 4 hours. With about 19,000 gallons per foot in the tank, this would equate to about 13,300 gallons over the 4 hour period, or a fill rate of 55 gpm from the 3 wells. Since we know BW#2 operates at about 24 gpm, this would mean W-1 and BW#1 combined were pumping about 31 gpm.

Depending upon the actual capacity of the wells, it appears that the system may have adequate source capacity to supply current design flows if all sources are viable long term at the assumed yields, which should be verified.

In larger systems, source capacity is evaluated by comparing the maximum daily use (about 26,000 gpd) with the available source capacity with the largest source out of service. In this case, that largest source would be BW #2, which provides nearly all of the water to the system. If W-1 and BW#1 are found to be reliable sources at the previously estimated yields, there is likely adequate source capacity. However, it is unknown if W-1 and BW #1 can supply adequate water to the system consistently and long term. The fact that air was encountered during a sampling event of BW#1 makes this somewhat suspect.

The well pump control system is programmed such that W-1 and BW #1 operate simultaneously when a low tank level is reached. However, the source meter records reported to NHDES show that water was pumped from BW#1 in Feb, April, May, and June 2021, yet flow was only recorded from W-1 in February. This has happened in other periods in the past, when flow was recorded from BW#1, but not W-1, in July-September 2017 and October to December 2014. This could signify that flow was not available from the dug wells during these periods. These sources only have metered flow a few months of the year, typically in the spring and fall. It is likely that the only time the storage tank level falls low enough to call these two sources to run is during system flushing.

The actual source capacity of the current wells is unknown. The following capacities are assumed:

BW #1	15 gpm =	21,600 gpd
BW #2	25 gpm =	36,000 gpd
Dug Wells	15 gpm =	21,600 gpd
Total estimated capacity =		**79,200 gpd**

This would meet the current required capacity of 76,000 gpd, but would not meet future requirements of 101,000 gpd if 50 beds were added to the facility.

If BW#1 and the dug wells have long term sustainable capacities of about 15 gpm each, it is likely that the system has adequate source capacity. However, if either of these sources has significantly less capacity, or is not able to provide that capacity at all times of the year, then it is likely that another source should be added to the system. Additionally, if the system is to be expanded in any capacity (additional beds at the County Complex, or significant additions to the village system), an additional source would be needed. Field investigations to evaluate the condition and long term yield of the wells will be needed to determine if adequate source capacity exists.

4.9 Required Storage

Section Env-Dw 405.18 of the *New Hampshire Code of Administrative Rules* outlines the requirements for sizing storage tanks in small community water systems. Requirements differ for systems that are served by one source or multiple sources (***Table 4-2***). With the largest source (BW #2) off-line, the source capacity of the system (using assumed source capacities noted above,) would be 43,200 gpd or 1.14 times the design flow. Based on the DES requirements in Table 405-4, the required storage would be 75% of the design flow, or 28,500 gallons. However, as previously mentioned, the NHDES rules for small systems only apply to community systems without fire flow, so this storage capacity would be to satisfy domestic use only.

Required storage capacity based on Env-Dw 405.18 (domestic only) = 28,500 gallons

Table 4-2 – Required Atmospheric Water Storage Capacity (Multiple Sources)

Table 405-4: Requirement for Atmospheric Water Storage Capacity
For Water Systems That Have More Than One Source

Minimum groundwater source capacity with largest producing well out-of-service	Atmospheric water storage capacity required
Peak flow	none required
2.5 times the design flow	25 percent of design flow
1.5 times the design flow	50 percent of design flow
Design flow	75 percent of design flow
Less than design flow	100 percent of design flow

In larger municipal systems, it is common to evaluate necessary storage using AWWA Manual of Practice M32 *Computer Modeling of Water Distribution Systems* to provide equalization storage, fire suppression storage and emergency storage. Recommended Standards for Water Works (Ten State Standards) recommends that storage facilities have sufficient capacity to meet domestic demands and fire flow demands.

Equalization storage is that required to meet system demands, above the source capacity. For example, if the three wells are capable of providing 55 gpm, but the peak hour demand is 158 gpm, the difference, or 103 gpm, must be provided by the tank. Peak hour demands are typically assumed for a period of 2 hours, which would equate to 12,360 gallons of storage. If the source capacity of the wells is determined to be less than the 55 gpm assumed, then these calculations should be adjusted.

Storage for Current peak hour demand for 2 hours = 103 gpm x 2 hrs = 12,360 gallons
Storage for Future peak hour demand for 2 hours = 155 gpm x 2 hours = 18,600 gallons

As previously noted, the last ISO survey was completed in 2017/2018 and identified the highest needed fire flow was 2,500 gpm at the nursing home for 2 hours, or 300,000 gallons. This volume is not available from the tank. The report also noted that fire flows of 3,000 – 3,500 gpm should be obtainable for 3 hours. We believe this is a general statement, and that "obtainable" could mean from off-site sources. The next highest requirements were 1,250 gpm for the administration building, and 1,250 gpm at another commercial building in the village.

Fire suppression storage = 2,500 gpm x 2 hrs = 300,000 gallons

The 1999 P&L report also noted the presence of a fire pond at the complex with an estimated capacity of 170,000 gallons. If this pond is still present, and accessible/available for fire use, then only 130,000 gallons of storage would be needed from the potable water system.

Emergency storage is recommended to provide buffer capacity in the event of an emergency, such as a power outage or unexpected equipment failure. Assuming an emergency would be resolved within two days, the emergency storage could be considered as follows:

Current emergency storage = 19,000 gpd average usage x 2 days = 38,000 gallons
Future emergency storage = 25,500 gpd average usabge x 2 days = 51,000 gallons

The Centers for Medicare and Medicaid Services (CMS) have specific requirements for nursing homes, and requires 3-days of storage. Assuming 103 beds at 125 gpd would yield a daily usage at the nursing home of 12,900 gpd. Three days of storage for that facility would be **38,700 gallons**. The County system has more than adequate storage to meet this requirement.

Therefore the recommended system storage volume, assuming the 170,000 gallon fire pond is functional, would be:

	Current	Future
Equalization storage	12,360 gallons	18,600 gallons
Fire Flow storage	130,000 gallons	130,000 gallons
Emergency storage	38,000 gallons	51,000 gallons
	180,360 gallons	**199,600 gallons**

If the fire pond is not providing functional fire storage, then the current storage required would be 350,360 gallons the the future storage required would be 369,600 gallons.

4.10 Available Storage

The storage tank has a reported capacity of about 200,000 gallons. The 1999 P&L report reported depth of the tank was 11 ft, but the pump shut-off level is 8.6 ft depth. The elevation of the tank overflow is unknown.

The tank currently has a pump shutoff level of 8.6 ft, which gives it a usable volume of about 164,000 gallons (35 ft x 75 ft x 8.6 ft, rounded down to account for baffle walls in the tank). The elevation of the tank is high enough that the entire volume of the tank is usable.

Current tank usable volume = 164,000 gallons

This meets the current storage requirements noted above (assuming a functional fire pond), but not the future requirements. If future users are added to the system, the tank overflow depth should be verified to see if the pump off setpoint could be raised to utilize more available storage in the tank.

With a current average daily flow of about 19,000 gallons, the tank will completely turn over every 8.6 days.

Sizing storage tanks for small systems like the County system with fire protection is difficult because of the need to balance potable water quality, and required fire storage. Chlorine residuals decay over time and may cause water quality issues as waterage increases. The system also has large mains (10-inch, with some 8-inch), which also provides significant residence time in the sytem. The current tank is more than adequate for current and future potable needs. Therefore, if additional storage is needed in the future, separate fire storage at the County Complex should be considered. This is where the high fire flow demand exists, and separate fire storage would not impact water quality concerns for the potable system.

We understand that the fire pond is not currently operable. It has not been cleaned out in 25 years and the ice has broken the pipe at the elbow. This has reportedly broken multiple times at the elbow. The fire chief reports that the pond can be used for fire protection when the pond is not frozen, but not when the pond is frozen because of the broken pipe.

We would not recommend adding additional storage to the potable water system, as the 8+ day current residence time is already lengthy. Instead, separate additional fire storage is recommended, which appears to be achievable by verifying the volume, and restoring the use of the existing fire pond.

4.11 Rate Evaluation

The 53 service connections (258 service population) are billed quarterly at a uniform rate. The current water rate for is $0.40/100 gal plus a $100 per quarter service charge. In 2020, the average monthly water usage based on meter data was 3,121 gallons per service connection. This is less than the state average of 6,000 gallons/month/service connection.

Carroll County was compared to the 126 participating utilities in NHDES's Table of Rate Structures for FY 20-21. At 4,000 gallons/month, the closest quantity to Carroll County's average usage for which data is provided, Carroll County was the 27th most expensive water utility in the state. Carroll County was also compared to a similarly sized water utility with the same rate structure: Plainfield Village Water District (284 service population). At 4,000 gallons/month, Carroll Country was 19.6% more expensive than Plainfield Village Water District which was ranked 53rd most expensive water utility in the state.

When compared to the statewide average annual water bill of $587.35 for 71,996 gallons, a Carroll County customer would pay $687.98 for the same annual quantity. A state affordability index is calculated by dividing the state annual average water rate by the statewide MHI, and comparing said state index to that calculated by using the same parameters for the specific utility

The median household income (MHI) for Carroll County is $62,917 (according to the NH Water Rate Dashboard), and the State-wide MHI average is $76,768. According to the NH water rate dashboard, the mean affordability for the system is therefore 1.1%, meaning the annual average water bill is 1.1% of the median household income, compared to a state average of 0.8%. Therefore, it appears the County would meet the disadvantaged status regarding loan/grant funding from the Drinking Water SRF.

The current water rates charged to the village appear to be reasonable. They are slightly above the state average. Based on metered usage, the village customers use about ¼ of the water produced by the system, and based on a cursory review of the DPW budget and water costs, the reveue generated appears to be reasonable given this usage.

4.12 Source Capacity and Demand Analysis

Ossipee Village Use

A meter vault is located near the maintenance building, which contains a compound meter. This meter was presumably intended to meter water leaving the Complex going to Ossipee Village. Downstream of this vault is a yard hydrant in the field between the Complex and Rtoute 28 (for watering the blueberry bushes). It is unclear where the connections for the Maintenance Building and Jail services are located, but they are believed to be from a branch main near the hydrant upstream of the vault.

An attempt was made to monitor water use (daily/weekly) at the vault during the month of October 2021, but based on meter readings returned by the Carroll County Complex maintence staff it appears the register on the low flow side of the meter is not operating correctly. The only operational dial on the meter was that of the hundreds, meaning verification of water used and comparison with billed water can not be performed. The high side flow of the meter appears to be operational and registered 34,940 gallons between October 26 and November 3rd, the week after the fire flow testing. There are 6 or 7 fire hydrants downstream of this meter (depending on where the hydrant near the jail is tied in). Assuming 6 hydrants downstream which were flushed during the test, the metered volume would average approximately 5,823 gallons flushed per hydrant. At a flushing rate of about 1,200 gpm, this would mean each hydrant was flushed for 4-5 minutes, which appears reasonable.

5. Recommendations

5.1 Existing sources

The capacity of the three existing well sources is largely unknown. BW#2 was operating at 24 gpm during a site visit in August, and this well is used as the primary source, supplying nearly all of the water for the system. There is antecdotal evidence that the other two wells (W-1 and BW#1) might contribute about 15 gpm each, but it is unknown if they are capable of that flow, or if it is sustainable long term, and during all times of the year. Testing of the wells to evaluate their capacity is recommended, and if necessary, exploration and installation of an additional source.

Additionally, there are no level transducers in the wells to monitor water level or to protect the pumps from damage in the event of a low water level. We recommend the following improvements to the existing sources:

1. Inspect existing wells and verify capacity
   - Remove pumps & inspect, verify well depth and water level depth in each of the wells. (open them up, see what is there and what is functioning).
   - Verify presence or absence of conduits between the wells and the control buildings (for level transducers).
   - Verify operation of Wells BW #1 & W-1, and pumping flowrate. This may be done by turning BW #2 off at the HOA switch and forcing BW#1 and W-1 to operate alone to fill the tank.
   - Verify the pumping rate of BW#2 throughout its pump cycle, drawdown and long-term yield..
   - Verify drawdown in each of the wells
   - Perform pumping tests on the wells to monitor drawdown over time, estimate the safe yield of each, determine if there is any interference between wells, and determine the Wellhead Protection Area (WHPA) for each source.
2. Install stilling tubes and level transducers in each well and connect to the SCADA system. Install safety interlocks to shut down the well pump if water level reaches a low level.
3. Clear brush from wellheads and upgrade the access road to allow easier maintenance
4. Replace wooden electrical boards for disconnects at the wells (W-1 should be replaced; further assess condition at BW-1 and 2).
5. W-2 and W-3 - clean and assess the condition of concrete covers; patch/resurface the concrete as necessary.
6. If W-1 and BW#1 are found to have adequate, reliable, long term yields year-round, consideration should be given to altering the control system so that the

wells are alternated each time the tank requires filling (perhaps BW#2 one cycle and W-1 and BW#1 together on the next cycle). This will allow resting of BW#2 and provide more even wear on equipment.

5.2 New supply source

The long term sustainable yield of the existing sources must be verified to determine if an additional source of supply is necessary. Currently, BW#2 supplies nearly all of the water to the system, with BW#1 and W-1 only operating occasionally. Until the necessary field work can be completed to determine the condition and yield of the existing sources, it is prudent to carry funds in the budget for a new source.

5.3 Well Meter Building

The meter and treatment building was constructed 20 years ago. The building structure in general is in good condition. However, some of the equipment is nearing the end of it's useful life, and should be replaced. Additionally, upgrades should be made to the control system, and a chlorine analyzer installed.

1. Replace three positive displacement meters on source discharges.
2. Replace the positive displacement distribution meter with equipment to provide signal to SCADA (this is currently not operable).
3. Upgrade the SCADA system so that information from the system can be accessed from the office, and so that the data can be stored long-term. Data retrieval is currently limited to only a couple of weeks prior to the retrieval date, and can only be accessed by the SCADA consultant.
4. Replace the SCADA system modem to a 5G model.
5. Replace areas of wall plywood as necessary, including insulation, to replace water/moisture damaged sections. Install FRP panels over all walls and ceiling.
6. Trim trees/branches from incoming electrical line
7. Replace propane heater
8. Assess condition of ventilation fan and louvers, and replace if necessary.
9. Install a chlorine residual analyzer and connect it to the SCADA system; install drywell for analyzer discharge if necessary.

At the time of this evaluation, based on the data available, we have assumed that treatment for iron and manganese will not be required.

5.4 Storage Tank Repairs

The storage tank is in need of some concrete and other minor repairs, as outlined in the 2018 tank inspection report, as follows:

Tank Exterior

1. The tank inspector recommended removing the expansion rivets and aluminum strips to roll back the rubber membrane and expose the exterior wall surfaces.
2. Power tool clean all surfaces of the exposed exterior walls (approx. 20%) having concrete spall to prepare the substrate and resurface all spalls with concrete repair material to seal the exposed reinforcement steel and prevent further concrete fatigue.
3. Repair cracked and deteriorated exterior corners of the tank, including exposed rebar.
4. Apply an elastomeric sealant having an ANSI/NSF 61 approval throughout the entire joint between the roof and walls to seal the junction and prevent intrusion into the tank.
5. Repair 4" x 2" tear in the roof membrane on the centerline of the easternmost side of the tank by applying sealant over the area.
6. Repair the aluminum strips and expansion rivets securing the roof membrane on the northernmost side of the tank where it has pulled free for approximately 36-inches.
7. Excavate metal overflow pipe at tank penetration, power tool clean to remove corrosion, coat the pipe and restore partial burial.

Tank Interior

1. Repair three 1/4-inch gaps between the roof and wall junction ranging from 2-inches to 12-inches in length on the eastern side of the tank. Apply an elastomeric sealant having an ANSI/NSF 61 approval throughout the entire joint between the roof and walls to seal the junction and prevent intrusion into the tank.
2. Repair a 20 ft section of joint between the precast concrete roof panels where the foam backing rod material has become dislodged. This is approximately 8 ft from the wall on the westernmost side of the tank.
3. The surfaces of the metal pipes that penetrate the tank wall are not coated and have mild corrosion on all surfaces. Power tool cleaning of the surfaces to remove corrosion and re-coating of the surfaces are recommended.

The existing fire pond at the complex is not fully functional and usable for 170,000 gallons. The volume of the pond should be verified. The pond should then be cleaned out and the piping repaired to restore the pond to full use.

5.5 Distribution System Improvements

The majority of the distribution system was installed in 2001 and appears to be adequately sized, and in good condition. There is a 4-inch main on Old Route 28 that is believed to be PVC, that should be replaced. This main is old, and too small to provide adequate fire flow to the hydrant at the end of the main. We recommend replacement of approximately 2,300 LF of water main on Old Route 28, with new 8-inch ductile iron pipe.

All 12 hydrants in the system should be replaced with a more modern hydrant model, with better parts availability. The DPW would like to replace the hydrants with Model B84B American Darling hydrants. This will require draining and shutdown of the system to depressurize the system to replace the hydrants.

The compound meter in the vault near the maintenance shed, which is not functioning properly, should be repaired or replaced.

New meters should be installed throughout the County Complex, including a new radio meter reading system. A radio read system will allow the County to read meters more reliably and more frequently. The current manual reading of meters means that sometimes meters can't be read if they are inaccessible due to blockage of access, by cars, owner's items, snowbanks, etc. The new system would also allow the meters to be read monthly providing better data on the system operation. The meters in the village are over 20 years old and should be replaced to ensure accuracy in tracking and billing. Radios for the new reading system should be installed on the village meters, as well as the new meters within the complex.

5.6 Management & Maintenance Recommendations

General operation and maintenance recommendations for the system include the following:

1. Inspect/clean tank every 10 years
2. Clear/mow paths over water mains annually to allow access in the event of a main break or other maintenance. This includes the mains from the wells to the pump house, from the pump house/tank to the courthouse. The main between the maintenance building and County Farm Road, near Rte 28 is already maintained as a hayfield.
3. Open dug wells and visually inspect annually
4. Hydrant flushing annually (this is currently performed by the Ossipee Center fire department).
5. Maintain records of daily meter readings for the source and distribution meters.
6. Maintain records of chlorine dosage/usage & residual testing.
7. Exercise all valves in the system annually
8. Clear trees and trim branches from electrical lines feeding the well meter building
9. Read the meter in the vault near the maintenance building monthly and compare to metered/billed usage.

An asset management plan should be considered for the system. This plan would finish the distribution system mapping that RCAP solutions started, and inventory the assets of the water system, their age, anticipated life, and replacement cost. The plan would help the County plan ahead for various repairs and replacements. NHDES strongly encourages systems to develop a plan and requires partial plans be completed for any infrastructure they help fund. They are currently providing grants for up to $100,000 to help systems pay for the plans.

5.7 Opinion of Probable Cost

Underwood Engineers' Opinion of Probable Cost (**See Table 5-1**) is based on the above recomendations and is estimated at $3.51 Million.

Carroll County
Engineer's Opinion of Probable Cost
Water System Improvements
Date: 11/8/2021

CAPITAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total	Phase Total
HYDROGEOLOGIC ASSESSEMENT OF WELLS					
BR-1					
Clear & construct access to BR-1	LS	$10,000	1	$10,000	
Engineering coordination for pumping tests	LS	$5,000	1	$5,000	
Evaluate water level and pump at BRW #1 to evaluate air issue, pump test (eval interference w/ BR-2)	LS	$20,000	1	$20,000	
BR-1 Subtotal				***$35,000***	
BR-2					
Engineering coordination for pumping tests	LS	$5,000	1	$5,000	
Pump test BR-2 to confirm safe yield	LS	$20,000	1	$20,000	
W-2 Subtotal				***$25,000***	
W-1					
Engineering coordination for pumping tests	LS	$5,000	1	$5,000	
Inspect 3 dug wells - Open covers; check water levels; document depth, pump test each	LS	$20,000	1	$20,000	
W-1 Subtotal				***$25,000***	
HYDROGEOLOGIC ASSESSEMENT OF WELLS					**$85,000**
STORAGE TANK					
Exterior					
Minimal surface excavation around tank to fully expose concrete surfaces to be repaired	LS	$5,000	1	$5,000	
Remove aluminum strips & expansion rivets and roll back membrane roof to access concrete walls & roof joint	LS	$1,000	1	$1,000	
Power tool clean exposed spalling concrete areas	LS	$5,000	1	$5,000	
Repair spalled areas.	LS	$5,000	1	$5,000	
Apply elastomeric sealant - ANSI/NSF 61 approved for potable water throughout the entire roof/wall joint to seal tank	LS	$10,000	1	$10,000	
Coat exposed exterior walls w epoxy/polyurethane flexible coating to seal and protect exposed concrete	LS	$10,000	1	$10,000	
Resecure rubber membrane	LS	$1,000	1	$1,000	
Repair easternmost edge of rubber roof in area of failure.	LS	$1,000	1	$1,000	
Excavate overflow pipe at tank, clean and coat	LS	$2,000	1	$2,000	
Exterior Subtotal				***$40,000***	
Interior					
Power tool clean pipes inside the tank to remove corrosion and coat the metal pipe (one bottom and one on western side) ; fix hangar for 4" PVC pipe	LS	$10,000	1	$10,000	
Repair 1/4" gap between walls and roof on eastern side of tank	LS	$10,000	1	$10,000	
Repair joint between concrete ceiling planks	LS	$2,000	1	$2,000	
Drain tank and Install temporary by-pass tank (while tank is off-line)?	LS	$20,000	1	$20,000	
Interior Subtotal				***$42,000***	
Restore fire pond capacity and functionality					
Clean/excavate pond	LS	$5,000	1	$5,000	
Repair piping for pumper connection	LS	$2,000	1	$2,000	
				$7,000	
STORAGE TANK SUBTOTAL					***$89,000***
WELLS					
Level Monitoring					
Level transducers	EA	$3,000	3	$9,000	
Conduits and wire between meter building and wells	LF	$45	1500	$67,500	
Replace wooden backboard for junction box at W-1	LS	$1,200	1	$1,200	
Install Junction boxes at each well	EA	$500	3	$1,500	
Pull bedrock pumps, inspect & install stilling tubes; reset pumps	EA	$1,500	2	$3,000	
Mount stilling tube in dug well for transducer	EA	$500	1	$500	
Level Monitoring Subtotal				***$82,700***	
Misc wells					
Allowance for repairs to well pumps & other equip in wells	LS	$50,000	1	$50,000	
Misc wells Subtotal				***$50,000***	
New Source					
Hydrogeologic Review of Available Groundwater Resources and Hydrogeologic Setting of the Selected Study Area – Project Site	LS	$30,000	1	$30,000	
Specific Siting of Exploratory Test Wells within the Study Area – Conduct Geophysical Surveys	LS	$50,000	1	$50,000	
Production Well Drilling -- Convert the Highest Yielding Exploratory Test Wells to Large Diameter Production Well(s	LS	$100,000	1	$100,000	
Long-Term Pumping Tests on Highest Yielding Wells	LS	$100,000		$0	
Preparation of Final Hydrogeological Report – Submittal to the NHDES for Public Water Supply Source Approval	LS	$45,000	1	$45,000	
Road to new well	LF	$150	500	$75,000	
Water main/power/signal to new well	LF	$200	500	$100,000	
Pitless, pump, level transducer, drop pipe, etc.	LS	$50,000	1	$50,000	
SCADA modifications for new well	LS	$8,000	1	$8,000	
Water conservation plan (if need new well)	LS	$8,000	1	$8,000	
New Source Subtotal				***$466,000***	
WELLS SUBTOTAL					**$598,700**

METERING/ CHLORINATION BUILDING					
Exterior					
Clear trees for electrical service to station	LS	$1,500	1	$1,500	
Exterior Subtotal				***$1,500***	
Interior					
Replace select areas of damaged walls (around chlorine area), scrape peeling paint	LS	$1,500	1	$1,500	
Install new FRP panels on walls & ceiling	LS	$3,000	1	$3,000	
Replace propane heater	EA	$2,500	1	$2,500	
Paint existing piping	LS	$5,000	1	$5,000	
Add continuous chlorine residual monitor & tie into SCADA (assume spare I/O exists)	LS	$12,000	1	$12,000	
Programming associated with chlorine residual monitor	LS	$2,000	1	$2,000	
Install drywell for analyzer discharge	LS	$5,000	1	$5,000	
Replace rusted wireway	LS	$2,500	1	$2,500	
Replace source and distribution meters	EA	$1,200	4	$4,800	
Replace 4-20 mA signal from distribution meter to PLC	LS	$1,200	1	$1,200	
capacity	LS	$5,000	1	$5,000	
Additional software to view SCADA info from office	LS	$2,000	1	$2,000	
Upgrades to SCADA panel	LS	$15,000	1	$15,000	
Cellular modem upgrade for SCADA	LS	$5,000	1	$5,000	
Interior Subtotal				***$66,500***	
METERING/ CHLORINATION BUILDING SUBTOTAL					**$68,000**
DISTRIBUTION					
Site Work					
Clear Water main corridor from tank to courthouse min 20 ft for access for repairs	LS	$5,000	1	$5,000	
Clear access from pump house to wells (existing road), clear over pipeline from W-1 and W-2 to W-3	LS	$2,000	1	$2,000	
Upgrade road to Wells & make drivable					
Excavation	CY	$12	814	$9,768	
Crushed gravel, 6", compacted	CY	$56	272	$15,232	
Bank Run gravel, 12", compacted	CY	$47	543	$25,521	
Site Work Subtotal				***$57,521***	
Hydrants					
Shutdown & drain main 3x; night work; coordination	LS	$25,000	1	$25,000	
new valves for hydrants	EA	$1,500	12	$18,000	
Replace hydrants with new Aerican Darling B-24-B hydrants	EA	$4,500	12	$54,000	
Hydrants Subtotal				***$97,000***	
Water Mains					
Replace 4" PVC main on Old Rte 28 with new 6" or 8" D.I. main	LF	$300	2300	$690,000	
Replace services to curb stop	EA	$1,200	15	$18,000	
Water Mains Subtotal				***$708,000***	
Radio Read Meters					
New Radios	EA	$209	50	$10,463	
Contractor admin, scheduling, tracking, record documents	LS	$10,000	1	$10,000	
Command link for ipad	EA	$650	1	$650	
Sensus radio read software	LS	$4,275	1	$4,275	
Installation, training & 1 year support	LS	$3,600	1	$3,600	
Radio Read Meters Subtotal				***$28,988***	
Ossipee Meters					
Replace residential meters (existing are 20 yrs old)	EA	$500	42	$21,000	
Ossipee Meters Subtotal				***$21,000***	
County Complex Meters					
Install meters in Complex buildings	EA	$4,860	7	$34,020	
Repair or replace compound meter in the vault near the maintenance building	LS	$5,000	1	$5,000	
Piping modifications req'd for new meters	EA	$1,200	7	$8,400	
County Complex Meters				***$47,420***	
DISTRIBUTION SUBTOTAL					**$959,929**
GENERAL/ MISC.					
Construction Subtotal					***$1,720,000***
Bonds, Insurance, General Conditions				11.5%	*$197,800*
Contractor Overhead & Profit				15%	*$258,000*
2 yr escallation to construction (5% per year)				10%	*$172,000*
Contingency				25%	*$344,000*
Total Probable Construction Cost					***$2,690,000***
Engineering - Preliminary Design, grant applications & permitting				3%	$10,300
Engineering - Final Design and Construction				25%	$672,500
Hydrogeological Phase					$85,000
New DPW Truck					*$50,000*
TOTAL RECOMMENDED IMPROVEMENTS COST					***$3,508,000***

6. Funding Evaluation

6.1 DWSRF

The Drinking Water State Revolving Fund (DWSRF) was established in 1996 as part of the Amendments to the Safe Drinking Water Act to provide assistance in the form of low-interest loans to public water systems to finance the cost of drinking water infrastructure. DWSRF funding is made available to states from the USEPA. The program is administered in New Hampshire by NHDES. Loans are offered with terms of 5, 10 or 20 years. A loan term of 30 years is available for disadvantaged systems or communities. Public water systems eligible for this program include all publicly and privately owned community water systems and non-transient non-profit public water systems.

A DWSRF pre-application is required in June for the following year's program. Projects are prioritized using a point ranking system which is defined in the Intended Use Plan (IUP) issued by NHDES. DWSRF typically offers 20% loan forgiveness, with an additional 10% forgiveness available if an applicant meets the definition of "disadvantaged" (serves residents whose median household income (MHI) is less than the statewide MHI based on the most recent census data and/or income survey), and if the resulting project user rate (which is the total of the existing rate in addition to the rate that results from the new project) exceeds the statewide affordability criteria. However, NHDES has received additional ARPA funds that have been used to increase grant funding, and many projects are currently receiving 30% up-front grant funding (as opposed to loan forgiveness).

The repayment period begins one year after the project improvements have been in operation. During construction, an interest rate of only 1% is applied.

The DWSRF Program requires that an asset management maintenance and renewal plan (AMRP) be developed for the funded asset(s). A system-wide AM Plan is not required by the DWSRF program although it is strongly encouraged.

The DWSRF Program is subject to federal provisions including Davis-Bacon and Related Acts (require payment of prevailing wage rates for all construction projects), American Iron & Steel (AIS), Disadvantaged Business Enterprise rules, Environmental Review and Single Audit.

6.2 American Recovery Plan Act (ARPA)

ARPA money is federal funding that has been allocated to municipalities through the Coronavirus State and Local Fiscal Recovery Funds (CSLFRF). Carroll County was approved to receive about $9 million in grant monies from this program, which may be used for water, wastewater, broadband communication, small business grants and lost revenue, due to the Covid pandemic. The County may use these funds to aid in the water project. It is our understanding that the CSLFRF funds must be obligated by December 31, 2024, and expended by December 31, 2026. Annual reporting is required in October of each year.

6.3 Asset Management Grant Program

The NHDES Drinking and Ground Water Bureau (DWGB) offers grants for the development of asset management programs for community water systems which serve populations of 150 or greater. The goal of the Asset Management Grant program is to create a centralized location to provide information, technical assistance, and funding opportunities for communities with the development of sustainable asset management programs. In the past, this program offered $20,000 matching grants (with the Owner providing $20,000). This year, the program is providing 100% grants up to $100,000 for community water systems to conduct asset management initiatives for drinking water infrastructure. The goal of asset management is to help communities shift from a reactive to proactive management.

Projects eligible for funding must include the following:

- Asset inventory and mapping with condition assessment and risk analysis
- A financial review that identifies current rates and determination if they reflect true cost of service. This cost of service is a monetary amount that must be reached for a utility to cover its costs to operate and earn a reasonable return for planning of future investments. Additionally, a capital investment plan and/or long-term funding strategies must be included to plan for replacement costs for existing assets and any improvements identified as being needed in the next 10 years
- A defined Level of Service developed using a workshop approach. This workshop should involve stakeholders such as operators, management, ratepayers, and engineers (if applicable).
- Implementation plan and community outreach strategy. This plan will address the use, the frequency of the review, and revision process to be submitted with the application. The plan must be done in coordination with the person(s) responsible for maintaining and executing the plan.
- Upon completion of the Asset Management Grant, complete an entry into the New Hampshire Asset Management Database (NHamD).

After approval, grant funds will expire after two years and the NHDES will not reimburse any completed work prior to grant approval. Grant applications are due January 7, 2022, and we recommend the County apply for a grant to accomplish this work.

This plan would help document the County's water infrastructure facilities, condition, and plan future needs. This is additional work that would be helpful and useful for the County to have, but was not included in the preliminary project estimate that was prepared at the start of the project.

6.4 Strategic Planning Grants Program

A new program being offered for 2022 is the Strategic Planning Grant program, offered by the NHDES DWGB to help community water systems improve their water infrastructure by initiating projects, and allowing them to apply for and receive funding for construction of eligible drinking water projects. Grants up to $50,000 may be awarded with no community match required. Projects may exceed $50,000, but grant funding will be capped at $50,000.

Planning efforts eligible for this grant include:

- Preliminary engineering evaluations
- Source exploration/hydrogeological investigation reports
- Capital improvement/water system business plans
- Master plans
- Community planning studies involving public water infrastructure components
- Other professionally prepared documents intended to enhance system capacities

The items listed above are not all-inclusive, and others may be considered for funding after review by the DWGB. To be eligible for this grant, community water systems must serve a population of 150 or greater. The NHDES will not reimburse any completed work prior to grant approval and if approved, grant funds will expire after two years. The deadline for applications for this program is January 7, 2022. We recommend the County apply for these funds to help offset the cost of hydrogeological investigations to evaluate source capacity and preliminary engineering.

6.5 Community Development Block Grant (CDBG)

The US Department of Housing and Urban Development provides grants to support economic development through improvements to public facilities, specifically, Public Facilities Grants for Water and Sewer. These grants are administered by the NH Community Development Finance Authority (CDFA). Eligible activities include; extending or replacing water or sewer lines, constructing water or sewer treatment facilities, constructing water storage facilities, and development of new water supply wells. Through a competitive process eligible applicants can receive implementation grants of up to $500,000 annually. A requirement for funding is that at least 51% of the population served must be of low to moderate income. This would have to be established by an income survey of the resident population.

Another requirement is that applicants must provide a 1:1 match of CDBG funds with non-CDBG funds. Counties are eligible applicants, however, per NH Administrative Rules, assistance for systems serving medical facilities and nursing homes are given low priority. Specifically, Cdfa 306.03 (b) states that, "Although an eligible activity, assistance for water and sewer systems serving primarily medical facilities and nursing homes shall be of low priority and shall receive 0 points when scored, as compared to the 50 points which an eligible activity otherwise shall receive." Along with this, Cdfa 310.01(m)(2) states that, "A county water or sewer system serving primarily institutionalized populations shall be eligible only if matching funds authorized for such improvements meet or exceed $1,500 per bed." If the Nursing Home has 103 beds and the Correctional Facility has 40 beds the County would need to come up with $214,500, as a threshold requirement and would not receive any points in the scoring process. A competing applicant that serves typical residential water users would receive anywhere from 10 to 50 points for this match depending on the percentage of non-CDBG funds compared to CDBG funds. This places the County in a disadvantageous position in terms of points in a competitive process.

There are two yearly deadlines for submitting applications for CDBG funds, the last Monday in January and the last Monday in July. It is our understanding that the January round is less competitive than the July round.

6.6 USDA Rural Development (RD)

The Rural Development (RD) Office of the US Department of Agriculture (USDA) offers a grant and low interest loan program for improvements to water and wastewater systems. Funds can be used to cover engineering, construction, property or easement acquisition, and equipment. Eligible applicants must serve communities of less than 10,000 or be economically challenged. Based on past discussions with RD, there was some question as to whether the County would fall under the Water and Waste Disposal Loan and Grant Program or the Community Assistance Program. Subsequent contact with RD's Washington D.C. office determined that the County would fall under the Water and Waste Disposal Loan and Grant Program, which is preferred as it offers much better grant and loan opportunities. The maximum grant amount is 75% of the project cost, but this is unusual. Grants up to 30% to 45% are more common. Grant eligibility is dependent both on the need/purpose of the project and on the MHI of the service area as compared to the statewide MHI. In the County's case, the average MHI of the entire County would be used to make this determination. The loan term is 30 years. In poverty areas, the term can be 40 years which reduces annual payments.

The actual grant/loan percentage eligibility takes into account user fees, debt on the system, new debt, and current and future O&M costs. Based on all these factors, RD makes a determination of what the grant recipient can afford to pay. This is in part based on an Equivalent Dwelling Unit (EDU) calculation. An EDU is defined as the level of service in gallons per day for an average residential dwelling. A typical municipal system is made up of residential, commercial, institutional, and perhaps industrial users. Using water meter data, a calculation is made on how much water an average single-family residence uses. The total system usage, minus leakage, is then divided by this amount to determine the number of EDUs. The County system is only partially metered (primarily the village users), so the system could be split between residential and institutional uses. RD typically uses a figure of 1.5% of the MHI as the amount that is affordable per EDU. The RD underwriters would likely look at what the County can afford, including the projected O&M cost for the selected project.

Before RD can commit funds to a project, authorization from the political body being served must be obtained. For a municipality, this would be a positive bond vote. In the County's case, this is assumed to be a positive vote by the County Commissioners and/or delegation.

To apply for RD funding, it is necessary to complete and submit a Preliminary Engineering Report (PER) and an Environmental Review (ER) in the format required by RD along with the application. While this report was not prepared strictly as a PER, it would form the basis of the report required by RD. The ER report would also be required. In the past RD accepted applications throughout the year which competed for funds in a national pool. Recently, a change was made such that USDA Vermont and New Hampshire have state allocation funds and they have typically instituted an application deadline of January 29th each year to compete for this local pool in a less competitive process. The complete PER and ER would need to be submitted by the January 29 date. To compete in the more competitive national pool, the application deadline is typically April 15.

6.7 DWGWT

The Drinking Water and Groundwater Trust Fund provides loan and grant funds for drinking water projects. The Trust Fund board looks for projects that have exhausted all other funding sources first. They require a complete project plan when applying and require signature of the authorizing board and evidence of approval as part of the application.

Ranking criteria for this program include:

1. Whether the proposed project results in the removal, reduction, or mitigation of contamination related to groundwater or drinking water.
2. Project readiness demonstrated through methods including but not limited to letters of support from local entities, preparation and submittal of preliminary engineering reports, and confirmation of approval of funds from leveraged funding sources. DWGTF funding requires that outside funding has been exhausted, the project maximizes non-DWGTF funding sources and maximizes trust fund loan over grant.
3. Consistency with the applicant's established Asset Management Program and proposed management of assets, Capital Improvement Plan, and rate analysis associated with the project.
4. DWGTF Rules for Construction.
5. Impact on economic development.
6. Energy efficiency.
7. Water efficiency in ensuring a minimization of water loss.

8. Enhancement of source water protection or acquisition of water sources for public consumption.
9. Long-term viability of the project.
10. The fairness of the geographic distribution of project awards.
11. Distribution system extensions.
12. Proof of thoroughness with respect to both applications and project development.
13. Innovation.
14. Whether the project serves a public water system with a low Median Household Income (MHI) or high Affordability Index (AI). AI is the project user rate divided by the community or water system's MHI.

Trust funds are not subject to Davis Bacon or AIS requirements. If after applying for other grant and loan programs, other funding options have been exhausted and the impact of the project makes the debt service unaffordable, the County could then apply to the DWGWT fund.

7. Conclusions

7.1 Funding

The total project cost is estimated to be about $3.5 Million.
We recommend the County apply for the following grant programs by January 7, 2021:

- Asset Management Grant Program: $50,000 (not included in the $3.51 Million above)
- Strategic Planning Grant Program: $50,000

The remainder of the funds (approx. $3.46 Million), should come from the County's ARPA funds. Alternatively, the County could apply to the DWSRF fund in June for a low interest loan, which may have up to 20% grant.

7.2