Comprehensive System Facilities Plan

For the Limerick Water District
Limerick, Maine



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#21508

March 18, 2020

Mr. Tony Carroll, Chairman
Limerick Water District
PO Box 180
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RE: Comprehensive Water System Facilities Plan for the Limerick Water District

Dear Tony:

We are pleased to submit this Comprehensive Water System Facilities Plan for the Limerick Water District. This study is intended to document the system needs, provide estimates for future costs and rates and help secure funding for needed upgrades.

This report includes a general inventory of the system with attention being given to the capital needs of the water system. We have developed a hydraulic system model, recommended a water main replacement program using` risk assessment methodology, evaluated favorable areas for ground water sources, addressed future issues that may affect the District, developed cost estimates for recommended improvements and assessed the impact on future rates.

This plan should be a "living document" that is used to help guide the future of the Water System. It should be updated periodically to document the progress and accomplishments of the System and prioritize future work.

It has been a pleasure to work with you on this project. We look forward to continuing our association with the Limerick Water District.

Sincerely,
Dirigo Engineering

Timothy D. Sawtelle, P.E.
President

Ricky S. Pershken, C.G.
Project Manager

Enclosures

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1. ABBREVIATIONS

AC – Asbestos Cement
ADD – Average Daily Demand
ASL - Anticipated Service Life
CDBG – Community Development Block Grant
CF—Cubic Feet
CO2 - Carbon Dioxide
CPI – Consumer Price Index
CT – Contact Time
CUPPS - Check Up Program for Small Systems
DEP -Department of Environmental Protection
DS – Dead Storage
DWP-Drinking Water Program
DWSRF—Drinking Water State Revolving Loan Fund
EPA – Environmental Protection Agency
ES – Emergency Storage
GPD – Gallons per Day
GPM – Gallons per Minute
FSS – Fire Suppression Storage
HUD – Housing & Urban Development
ISO – International Organization for Standardization
LWD – Limerick Water District
MCL – Maximum Contaminant Level
MDOT – Maine Department of Transportation
MEMA – Maine Emergency Management Agency
MGD - Million Gallons per Day
MGY –Million Gallons per Year
MHI – Median Household Income
OLW – Outside Lever & Weight
OS – Operating Storage
PE – Polyethylene
PF – Probability of Failure
PIS – Pipe Impact Score
PPB - Parts per Billion
PRV – Pressure Reducing Valve
PUC – Public Utilities Commission
PVC – Poly Vinyl Chloride
RD – Rural Development
RCAP – Rural Community Assistance Partnership
RoF –Risk of Failure
RUL – Remaining Useful Life
SCADA – Supervisory Data Acquisition & Control
SS – Standby Storage
TDH – Total Dynamic Head
VFD– Variable Frequency Drive

2. INTRODUCTION

The purpose of this report is to document the current and future needs of the LWD water system, to prioritize needs, estimate costs and to develop a schedule for implementation. This evaluation of the system needs was based on the experience and opinions of the District and Dirigo Engineering, along with current and anticipated government regulations regarding the safe operation of a public water supply. This report also includes an analysis of the system's current capabilities based on existing information. This study is a living planning tool and should be updated every 5 to 10 years to help the LWD remain on a sustainable path.

The LWD water system serves a total of approximately 232 residential customers, 13 commercial, and 3 governmental customers. The water system consists of approximately 5.3 miles of transmission and distribution water mains of varying sizes and age, along which are located 44 public fire hydrants and 3 private hydrants. The District has a 200,000-gallon concrete reservoir with booster station, a 300,000-gallon welded steel standpipe, a pump station with one gravel well and a pump station with one bedrock well.

The major issues currently facing the Limerick Water District are:

- Elevated levels of iron and manganese in the gravel well leading to numerous customer complaints
- Disinfection byproducts in the distribution system
- Arsenic in the bedrock well water
- Mangamenet of a small water system with limited financial resources.

In the future, the LWD may be faced with changes in demand and other changes. Demand is expected to increase slightly or remain stable through the planning period; however, a new large user could reverse this trend. Most needs will be driven by aging equipment, safety considerations, federal regulations regarding water quality, and the general need to modernize equipment. It is the goal of this report to help the District make the best decisions regarding these improvements allowing the water system to continue to be sustainably operated.

3. SUMMARY

Dirigo Engineering has prepared a Comprehensive System facilities Plan for the LWD Water System. The Plan has identified several areas of system needs and makes recommendations for addressing these issues. The study period is 20 years or up to 2040.

First, the existing condition of the water system was evaluated. The present source of supply is a gravel well located off the Emery Corner Road near a bog associated with Leavitt Brook and a deep bedrock well that is currently used as an emergency backup supply located off Washington Avenue. The LWD has excellent office procedures and staff, and operator training, safety and public service has always been a high priority.

Until recently, the water system lacked a licensed operator. This service is being provided by Water Quality and Compliance Services on a contract basis.

We evaluated the system with respect to several areas:

- water production and adequacy of supply and storage
- water quality and treatment
- water system reliability
- water storage needs
- office & equipment
- water main replacement

In general, the water quality is aestehetically unpleasant due to high levels of iron and manganese. There are recent The capacity of the supply has been adequate.

Recommendations for future improvements have been made in each area of the system. Each area is discussed in detail. These recommendations have then been prioritized into three phases: short term, midterm and long term. In addition, we have developed a pipe ranking system to help prioritize needed main replacements.

Recommended projects include:

- Rehabilitation of Washington Street Well
- Replacement of Emery Corner Well
- Prioritized Water Main Replacement, 6,000 feet in the next 20 years.

Cost estimates for the short-term (5 years), mid-term (10-years) and long-term improvements (20-years) have been prepared. In addition, Dirigo has recommended the District start a Capital Reserve account and has provided an estimate of the rate increases necessary to pay for the recommended projects.

The total estimated costs are as follows:

- Short term - $847,305.00
- Midterm - $1,075,370.00
- Long term - $1,308,605.00

The impact on rates with these improvements has also been estimated. The analysis indicates that current rates should be raised approximately 23% now to start funding a Capital Reserve Account. This increase is in addition to the recent 59.82% increase.

It is estimated that the impact of the short-term improvements would be an increase in rates of about 50% percent. The midterm improvements would result in an additional increase of 48% and the long-term improvements an additional increase of 35%. The cumulative rate increase over the 20-year planning period is estimated at 270%.

4. STUDY AREA

4.1 Communities Served

The Limerick Water District distribution system extends from Newfield Road in the west to just east of Pickerel Pond Road on the east. The District service area is shown in Figure 1 below. The primary service area follows along Washington Street, Emery's Corner Road, and Central Avenue with some small streets being serviced along the way. A detailed GIS based system map can be found in Appendix 1.

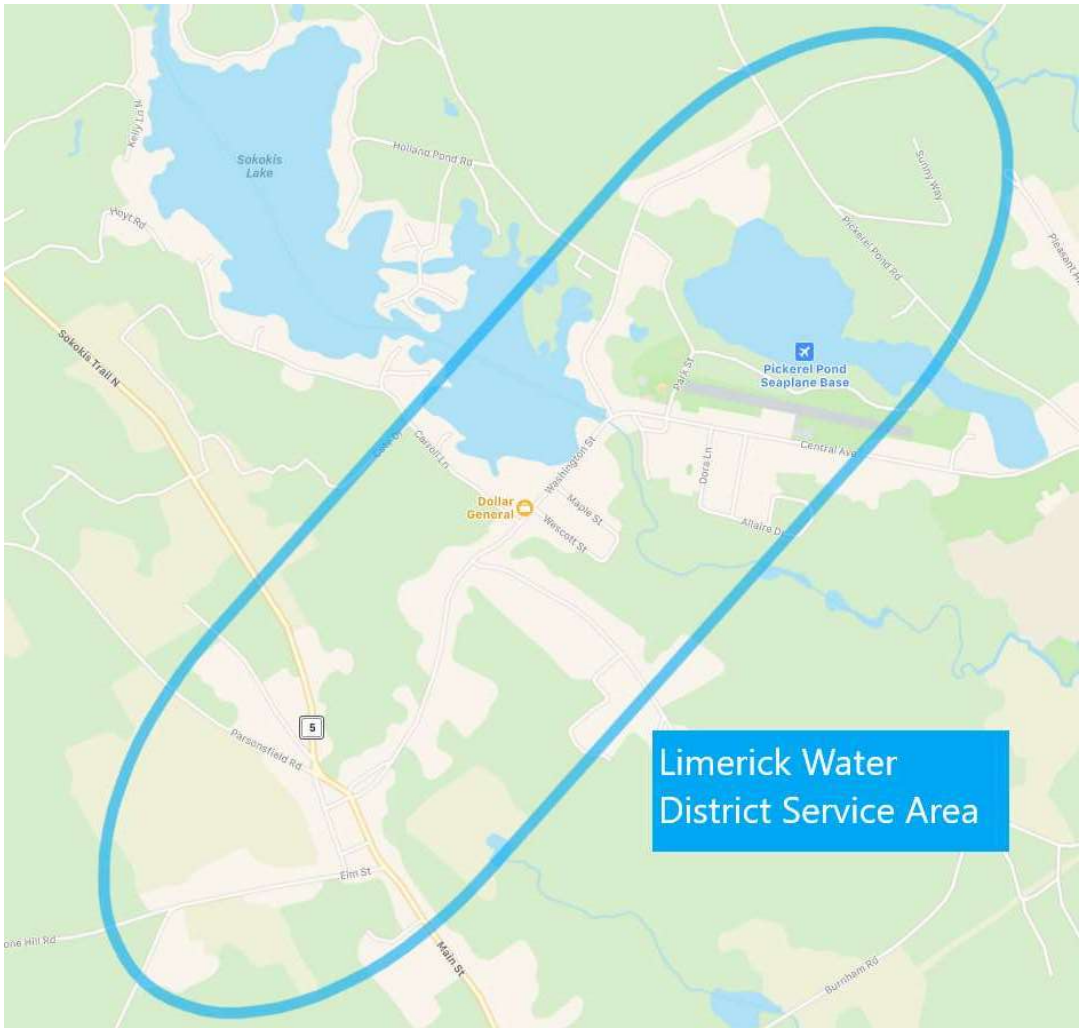


Figure 1- Limerick Water District Service Area

4.2 Community History, Population

The Town of Limerick was originally settled circa 1775 and incorporated in 1787. Limerick was a thriving farming community with primary crops including hay, apples, grapes and cranberries. In 1846 The Limerick Manufacturing Company was founded and began producing the Holland Blankets, which were used by troops throughout the civil war.

Population in Limerick has increased in recent decades. Table 1 below provides population data and projected population data from the Maine State Economist website.

Table 1 – Population Trends

Year	Population
2006	2704
2011	2910
2016	2914
2021	2952
2031	2979
2036	2976

The Median Household Income for the Town of Limerick was reported to be $50,547 in the 2010 Census.

4.3 Water System History

Limerick's first water system was constructed in 1899 by the Limerick Mill Corporation. The system's primary source of supply was a series of five springs which were located on the hill south of the Mill. Water flowed from the springs by gravity into a domestic distribution system with small diameter pipe. The system served Limerick Mills.

In 1909 a 175,000-gallon circular reservoir was constructed. The reservoir was constructed with a stone foundation with brick above grade. The reservoir was located adjacent to the springs at an elevation of 437 feet.

In 1913 the Limerick Water & Electric Company was formed to provide domestic water and fire protection to the Limerick Mills area. The Company installed new piping and developed a new water supply. The new sources of supply for the water system included a 500 foot deep (approximate) drilled well. The well has an approximate capacity of 17 gallons per minute and is located inside Pump House No. 1 on Washington Street. The second source was a shallow dug well located adjacent to the Bosal Foam Mill. This well had an approximate capacity of 40 to 60 gallons per minute. This source was discontinued when the dug well was contaminated by a fire at the Bosal Foam Mill in June 1994. The bedrock well is currently an emergency back-up source.

Circa 1917, the water system was purchased by Western Maine Power Company. In 1925 Western Maine Power Company was absorbed into the Central Maine Power Company. The new owner constructed the upper village water system and connected it to the existing system at Pump House No. 1. Booster pumps were added to Pump House No. 1 to pump water from the 175,000 gallon reservoir into the upper system. Storage for the upper village system was a 3,500 gallon elevated tank located behind the Bank on Main Street. In 1925 the existing 300,000 gallon riveted-steel reservoir was built. The reservoir is located at the western-most end of the water system at an elevation of 688.

The water system eventually came under the ownership of a local resident, Mr. Arthur Lougee. The system was then operated as the Limerick Water Company.

In 1958 the Limerick Water District was formed, and the water system was purchased. From 1958 to 1994 the water system remained essentially unchanged with the exception of a few short water main extensions along Route 160 and Route 11. In December of 1990 the District began chlorination to comply with an engineering order from the Maine Department of Human Services.

During the 1960's and 70's the District conducted a test drilling program to search for a new well supply. The drilling program did not have great success with sites that were close to the system and the search was suspended. Unfortunately, we could find no reference in the LWD files regarding these early test drilling investigations.

During the early 1990's Trichloroethylene (TCE) was discovered in the system's water. The District was working with the Maine Department of Human Services and the Department of Environmental Protection to remove the TCE from its water. In June of 1994 an aeration system to remove the TCE had just been installed on the dug well when a major fire occurred at the Mill in Limerick on June 10, 1994. This fire catapulted the Limerick Water District into a severe water supply crisis.



Photo 1- Bosal Foam Fire, 1994 (Maine DEP photo)

In the process of fighting the fire, millions of gallons of water were pumped from Sokokis Lake and dumped on the fire. This water leached through the building debris and into the soils under the Mill. As water was pumped from the District's dug well over the following days contaminated water was pulled toward the well and eventually pumped into the water system.

As soon as problems were encountered, the District immediately began to work around the clock to solve them. Temporary pumps and piping were installed to pump water from Sokokis Lake into the system and by July 1, 1994 the District had the water system flushed of all contaminated water. Water from Sokokis Lake was being delivered to the system on an emergency basis.

Once the water system was on the emergency lake supply, the District immediately pursued the installation of a temporary well. A temporary well was located and drilled in a gravel pit adjacent to Brown Brook and south of Route 11. The well was connected to the system using some borrowed temporary surface lines. A small chlorination shack was also used. It has been reported that this well was extremely high in iron although no records could be found.

In the summer and fall of 1994 a search was conducted in Limerick for a new groundwater supply. Potential well sites were identified and 2½-inch test wells were drilled and pump tested off Route 11 near Leavitt Brook and off the Emery Corner Road near Leavitt Brook. The District made the decision to pursue the "Libby Site" off the Emery Corner Road because it had the potential for the best yield and also because it was a site that should lend itself better to long-term protection.

A 12" diameter naturally developed well was installed at the Libby site to a depth of 50 feet (below top of casing) in December 1994. The well has an estimated safe yield of over 300 gpm and originally had excellent water quality. However, the water quality has deteriorated significantly over the years, most likely due to the well's proximity to a peat bog.

A 12" diameter ductile iron transmission main was installed from the Watson Hill Road to the proposed pump station site in the fall of 1994.

In January of 1995 the Limerick Water District started pumping water from its new well on the Emery Corner Road to the water system through the new transmission main. This was done using a temporary chlorination shack for housing chemical feed equipment and controls. In May of 1995 construction on the new pump station was started and the new pumping station was placed in operation in September of 1995.

5. EXISTING SYSTEM

An investigation of the existing conditions was performed to establish a baseline for recommendations. This provides a snapshot of the system as it currently exists and identifies the strengths and weaknesses of the system.

We separated the existing system assessment into several major categories:

- Buildings
- Land
- Water Usage
- Water Supply
- Storage
- Transmission and Distribution System
- Storage

Each item is discussed in the following sections.

5.1 Buildings

The LWD maintains several buildings in support of water district operations. These buildings are:

- Washington Street Pump House
- Washington Street Office
- Emery Corner Pump House

5.1.1 Washington Street Pump House (Pump House #1)

The Washington Street Pump House was constructed in 1913, apparently on top of a bedrock well that was likely the primary source of supply for the town. Apparently, the well was formerly equipped with a line shaft turbine.

In addition, the building contained booster pumps that were used to pump water from the old reservoir to the standpipe on Academy Hill (Village tank).



Photo 2 - Washington Street Pump House

The old pumping equipment has been removed although many of the old supports are still in place. The well pump is now a submersible, hung on 2-inch diameter galvanized drop pipe. The well is plumbed to pump directly to the system with a timer control.

The building is brick and stone masonry with a flat membrane roof, measuring approximately 20' x 20'. The exterior masonry has recently been repointed and the roof was replaced recently. The interior requires work to remove old piping, protruding bolts, concrete supports and defunct controls. There is also cracking evident on the interior brick walls and concrete ceiling. In addition, the exterior wood trim requires scraping and painting.



Photo 3- Interior of Washington St. Pump House

The building houses a 400 amp (currently w/ 250 amp breaker) electrical distribution panel which has branch circuits running underground to the nearby office and reservoir booster pump chamber.

This building has several needs including:

- Electrical fitting repair (conduit seal cracked)
- Removal of old pumping equipment
- Interior masonry repair

5.1.2 Washington Street Office

The Washington Street Office is now used as long term storage space and little else. It is a one story wood frame structure with a shingle roof and concrete basement foundation. The building has been well maintained and is in fair condition on the exterior. A new roof will be required during the planning period of this study.

5.1.3 Emery Corner Pump House (Pump House #2)

The pump station building is of masonry construction with a wood trussed roof. The building was constructed in 1995 and is in good condition.

The exterior walls are constructed of 8" split-ribbed exterior blocks insulated with Vermiculite, 4" interior blocks and 2" Thermax insulation between the two layers of blocks. Interior walls are constructed of 6" masonry blocks. The ceiling is sheathed with AC plywood with 12" of fiberglass insulation above.



Photo 4- Emery Corner Pump House

Heating is provided by propane wall heaters and electric baseboards.

The building generally appears to be in very good condition. The roofing is starting to show its age and should be replaced in the next few years.

5.3 Land

The LWD owns several parcels of land. The following parcels in Table 2 were identified from deed research and the Town of Limerick tax records.

Table 2. LWD Water Land Ownership			
Lot	**Location**	**Size (acres)**	**Use**
15-2-A	Emery Corner	8.9	Pump Station #2/Well
15-2-D	Emery Corner	3.8	Wellhead Protection
15-2-C	Emery Corner	5.6	Wellhead Protection
23-102	Washington St.	7.8	Pump Station #1/Reservoir/Booster Station/Office
23-66	Behind Mill	0.06	Contaminated dug well
30-25	Academy Hill	0.14	300,000 gallon standpipe

5.2 Water Usage

Table 3 shows a breakdown of customers by class in 2004 and 2018.

Table 3. LWD Water Customers		
	2004	**2018**
Residential	205	232
Commercial	13	13
Industrial	0	0
Governmental	3	3
Fire Services	3	3
Total	224	251

The table shows an increase of 27 customers of the LWD between 2004 and 2018.

5.2.1 Production Water

Production water is defined as the amount of water produced from the source. There are several subsets of production water including:

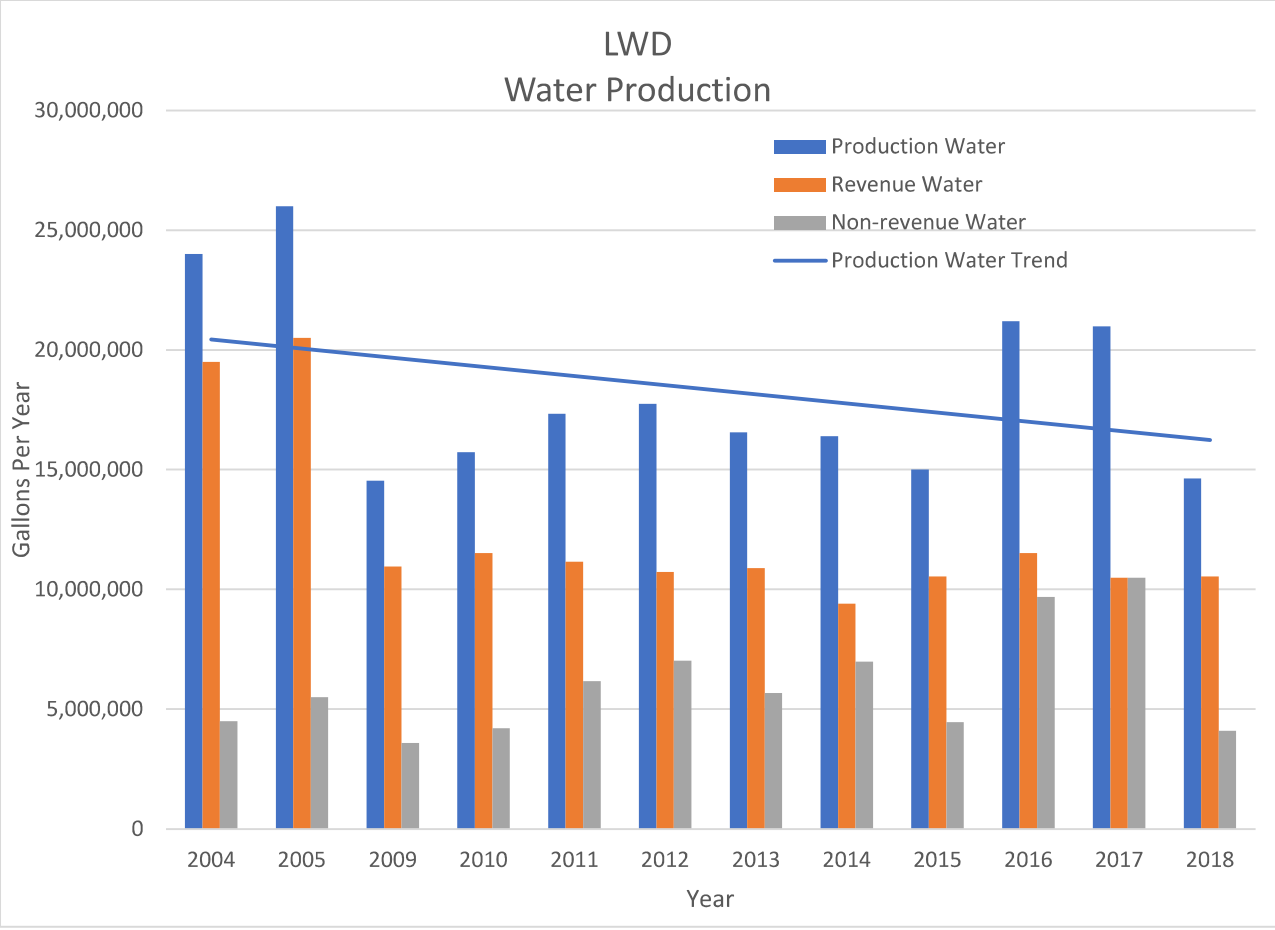
- Revenue water – this is water that is billed, usually through customer meters.
- Non-revenue water – this is water that is produced but not billed. There are two subsets of non-revenue water
    - Accounted for non-revenue water – this is water that is used for fighting fires, flushing the system, testing meters and other purposes. This is generally non-metered and is usually estimated. This is generally not an accurate number due to the difficulty of making these estimations.
    - Unaccounted for water – this is water that is simply lost. This can include unknown leaks, meter errors, unauthorized use of water or other undocumented non-

revenue water. Water Districts generally strive to maintain less than 10% unaccounted for water.

Figure 1 is a graph of water produced, revenue water and non-revenue water for the LWD water system from 2004 to 2005 and 2009-2018. Water production from 2006 to 2008 was not available on the PUC website.

- 2005 was the highest year of production with 26 MG
- 2009 was the lowest year of production with 14.5 MG
- 2018 production was second lowest at 14.6 MG
- Overall, there has been a declining trend in water use from 2004 to the present
- Non-revenue water has been up and down, ranging from 19% in 2004 to 65% in 2016. The amount of non-revenue water is high.
- Because LWD does not track accounted for non-revenue water, the non-revenue water is reported as unaccounted for water.

Figure 2 - Water Production & Use



5.2.2 Unaccounted for Water

Unaccounted for water is the difference between water pumped from the wells (production water) and water sold (revenue water) to the LWD customers and non-metered water used for other purposes. From 2004 to 2018, LWD unaccounted water (as reported on annual PUC reports) has ranged from less than 19% (which is not possible) to a high of 65% in 2016.

Unaccounted for water is difficult to track because it is estimated by subtracting accounted for non-revenue water from non-revenue water. All of these are generally unmetered uses. The accounted for non-revenue water should tracked as best as possible by measuring and/or estimating the non-revenue water. Whichever methods are used, the LWD should be consistent year to year in how they determine non-revenue water.

Sources of unaccounted for water would include:

- Unknown illegal connections or un-metered use
- Unreported fire system use
- Undiscovered leaks
- Meter inaccuracy

Inaccurate metering can be a source of unaccounted for water. Large meters should be calibrated frequently as they can be a significant source of revenue. Residential meters should be calibrated or replaced at least once every 10 years. The production meters on the well pumps should also be calibrated frequently to more accurately determine unaccounted for water.

Water system leaks are another source of on-going unaccounted for water. Leaks are repaired soon after they are discovered, however, they will always be a source of unaccounted for water. An annual main replacement program helps tighten the system and reduce the amount of unaccounted for water due to water main leaks.

Unauthorized and unmetered uses are difficult to account for. The LWD records indicate 14 unmetered customers. These unmetered customers should be metered as soon as feasible. Fire services are generally not metered and can be a source of unaccounted for water. PUC regulations require owners of fire services to report their annual usage to the water supplier but in practice, we have not seen this done in Limerick or elsewhere.

5.3 Water Supply

5.3.1 Sources

Since 1995, the primary water source for the LWD has been the Emery Corner Gravel Well. This well is a 12-inch diameter naturally developed gravel well. The well is 48 feet deep and has a 110 slot (0.110”) stainless steel screen that is 10 feet long. The yield of the well is estimated at 300 gpm based on the original 2-day pumping test completed in 1994.

The secondary source for the LWD is the 500 foot deep bedrock well located in Pump Station #1 on Washington Street. Based on historical pumping rates and a verbal report from Frank Hegerty, this well has a capacity of approximately 17 gpm.

5.3.2 Emery Corner Well and Pump Station

The Emery Corner Road supply includes a well, transmission main and pumping station. The pumping station includes an aeration system, clear well, duplex finish water (service) pumps, chemical storage room, chemical treatment equipment, metering, water quality monitoring equipment and a small laboratory. The components are described in more detail below.

5.3.2.1 Gravel Well

The Limerick Water District's primary source of supply is a 12" diameter naturally developed well located about 450 feet north of the Emery Corner pump station. The well has a depth of 50 feet below top of casing. At the time of installation, the well had an estimated safe yield of over 300 GPM and excellent water quality. A copy of the 1994 record drawing showing the well, pump dimensions and the connection to the transmission main can be found in Appendix 2 along with additional well data. A copy of the Water Quality Analysis results from December 1994 is included in Appendix 3 along with additional water quality data. The iron and manganese concentrations in the well water have increased significantly in the ensuing 25 years and are currently an aesthetic quality problem for the District. The well's water quality is addressed in more detail in the treatment section.

The well is located in a gravel bank surrounded by wetlands and a generally swampy area on the western side of Leavitt Brook. The well head is enclosed by a security fence.

Condition – The well and screen appear to be in good condition. Due to the elevated iron and manganese results the well and screen require cleaning at least annually. The iron and manganese levels should be reduced by treatment.

Recommendations:

-Inspect and rate well and pump annually

-Clean well when specific capacity drops by more than 10%.

5.3.2.2 Well Pump

The original well pump was a Crown S6-150, 1 Stage submersible turbine pump with a C-Trim impeller. The original pump pumped at about 145 GPM at 40 feet of TDH. The motor was 3 HP, 240-volt, single phase Franklin Electric submersible motor with its starter and capacitor box located in the electrical room at the pump station. There is a local electrical disconnect at the well head.

5.3.2.3 Transmission Main

The transmission main from the well to the pump station is 6" diameter Class 150 C-900 PVC. The pipe extends from the connection at the well to a 6" ductile iron valve and tee assembly adjacent to the pump station. The 6" ductile iron extends into the pump station to the operations room. The pipe has not had any reported operational issues. The pipe has a capacity of over 300 GPM.

5.3.2.4 Station Piping

The station piping is shown schematically in Figure 3. The station piping includes 3" Sensus W-350S turbo meters for both raw water and finish water flow. When these meters need to be replaced or when future piping changes are made, we recommend that the meters be replaced with electromagnetic flow meters. The electromagnetic meters have no moving parts and do not require strainers. The existing meters have turbos, fins and strainers that can wear or coat with substances that cause metering inaccuracies.

5.3.2.5 Aeration System

The station includes a multi-staged diffused bubble aeration system. The original system was sized and intended to provide 93 percent removal of radon at 175 GPM and 10°C. The raw water radon had tested at 4300 pci/l and the target finish water radon level was 300 pci/l. In addition to the net reduction in radon the aeration system has been effective in the reduction of CO_2 in the raw water which contributes to a modest increase in the raw water pH.



Photo 5- Aeration Unit

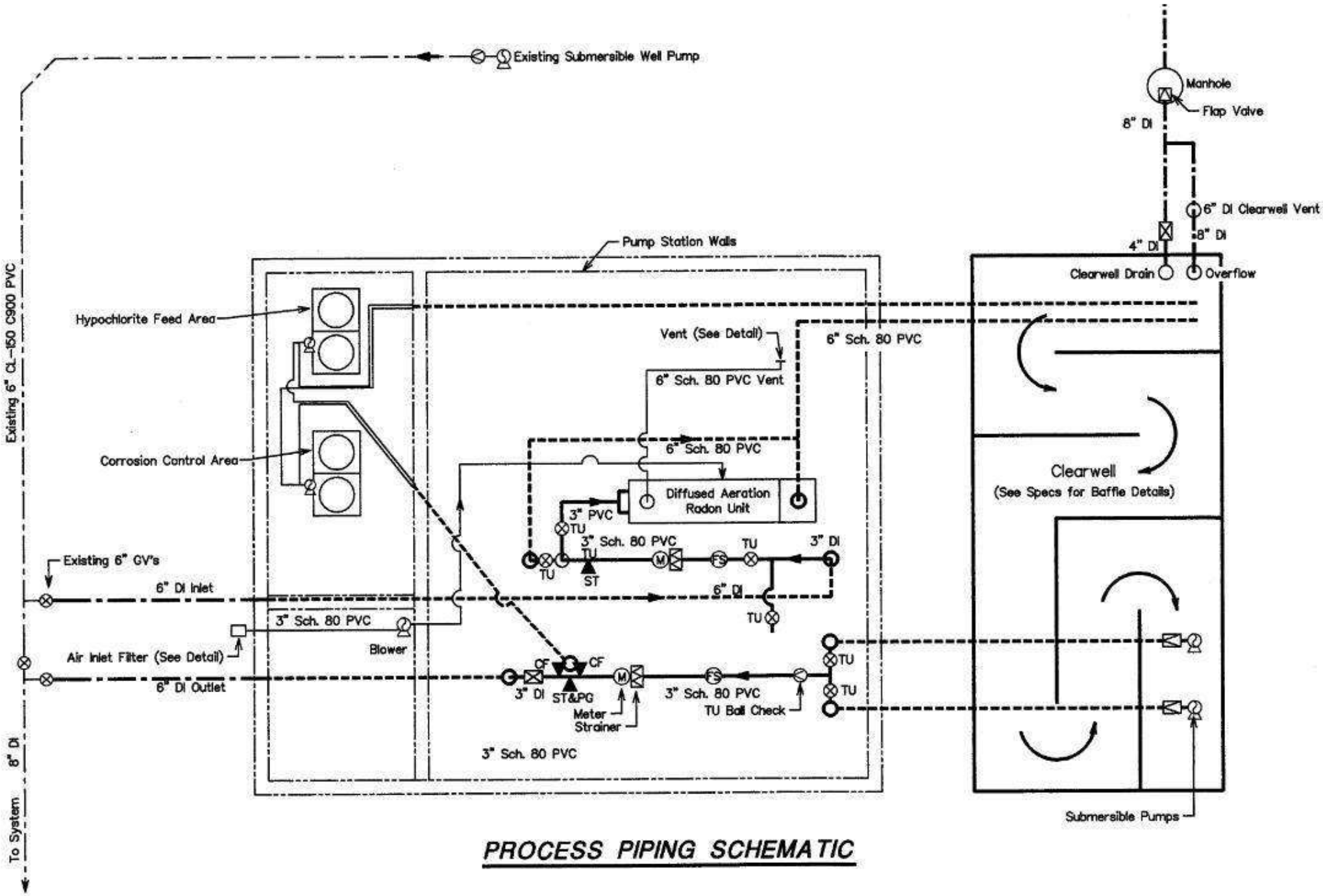
The aeration system is an Aeromix Breeze VOC stripping unit. The manufacturer's original label on the sides of the units notate the unit as a "Compact VOC Stripping System". However, the unit was installed primality for radon reduction and any other removal such as CO_2 is a secondary benefit. There has never been a requirement for VOC stripping at this pump station.

The aeration tank is a ½" thick polypropylene tank with baffles, stainless steel CYCLONE air diffusers and a sealed air-tight polypropylene cover. Sealed tank connections are provided for water inlet, water discharge and gas venting/ discharge. The tank includes 6 aeration chambers and 1 quiescent chamber. The system includes a regenerative centrifugal blower rated for 280 SCFM at 24" of water head. The motor is 5 HP, 240-volt, single phase.

Condition – The aeration system appears to still be in good condition. The system does need to be cleaned at least annually to remove oxidized iron and manganese from the unit. During the cleaning process the baffles, diffusers, etc. should be inspected and repaired as needed to keep the system functioning efficiently. In addition, the inlet and outlet filters for the blower should be inspected and cleaned on a regular basis.

5.3.2.6 Clear Well

The foundation for the operations room is a 16,000-gallon baffled concrete clear well. The clear well provides contact time for disinfection internal to the station. In addition, the clear well allows for dissipation of any air that may still be diffused in the water prior to pumping of the finish water



PROCESS PIPING SCHEMATIC

to the system. The clear well includes an 8" ductile iron overflow pipe and a 4" ductile iron drainpipe connected to a common drain line.

Recommendations:

-Clean clearwell and pumps regularly

5.3.2.7 Finish Water Pumps

The station includes duplex submersible turbine pumps for pumping finish water from the clearwell to the distribution system. The pumps are installed in cans or wells within the clearwell that keep water flowing past the motors. The pump discharges are directed through pitless adapters to the finish water piping.

The original finish water pumps were Crown S6-150, 2 Stage submersible turbine pumps with a B-Trim impeller. The original pump pumped at about 125 GPM at 95 feet of TDH. The motor was 5 HP, 240-volt, single phase Franklin Electric submersible motor with its starter and capacitor box located in the electrical room. There is a local electrical disconnect near the pump.

We recommend consideration be given to utilizing VFDs for phase conversion of these pump motors to three phase power in the near future.

5.3.2.8 Chemical Treatment

Disinfection

Currently the District feeds sodium hypochlorite (bleach) in its raw water just after the aeration unit as the water enters the clear well. The District purchases the bleach in small carboys, pumps it into a 35-gallon storage/day tank where it is diluted with water to their preferred concentration. The solution is pumped to its injection point at the clear well access hatch by an LMI diaphragm pump whenever the well pump is on and the raw water meter indicates raw water flow.



Photo 6 - Chemical Storage at Emery Corner PS

Corrosion Control

Currently the District feeds N-Sodium Silicate in its finish water for corrosion control purposes. The Silicate is injected in the finish water main as water is pumped to the system. The District purchases the Silicate in barrels and pumps it into a 35-gallon storage/day tank at full strength. The undiluted Silicate is pumped to its injection point in the finish water piping by an LMI diaphragm pump whenever a finish water pump is on and the finish water meter indicates finish water flow.

5.3.2.9 Online Monitoring

The station is equipped with online monitors for:

- Well Flow
- System Flow
- pH
- Chlorine
- Temperature
- Chart recorder for flow
- Reservoir Level Control

Currently, the pH/Cl/temperature meter is not hooked up and District personnel are taking manual readings. When this device is reconnected, the District should maintain and calibrate this device on a monthly basis.

The station also has an autodialer for alarms which consist of:

- pH alarm (high/low)
- Cl alarm (high/low)
- Clearwell alarm (high/low)
- Building low temperature alarm

5.3.2.9 Electrical

The pump station is fed by a 200 Amp 120/240 Volt single phase overhead service entrance across Emery Corner Road and then underground to the station. The electrical service available on Emery Corner Road is single phase only. The existing service has plenty of energy for the current and any currently anticipated loads at this location.



Photo 7- Pump Protection & Starters

There is a manual transfer switch that can be used with a portable generator to provide emergency power to the station. In the future the District should consider the addition of an automatic transfer switch and permanent generator to provide uninterrupted service from this station.

5.3.2.10 Controls

The Limerick Water System does not currently have any control related communications between any of its facilities. The finish water (service) pumps at the pump station are started and stopped manually by the operator or in automatic mode by a 24-hour time clock. In addition to the time

clock the pump station does include a clear well level indicator with control setpoints based on clear well level. The control logic for the station is summarized as follows:

Finish/ Service Pump

Put desired pump in "Auto"
Time clock starts and stops pump
Pump is stopped by clear well controller on low level to protect pump

Finish Water Chemical Feed

Chemical Pump called when Finish/ Service Pump is called
And flow must be indicated by meter

Well Pump

Well pump must be in "Auto"
Well Pump is called and stopped based on clearwell level

Aeration Blower

Blower must be in "Auto"
Blower is called and stopped based on clearwell level (same as well)

Raw Water Chemical Feed

Chemical Pump called when Well Pump is called
And flow must be indicated by meter



Photo 8- Station Control Panel

5.3.2.11 Control Upgrades

The Limerick Water System needs to upgrade its system control system so that the major system pumps and processes can be automated. The system controls should allow the operators to remotely see and control the process. In addition, alarms should be automatically sent to the operator and important operational data should be recorded.

The primary piece of operational data missing currently at the Emery Corner Road Pump Station is the water level at the reservoir. When the reservoir water level is automatically transmitted to Emery Corner Road the entire station can be automated. Full SCADA would include:

- Computer/HMI at District Office
- RTU at Emery Corner Pump Station
- RTU at Washington Street Pump Station
- RTU at Mills Reservoir
- RTU at Village Tank
- Communications between sites (radio, cell, dedicated phone, etc.)

5.3.3 Emery Corner Road Well Treatment

The 12" diameter naturally developed well at the Emery Corner Road pump station had excellent water quality in 1994 when it was brought online. The iron and manganese results in 1994 and in recent tests are shown below in Table 4 along with the drinking water standard.

Table 4. – Gravel Well Iron/Manganese

Parameter	1994 Results	2017 Results	Standard/ Limit
Iron	0.03 mg/l	1.1 mg/l	0.30 mg/l
Manganese	<0.01 mg/l	0.089 mg/l	0.05 mg/l

The current results are well above the secondary limits. Iron and manganese levels in this range cause red, brown and black water issues in the water system. The iron and manganese are oxidized by oxygen and chlorine and become insoluble. They settle out in pipes, tanks, toilet tanks, etc. During high flow events the sediment gets stirred up and causes cloudy water that is red, brown or black. Clothes can be stained along with sinks, tubs, dishwashers, clothes washers, etc. The problem is often more noticeable with hot water.

The two best options are 1.) to find a new source of supply that does not have iron and manganese or 2.) to treat the water so that the iron and manganese levels are significantly reduced.

5.3.3.1 GreensandPlus Treatment

GreensandPlus Overview – One of the most successful treatment processes used to remove iron and manganese from systems similar to Limericks is GreensandPlus Filtration (GSPF). The proposed GSPF process would involve the following:

- Adjust pH, if necessary
- Chlorinate raw water, estimated dose is 1.5 mg/l
- Filter water through pressure filters containing Greensand Plus media
- Add small dose of SeaQuest to finish water to sequester any residual Fe and Mn

GreensandPlus™ is a black filter media used for removing soluble iron, manganese, hydrogen sulfide, arsenic and radium from groundwater supplies. The manganese dioxide coated surface of GreensandPlus acts as a catalyst in the oxidation reduction reaction of iron and manganese. The silica sand core of GreensandPlus allows it to withstand waters that are low in silica, TDS and hardness without breakdown.

Catalytic Oxidation (CO) operation is recommended in applications where iron removal is the main objective in well waters with or without the presence of manganese. This method involves the feeding of a predetermined amount of chlorine (Cl_2) or other strong oxidant directly to the raw water before the GreensandPlus Filter. Chlorine should be fed at least 10-20 seconds upstream of the filter, or as far upstream of the filter as possible to insure adequate contact time. A free chlorine residual carried through the filter will maintain GreensandPlus in a continuously regenerated condition.

GreensandPlus Preliminary Design – The preliminary design criteria for a GreensandPlus filter system similar to recent systems designed by Dirigo is shown below. Actual system design parameters are subject to adjustment pending sampling and pilot system operation. Figure 4 is a preliminary schematic showing a GSPF system.

Description	Design Parameter
Typical Maximum Filter Rate	5 GPM/sf
Recommended Filter Rate	4 GPM/sf
Filter Vessels	3 at 3.5 ft. diameter
Recommended Filter Flow per Filter	38.5 GPM
Total Recommended Filter System Flow	115.5 GPM
Maximum Filter System Flow	144 GPM
Recommended Backwash Rate	10-12 GPM/sf
Recommended Backwash flow per Filter	115 GPM
Typical Backwash Time per Filter	5 minutes
Total Estimated System Backwash Volume	1732 Gallons
Typical Backwash Frequency	2-3 times/ week
Backwash Tank Volume	5000 Gallons
Reclaim Delay (optional)	30-60 minutes
Reclaim Flow (optional)	12 GPM
Required Reclaim Time (optional)	2.5 Hours

The filter system will require the construction of a filter room on the existing pump station to house the filters and ancillary components. The backwash discharge would be put in a backwash tank where the solids would settle to the bottom. The cleaner supernatant water on the top of the tank would be injected back into the filters as a small percentage of the filters flow or alternatively discharged to the ground in a large leach field.

We recommend the injection of Seaquest into the finish water as it leaves the pump station to replace the existing N-Sodium Silicate for corrosion control purposes and to sequester any remaining iron and manganese in the finish water. The District was approved for a full-scale system pilot usinf SeaQuest blended phosphate to do this in 2018.

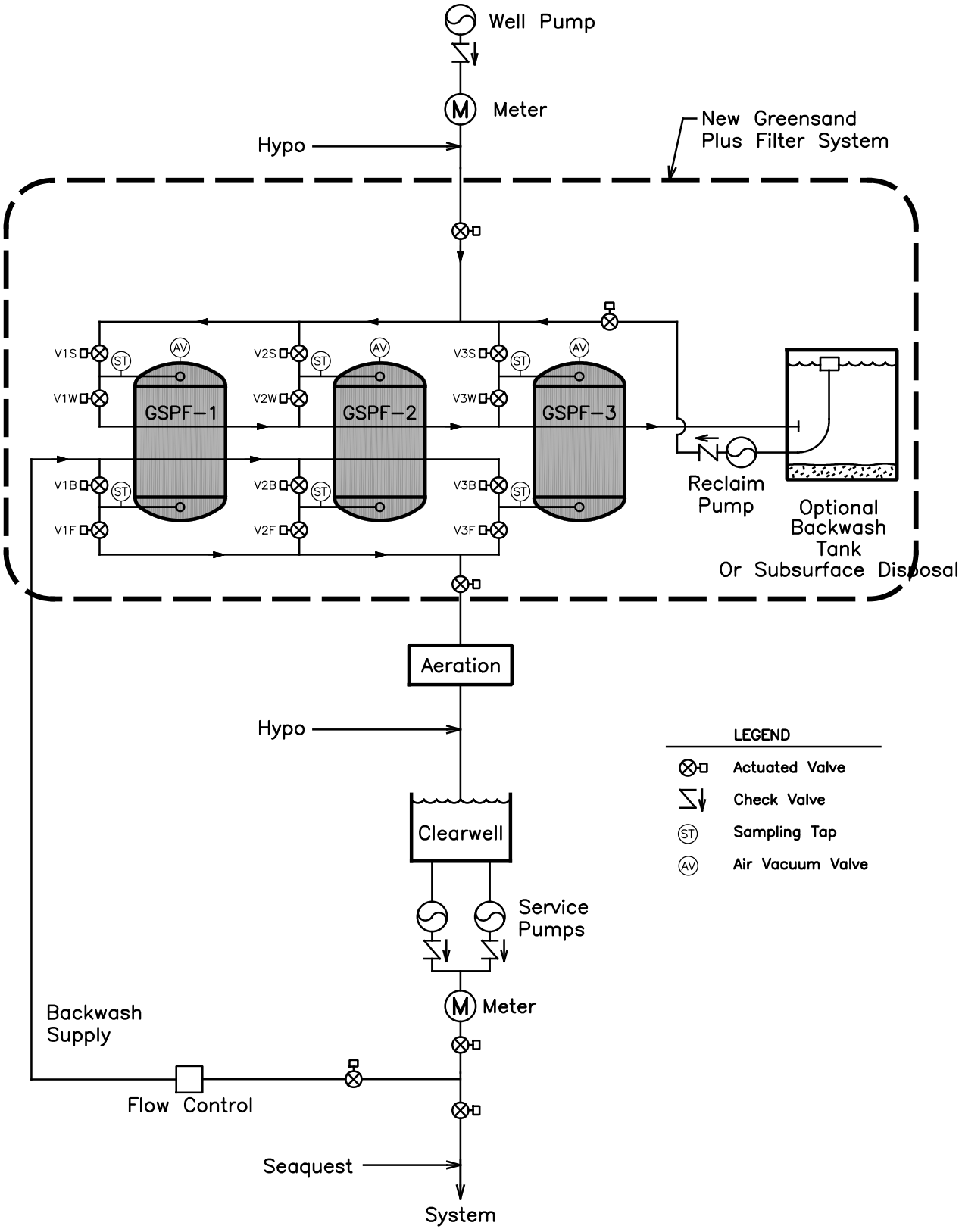
5.3.3.2 GreensandPlus Treatment Preliminary Opinion of Cost

The estimated cost for the above described iron/manganese removal system is $381,600.00. Detailed cost estimates can be found in Appendix 5.

5.3.4.1 Organic Removal Treatment

Recent disinfection by-products testing in the LWD system indicates that the running annual average for Total Trihalomethanes (TTH) may soon exceed the 80 ug/l running annual average (RAA). High TTH in a ground water system might indicate that the groundwater is under the influence of surface water.

We recommend testing the raw water from the gravel well for TOC and DOC. The testing should be done quarterly for a year to establish the seasonal variation. High levels of TOC/DOC may lead


Well Pump
Meter
Hypo
New Greensand
Plus Filter System
V1S
V1W
V1B
V1F
V2S
V2W
V2B
V2F
V3S
V3W
V3B
V3F
ST
AV
GSPF–1
GSPF–2
GSPF–3
Reclaim
Pump
Optional
Backwash
Tank
Or Subsurface Disposal
Aeration
Hypo
Clearwell
Service
Pumps
Meter
Backwash
Supply
Flow Control
Seaquest
System
LEGEND
Actuated Valve
Check Valve
Sampling Tap
Air Vacuum Valve

to additional testing such as Micro-particulate Analysis (MPA) to determine the risk of surface water influence of the existing well.

If the TOC/DOC in the well is high and/or the well is determined to be under the direct influence of surface water, additional treatment will be required. Several options are available for TOC/DOC removal. The most appropriate option for LWD would likely be an absorption base system using granular activated carbon (GAC). This system would require pilot testing and might require pre-treatment to remove iron and manganese to prevent fouling of the media.

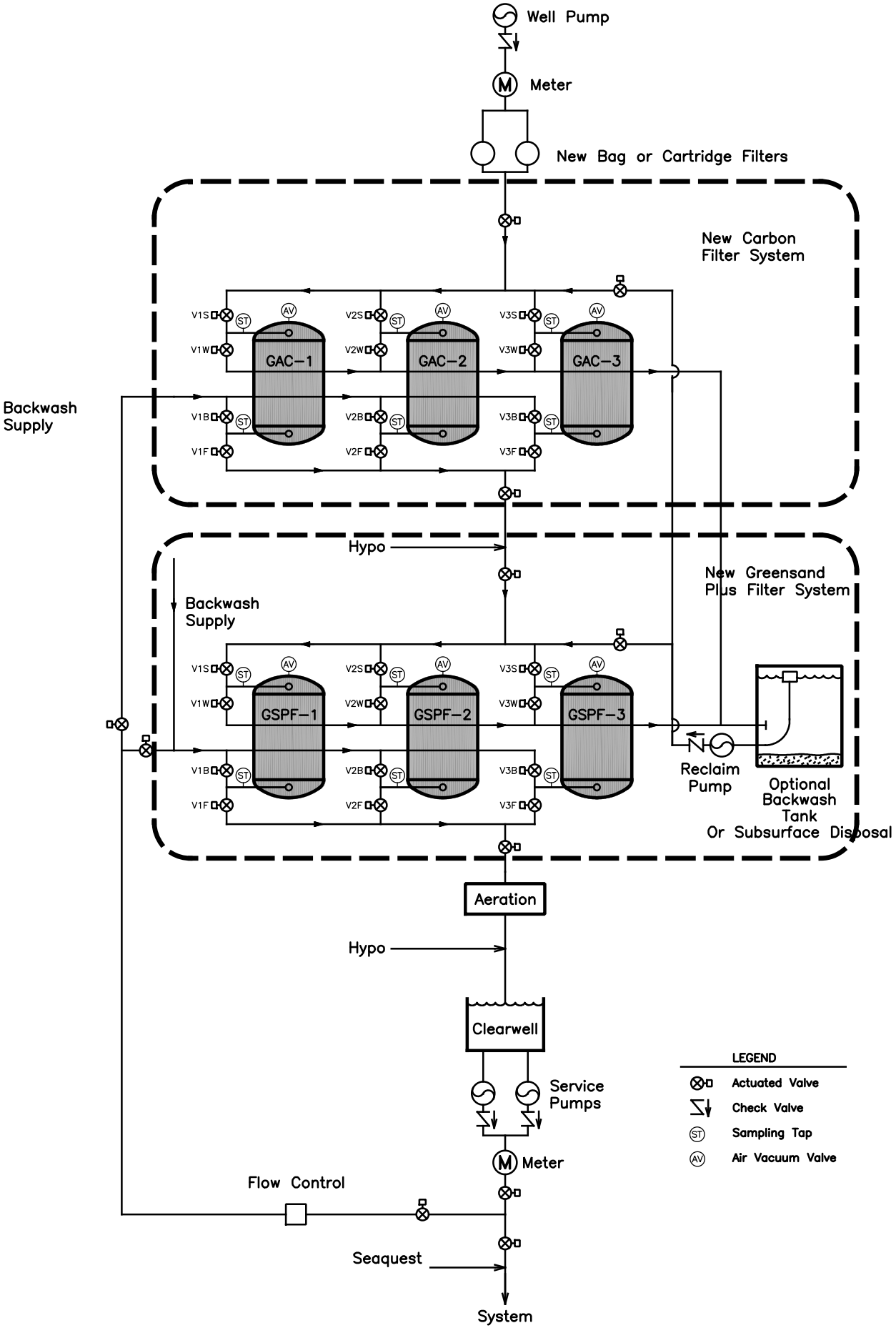
In addition, if the well is determined to be under the direct influence of surface water, filtration to provide 2-log removal of Giardia may be required. This could be accomplished using approved alternative filtration methods (bag or cartridge filtration). We are assuming that alternative filtration will be required ahead of the GAC filters.

5.3.4.2 GAC Design Parameters

Description	Design Parameter
Filter Rate	2 GPM/sf
Filter Depth	4.1 feet
Filter Volume	240 cu. ft.
EBCT	15 minutes
Total Filter System Flow	115.5 GPM
Filter Vessel Size	63” x 67”
Number of Filters	3
Recommended Backwash Rate	4 GPM/sf
Recommended Backwash flow per Filter	80 GPM
Typical Backwash Time per Filter	5 minutes
Total Estimated System Backwash Volume	1200 Gallons
Typical Backwash Frequency	1 times/ week
Organic Loading Rate (5 ppm TOC)	4 x 10-5 lb/gal
Adsorption Capacity	0.1 lb/lb carbon
Weight of Carbon (92 lb/ft3)	22,000 lbs
Quantity of Water Treated	55 MG
ADD	0.05 MG
Exhaustion	1,100 days (3 years)

Figure 5 is a preliminary schematic showing a combined bag filtration, GAC and GSPF system. The estimated cost for the GAC treatment system in addition to the GSPF treatment system is $294,000.00.

We would not recommend this system for Limerick due to the complexity. If the gravel well is determined to be under the influence of surface water, Dirigo recommends developing a new well source.


Well Pump
Meter
New Bag or Cartridge Filters
New Carbon Filter System
GAC–1
GAC–2
GAC–3
V1S
V1W
V1B
V1F
V2S
V2W
V2B
V2F
V3S
V3W
V3B
V3F
ST
AV
Backwash Supply
Hypo
New Greensand Plus Filter System
GSPF–1
GSPF–2
GSPF–3
Reclaim Pump
Optional Backwash Tank
Or Subsurface Disposal
Aeration
Clearwell
Service Pumps
Flow Control
Seaquest
System
LEGEND
Actuated Valve
Check Valve
Sampling Tap
Air Vacuum Valve

5.3.4 Washington Street Well

5.3.4.1 Background

Little existing information is available for the bedrock well. District maps indicate that it was installed in 1913 and is 565' deep. The State of Maine lists the well as 6-inch diameter, 500 feet deep with a yield of 20 gpm (gallons per minute).

The well is located inside Pump Station #1 which must have been constructed after the well was drilled. Booster pumps, which have now been removed, were also installed in Pump Station #1 to deliver water from the old reservoir to the high-pressure zone in the system.



Photo 9- Bedrock Wellhead Inside PS #1

During the early 1990's TCE (trichloroethylene) was discovered in the system's water. The District was working with the Maine Department of Human Services and the Department of Environmental Protection to remove the TCE from its water. In June of 1994 an aeration system to remove the TCE had just been installed when a major fire occurred at the Mill in Limerick on June 10, 1994. This fire catapulted the Limerick Water District into a severe water supply crisis.

As a result of this crisis a new gravel well was installed which became the primary supply for the District. The bedrock well was then relegated to back-up status. The LWD would now like to restore this well to be a primary source.

5.3.4.2 Well/Pump Evaluation

We recommend that the following information be obtained regarding this well:

- Well Depth
- Pump Setting Depth
- Pump & Motor Model Number and performance curve
- 4-hour pumping test to measure drawdown and yield

In addition to this data, the well should be upgraded with the casing extended at least 18-inches above the floor of the pump station. The well should also be equipped with a pressure transducer

or other water level monitoring device inside a 1-inch polyethylene pipe run down in the well. This would be used to make sure the well is not pumped at a rate beyond its capacity.

5.3.4.3 Water Quality

The water quality of the well has recently been evaluated by Water Quality and Compliance Service. The well was found to have elevated levels of iron and a level of arsenic that is slightly above the drinking water standards.

5.3.4.4 Controls

The well currently operates by a timer. A flow sensor switch is used to activate a dedicated outlet which powers a LMI chemical feed pump to feed chlorine when the pump is running.

We have previously recommended the installation of telemetry and SCADA for monitoring the system and still recommend this. However, for the time being, the well pump can simply be controlled by a timer and can be pumped into the low pressure/Mills reservoir system. If the well will pump nearly continuously, pumping from the gravel well would need to be adjusted. The worst-case scenario would be that the Mills reservoir overflows if the wells are pumped too much.

At a minimum, Dirigo recommends the gutting of the existing controls and the installation of a new pump control box, pump protection and a timer. Additional controls for chlorination are discussed below.

5.3.4.5 Chlorination & Contact Time

If the bedrock well has no history of the presence of coliform, disinfection may not be required. However, it is recommended that this well be chlorinated and the State may require that it be chlorinated for a certain period of time after it is placed on-line.

The bedrock well may require chlorination and sufficient contact time to obtain 4-log virus inactivation.



Photo 10- Pump Station Interior

The well has chlorination equipment consisting of a chemical feed pump tied to a flow switch that turns the chemical feed pump on when flow is sensed. The existing chemical feed pump is too large for the application. We recommend the installation of a 35-gallon flooded suction day tank with a chemical feed pump that is more closely matched to the chlorine feed rate needed. The chemical feed pump should be plugged into a dedicated 120-volt circuit that is only energized when the pump runs and flow is indicated. An online chlorine residual monitor and a magnetic flow meter are also recommended.

For 4-log virus inactivation at a temperature of 5°C (41°F) and a pH of 6-9, a CT of 8 is required. CT is simply chlorine residual multiplied by contact time (in minutes). With a chlorine residual of 1 ppm, a contact time of 8 minutes is required. At 20 gpm this equates to a storage volume of 160 gallons (20 gpm x 8 min). This contact time can be most economically obtained by installing pressure contact tanks in series, immediately after chlorination. Contact tanks in series are generally assigned a baffling factor of 0.5 because of short circuiting in the tanks. Applying a 0.5 baffling factor indicates a storage requirement of 320 gallons.

The needed contact time can be obtained by installing a series of pressure vessels. Several tanks in series provide a higher baffling factor than a single larger tank. We recommend the installation of four 80-gallon tanks in series. Figure 2 is a sketch of the proposed installation.

5.3.4.6 Iron and Arsenic Removal

The bedrock well will most likely require arsenic removal before being placed online as a primary source. Viable options for the site include:

- Anion Exchange
- Adsorptive Media
- Manganese Greensand

Anion exchange and adsorptive media are appropriate for removing arsenic when no other compounds are being treated. If, as is the case with the bedrock well, iron and or manganese are present, pre-treatment to remove these compounds is necessary for these approaches to work well. In addition, anion exchange usually requires pH adjust after arsenic removal as the treatment unit also strips alkalinity.

Manganese greensand media related to iron and manganese removal have been discussed previously. In relation to arsenic removal, the arsenic in solution must be raised (oxidized) to the +5 state. This is generally done using chlorine which also oxidizes iron to the +3 state. The iron and the arsenic are precipitated together and filtered by the greensand media.

The use of chlorine ahead of the manganese greensand unit will help with chlorine contact time and may eliminate the need for some or all of the chlorine contact vessels.

5.3.4.7 Interior Piping

The interior piping is currently schedule 40 PVC. When the chlorination contact tanks and/or greensand filtration are installed, Dirigo recommends replacing the interior piping with schedule 80 PVC or type K copper. Pipe size should be a minimum of 1½" diameter.

5.3.4.8 Exterior Piping

The bedrock well discharge is plumbed to both the high pressure and low-pressure mains in Washington Street directly in front of Pump Station #1 (Figure 6). We recommend adjusting the valves so the bedrock well is connected to the low-pressure system.

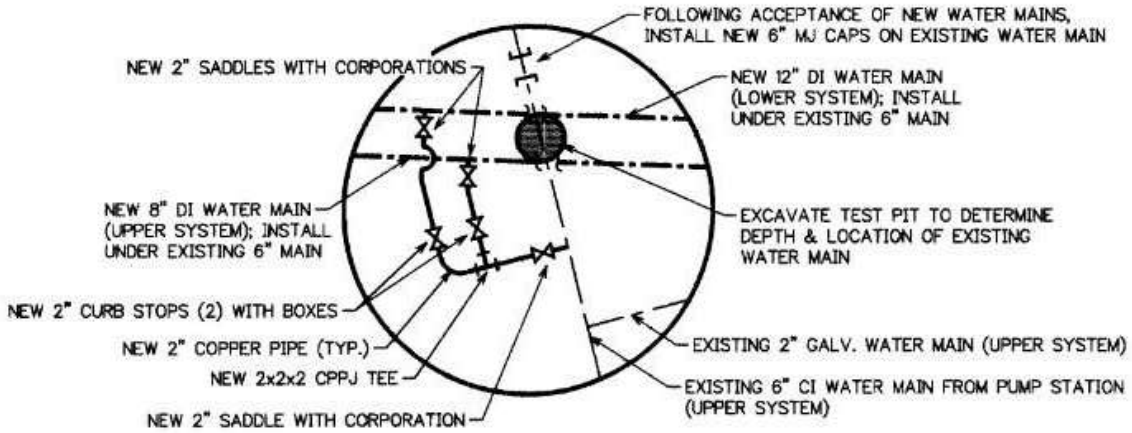


Figure 6. Bedrock Well Sysytem Connection

5.3.4.9 General Clean Up

Pump Station 1 was formerly used as a booster station and the bedrock well was formerly equipped with a line shaft turbine. The pump pads, pipe supports, protruding bolts, etc. should all be removed to provide more interior space and eliminate tripping hazards.

5.3.4.10 Bedrock Well Upgrades Opinion of Probable Costs

The construction cost opinion for the recommended improvements to the bedrock well is $36,400.00

5.3.5 Wellhead Protection

The LWD owns approximately 18 acres around the Emery Corner wellhead. There is no local Wellhead Protection Ordinance in place although the town does have an ordinance related to large scale extraction of ground water.

The bedrock well is located on a 7.8 acre lot in a residential area of Limerick. The modeled wellhead protection zone for this well includes several potential sources of contamination including;

- Residential heating oil tanks
- Major roads
- An underground storage tank at Uptown Auto Sales & Service
- 3 auto repair facilities

The LWD should consider working with the Town of Limerick to establish Wellhead Protection Zoning around both of their water sources.

5.4 Transmission & Distribution System

5.4.1 General Description

The transmission system is the portion of water mains that link the sources of supply and the reservoirs with the distribution system. The transmission system consists of 12", 8" and 6" mains that connect the two well sources to the lower reservoir/booster station and the upper reservoir. This is not a dedicated transmission main as many of the water services in town are tapped off it.

The distribution system is the portion of the system that delivers water from the transmission system to the customers. The LWD distribution system is composed of varying size pipes ranging from 16" diameter (HDPE, 12-inch inside diameter) to 6" diameter. Most of the distribution system pipes are 6" and 8" diameter cast iron and ductile iron. Pipe material primarily includes cast iron and ductile iron with small amounts of PVC and high density polyethylene (HDPE).

5.4.2 Pipe by Age

We estimated the age of pipe that is currently present in the water system using district records, available deeds and approximate age of hydrants. The estimated ages were placed in a GIS database. Figure 7 is a chart of pipes by age. The system dates to the early 1900's and some of the original pipe is still in service, primarily in the Village. Some of this older main, located along Main Street, will be replaced in the near future as part of a Maine DOT road reconstruction project.

This graph indicates that about 20% of the distribution system is older than 80 years and 50% is older than 50 years. All the pipe older than 50-years is cast iron, most of which is likely unlined.

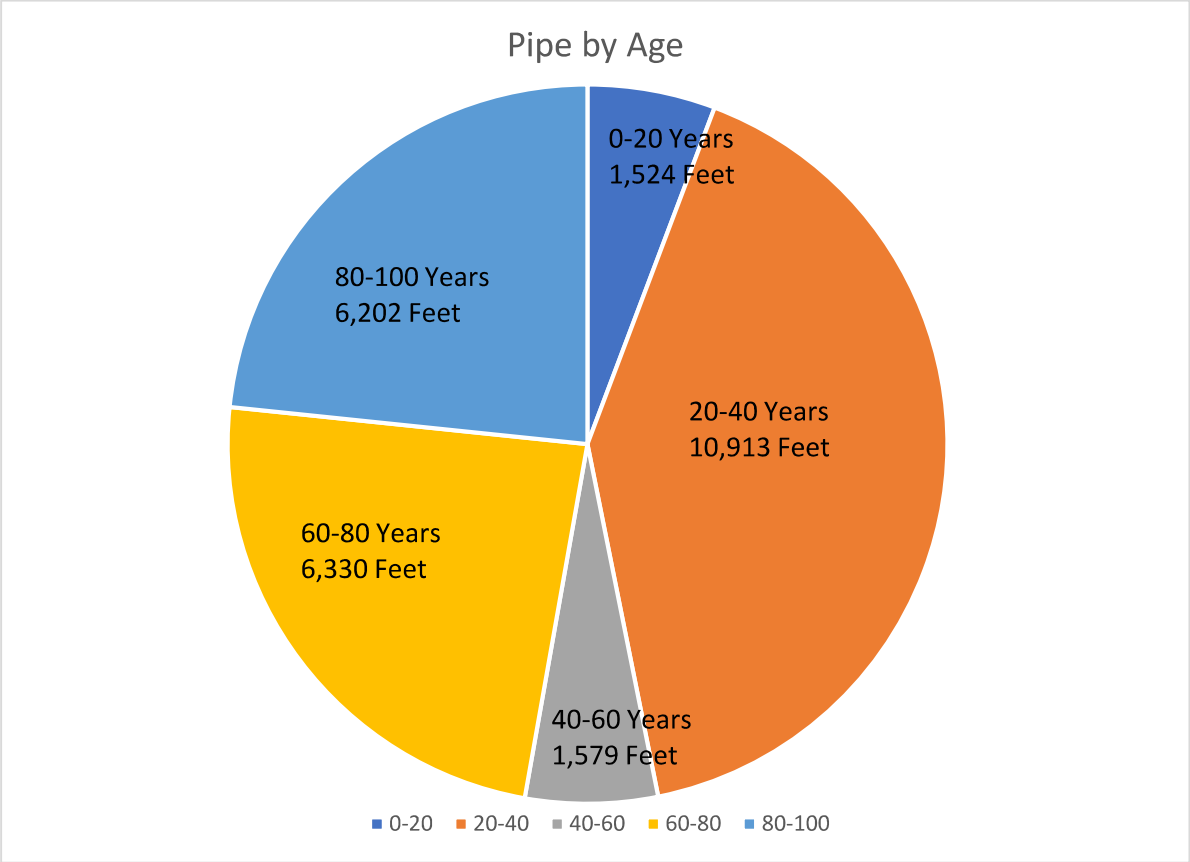
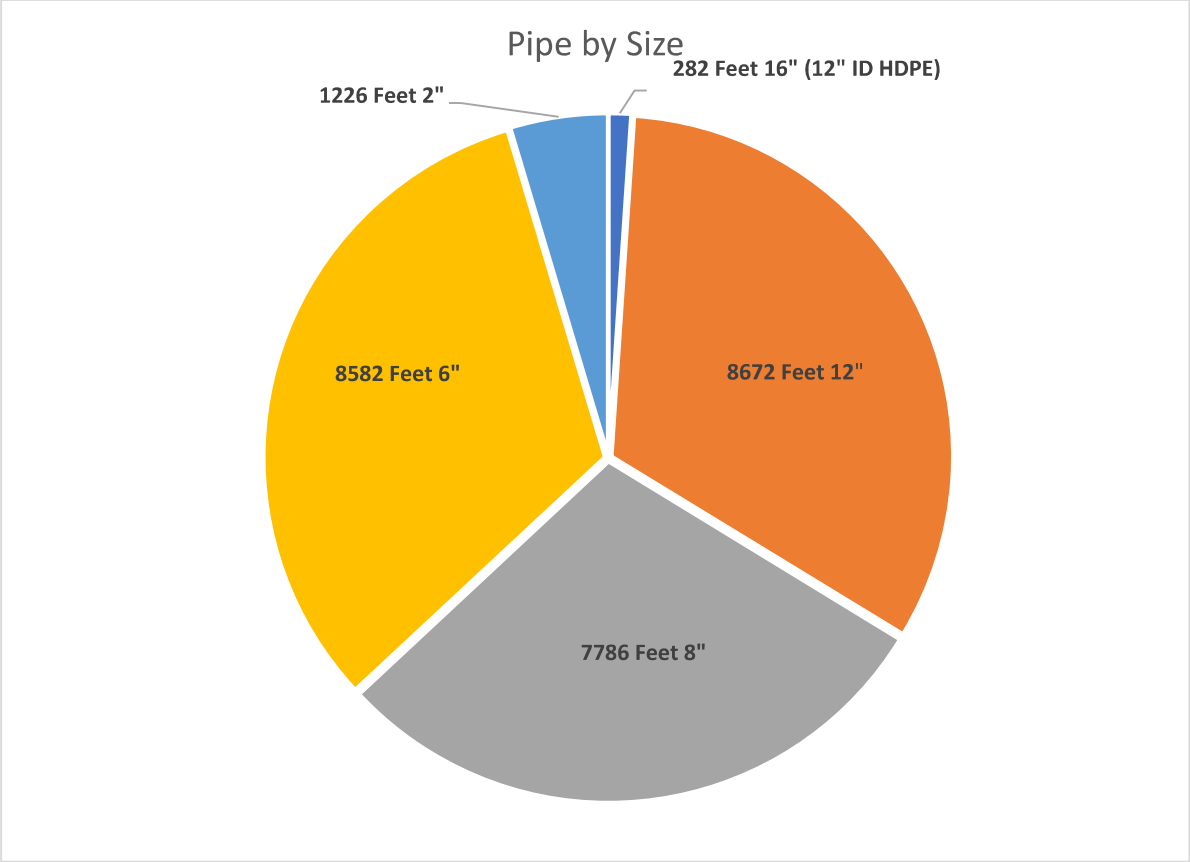


Figure 7 - Pipe by Age

5.4.3 Pipe by Size

Using the GIS system, we created Figure 6 which is a chart of the sizes of pipe in the distribution system. The 6" water main makes up the bulk of the distribution system. These pipes can be found mostly on side streets. The backbone of the system consists of 12-inch and 8-inch mains with a section of 6-inch main along the Emery Corner Road and a 16-inch HDPE (12-inch ID) submarine crossing at Sokokis Lake. The backbone mains supply fire flows and connect the sources of supply to the storage reservoirs.

Figure 8 - Pipe by Size



5.4.4 Pipe by Material

We also used the GIS database to provide a breakdown of pipes by pipe material. Figure No. 9 is a graph of pipe by material in the LWD system. The graph shows that the water system has over 50% newer Ductile Iron and PVC/PE pipe in the ground. However, the remaining pipe is older cast iron.

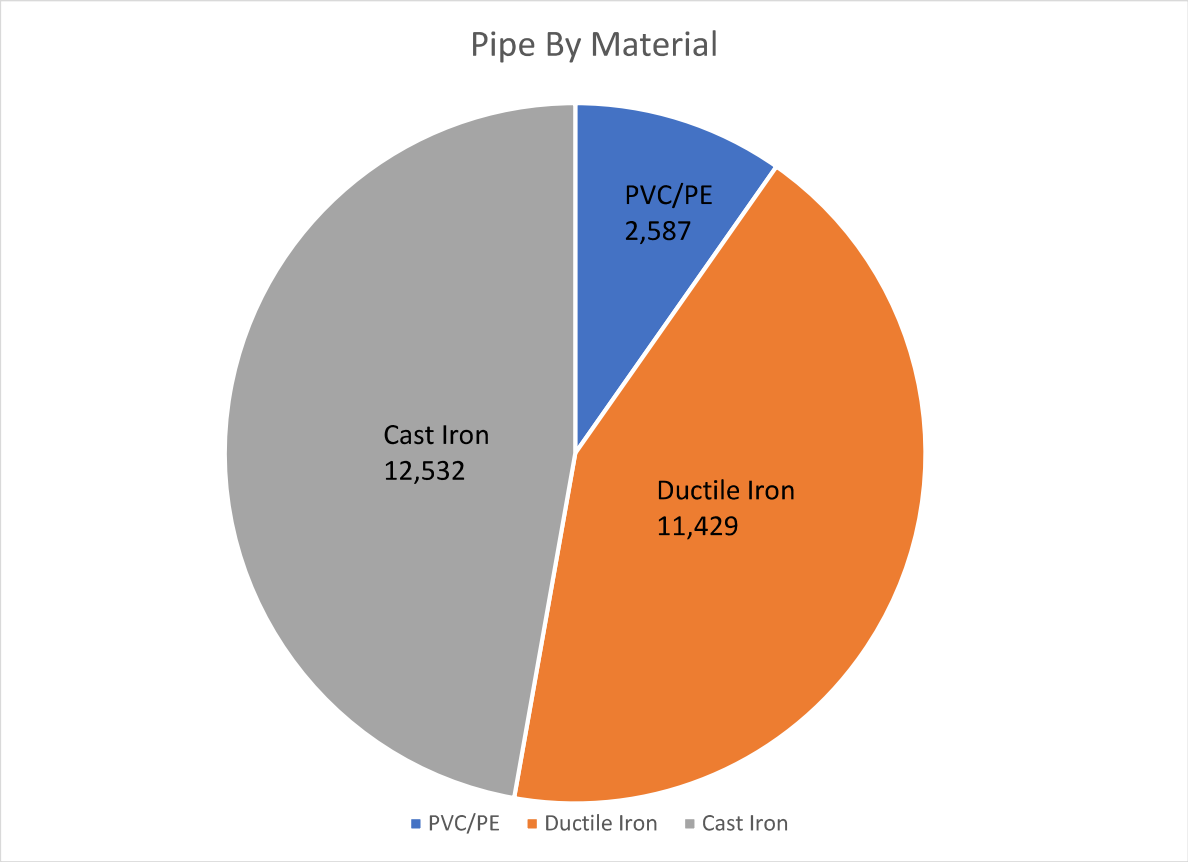


Figure 9- Pipe by Material

5.4.5 Pressure Zones

The LWD water system has two separate pressure zones dividing the distribution system. The lower, or main pressure zone provides pressure in the part of Limerick that is easterly of the Mills reservoir on Washington Street (with the exception of Limerick Housing which is on the high pressure system).

The higher, or upper pressure zone provides pressure to the area of Limerick westerly of the Mills reservoir.

The two zones are separated by a booster station that is integrated with the Mills reservoir on Washington Street. The booster station also incorporates a pressure reducing valve which will allow flow from the high system back to the low system if the low system pressure drops significantly.

5.4.6 Water Pressure

Because of the hilly terrain in Limerick, there are places in the system that have higher pressure such as just west of the Mills reservoir. This area of the system has pressures exceeding 100 psi. In these areas, individual pressure reducing valves are recommended to not place undue stress on household plumbing.

The only areas in town that have low pressure are in the immediate vicinity of the Mills reservoir and the Village tank pipe. These areas would be especially susceptible to low pressure when large demands are placed on the system by fire flows or large main breaks.

5.4.7 Valves

The LWD water system has approximately 69 valves in the distribution system with the condition unknown. Valve clusters are usually placed at road intersections throughout the distribution system. Hydrant branch valves are set on the hydrant branch to allow shutting the hydrant down for service or replacement. The valves are used to shut down segments of the system to make repairs and to perform routine maintenance operations. Valves are normally located so that as small a section of pipe can be shut down as possible. The Limerick Water District has standardized on open left valves.

We recommend that the District make a complete inventory of all valves in their system and begin an annual valve exercising program.

5.4.8 Hydrants

The District has approximately 44 public and 3 private fire hydrants in service. Hydrant models used in the system include:

Table 5. LWD Hydrants		
Manufacturer	**Qty.**	**Notes**
Matthews 81	11	Discontinued
A.P. Smith	2	Discontinued
US Metropolitan	8	Discontinued (now Mueller)
Waterous Pacer	18	
Mueller	3	
American Darling	2	
TOTAL	**44**	

We recommend annual maintenance on the system's hydrants consisting of pressure checking and flowing all the hydrants twice a year, inspecting and pumping all hydrants dry in the fall and periodic checks on all hydrants during the winter to ensure that they are operational. In addition, the district should paint hydrants on a regular schedule.

Most fire hydrants are equipped with a branch valve located between the fire hydrant and the water main. These valves are used to shut off damaged hydrants. Only 2 hydrants require repair or replacement within the next 10-years.



Photo 11 - Vintage Matthews Hydrant

5.4.9 Cross-Connection

The purpose of a cross-connection control program is to protect the customers of the LWD from substances that could be introduced into the water supply by other customers and industries. Backflow prevention devices prevent water that has entered buildings from flowing back into the distribution system. The District has a written cross-connection control policy.

5.5 Storage

The District has two storage facilities. These are the Mills Reservoir and Village Tank. These reservoirs supply the system when the pumps are not operating, provide constant pressure to the system, and supply a large volume of water to fight fires. The Village Tank has an

approximate overflow elevation of 688 feet and provides pressure to the upper pressure zone. The Mills Reservoir has an overflow elevation of 462.5 and provides pressure to the lower zone. The tank attributes are summarized in Table 6.

Table 6. Limerick Storage

Attribute	Village Tank	Mills Reservoir
Service Area	Limerick Village	Limerick Mills
Location	South of Elm Street	Off Washington Street
Type Roof	Riveted Steel Steel	Dual Chamber Concrete Concrete, Insulation, Buried
Year of Construction	1925	1999
Built by	Chicago Bridge & Iron Works	Penta Corporation
Overflow Elevation	688' +/-	462.5'
Base Elevation	659' +/-	453.0'
Dimensions	42' dia. X 29'h	72' x 19.5' x 9.5'h per chamber
Nominal Capacity	300,000 gallons	200,000 gallons

Average daily water usage in the system is approximately 50,000 gallons per day; therefore, total storage in the system amounts to ten days during average usage. Almost all the water in the Mills Reservoir is available for use as it can be pumped to the Village Tank. Because the Village Tank is at a high elevation with no customers at the base of the tank, almost all the water in that tank is available for use. If full, the existing reservoirs can sustain a 2-hour fire flow of 3,500 GPM.

5.5.1 Village Tank

The Village Tank serves the upper village area of Limerick including Elm, School, Main Street and connected areas. In addition, the Village Tank serves Washington Street down the hill as far as John and Marie Drive. The tank volume is sufficient for fire protection and domestic service. The tank overflow elevation is also sufficient to provide adequate pressure to the current service area.

The Village Tank was constructed in 1925 of riveted steel. The tank was last painted in 2015 by Limerick Steeple Jacks at a cost of approximately $163,000.00. The 2015 paint job included complete paint removal and recoating of both the tank interior and exterior. In addition, 2500 rivets were drilled out and replaced in the upper parts of the tank where their heads and been worn down by ice action.

The tank has reached its expected service life. However, due to diligent maintenance by the District the tank is still in good condition and can continue to provide service to the water system. The riveted construction method, compared to the modern practice of welding, will continue to require special maintenance to combat weeping at rivets and joints and the related corrosion this causes.

This tank will require repair/repainting or replacement near the end of the 20-year planning period. Options to consider include:

- Keeping the existing tank and repairing/repainting it
- Replacing the tank with a:
  - New welded steel/glass fused steel standpipe
  - New in-ground concrete reservoir
  - New above ground concrete reservoir.

When the time comes, the District should perform a Life Cycle Cost analysis to determine the best option. Regardless of the selected option, the transmission main that connects this tank to the system should be replaced and probably be re-routed.

The existing transmission main runs cross country, down a steep part of Academy Hill approximately 300 feet to Elm Street. A break on this main would be very difficult to repair and might cause significant property damage to residences.

5.5.2 Mills Reservoir/Booster Station

The Mills Reservoir was constructed in 1999 and is in excellent condition. The reservoir is an in ground concrete structure that measures approximately 74 feet long by 42 feet wide with a maximum water height of 9.5 feet. The reservoir is split down the middle in two separate chambers.



Photo 12- Booster Station Vault & Mills Reservoir

Water can enter either or leave either side of the chamber through either of two pipes, one on each side of the divider wall.

A valve chamber/booster pump station is located in a vault constructed adjacent to (and sharing a wall with) the concrete reservoir.

Two canned submersible booster pumps are located in the valve chamber and are connected to the tank inlets/outlets on the low pressure side. These two pumps are used in a lead/lag configuration to boost water from the lower system/Mills reservoir to the upper system/Village tank. Controls can be on a timer or through a system pressure controller, selectable by a switch. The LWD commonly runs the system on a timer.



Photo 13- Submersible Pumps in Cans at Booster Station

The controls also include a reservoir controller. In either mode, the booster pumps can only run if the reservoir controller indicates that water level is above both the low low level and the low level when they are placed in automatic by a hand-off-auto switch. If pumps are placed in hand, the reservoir can be drawn down to the low low level before the controller interrupts the circuit.

The pumps are driven by VFD's which can vary the rate of flow based on output from a pressure transducer. This function is only available when the pumps are run on system pressure.

The station has the following alarms, which are locally reported only:

- Pump/VFD 1 Fault
- Pump/VFD 2 Fault
- System Pressure High
- System Pressure Low
- Reservoir High
- Reservoir Low
- Building low temperature alarm



Photo 14- Chlorine Day Tank & Feed Pump at Booster Station

Also, the station contains a 4-inch diameter Sensus turbo meter with an Act-PAK signal converter. In addition to recording flow out of the booster station, the signal from the ActPAK is used to energize a chlorine feed pump outlet when flow is greater than 10 gpm.

The reservoir and booster station are in a well maintained condition and will require little work over the next 20-years. In the short term, the reservoir should be drained, cleaned and inspected. This can be done one side at a time while the other side remains active.

In the long term, we recommend that tank mixing be improved. This can be accomplished with some piping changes in the vault and a pipe loop at the far end of the reservoir to promote plug flow through the reservoir.

5.6 Safety

Recently there has been an increased effort by state and federal agencies to promote workplace safety in several areas that directly affect the District. The District has made timely progress towards meeting the current safety regulations.

Previously, the District has implemented a Hazardous Materials Communication Policy to meet these new standards. This is a plan whereby employees are made knowledgeable about the hazards in the workplace by providing training, Material Safety Data Sheets, and a labeling system that properly identifies all chemicals and their known hazards.

A lockout/tagout policy has been implemented. This involved developing written procedures for isolating all electrical and mechanical equipment within the district and purchasing the necessary locks and tags.

Two major safety concerns of water utilities are trench safety and confined space entry. According to OSHA standards, any excavation that is 5 feet or greater in depth requires shielding (trench box or shoring).

Throughout the District, there are several facilities that qualify as confined spaces. Briefly, a confined space is a small compartment with limited means of entry that was not meant for constant human habitation. The confined spaces within the system include manholes, the clear well at the Emery Corner pump station and the reservoirs. Any trench that is excavated to a depth of four feet or deeper is also considered a confined space. The danger in entering a confined space is that a worker may be overcome from fumes, lack of oxygen, and/or become injured and entrapped within the space. District personnel should purchase and calibrate a multi-gas meter and routinely monitor the confined spaces in the system. If any hazardous conditins are found, that space should not be entered without proper training and safety equipment.

5.6 Offices

The Limerick Water District maintains an office at the sewage treatment plant. That office maintains water system operations records. An old office is located near the Mills reservoir on Washington Street. This office is currently used for storage.

Currently, the main item of office equipment are personal computers. These devices have been a great aid in keeping track of accounts, billing, inventory control, and all other facets of running the District.

5.7 Equipment

The Limerick Water District has no construction equipment. The District has trained several local contractors to assist with digging and repairs. By working with more than one contractor, they are more certain that help is available when needed.

5.8 Inventory

The Water District maintains a small inventory of service brass, meters and other miscellaneous water system materials.

5.9 Management

Anthony Carroll is the chairman of the District and has recently been actively involved in the District. Aaron Carroll has recently obtained his Class 1 Water Operators licensing and handles the day to day operations. Bill Aronson is a volunteer who helps as needed. Licensed Operator service is currently provided by Chuck Applebee and Ray Bates of Water Quality and Compliance Services, Inc.

The Limerick Water District is overseen by a 3-member Board of Trustees that must be residents of Limerick and be elected. The terms are three years and staggered so that one board member is appointed each year. The current board consists of:

- Glen Wagner
- Vacant
- Anthony Carroll

5.11 Licensing Requirements

Public water system licensing requirements are determined by the type of system, size of system and the complexity of operating the system. Two types of license are required for running a community public water system in Maine. These are a Distribution and Treatment license. Water System Licenses start with Class I and go up to Class IV.

In the case of Limerick, a Class I Distribution license is required because the population served is less than 1,500 people. A Class 1 Treatment license is also required based on Appendix A of State of Maine Water Systems Operating License Rule (2018). Proposed changes to the system, such as adding manganese greensand iron/manganese/arsenic removal will increase the required Treatment license class to Class II.

5.12 Staff

Current staff for the Limerick Water District includes:

- Aaron Carroll, Designated Water Operator
- Becky Nutting, Bookkeeper
- Bill Aronson, Volunteer

5.13 Contract Operations

The LWD water system is currently contracted with Water Quality and Compliance Services, Inc. (Chuck Applebee, Ray Bates) for licensed operators services.

5.14 Policies & Programs

The District has several documented policies and programs. Some of the more important ones especially those that relate to the public are discussed briefly. The policies include:

5.14.1 Water Main Extensions

The District does not participate financially in main extensions. Main extensions are reviewed by the District, and the District provides technical assistance with design, however costs are born by the individual developers. District personnel inspect all installations.

5.14.2 Flushing Program

The LWD has a good flushing program. The mains are flushed in the spring and fall of each year of each year. This policy should have a written documentation as it relates directly to water quality.

The District should consider implementing a directional flushing plan where valves are open and shut in sequence to provide high velocity one-direction flushing. This could be combined with a valve exercise program.

5.14.3 Leak Detection Program

The system water production is monitored closely, and any possible indication of a leak is responded to by checking the system, locating leaks and repairing them as soon as possible. The District generally uses the services of Maine Rural Water for hard to locate leaks.

5.14.5 Bleeder Policy

The system has one bleeder for water quality purposes located at the end of Depot Street on a dead end line. Other than that, the use of bleeders is discouraged.

5.14.6 Pressure Regulators

The District encourages that customers install pressure regulators when the pressure exceeds 80 psi. The use of pressure regulators should be required by a written policy.

5.14.7 Backflow Prevention

Backflow prevention devices (Watts 007 double check valves) along with meters are installed on all new services and during meter change outs if there is an existing corner horn. Some residences do not have backflow prevention; however, all the "commercial" users have backflow prevention. The District is currently working on a written backflow prevention policy.

5.14.8 Metering

The LWD water system is mostly individually metered. Most meters were installed in 2005 and may not meet the lead reduction act. The District has switched to the Sensus iPERL meters which are 100% lead free. All new meter installs will meet the lead reduction act.

5.14.9 Other Policies

There are many policies that are recommended for water districts. These include:

1. Safety Policy
2. Personnel Policy
3. Drug Free Workplace Policy
4. Sexual Harassment Policy
5. Personnel Protective Equipment and Hazard Assessment
6. Hazard Communication
7. Confined Space Entry
8. Lock/Out Tag/Out

The District should evaluate their existing policies to see what policies are critical to their operation and implement the necessary ones in writing.

5.15 Asset Management

The District does not currently have an Asset Management Plan. The CUPSS (Check Up Program for Small Systems) series of spreadsheets provided by the USEPA is a great starting point for asset management planning. We recommend that the District complete a CUPSS asset management plan.

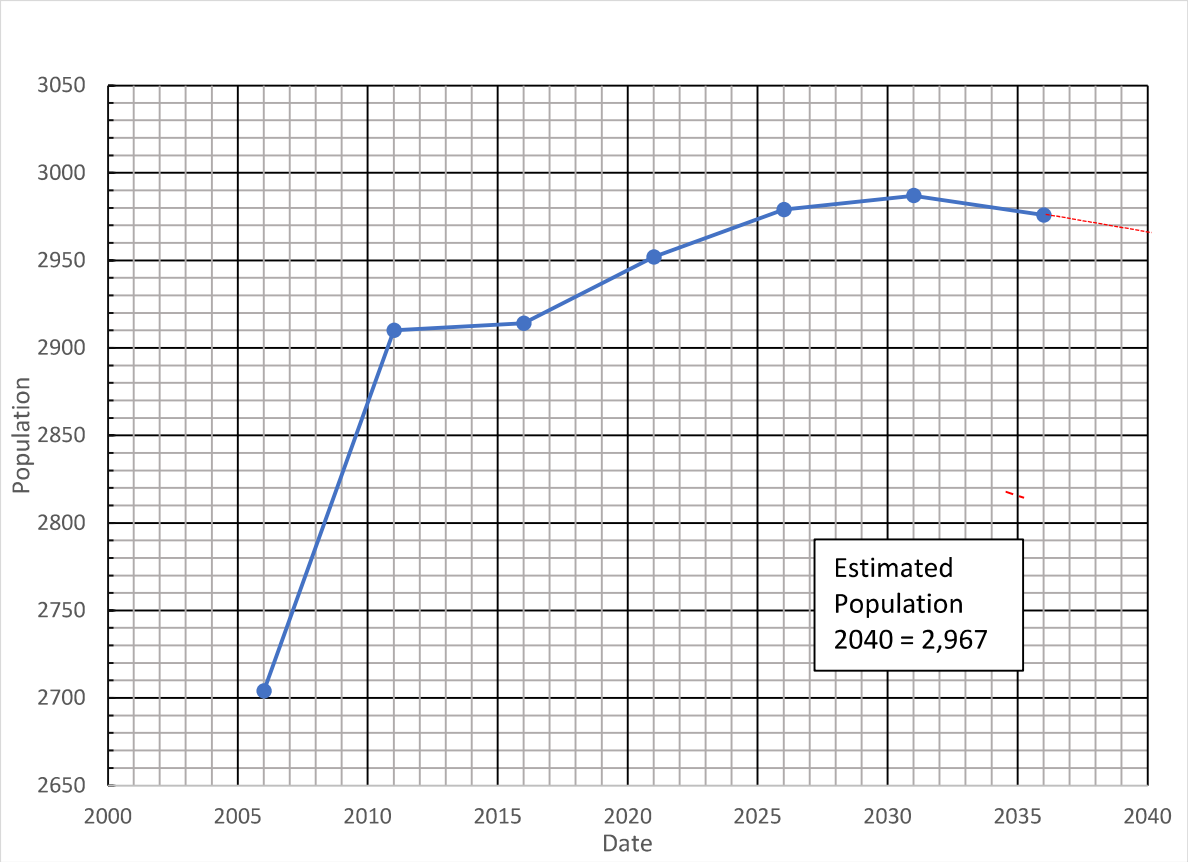
6 FUTURE CONCERNS

6.1 Development Trends & System Growth

The service area of the LWD water system has experienced little growth for the past 20 years. Average daily water use has decreased slightly since 1995 when water use was reported as being between 60,000 to 80,000 gallons per day. Water use in 2018 was reported as 40,101 gallons per day.

Using data from the US Census, we have plotted population trends in Limerick. Population grew from 2,704 residents in 2006 to a peak of 2,914 residents in 2016. Population is expected to increase slightly to just under 3,000 until 2031 where it is expected to stabilize or decline slightly. Figure No. 6 is a graph of population projection for Limerick.

Figure 3- Limerick Population Trends



The system demand is expected to remain steady, or perhaps decrease slightly. Several factors may influence future use. First, much of the new development in Limerick is expected to take place in areas where water service may not available. Secondly, rising energy prices should result in increased conservation measures, reducing the per capita water usage. Lastly, with

relatively high unaccounted for water, water main replacements and on-going leak repair may reduce water use further.

In estimating future water consumption, we compared the average water usage over the past several years and then projected it to the future. The decrease in water usage has been relatively linear and we expect this trend to continue or flatten in the future. We, therefore, used straight-line projections for the estimates. The projected system demand can then be compared with the system capacity. This comparison gives the LWD a guide for planning future system expansion.

With the LWD water system currently operating at about 25% of sustainable system capacity and little or no growth expected during the planning period the LWD appears to have enough water for the next 20 years. Water usage might increase significantly if a new large water user were to locate in Limerick. The District has enough excess capacity to support potential new large water users, up to a point.

6.2 Regulatory Considerations

There are numerous drinking water rules and regulations at the state and federal levels. In addition, there are some proposed regulations that may affect the future operations of the LWD water system. Relevant regulatory considerations are discussed in this section.

6.2.1 Lead & Copper

Lead and copper are often present in tap water; however, it is not usually found in the source or distribution system water. Water samples from the wells used by the LWD confirm that there is no detectable level of lead or copper in the source water. The source of lead and copper is most commonly from corrosion of pipes and fixtures caused by water. The LWD has been sampling for lead and copper, as required by state regulations for several years. The system has been passing both the lead and copper standard, because of the aeration unit which strips C02 from the ground water and sodium silicate which raises pH and forms a protective film in the piping system.

Proposed changes to the lead and copper rule are on the horizon. Some of the key provisions include:

- Establishment of a lead service line replacement program
- Improved optimal corrosion control treatment requirements if the system exceeds the lead action level.
- Establishment of a MCL for lead rather than the current 90th percentile action level limit of 15 ppb
- Evaluating point-of-use treatment for lead reduction at the tap
- Revising sampling requirements to standardize collection practices.
- Requirements to provide public information regarding sampling results and the locations of lead service lines
- More public education/awareness of lead in water issues
- Revised copper regulations based on the chemical composition of the water instead of in home sampling. Water Districts would still have to test for copper periodically in certain homes to prove that their corrosion control is effective.

6.2.2 Use of Lead Free Pipes, Fittings, Fixtures, Solder & Flux for Drinking Water

Currently, lead free is defined as less than 0.25% of lead (calculated across the wetted surface area of the fitting) and 0.2% for flux and solder. The SDW (Safe Drinking Water Act) currently prohibits (with certain exceptions) the "use of any pipe or plumbing fitting or fixture, any solder, after June 1986, in the installation or repair of (i) any public water system; or (ii) any plumbing in residential or non-residential facility providing water for human consumption that is not lead free."

The proposed rule will still require lead free materials but the definition of lead free will change to match the statute passed by Congress that prohibits the use of materials with a lead content greater than 0.25% (by weight), require labeling of lead free materials and require manufacturers to certify that they are meeting the lead free requirements. The regulation will make it easier for water suppliers to determine if the materials they are using are lead-free.

6.2.3 Perchlorate

Perchlorate is a chlorine compound that can occur naturally but is also used in manufactured products. It can be found in rocket fuel, munitions, fireworks, matches and some fertilizers. The Environmental Protection Agency (EPA) has just released a pre-publication notice of proposed rulemaking regarding the regulation of perchlorate in public drinking water systems. Currently, the EPA has not established an MCL for perchlorate in drinking water. They are considering one of the following options:

- MCL and MCLG of 56 ppt
- MCL and MCLG of 18 ppt
- MCL and MCLG of 90 ppt
- No regulation

Maine has set a 0.8 ppt (parts per trillion) guideline for clean-up of perchlorate in groundwater but no drinking water standard has been set.

6.2.4 Per- and Polyfluoroalkyl Substances (PFAS)

Perfluoroalkyl Substances are a group of fluorinated organic chemicals that are used in a wide variety of consumer products such as fabrics, food packaging and cookware. They are also used in firefighting foams and several industrial processes.

The EPA has issued health advisories for two types of PFAS, PFOA (perfluorooctanoic acid) and PFOS (perfluorooctanesulfonic acid). The health advisory levels for these two compounds combined has been set at 70 ppt.

The Governor of Maine has recently enacted a PFAS task force to study the issue in Maine. Currently, sampling for PFAS is not required, however, the EPA is looking into establishing a national primary drinking water standard for these compounds. It is likely that all public water systems will be required to sample for these compounds in the future.

6.2.5 Radon

The raw water radon levels of LWD's gravel well are in the 4,000 to 5,000 picocuries/liter range. However, the well is treated with an aeration system to remove radon to below the MCL (maximum contaminant level) of 300 picocuries/liter. The aeration units have the secondary benefit of removing carbon dioxide which provides corrosion control benefits.

6.2.6 Groundwater Rule

The Groundwater Rule was established by the EPA in 2006 with deadlines for compliance of December 1, 2009. The District provides 4-log removal of virus for its well sources using free chlorine. Chlorine contact for the bedrock well is discussed under section 5.3.4.

Because of this treatment, the LWD is only required to do compliance monitoring. This consists of continuously monitoring chlorine concentration and reporting the lowest residual recorded each day.

6.2.7 Water Quantity

The expected demand growth in the system was discussed previously. The analysis indicates that average demand will be relatively flat out to 2040 unless a large water user moves to Limerick. This is based on the declining to stable water use over the last two decades and longer term trends which are affecting water use in a more general sense. These trends include the awareness of the importance of resource conservation and the installation of more efficient water fixtures.

The current reliable peak yield of the system is approximately 200,000 gallons per day. This is derived from the maximum pumping rate of the gravel well pump (125 gpm) at Emery Corner and the bedrock well pump (17 gpm) on Washington Street.

With an average daily usage of less than 50,000 gpd that is expected to remain flat, LWD is using about 25% of its maximum daily capacity. These estimates indicate that currently, the LWD has adequate water to support the existing development and projected development for the next 20 years.

Dirigo recommends that the LWD should always be on the lookout for potential additional sources of groundwater. If land on known aquifers in town can be obtained for a reasonable price, the District should consider evaluating the source and purchasing the property for future needs.

6.2.8 Transmission & Distribution

The transmission portion of the water system has been evaluated and is generally in good condition. Much of the distribution pipe dates to the early 1900's. However, much of transmission main (with a few notable exceptions) is newer ductile iron pipe. Our evaluation and calibration of the hydraulic model indicates that the pipe is hydraulically in appropriate shape.

An important consideration of the distribution system is looping. Looping of pipes causes improved water quality, increased system reliability, reduces water age and improves fire flows. The LWD water system is very linear and not well looped. A few areas may benefit from looping, however the costs of doing this work may outweigh the benefits.

Areas that could potentially benefit from looping include:

- Locust Hill
- Main Street between Cannon Hill Rd & Burbank St.

6.2.9 Storage

The existing Village Tank provides a total of 300,000 gallons storage and the Mills Tank provides approximately 2000,000 gallons for a total volume of 5000,000 gallons. The Operational Storage (OS) is the upper portion of water in a reservoir that fluctuates on a regular basis. It is the storage between the level that pumps are started, and pumps are stopped.

The range at which the reservoirs operate is unknown because the system is run on timers. With an average day of 50,000 gallons, we can assume that the reservoirs are operating through a very small range under normal circumstances. This equates to a daily 10% turnover rate or 10-day residence time in the system.

It is generally recommended that tanks be operated through a 20% turn-over rate. This cannot be adequately achieved by the use of timers.

Equalization Storage (ES) is storage required to meet peak demand days when pumps cannot keep up. The pumping capacity of the Emery Corner pump house is greater than the peak daily use of the Limerick Water System. Consequently, ES is not required in the system.

Standby Storage (SS) is storage available to supply the system in the event of a pumping failure. This is the water that is located between the Mills reservoir operating level and the level that would result in pressures less than 20 psi in the system. Assuming the lower operating level is 80% of reservoir capacity, the Mills Reservoir SS is 160,000 gallons. The Village Tank also has considerable standby storage (240,000 gallons) as it is located on a hill above the high pressure zone.

Adequate SS is twice the average daily demand (ADD) and the LWD reservoirs provides 8 times the ADD. This indicates that the LWD Water System has adequate SS.

SS is often combined with Fire Suppression Storage (FSS) and in the case of Limerick, can be considered the same thing. FSS requirements are detailed by the International Fire Code for individual buildings. FSS for a municipality is based more on practicality with buildings requiring larger flows than a municipality can provide to handle their own individual requirements. The practical minimal required FSS is 1,500 gpm for 2 -hours or 180,000 gallons. The practical maximum required FSS is 3,500 gpm for 3-hours or 630,000 gallons. With a FSS of 400,000 gallons, the LWD District capacity is adequate for a FSS of more than 2,000 gpm for 3-hours

Dead Storage (DS) is storage that is below the level that would result in pressures less than 20 psi in the system. Because it can be pumped, the Mills Reservoir has no dead storage. Because the Village tank is elevated above surrounding customers, it also has little or no dead storage.

6.3 Management

The Limerick Water District owns and manages the assets of the water system. Many items require constant management attention. Some of the more important items include:

LWD Policies: These policies are generally outlined or referred to in the District's Terms and Conditions which must be approved by the Maine PUC. The policies are written for both customers and employees of the Water District to know what to expect.

Safety Records: These are kept up to date by the District. Certain records must be kept on file and made available for the Maine Department of Labor during periodic inspections. Required records include:

- Lock Out/Tag Out
- Fire Extinguisher Inspections
- Eye Wash Inspection
- Confined Space Entry Permits
- SDS sheets
- Training records

Customer Complaint Records: These records are important in helping resolve customer concerns. When a concern cannot be addressed, the records are important in showing that the Water District has made a good faith effort to resolve issues.

Rates: Rates should be adjusted immediately before expenses are forecasted to exceed revenue. Many District's postpone rate increases and fund operational expenses from their depreciation budget before raising rates. Overall, this is not a sustainable practice as the District ends up with no money to replace deteriorated infrastructure. Instead, Dirigo Engineering recommends smaller, more frequent rate increases along with adequate funding of depreciation accounts and establishment of a capital reserve account.

6.3.1 Office

The public office for the Limerick Water District is in the sewage treatment plant and is staffed on a part time basis. The District is currently keeping books by hand and should upgrade to computerized billing in the future.

6.3.2 Insurance

The District has insurance on its assets. The building and structure replacement values are updated on a regular basis to assure adequate compensation in event of a loss.

7 WATER MAIN REPLACEMENT PRIORITY

Aging infrastructure is affecting most utilities and the Limerick Water District is no exception. Due to the age of the system, some of the distribution system piping in Limerick has exceeded its design life. The infrastructure in the water system can be conveniently divided between before and after 1994. Before 1994, there were little upgrades to the system. Assets from before this period include:

- Water mains
- Village tank
- Pump Station #1 and bedrock well

Beginning in 1994, significant upgrades have been made to the system including:

- Gravel well and Pump Station #2
- 12-inch diameter transmission main from Pump Station #1 to Watson Hill Road on Emery Corner Road
- 12-inch diameter transmission main from Main Street to Emery Corner Road on Washington.
- 8-inch water main extension on John & Mary Drive
- Water main loop on Allaire Dr.
- Mills reservoir and booster station
- Repairs to Pump Station #1 building
- Painting and welding the Village Tank

The design life of ductile iron pipe or cast iron pipe is difficult to accurately determine. Many engineers and utilities use a 50 year design life. To have no pipes in the system older than 50-years, 2% of a systems water main would be replaced on an annual basis. As shown in Limerick and elsewhere, cast iron water main can remain serviceable for 75 to 100-years.

Replacing 2% of LWD's water main per year may seem like a reasonable goal, but it might not be cost effective. The Water District has approximately 26,000 feet of main. At 2 % per year, this is roughly 520 feet of water main per year at an estimated cost of $100,000.00 per year.

Dirigo used a modification of the risk assessment methodology by Devera (2013) to prioritize the water main replacement program. The water main replacement program is intended to replace water mains in an economical and sustainable manner. All water mains require replacement eventually and this methodology helps to identify when that should be done. Because the newer pipe materials have design lives approaching 100 years, a sustainable replacement goal of 1% of the pipe in the distribution system per year is recommended. This is roughly 260 feet of main replacement per year at an estimated cost of $54,270.00/year. Over the past 25 years, the District has replaced approximately 4,700 feet of main or about 19% of this system. This indicates that the District is falling slightly short of a 1% per year replacement goal.

7.1 Remaining Useful Life (RUL)

The first step in the assessment is calculation of the remaining useful life (RUL) of each main in the system. This is done by determining the type of water main in the system, the estimated date of installation and assigning anticipated service life (ASL) to each type of pipe. Leak history is generally considered before assigning RUL to a water main, however, the District has no records of past leaks.

Table 7. Anticipated Service Life (ASL)		
Material	Estimated Service Life (Manufacturer's)	Anticipated Service Life (ASL)
Asbestos Cement (AC)	75-125	100
Galvanized Iron	40-60	50
Ductile Iron	75-125	100
Cast Iron	50-100	75
PVC/PE	50-150	100
Unknown		50

7.2 Probability of Failure

Probability of failure is assigned to each pipe with a score of 1 to 10 based on pipe RUL. The higher scores indicate old leaky pipe with short remaining life. Newer pipe with no leak history would receive the lowest score.

Table 8. Probability of Failure	
RUL (Years)	Probability of Failure
0-3	10
4-6	9
7-9	8
10-13	7
14-17	6
18-21	5
22-25	4
26-29	3
30-33	2
More than 33	1

7.3 Impact Criteria

After each pipe segment is assigned a probability of failure number, the effect of failure is evaluated for several factors. This part of the analysis is often referred to as the Consequence of Failure.

The six factors chosen for this evaluation include:

- Customer Criticality – based on importance of customer

- Land Use – pattern of development in pipe area
- Pipe Material – based on material pipe is made from
- Traffic Impacts – reflects location related to major roads
- Cost of Replacement
- Service Demand - based on size of pipe

Each pipe segment is assigned a value of between 1 and 5 for each factor. All factors are weighted equally.

7.4 Customer Criticality

Critical customers include nursing homes, hospitals, schools, business centers, industrial users and police and fire stations.

The ranking is based on the number of critical customers served by a pipe segment as indicated in the following table.

Table 9. Customer Criticality Score	
No. of Critical Customers Served	**Score**
More than 1	5
1	3
None	1

7.5 Land Use

This factor considers the relative importance of the development in the area served by the water main. High rankings are given to densely built up areas and low rankings are assigned to less developed areas.

Table 10. Land Use Score		
Land Use	**Local Example**	**Score**
Community	Fire Station	5
Industrial	Limerick Mills	4
Commercial	Route 11	4
Mixed Use	Washington St/Main St.	2
Single Family	Elm Street	1

7.6 Water Main Material

Several types of piping materials have been used in Limerick. Some materials are no longer used, such as cast iron and galvanized iron. Newer materials include ductile iron, PVC and PE. In a pipe replacement program, more attention should be given to replacing the older iron pipes rather than newer types of pipes that have longer service life such as cement lined ductile iron and PE/PVC. In the ranking in Table 11, pipes made from cast iron will have a higher score than pipes made from ductile iron.

Table 11. Water Main Material Score	
Pipe Material	**Score**
Galvanized Iron	5
Cast Iron	5
Asbestos Cement	3
PVC/PE	1
Ductile Iron	1

7.7 Traffic

This item ranks pipe replacement according to the how busy the road is which the water main is located on. Low scores are given to local streets where main breaks create less of a disturbance to traffic flow and high scores are assigned to pipelines located along major roads such as State Route 11. Table 12 scores the traffic impacts.

Table 12. Traffic Impacts	
Road Type	**Score**
Arterial Roads	5
Local Collectors	3
Neighborhood Roads	1

7.8 Replacement Cost

The cost of replacement is an important consideration in developing a main replacement program. We assume that the District will use cement line ductile iron water main for their main replacements. There are several factors that affect water main replacement costs but for simple comparative purposes we used a per foot price based on water main size. Large water mains have the highest score as shown in Table 13.

Table 13. Cost	
Diameter of Main	**Score**
12-inch or larger	5
10-inch	4
8-inch	3
6-inch or less	2

7.9 Demand

This item considers the demand placed on sections of water main in the Limerick system. For example, a break in the transmission main on Washington Street would cause a more significant interruption than a break on a 6-inch main on Maple Street. Pipe size is used as an indicator of service demand for the scoring in Table 14. Larger diameter pipes receive a higher score.

Table 14. Demand	
Main Size	**Score**
12-inch	5
10-inch	4
8-inch	3
6-inch or less	2

7.10 Summary Score

7.10.1 Pipe Impact Score

The scores are added together for each pipe to develop a Pipe Impact Criteria ranking or relative importance of each pipe in the distribution system. The maximum score is 30, indicating a pipe that is critical to the Limerick water system. Lower scores indicate lower importance.

7.10.2 Risk of Failure Score

The final part of the analysis is to multiply the Probability of Failure (POF) Score and the Pipe Impact Score (PIS) to provide a Risk of Failure Score (RFS) for each pipe segment.

The Risk of Failure is determined by the following relation:

Probability of Failure Score (PFS) x Pipe Impact Score (PIS) = Risk of Failure Score (RFS).

The maximum score for POF is 10 and the minimum is 1. The possible range for the PIS is 8 to 30. The range of possible Risk of Failure Scores is 8 to 300. An RFS score on the low end of this range indicates a pipe that is not in need of replacement. A higher score indicates priority for main replacement.

A Pipe Replacement Priority table was developed based on the score. The table is divided into three areas of Risk of Failure ranging from Very Low to High priority for replacement. Table 15 is the RFS table summary.

The pipe information from the risk assessment is shown on a system map that can be found in Appendix 4 . This map provides an overview of the ranking for all pipes in the system. In addition, the data used to develop this model has been entered into the LWD GIS system and can be provided on a thumb drive.

Table 15. – Pipe Replacement Priority

POF \ PIS	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
3	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90
4	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
5	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
6	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168	174	180
7	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168	175	182	189	196	203	210
8	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	208	216	224	232	240
9	72	81	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216	225	234	243	252	261	270
10	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300

KEY

Replacement Priority	Score
Lowest Priority	0-25
Low Priority	25-75
Medium Priority	75-150
High Priority	150-300

As improvements are made to the system, the lower priority mains move up in priority. The pipe replacement ranking should be re-visited every 5 years or so to keep the distribution system up to date.

8 HYDRAULIC MODEL

Diriigo used the WaterCAD computer model to develope a hydraulic model of the LWD system. Information for all pipes in the system larger that are larger than 4-inches diameter were entered in the model including:

Diameter
"C" Value
Elevation at intersections
Material type

The system was skeletonized and evaluated for fire flows with supply and booster pumps off. Existing fire flow data was not available to calibrate the model. We used the model to determine where hydraulic restrictions are in the system and to evaluate upgrades in the system.

Based on descriptions of pipe inernal conditions from operators we utilized a C value of 75 for the old cast iron mains. The ductile iron mains in the system, which are newer, generally have C values in the 120 to 130 range. The model assumed a typical background system demand by users of 41 gpm.

The model can be used for examining other aspects of the system or changes to the system in the future, including but not limited to additional reservoirs, water sources, fire flow analysis, water age simulations, leaks, water quality and many other scenarios.

8.1 Description

The basic steps involved in constructing the WaterCAD model include:

- Model input
- Calibration
- Model output

8.2 Model Data

A GIS map was used to create a base map for the model. The model includes:

- Emery Corner Pump House
- Village Tank
- Booster Station
- Mills Reservoir
- Pipes
- Junction nodes (where pipes come together)
- Pumps

8.3 Model Output

The model output is summarized in the table below. The upgrade system includes the following upgraded pipes.

- New 12" Water Main on Emery Corner Road to Watson Hill Road
- New 12" Transmission Main from Village Tank to Elm Street
- New 8" Water Mains in the Village area including:
    - Main Street
    - School Street
    - Burbank Street
    - Route 11, Elm Street
    - Route 160, Parsonfield Road
    - Route 5, Sokokis Trail

	Calculated Available Fire Flow in GPM at 20 psi residual	
Location	**Existing System**	**Upgraded System**
Emery Corner Rd. at Pickerel Pond Rd.	426	1888
East End of 11 (Central St.)	1272	1272
11 at Prospect	3386	3386
Washington at John & Marie (Lower System)	961	961
Washington at John & Marie (Upper System)	1804	2631
Town Office	1971	3500
Main at Washington	1746	3500
Parsonfield Road at End	1100	1948
Elm at West End	560	1879

9 GROUNDWATER FAVORABILITY ANALYSIS

9.1 Introduction

The Limerick Water District currently supplies approximately 50,000 gallons per day (GPD) of municipal water, primarily from a 16" x 12" gravel well located at the Libby Site (Emery Corner Road) northeast of Limerick Mills. This has been the primary source of supply since 1994. The well is 49.5 feet deep and has an estimated sustainable yield of approximately 300 gallons per minute (GPM). The pumping capacity is limited to 110 - 125 GPM (160,000 - 180,000 GPD) by the installed well pump.

This well has a history of increasing dissolved iron and manganese in the raw water. The drinking water limits for iron and manganese are known as secondary standards. Secondary standards are recommended by the EPA for aesthetic or cosmetic purposes and are not enforceable. However, iron above the 0.3 mg/l and manganese above the 0.05 mg/l limits, as they are in the Limerick system, produces effects that are very noticeable to customers. These effects include noticeable color in the water and staining of fixtures and laundry. Under the right circumstances, iron and manganese can produce odors, especially if bacteria are also present.

The District also has a bedrock well located on Washington Street near the Mills Reservoir and booster station. The State of Maine Drinking Water Program (DWP) lists this as a 6-inch diameter well that is 500 feet deep. The yield is reportedly between 17 and 20 GPM.

The District is facing a decision on whether to replace or treat the existing gravel well. To identify favorable sites for the location of a new high yield municipal well in the Limerick area, we used several sources of information. Areas that are identified as favorable for groundwater would require extensive on-site testing to determine if the quantity and quality of water is sufficient to replace the existing source.

9.2 Sources of Information

We examined existing published data for the town of Limerick, including:

- Topographic maps
- Bedrock Geologic Map of Maine (Osberg and others, 1985)
- Surficial Geology of the Limerick Quadrangle Maine (Wilch, Thom 1999)
- Significant Sand & Gravel Aquifer Map, Limerick Quadrangle, Maine (Neil and others, 1998)
- Maine Geological Survey Well Database (Published and Unpublished)
- District drilling records

9.3 Previous Studies

Available records indicate that the Limerick Water District has previously completed several test wells within Limerick. Apparently, test well drilling was done before the fire at the Mill in 1994. Unfortunately, no records of these previous investigations could be found, however, at least

three of these old test wells were recovered at the Libby site during the 1994 test well drilling investigations.

We also found a reference to two areas that were previously tested located off the end of Allaire Drive. These sites were labeled as "Dole Property". No information is available for these sites.

9.4 Existing Gravel Well

The existing well is located on a narrow sand and gravel ridge in the midst of a peat bog. The well is most likely showing increased iron and manganese due to increased seepage from the peat bog into the sand & gravel aquifer. Water seeping from the peat bog into the aquifer will be low in dissolved oxygen simply because the organic matter and bacteria in peat bogs use up oxygen. Water that is high in dissolved oxygen generally does not mobilize iron and manganese (which is present just about everywhere in Maine soils). However, water that is anoxic (low in oxygen) tends to dissolve iron and manganese.

The level of dissolved iron and manganese generally increases with depth in sand & gravel aquifers. This is also caused by anoxic conditions and stratification (layering) of sand & gravel deposits. Oxygen comes from the atmosphere and the further the water is from the atmosphere (deeper), the less oxygen and more iron and manganese.

During test drilling, brightly stained soils (orange-red) indicate oxygenated conditions which generally means that the iron is not dissolved in the water but is in a solid state. Gray gravels with no visible iron generally indicate anoxic conditions with the iron and manganese being dissolved in the water.

Unfortunately, the existing well is in a location where the primary recharge area to the well is the bog itself. The well will continue to receive low oxygen water from the bog and there is almost no chance of developing a well next to this well that will be iron/manganese free.

9.5 Sand & Gravel Aquifers

Sand & Gravel Aquifers are found where deposits of sand & gravel lie beneath the water table. All of the spaces between the sand & gravel particles are filled with water that can flow in large quantities to properly located and constructed wells. Most high yield wells in Maine (including Limerick's Libby Site well are constructed in Sand & Gravel Aquifers.

The Sand & Gravel Aquifers in the study area consist of materials that were deposited by meltwater streams towards the end of the last glacial period (approximately 12,000 years ago). Sand & gravel deposits in Limerick include:

- Esker Deposits – These are narrow winding ridges of layered sand & gravel that was deposited by subglacial streams. Eskers in Maine are a primary target for high yield wells because they generally contain coarse, clean material that produces excellent quality ground water.
- Ice-Contact Deposits – These are generally terrace-like forms along the sides of valleys. They were deposited by meltwater streams flowing between ice in the valley and the valley sides. These deposits are also sand and gravel but perhaps more variable and not as clean as esker deposits. These deposits can produce significant amounts of water if the material is thick enough and clean enough.

- Stream Terrace Deposits – These deposits were formed by glacial meltwater when local lakes were higher. They are generally layered sand & gravel deposits that can be good sources of groundwater. These deposits were cut into by modern steams after the glacial lakes in the area receded.
- Glaciolacustrine Deltas – These deposits were formed by glacial meltwater where it entered the glacial lakes. They generally form flat topped deposits and consist of sand with gravel.

A significant portion of Limerick is underlain by mapped Sand & Gravel aquifers. Sand and gravel aquifers are located along

- Leavitt Brook
- Brown Brook, Sokokis Lake and Pickerel Pond
- Underlying Limerick Mills
- Continuing along Brown Brook to Lake Arrowhead

Certain areas of the Sand & Gravel Aquifers in Limerick should be considered as off-limits due to the presence of potential or historical sources of contamination. These areas include:

- Town dump, MDOT Salt Sand, Sewage Treatment Plant, F.R. Carrol yard in the vicinity of Doles Ridge Road, Burnham road and Fisher Drive
- Limerick Mills Area (Mill fire)
- CIA Auto Parts on Route 5 (oil/fuel spills)
- Limerick Village area (oil/fuel spills)
- Taylor Property on Range E Road (municipal sludge spreading)

In addition, potential sites for gravel wells should be located a sufficient distance from the numerous bogs in Limerick that also happen to be within Sand & Gravel Aquifers. To minimize the chances of iron and manganese, a well should be located so that its primary recharge area is not a bog wetland.

9.6 Bedrock Aquifers

We used topographic maps, aerial photographs, hill shade LiDAR and other published sources to identify linear features which may represent fractures in the underlying bedrock. Since ground water in the bedrock aquifer occurs mostly in discrete fractures, this “Fracture Trace Analysis” can help to identify areas that might produce high yield wells.

It should be noted that bedrock wells completed in areas with extensive overlying Sand & Gravel aquifers are often recharged by fractures extending to the bottom of the sand & gravel. For this reason, bedrock wells should also be sited so that their primary recharge area is not bog wetland.

The bedrock underlying Limerick consists of metamorphic rocks (Gneiss and Schist) with a granite body located in the vicinity of Emerys Corner. Rock units include:

- Mostly Devonian Silurian Rindgemere Formation lower member – schist and migmatite (partially melted rock)`
- Devonian Silurian Rindgemere Formation lower member – thin bedded lime-silicate gneiss and schist

- Devonian Granite

In addition to the fracture trace analysis, we looked at mapped bedrock contacts between the various units, such as the contact between the granite and the Rindgemere Formation. These contact zones are often fractured and can produce more water.

9.7 Water Quality

Water quality in the bedrock aquifer is expected to be higher in dissolved minerals than water in the sand & gravel aquifer. In other words, it is expected that water from the bedrock aquifer will generally be of lesser quality than that from the sand & gravel aquifer. Table 16 is a comparison of select inorganic parameters from the LWD's two wells. The bedrock well shows higher levels of nitrate, hardness, chloride, uranium and arsenic. In fact, the bedrock well exceeds the arsenic standard, indicating that treatment is necessary for this well. Iron in the bedrock well is similar to the sand and gravel. Only manganese is lower in the bedrock well.

Table 16. Water Quality Comparison

	Libby Site	**Washington St. Well**	**Limit**
Iron	**1.1**	**1.08**	0.3 (Recommended)
Manganese	0.089	0.007	0.05 (Recommended
Arsenic	0.0033	**0.0129**	0.01
Hardness	41	117	No limit
Sodium	9.7	9.4	No limit
Chloride	17	32	250
Nitrate	<0.05	0.62	10
Uranium	1.3 ug/L	16 ug/L	30 ug/L

9.8 Favorable Zones

Wells primarily depend on recharge from rainfall and snowmelt for recharge. Therefore, when looking for an area to drill high yielding wells, the amount of drainage (or recharge) area uphill of the well site must be considered. In the Limerick area each GPM of sustainable well yield requires about 1 acre of sand and gravel or 4 acres of upland recharge areas. For potential bedrock wells not located on sand & gravel aquifers, each GPM of sustainable yield will require about 4 acres of recharge area.

Most of the Sand & Gravel Aquifers located in Limerick are located in extensive lowland areas adjacent to streams and lakes. Wells drilled here will generally have large recharge areas. Some potential bedrock well locations may not have large recharge areas. Also, bedrock wells depend on storage in fractures, connection to a sand & gravel aquifer or to a surface water source for sustainable yield during drought. Sometimes these factors cannot be determined until there is a drought and well yield drops off sharply.

Our analysis of the above data indicates several favorable areas where high yielding sand & gravel wells may be located. We have also identified a few potential bedrock well areas. We strongly recommend that bedrock wells only be used as a last resort because of their

unpredictable nature. The favorable areas are discussed in the next section and are listed in order of most favorable to least favorable. Cost is the primary factor in the ranking with favorable sites that are located closer to the existing distribution system being ranked higher than those that are further away. Favorable areas are shown in Figure

9.8.1 Favorable Area 1 – Near Emery Corner Pump House.

In order to minimize development costs, it makes sense to start a search for a new well as close to the existing distribution system as possible. The LWD owns approximately 18 acres of land off the Emery Corner Road. This land is currently occupied by the gravel well and Pump Station #2. A small telephone building is also located on-site.

Much of this property is peat bog, making it unsuitable for well development based on the water quality in the existing gravel well. However, there are approximately 5 acres of upland area on this parcel. A well located away from the bog might produce better quality water than the well that is in the bog. The most favorable location for a gravel well on this site would be in the middle of the 5-acres of upland.

The LWD has expressed interest in a bedrock well at this site. We completed a fracture trace study in this area and have mapped several prominent photo lineaments. The most prominent lineament which runs in a northwest/southeast direction follows the Leavitt Brook valley. Bedrock mapping in the area indicates an inferred contact zone between two different units of the Rindgemere Formation. This contact zone runs beneath the site and is the most likely target to drill on-site. Fortunately, the best location for a sand & gravel well roughly coincides with the best location for a bedrock well. We can therefor evaluate both the sand & gravel and bedrock potential of Area 1 by using a rotary rig to first evaluate the sand & gravel and then proceed into the bedrock.

9.8.2 Area 2 – Quarry Road Site

This area is located easterly of the Cornish Road/Quarry Road Intersection. The area was selected for the following reasons:

- Mapped sand & gravel aquifer
- Undeveloped recharge area
- Presence of esker deposits
- Absence of large boggy areas

9.8.3 Area 3 – Pleasant Hill Road/Leavitt Brook Road

This area is located north of Route 11 on the east side of Leavitt Brook. The area just south of this site, across from Route 11 was tested in 1994 and shown to have some promise for well development. This area was selected because of:

- Mapped sand & gravel aquifer
- Undeveloped recharge area
- Presence of esker deposits
- Absence of large boggy areas

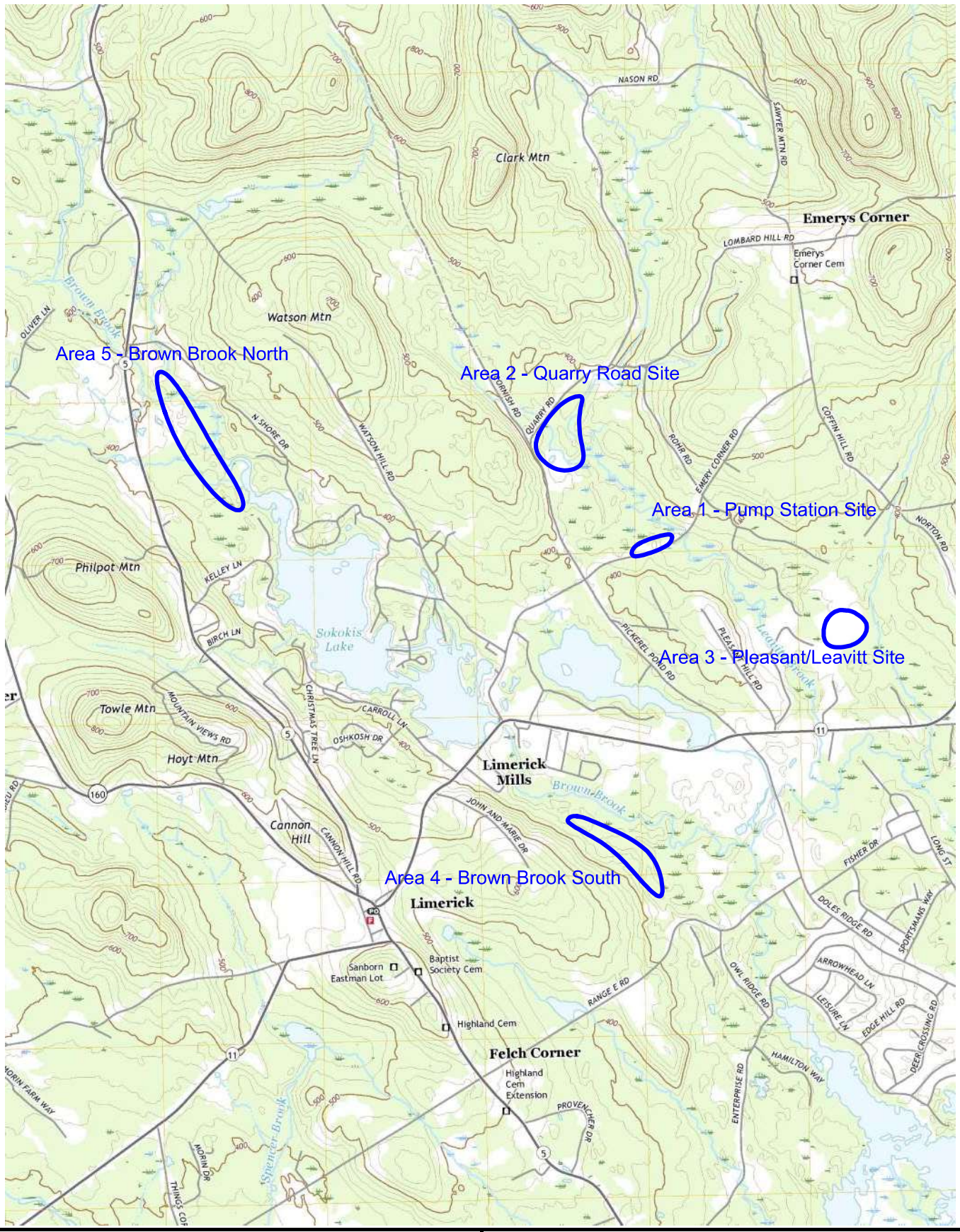


FIGURE
FAVORABLE ZONES
SAND & GRAVEL AQUIFER

DIRIGO ENGINEERING
2 DIRIGO DRIVE FAIRFIELD, ME 04937
(207) 453-2401

FILE: location map.dwg	DATE: 03/10/19	#21508

9.8.4 Area 4 – Brown Brook South

The Brown Brook Valley is underlain by an extensive mapped Sand & Gravel aquifer from the Cornish town line in the north west to the Waterboro town line to the southeast. However, many areas of this aquifer are developed. Due to the potential risk of contamination, these developed areas should be avoided when evaluating potential well locations.

This area is located south westerly of Brown Brook and northerly of the Burnham Road. This are was selected because of:

- Mapped sand & gravel aquifer
- Lightly developed recharge area
- Presence of esker deposits
- Absence of large boggy areas

9.8.5 Area 5 – Brown Brook North

This area is located easterly of Brown Brook along the Allan Spring Road in the north of Limerick. This area was selected because of:

- Mapped sand & gravel aquifer
- Undeveloped recharge area
- Presence of esker deposits
- Absence of large boggy areas

9.9 Estimated Costs

Costs for developing an additional well supply include the costs of:

Exploration and Development
Land Purchase
Water Main Extensions
Pumping/Treatment Facilities

Area 1 has the advantage of being piped directly to the existing Emery Corner Pump Station. Area 1 also has the advantage of being very close to the existing Emery Corner Pump Station and is on land already owned by the LWD. The costs for developing areas other than Area 1 will be significantly greater. However, locating a new well outside of Area 1 has the advantage of being in an area that may have better water quality and have a separate recharge area from that of the current gravel well.

Estimated costs for well development at each area is shown in Table 17. Detailed cost estimates can be found in Appendix 5.

Table 17. Estimated Costs			
Favorable Area	Location	Distance from Distribution System	Estimated Cost
Area 1	Emery Corner Property	600 feet	$368,400.00
Area 2	Quarry Road	3,000 feet	$1,779,600.00
Area 3	Pleasant Hill	1.25 miles	$2,424,000.00
Area 4	Brown Brook South	2,000 – 3,500 feet	$1,872,000.00
Area 5	Brown Brook North	2.25 miles	$3,732,000.00

10 CAPITAL IMPROVEMENT PLAN

A 20-year Capital Improvement Plan is intended to provide a guideline, or roadmap for capital improvements over the next 20 years. We have included some maintenance items but the plan is primarily intended to identify and prioritize capital improvements. The plan is prioritized based on the following factors:

- Age and projected service life of component
- Importance of the component to the system operation
- Probability of failure
- Consequence of failure
- Estimated cost of improvement

Recommendations have been made regarding the proposed improvements. The proposed improvements have been separated into categories based on the recommended schedule for implementation. There are three categories listed as follows:

Immediate implementation (0 to 5 years - Priority 1)
Short term improvements (5 yrs. to 10 yrs. - Priority 2)
Long term improvements (10 yrs. to 20 yrs. Priority 3)

When developing our list of recommended capital improvements, we kept several things in mind, foremost being the reliability of the system and the ease and safety of operation. Each category has been discussed and the specific recommendations listed.

Uogrades to piping and meters are included in the Capital Improvement Plan but costs are distributed yearly for the 20-year planning period. Piping replacement costs are estimated at $54,270.00 per year and meter replacement cost, based on 250 meters replaced over 20-years is $3,500.00 annually.

10.1 Short Term Improvements (0-5 Years)

There are several improvements that are recommended for immediate implementation. These improvements should be made and put into service within the next 5 years. They are listed in general order of importance.

10.1.1 O&M Issues

- Repair/install chlorine analyzers
- Repair/replace clear well level control
- Master meter calibration
- pH unit calibration
- Clean aeration unit frequently
- Inspect aerator inlet and outlet screens
- Clean/inspect Mills reservoir
- Clean/inspect Emery Corner Road clear well
- Repair insect screen on Mills reservoir
- Install screen on Village tank overflow
- Label all chemical day tanks
- Test backflow device at Mills reservoir booster station

The estimated cost for addressing all current 0&M issues is $15,000.00.

10.1.2 Return Bedrock Well to Permanent Status

The bedrock well should be returned to permanent use. The necessary upgrades are described in Section 5.34. The estimated cost for these upgrades is $43,680.00.

10.1.3 Develop Replacement Water Source for Gravel Well

The existing gravel well has water quality issues with iron and manganese and potentially with surface water contamination. The cost to treat for iron and manganese alone is estimated at $381,600.00. If the well also requires treatment for organic removal or for ground water under the influence of surface water, the costs are estimated at an additional $306,000.00 for carbon filtration. This would bring the total estimated cost for treating the existing well to $687,600.00.

Cost estimates for developing a replacement water source vary considerably depending on where the source is located. The location of a replacement well is unknown at this time and must be located and tested before cost estimates can be finalized. The least expensive option is to develop another well on-site that is further away from the peat bog at an estimated cost of $368,400.00.

10.1.4 SCADA Upgrades

SCADA upgrades will allow the District to remotely monitor and control the water system. The estimated cost for installing a new SCADA system with monitoring of four remote sites is $86,400.00.

10.2 Mid Term Improvements (5-15 Years)

The mid-term improvements provide improved performance and reliability of the system. The improved performance comes in redundancy such as looping that increases reliability and will improve fire protection and may improve water quality. The following upgrades are included in this phase.

10.2.1 Looping

The Limerick Water System is linear and does not lend itself to looping. Opportunities for looping, which increase redundancy, increase fire flows and improve water quality include:

- Locust Hill
- Main Street between Cannon Hill Rd & Burbank St.

Estimated cost for the Locust Hill Loop is $150,000.00 and for Main Street is $87,600.00

10.2.2 Standby Generator

A standby generator and automatic transfer switch should be installed at the Emery Corner pump station. The generator should be a 60 KW propane fired unit with a 200 amp rated automatic transfer switch. The estimated cost for this is $67,680.00.

10.2.3 Mills Reservoir

Mixing (and water quality) can be improved in the Mills Reservoir by adding valving and a pipe loop at the far end of the reservoir to create serial flow through one chamber and then through the second chamber. This will keep the water fresher, lower chlorine demand and help control disinfection by-product in the water system. The estimated cost for this work is $82,440.00. Alternative designs that should be considered include proprietary mixers or extending pipes from the inlet to the far end of the tank, similar to a Tide-Flex system.

10.2.4 Hydrant Replacement

The District has 2 hydrants that currently require replacement. Hydrants are generally replaced when mains are replaced and the cost for hydrants is included in the pipe replacement plan.

10.2.5 Valve Replacement

Valves are generally replaced when water main is replaced. Circumstances arise where a valve may need to be repaired or replaced periodically. Valve replacement costs are included in the main replacement program.

10.3 Long Term Improvements (15 to 20-Years)

The long-term improvements are generally expensive to implement. These improvements usually involve major components in the system. However, as time passes, the long-term improvements will likely increase in priority. The following upgrades are included in this phase:

10.3.1 Village Tank

The Village tank will require repair/painting or replacement towards the end of the 20-year planning period. A life cycle cost analysis should be done at that time to determine the best option. The estimate included here is for replacing the existing tank with a concrete in-ground tank. The estimate is $969,780.00.

10.4 Cost Estimates

Cost estimates have been prepared for the recommended improvements and can be found in the Appendix 5. The costs are preliminary, but they give the Limerick Water District a picture of the financial considerations associated with the improvements to the water system.

Estimated costs include construction costs of proposed improvements, contingency, and additional project costs, such as engineering, land acquisition, legal and administrative. These estimates it will help the District to make informed decisions regarding the improvements.

10.4.1 Construction Cost

The estimated costs are based on today's prices of water works projects constructed by competitive bids. Costs include a 20% contingency; however, costs are subject to inflation and will need to be adjusted in the future.

10.4.2 Other Project Costs

Waterworks construction projects generally have additional associated costs. These costs include land acquisition, legal fees, engineering, construction management and administration.

Administrative costs include expenses for managing the construction contracts such as pay requisition review, change orders and monthly progress meetings. Engineering services generally include studies, design and construction inspection services.

Legal fees are sometimes required for obtaining easements or purchasing land. Also, bond counsel is necessary to file the proper forms for project loans. In addition, temporary financing interest is also included in other project costs. For estimation purposes, we have used 20% of estimated construction cost as other project costs.

10.4.3 Total Project Cost

Total project cost includes the estimated construction costs plus the other project costs. Table 18 shows the sum of the total project costs for the recommended improvements.

Table 18 – Total Project Costs – Recommended Improvements

	Short Term	Mid Term	Long Term	Total
Total Project Costs	$847,305.00	$1,075,370.00	$1,308,605.00	$3,231,280.00

10.5 Estimated Impact on Water Rates

10.5.1 Annual Costs

Annual costs represent the cost of running the water system. The amount of annual costs of running the Water District must be recovered from customer billing to keep the District sustainable. Annual costs include three parts - operation and maintenance (O&M), annual debt service and a depreciation allowance.

10.5.2 O&M Costs

These estimates have been prepared from the PUC and financial records of the District. Adjustments were made to future O&M by applying an annual increase and accounting for proposed improvements.

10.5.3 Debt Service

Annual debt service is the cost of borrowing money used to make the necessary improvements. The best alternatives for financing are currently the State Revolving Loan Fund and USDA Rural Development Water and Wastewater Disposal Loan & Grant programs. For the analysis below, the current Rural Development rates and 20-year term have been used as a guide. Rural Development funding with a longer term may be available. The terms of borrowing for a utility are presently approximately 2.5 % interest rate and a term of 20 years. Table 19 is a projection of debt if recommended improvements are made.

Table 19. Debt[1]

Time Period	Debt	Annual Payments
Present (2020)[1]	$17,188.00	$1,719.00
Short Term (2025)	$864,493.00	$54,352.00
Mid Term (2035)	$1,922,675.00	$121,613.00
Long Term (2040)	$3,231,280.00	$205,556.00

[1] Existing debt is $17,188.00 loan from sewer department with 10 year term, 0% interest.

10.5.4 Depreciation

Depreciation is money that is set aside each year to replace water system components. Sometimes, these funds are used for Operation and Maintenance costs. Depreciation rates are spelled out in Chapter 68 of the PUC regulations. Depreciation ranges from a low of 1% for long lived items such as reservoirs to as high as 20% for communication equipment. Future depreciation was estimated by adding 1.3% of the project construction costs and adding it to the current depreciation. These numbers will likely be a bit high because of the potential for contributions in aid of construction (grant money). O&M, Debt Service and Depreciation expense are summarized in Table 20.

Table 20. O&M, Debt Service & Depreciation Expenses

Item	2020	2025	2035	2040
O&M Expense[1]	$121,676	$134,340	$163,760	$180,804.00
Debt Service	$1,718	$54,352.00	$121,613.00	$205,556.00
Depreciation	$20,217	$27,979	$36,390	$48,322.00

[1] Includes 2% Annual Increase

10.5.5 Capital Reserve Account

A Capital Reserve account is defined by the PUC as "revenue collected and maintained in a fund to pay for future replacement and repair of qualifying infrastructure projects." This is a mechanism to generate additional revenue now for future upgrades. A Capital Reserve Account helps a District pay for needed improvements/replacements out of their own accounts, rather than borrowing as much money.

The District currently does not have a Capital Reserve account. We recommend that the District establish a Capital Reserve account as part of their next rate case. The Limerick Water District is classified as a small water utility. The Capital Reserve account is limited to 20% of total required revenue and 5% of the gross utility plant.

10.5.6 Estimated Annual Costs

The estimated annual costs of the proposed improvements are summarized in Table 21. These costs include a 20% surcharge for a Capital Reserve Account.

Table 21. Estimated Annual Costs

Item	2020	2025	2035	2040
O&M Expense[1]	$121,676	$134,340	$163,760	$180,804
Debt Service	$1,718	$54,352	$121,613	$205,556
Depreciation	$20,217	$27,979	$36,390	$48,322
Capital Reserve (20%)	$28,722	$43,334	$64,353	$86,936
TOTAL BUDGET	$174,353.00	$262,030.00	$388,151.00	$523,658.00

10.5.7 User Costs

Using the estimates, we can determine how the needed revenue will be generated. According to the 2018 PUC Report, the total income for the system was $88,427.00 from water sales and other revenues. The numbers show a net loss of $20,634.00 in 2018.

The rate case prepared for the District that went into effect on July 1, 2019, resulted in an overall increase of 59.82%. This brings the minimum rate up to $62.20/qtr. (for 1200 cu. ft.) and $100.60/qtr. for 2,000 cu.ft. The rate increase is expected to result in an increase in revenue of approximately $53,000.00 per year for a total revenue of $141,427.00. This recent rate increase is factored in the estimated rate increase calculations.

The costs for projects must be paid out of user rates. Table 22 shows the estimated rate increases needed to pay for the projects.

Table 22. Estimated Rate Increases				
	2020	2025	2035	2040
Increase (%)	23%	50%	48%	35%
Cumulative (%)	23%	85%	174%	270%

10.5.8 Financing

There are two sources of financial grant (RD and SRF) for community water system improvements, however, it does not appear that the Limerick Water District will qualify for these grants as they are based on the affordability of rates compared to the local median household income. Grant funding, if available, is usually part of a grant/loan funding package.

The SRF program will provide grant funding as part of a loan package if the water rates (based on 2,000 cf/qtr.) are more than 1.5% of the MHI. Current MHI is $50,547 in Limerick. The annual water rate for 2,000 cf./qtr. is $100.60 or $402.40 annually compared to $758.21 which is 1.5% of the MHI. This means that the SRF program will likely not provide grant funding.

The RD uses a similar process in evaluating the affordability of water rates. With water rates in Limerick currently considered "affordable" it is unlikely that RD would provide any grant money for future projects. RD also provides low interest loans, the rate depending on the MHI compared to poverty level.

The Limerick Water District should perform an income survey for just the customers that are served by the water system. This may show that the customers on the water system have a lower income than the town wide MHI. If the MHI of the customers is significantly lower than the town MHI, grant funding may be available.

Another source of funding that may provide grant is the Community Development Block Grant Program (CDBG). This program funds projects on a competitive basis depending on the need. This funding, in conjunction with SRF funding was used to finance the recent Downtown Revitalization project in Rumford.

Both the SRF and RD programs have funds available to borrow at low interest rates. Current SRF rates are 1.0% and Limericks' rate for RD funds would be 2.5%. In addition, the Maine Municipal Bond Bank has general obligation funding available at a current effective interest rate of approximately 2.75%.

10.5.9 Additional Considerations

The calculations above assume no grant funding. Grant funding may become available in the future and would reduce the costs to the rate payers.

9 REFERENCES

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10 APPENDICES

Appendix No. 1 – GIS System Map
Appendix No. 2- Well Information & Pump Information
Appendix No. 3 - Water Quality
Appendix No. 4 - Risk Assessment Map and Spreadsheet
Appendix No. 5- Cost Estimates

Appendix 1 – GIS System Map


N
W
E
S
Old Dole
Old 2.5
WW
0
305
610
1,220
1,830
2,440
Feet

Appendix 2 – Well & Pump Records

R. E. Chapman Co.

ARTESIAN and GRAVEL PACKED WELLS

30 NORTH MAIN ST., WEST BOYLSTON, MA 01583-1126 (508)835-6231

SITE PLAN FOR TEST HOLES

By.....

DRILLER Rick Sullivan DATE October 4, 1994 MACHINE NO. 20W-1

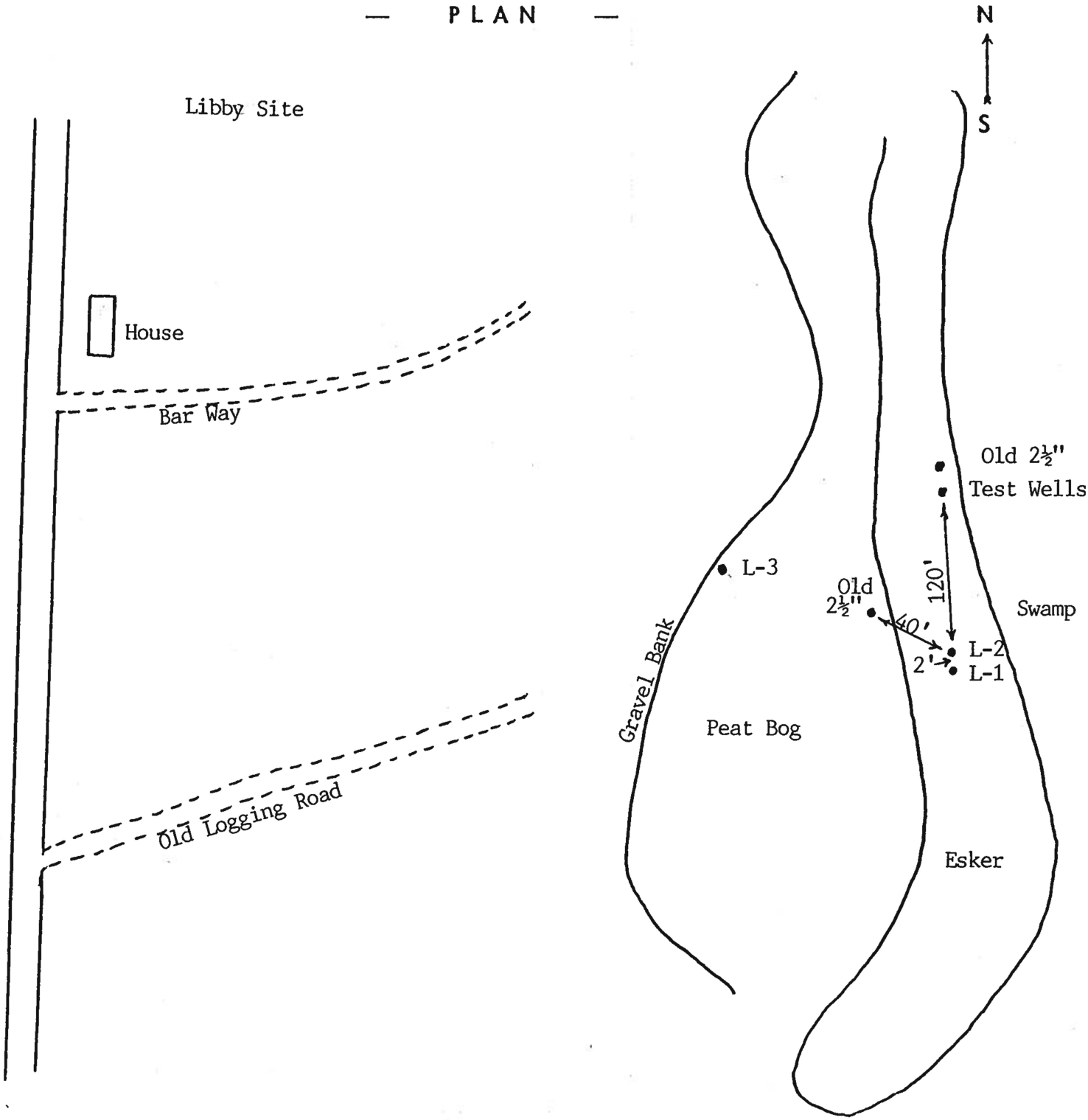
CUSTOMER Limerick, Maine ADDRESS

Hole Nos. on This Site Plan L-1, L-2, L-3

Hole Nos. Driven and Removed

Hole Nos. Driven and Left in Place L-1, L-2, L-3

— PLAN —



Limerick, Maine
Test Well Summary

Work Completed October, 1994

Well ID	2½" Drive	2½" Remove	2½" Leave	Screen Set	Screen Removed	Screen Left	Pump and/or Develop
L-1-94	54'	12'	42'	5'(49'-54') 10'(42'-48')	5'(49'-54')	10'(42'-48')	
L-2-94	48'	5'	43'	5'(43'-48')		5'(34'-39')	
L-3-94	39'	4'	35'	5'(34'-39')		5'(34'-39')	
L-1-94							2 hours
Totals	141'	21'	120'	25'	5'	20'	2 hours

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS

DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date October 3, 1994 Hole No. L-1-94 API

Started October 3 Finished October 3

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in Inches
0	11	Very coarse gravel, cobbles		
		boulders		
11	20	Very coarse gravel & cobbles		
20	27	Very coarse gravel & cobbles		
27	34	Very coarse brown sand & gravel		
34	42	Very coarse brown sand & gravel		
42	49	Very coarse brown sand & gravel		
49	53	Very coarse brown sand, gravel		
		& silt		
53	54	Very coarse brown sand, gravel,		
		silt, trace of clay		
	54	Refusal		

Used 42 ft. inches of casing

Well rated at 50 G.P.M. 20 " Vacuum

Water level is 4 ft. below ground level

Remarks Expose 5' of 60-slot screen from 49'-54' Pump 5 gpm, 27" vac. Pull & reset Expose 48'-42'. Pump 50 gpm. 10' of 60-slot screen with 3' riser

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS

DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date October 4, 1994 Hole No. L-2-94 API

Started October 4 Finished October 4

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in Inches
		2' off L-1		
		Same as L-1		
		48' deep		

Used 42 ft. inches of casing

Well rated at 40 G.P.M. 25 " Vacuum

Water level is 4 ft. below ground level

Remarks Set 5' of 60-slot screen, 3' riser 48'-43'

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date October 4, 1994 Hole No. L-3-94 API

Started October 4 Finished October 4

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in Inches
0	4	Peat		
4	13	Very coarse gray-brown sand, gravel, cobbles		
13	20	Very coarse gray-brown sand, gravel, cobbles		
20	27	Very coarse light-brown sand & gravel		
27	34	Very coarse gray-brown sand, gravel & silt		
34	39	Very coarse gray-brown sand, gravel & silt, trace of clay		
	39	Refusal		

Used 35 ft. inches of casing

Well rated at 5 G.P.M. 27 " Vacuum

Water level is 1.3 ft. below ground level

Remarks Set 5' of 30-slot screen & 3' riser
39'-34'

Foreman Rick Sullivan

H. E. CHAPMAN CO., OAKDALE, MASS. 01539

LOG OF PUMP TEST

Tel.: West Boylston 835-6231

CUSTOMER

TOWN Limerick

STREET STATE Maine

OWNER OF PROPERTY:

OPERATORS: Stephen Turner, Arnold Thomas, Jack Stark

SIZE & TYPE OF PUMP:

DISCHARGE LINE: Size 6 in.: Length 130 feet

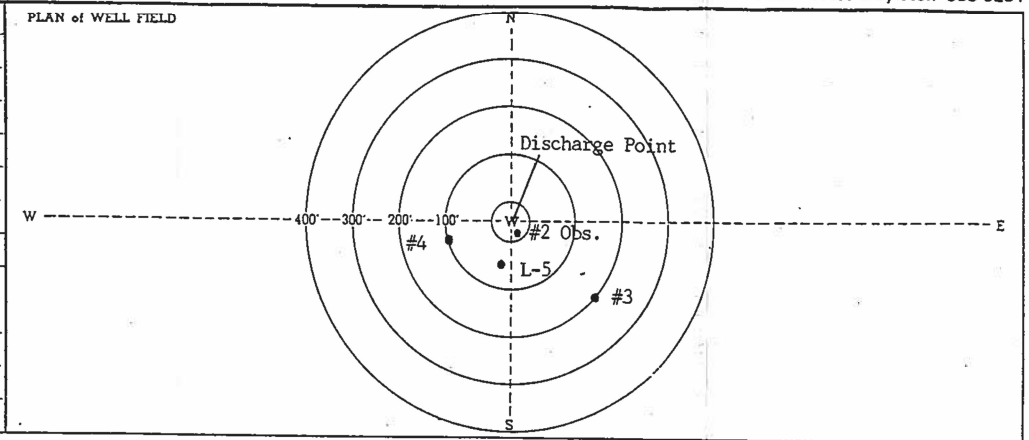
ORFICE PIPE 6 in.: SIZE ORFICE PLATE 4 in.

DESCRIPTION OF WELL BEING PUMPED: 12"

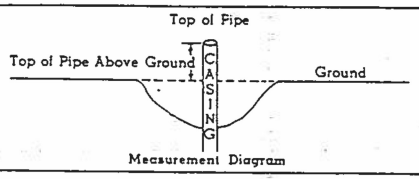
LENGTH OF DUNKER ON TAPE in. ADD TO READINGS (When you make read.)

LENGTH OF ALTITUDE LINE FROM CENTER OF GAUGE ft. in.

PLAN of WELL FIELD



ALL MEASUREMENTS TO BE MADE FROM TOP OF CASINGS



Measurement Diagram

	Observation Wells Information					
FINISHED WELL NO.	No. 12"Well	No. 2 Obs.	No. 4	No. L-5	No. 3	No.
DEPTH OF WELL	Depth 47.5'	Depth	Depth	Depth	Depth	Depth
TOP OF PIPE ABOVE GROUND	Pipe AG 2'	Pipe AG 10"	Pipe AG 1'6"	Pipe AG 1'6"	Pipe AG 1'	Pipe AG
STATIC READING	Static 6.90'	Static 5.40'	Static 5.38'	Static 3.35'	Static 3.17'	Static

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Alt. Gauge Reading	Tape Measm't in Well	Orfice Head in Inches	GPM	Water Level	Water Level	Water Level	Water Level	Water Level	Water Level
12/20/94 Tuesday	1:00:30 pm				25	322	9.00		5.79	4.03		
	1:01				25	322	9.40	7.30	6.14	4.18		
	1:02				25	322	9.40	7.40	6.44	4.32		
	1:03				25	322	9.48	7.51	6.50	4.42		
	1:04				25	322	9.50	7.54	6.56	4.47		
	1:05				25	322	9.54	7.58	6.59	4.52		
	1:06				25	322	9.58	7.60	6.62	4.55		
	1:07				25	322	9.60	7.60	6.63	4.57		
	1:08				25	322	9.62	7.62	6.66	4.59		

H. E. Chapman Inc., Worcester, Mass.

R. E. CHAPMAN CO., OAKDALE, MASS. LOG OF PUMP TEST

NO. 2

CUSTOMER TEL. WEST BOYLSTON 508 835-6231

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Alt. Gauge Reading	Tape Meas'nt in Well	Orfice Head in Inches	GPM	Water Level	Water Level	Water Level	Water Level	Water Level	Water Level
							12"Well	#2 Obs.	#4	L-5	#3	
12/20/94 Tuesday	1:09 pm				25	322	9.69	7.65	6.67	4.61		
	1:10				25	322	9.69	7.70	6.69	4.63	3.64	
	1:20				25	322	9.78	7.80	6.81	4.74		
	1:30				25	322	9.90	7.90	6.90	4.87	3.78	
	1:40				25	322	9.93	8.00	6.97	4.92		
	1:50				25	322	9.97	8.00	7.03	4.97	3.90	
	2:00				25	322	10.02	8.04	7.07	5.02		
	2:10				25	322	10.10	8.08	7.10	5.06	3.93	
	2:20				25	322	10.10	8.10	7.12	5.10		
	2:30				25	322	10.13	8.15	7.16	5.14	4.01	
	2:40				25	322	10.20	8.20	7.19	5.16	4.07	
	4:00				25	322	10.30	8.36	7.25	5.32	4.22	
	5:00				25	322	10.37	8.42	7.33	5.41	4.31	
	6:00				25	322	10.47	8.51	7.40	5.52	4.40	
	7:00				25	322	10.51	8.56	7.47	5.58	4.49	
	8:00				25	322	10.60	8.67	7.52	5.65	4.55	
12/21/94 Wednesday	12:00 midnight				25	322	10.78	8.79	7.69	5.83	4.75	
	4:00 am				25	322	10.95	9.00	7.85	5.97	4.93	
	8:00				25	322	11.02	9.06	7.93	6.08	5.05	
	12:00 noon				25	322	11.10	9.10	8.05	6.16	5.15	
	4:00 pm				25	322	11.20	9.25	8.10	6.24	5.25	
	8:00				25	322	11.25	9.35	8.17	6.32	5.34	
12/22/94 Thursday	12:00 midnight				25	322	11.32	9.39	8.24	6.38	5.42	
	4:00 am				25	322	11.37	9.43	8.30	6.44	5.51	
	8:00				25	322	11.45	9.49	8.36	6.53	5.57	
	12:00 noon				25	322	11.52	9.56	8.42	6.57	5.60	
Shutdown at 1:00 pm	1:00 pm				25	322	11.57	9.58	8.43	6.58		
	1:00:30				25	322	9.78	8.25	8.16	6.31		
	1:01				25	322	9.65	8.13	8.06	6.11		
	1:02				25	322	9.55	8.00	7.94	6.02		

R. E. CHAPMAN CO., OAKDALE, MASS. LOG OF PUMP TEST

NO. 3

CUSTOMER TEL. WEST BOYLSTON 508 835-6231

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Alt. Gauge Reading	Tape Meas'nt in Well	Orfice Head in Inches	GPM	Water Level	Water Level	Water Level	Water Level	Water Level	Water Level
							12" Well	#2 Obs.	#4	L-5	#3	
12/22/94 Thursday	1:03 pm				25	322	9.45	7.96	7.87	5.93		
	1:04				25	322	9.40	7.91	7.84	5.89		
	1:05				25	322	9.36	7.88	7.79	5.85		
	1:06				25	322	9.33	7.85	7.76	5.82		
	1:07				25	322	9.30	7.81	7.74	5.80		
	1:08				25	322	9.28	7.79	7.71	5.77		
	1:09				25	322	9.26	7.78	7.69	5.74		
	1:10				25	322	9.24	7.76	7.66	5.72	5.30	
	1:20				25	322	9.08	7.60	7.49	5.56	5.20	
	1:30				25	322	8.94	7.45	7.35	5.46	5.15	
	1:40				25	322	8.85	7.37	7.25	5.36	5.09	
	1:50				25	322	8.79	7.30	7.16	5.28	5.03	
	2:00				25	322	8.69	7.20	7.08	5.21	4.99	
	2:10				25	322	8.61	7.11	7.00	5.15	4.94	

R. E. Chapman Co.

ARTESIAN and GRAVEL PACKED WELLS

30 NORTH MAIN ST., WEST BOYLSTON, MA 01583-1126 (508)835-6231

SITE PLAN FOR TEST HOLES

By.....

DRILLER Rick Sullivan DATE MACHINE NO.

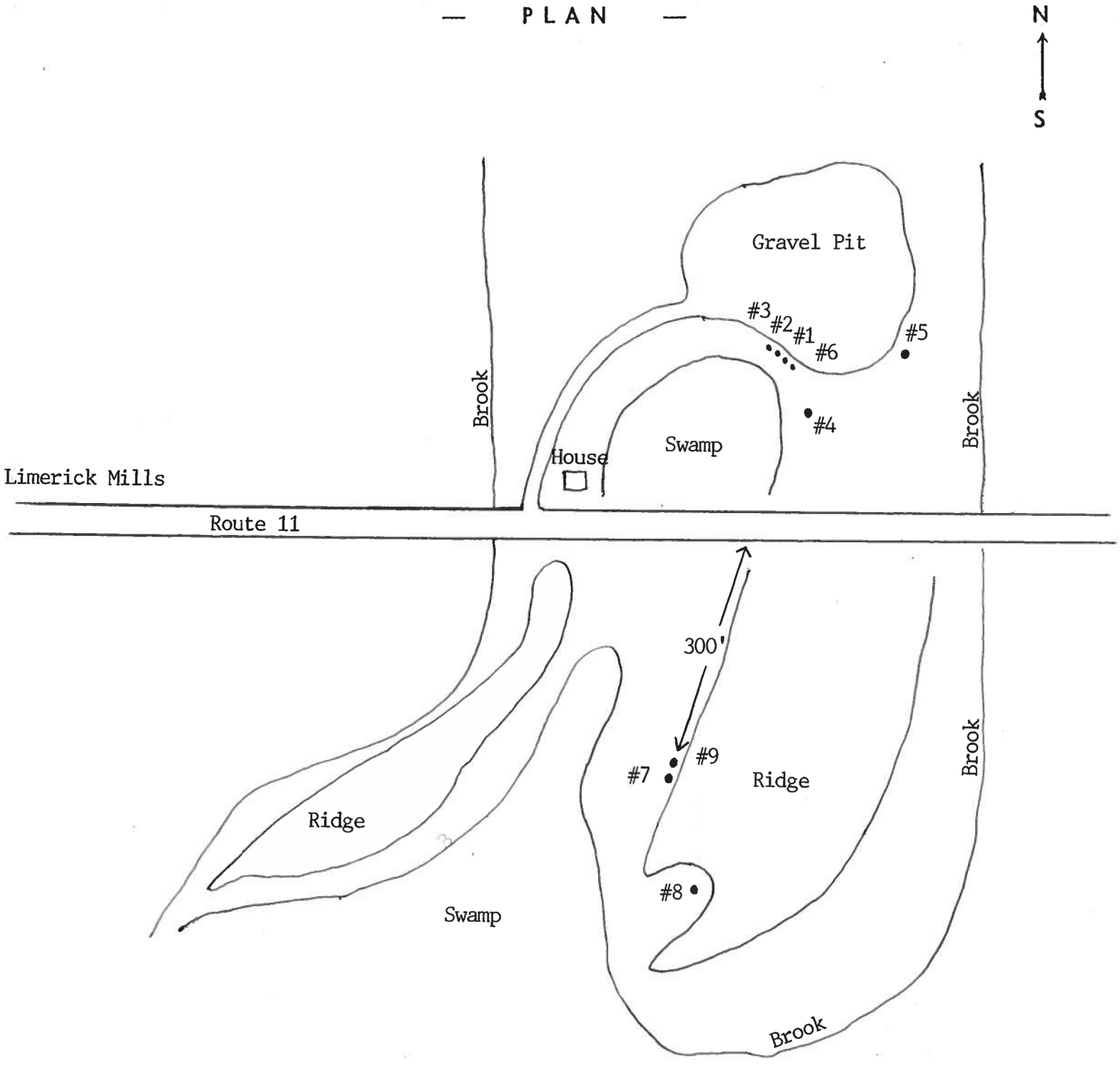
CUSTOMER Town of Limerick, Maine ADDRESS

Hole Nos. on This Site Plan 1 thru 9

Hole Nos. Driven and Removed #2 and #5

Hole Nos. Driven and Left in Place #1, #3, #4, #6, #7, #8, #9

— PLAN —



Limerick, Maine
Test Well Summary
Completed July-August 1994

#	2½" Drive	2½" Remove	2½" Leave	Screen Set	Screen Removed	Screen Left	Pump & Develop
1-94	24'	5'	19'	5'(19-24)	-	5'(19-24)	2 hrs
2-94	10'	10'	-	-	-	-	-
3-94	25'	6'	19'	5'(20-25)	-	5'(20-25)	2 hrs
4-94	18'	6'	12'	5'(13-18)	-	5'(13-18)	1 hr
5-94	20'	20'	-	-	-	-	-
6-94	24'	3'	21'	5'(19-24)	-	5'(19-24)	2 hrs
7-94	30'	9'	21'	5'(21-26)	-	5'(21-26)	2 hrs
8-94	25'	4'	21'	5'(20-25)	-	5'(20-25)	1 hr
9-94	26'	5'	21'	5'(21-26)	-	5'(21-26)	1 hr
#9 Libbey Site							1 hr
7-94							5 hr Pump Test
6-94							6 hr Pump Test
Totals	202'	68'	134'	7 set	0 removed	7 left	23 hours

R. E. CHAPMAN CO., OAKDALE, MASS.

CUSTOMER Limerick, Maine NO. 1 TE

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Alt. Gauge Reading	Tape Meas'nt in Well	Orfice Head in Inches	GPM	Water Level	Water Level	Water Level	Wa
							L-2	40' Obs.	120' Obs.	
October 4, 1994	Static						4.92	2.78	4.72	
	1 min.						5.38			
	2			VAC			5.34			
	3			19.5"	18"	48.1	5.35			
	4						5.37			
	5						5.37			
	6						5.38			
	7						5.38			
	8						5.38			
	9						5.38			
	10			19.5"	18"	48.1	5.38	2.99	4.95	
	15						5.39			
	20						5.40	3.00	4.96	
	30			19.5"	18"	48.1	5.40			
	40						5.41	3.02	4.97	
	75						5.43	3.03	4.98	
	105						5.44	3.04	5.00	
	120			19.5"	18"	48.1	5.44	3.05	5.01	
Pump off	0.15 sec						5.18			
	0.30						5.11			
	0.45						5.09			
	1 min.						5.07			
	2						5.01			
	3						5.01			
	4						5.01			
	5						5.00			
	6						5.00			
	15						4.98	2.82	4.76	

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date July 28, 1994 Hole No. 1-94

Started July 28, 1994 Finished July 28, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	7	Very coarse light-brown gravel & cobbles		
7	14	Very coarse light-brown gravel & cobbles		
14	21	Very coarse light-brown gravel & cobbles		
21	24	Very coarse light-brown gravel & cobbles		
	24	Refusal		

Used 19 ft. 3 inches of casing

Well rated at 25.3 G.P.M. 26 " Vacuum

Water level is 3 ft. below ground level

Remarks FEO MNO

5' of 30-slot screen from 19'-24' 3' riser

2 hours of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date July 28, 1994 Hole No. 2-94

Started July 28, 1994 Finished July 28, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	10	Very coarse gravel & cobbles		
	10	Refusal		
		Pulled out		

Used 0 ft. inches of casing

Well rated at G.P.M. " Vacuum

Water level is ft. below ground level

Remarks

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date July 28, 1994 Hole No. 3-94

Started July 28, 1994 Finished July 28, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	25	Very coarse gravel & cobbles		
	25	Refusal		

Used 19 ft. 2 inches of casing

Well rated at 36 G.P.M. 18 " Vacuum

Water level is 4 ft. below ground level

Remarks Well 8' off #1

Set 5' of 60-slot screen from 20'-25' 3' riser

2 hours of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date July 29, 1994 Hole No. 4-94

Started July 29, 1994 Finished July 29, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	17	Very coarse gravel & cobbles		
17	18	Till		
	18	Refusal		

Used 12 ft. - inches of casing

Well rated at 3 G.P.M. 24 " Vacuum

Water level is 0.8 ft. below ground level

Remarks Set 5' of 30-slot screen from 13'-18'

3' riser

1 hour of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date August 1, 1994 Hole No. 5-94

Started August 1, 1994 Finished August 1, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in Inches
0	20	Very coarse gravel & cobbles		
	20	Refusal		
		Pulled out		

Used ..... ft. ..... inches of casing

Well rated at ..... G.P.M. ..... " Vacuum

Water level is ..... ft. below ground level

Remarks Rick Sullivan

Foreman .....

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date August 2, 1994 Hole No. 6-94

Started August 2, 1994 Finished August 2, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	24	Very coarse gravel & cobbles		
	24	Refusal		

Used 21 ft. inches of casing

Well rated at 40 G.P.M. 21 " Vacuum

Water level is 3 ft. below ground level

Remarks 2' off #1

Set 5' of 80-slot screen from 19'-24'

2 hours of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date August 3, 1994 Hole No. 7-94

Started August 3, 1994 Finished August 3, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	7	Very coarse light-brown gravel & cobbles		
7	21	Very coarse light-brown sand, fine gravel		
21	26	Very coarse light-brown sand & fine gravel		
26	30	Very coarse dark-gray sand & gravel		
	30	Refusal		

Used 21 ft. 2 inches of casing

Well rated at 50 G.P.M. 14 " Vacuum

Water level is 7 ft. below ground level

Remarks Set 5' of 60-slot screen from 21'-26'

3' riser

2 hours of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date August 3, 1994 Hole No. 8-94

Started August 3, 1994 Finished August 3, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in inches
0	21	Very coarse light-brown gravel & cobbles		
21	25	Very coarse dark-gray gravel & cobbles		
	25	Refusal		

Used 21 ft. 3 inches of casing

Well rated at 1 G.P.M. 24 " Vacuum

Water level is 10 ft. below ground level

Remarks Set 5' of 60-slot screen from 20'-25'

1 hour of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date August 4, 1994 Hole No. 9-94

Started August 4, 1994 Finished August 4, 1994

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in Inches
0	7	Very coarse light-brown gravel & cobbles		
7	26	Very coarse light-brown sand, fine gravel		

Used 21 ft. inches of casing

Well rated at 30 G.P.M. 26 " Vacuum

Water level is 7 ft. below ground level

Remarks #9 2' off #7

Set 5' of 40-slot screen from 21'-26'

1 hour of development

Foreman Rick Sullivan

R. E. CHAPMAN CO.

OAKDALE, MASSACHUSETTS
DIAL 835-3727 — 835-3221

Job Location Limerick, Maine

Date August 2, 1994 Hole No.

Started Finished

LOG OF HOLE

Depth From Ground Surface	Depth To	CLASSIFICATION of MATERIALS	No. of 30" blows on spoon	Penetration of Spoon in Inches
		Pump #9 Well at Libbey Site		
		1 hour pumping time		
		Water sample taken		

Used ft. inches of casing

Well rated at G.P.M. " Vacuum

Water level is ft. below ground level

Remarks

Foreman

R. E. CHAPMAN CO.

OAKDALE, MASS.

ne of Driller Stephen Turner Names of Helpers. Charlie Birchard

ob: Name & Location Limerick, Maine 12" Well

e Started 11/14/94 Date Finished 11/16/94

ole No.

Depth From	Depth To	Classification of Material
0	11	Very coarse brown gravel, cobbles, boulders
	47	Very coarse sand and gravel
	48	Brown till

Feet of Screen Exposed

Size of Screen & Slot

Screen Left in

Screen Pulled Out

Pipe Left in

Pipe Pulled Out

Remarks

Pump Test on Hole No.

Date	Time	Dr. Down	G. P. M.	Static and Other Info.

Date Started Date Finished

Hole No.

Depth From	Depth To	Classification of Material

Feet of Screen Exposed

Size of Screen & Slot

Screen Left in

Screen Pulled Out

Pipe Left in

Pipe Pulled Out

Remarks

Pump Test on Hole No.

Date	Time	Dr. Down	G. P. M.	Static and Other Info.

SAND ANALYSIS

R. E. CHAPMAN CO.
30 North Main St.
Oakdale, Mass. 01539

Customer's Name LIMERICK WATER DISTRICT

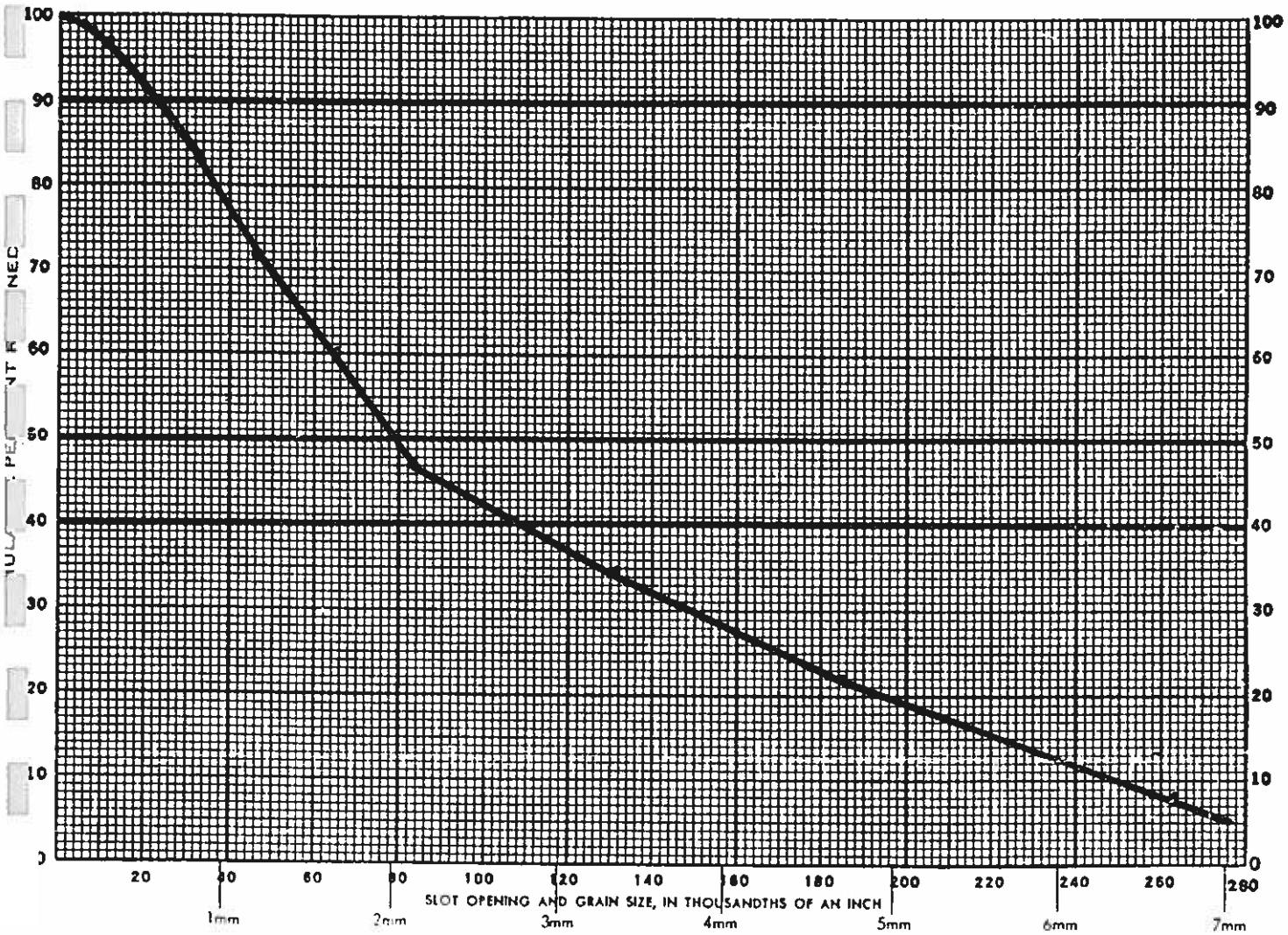
Town LIMERICK State ME Date NOV. 16, 1994

Well Location (LIBBY SITE) OFF EMERY CORNER Rd

Type of Well 12" GRAVEL WELL

Depth of Sample 35'-47'

Sample taken by S. TURNER DRILLER - R.E. CHAPMAN CO.



Sieve Openings	Cumulative Per Cent Retained
.263	8.0
.185	22.3
.131	24.5
.093	47.3
.065	70.0
.046	81.5
.033	93.0
.023	96.0
.016	98.5
.012	97.0
.008	98.0
.006	99.
.004	
Dust	100.0

Gravel Pack Recommended

40% = .110"

Slot Opening Recommended

Recommended Screen Dia. ____ in. Length ____ ft.

Type Screen _____ Metal _____

By W.A.

SAND ANALYSIS

R. E. CHAPMAN CO.
30 North Main St.
Oakdale, Mass. 01539

Customer's Name LIMERICK WATER DISTRICT

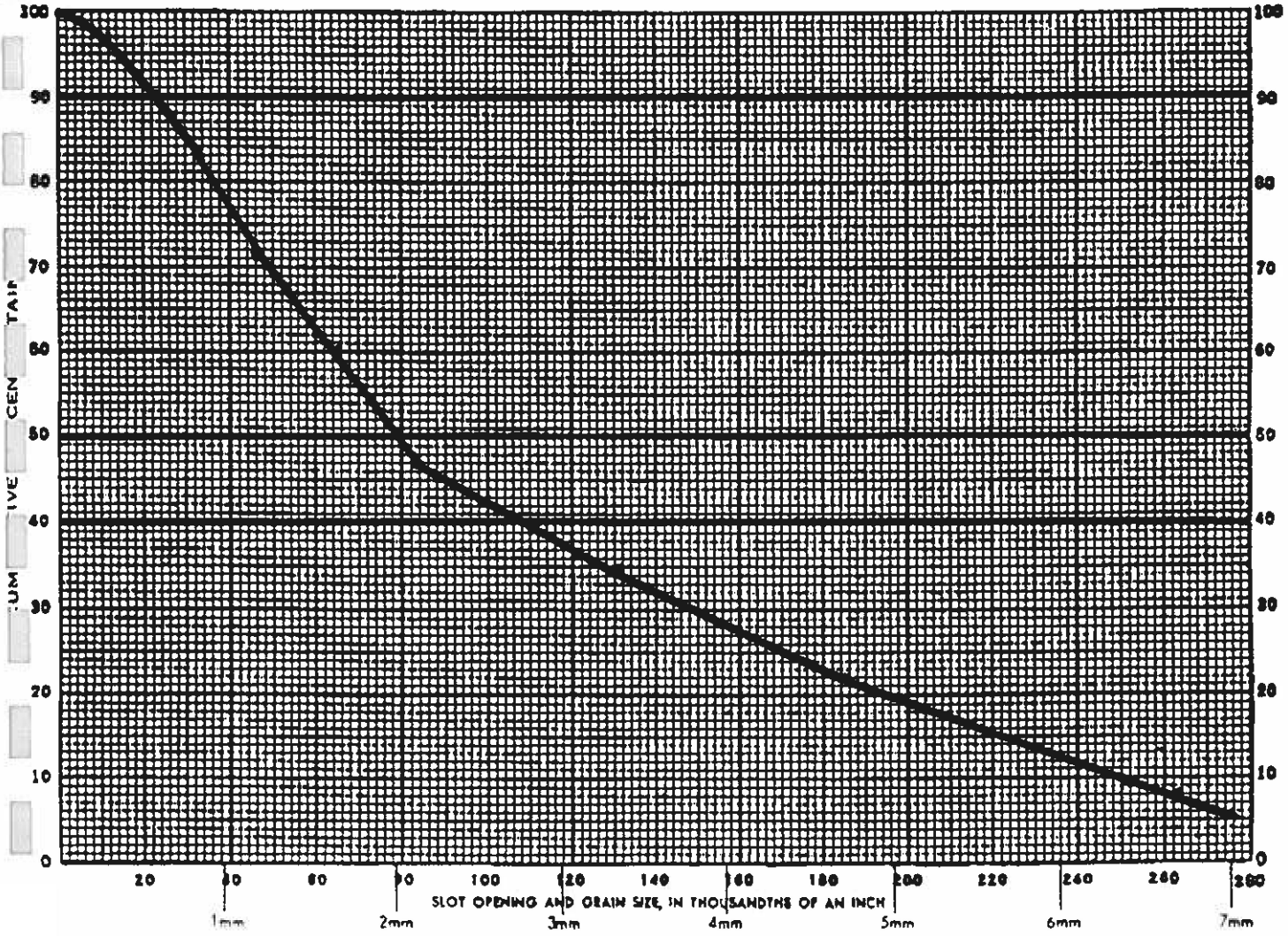
Town LIMERICK State ME Date NOV. 16, 1994

Well Location (LIBBY SITE) OFF EMERY CORNER Rd

Type of Well 12" GRAVEL WELL

Depth of Sample 35'- 47'

Sample taken by S. TURNER DRILLER - R.E. CHAPMAN CO.



Sieve Openings	Cumulative Per Cent Retained
.263	8.0
.185	22.2
.131	34.5
.093	47.3
.065	60.0
.046	71.5
.033	83.0
.023	90.0
.016	94.5
.012	97.8
.008	98.0
.006	99.8
.004	

Gravel Pack Recommended

40% = .110"

Slot Opening Recommended

Recommended Screen Dia. ____ in. Length ____ ft.

Type Screen _____ Metal _____

By W. A.

SAND ANALYSIS

R. E. CHAPMAN CO.
30 North Main St.
Oakdale, Mass. 01539

Customer's Name LIMERICK WATER DISTRICT

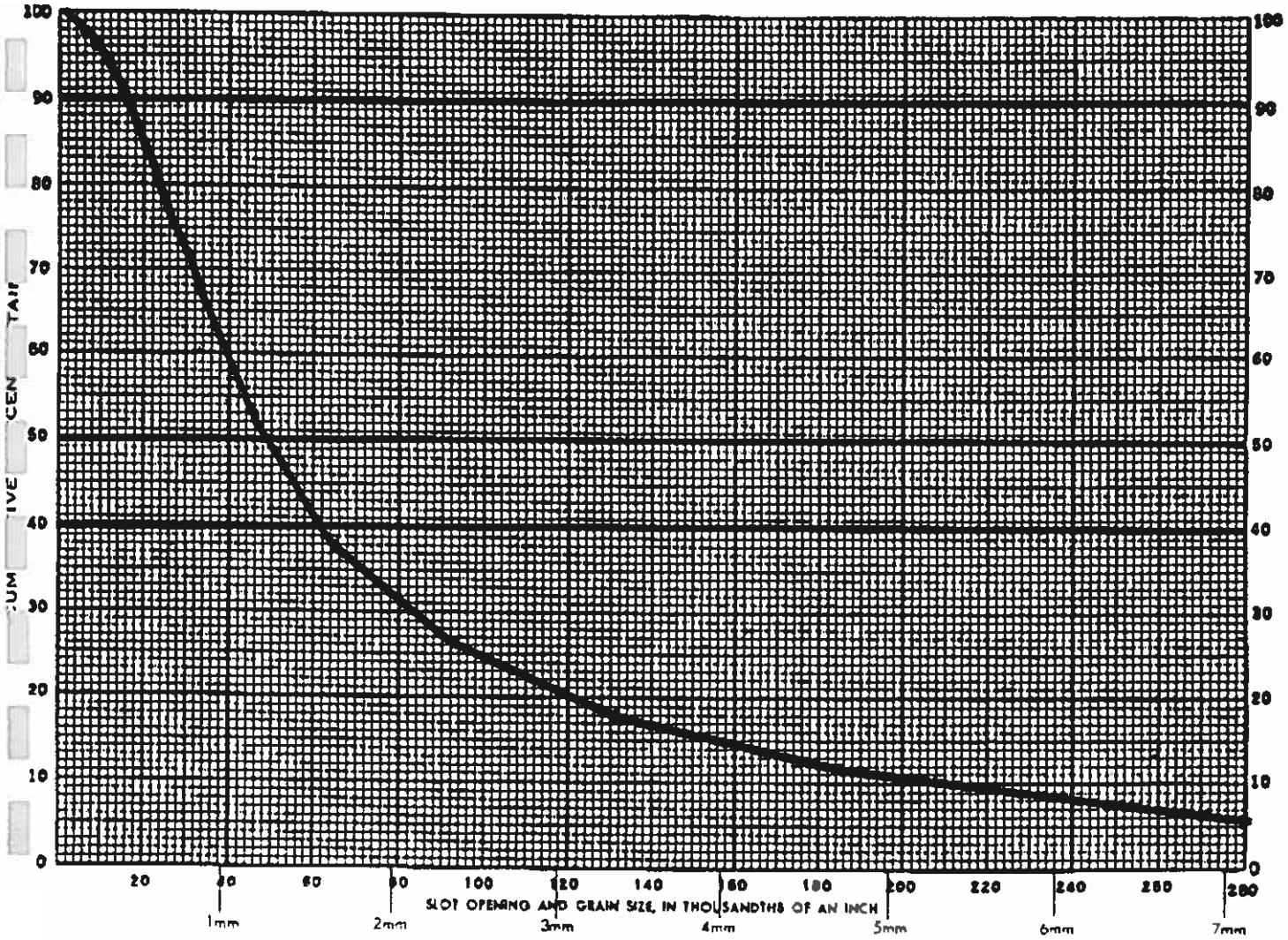
Town LIMERICK State ME. Date NOV. 16, 1994

Well Location (LIBBY SITE) OFF EMERY CORNER RD

Type of Well 12" GRAVEL WELL

Depth of Sample 30'-35'

Sample taken by S. TURNER, DRILLER - RE CHAPMAN CO.



Sieve Openings	Cumulative Per Cent Retained
.263	6.5
.185	11.8
.131	18.0
.093	26.5
.065	38.0
.046	52.5
.033	67.5
.023	80.4
.016	89.5
.012	93.8
.008	96.0
.006	97.3
.004	

Gravel Pack Recommended

40% = .060"

Slot Opening Recommended

Recommended Screen Dia. ____ in. Length ____ ft.

Type Screen ____ Metal ____

By W.A.

SAND ANALYSIS

R. E. CHAPMAN CO.
30 North Main St.
Oakdale, Mass. 01539

Customer's Name LIMERICK WATER DISTRICT

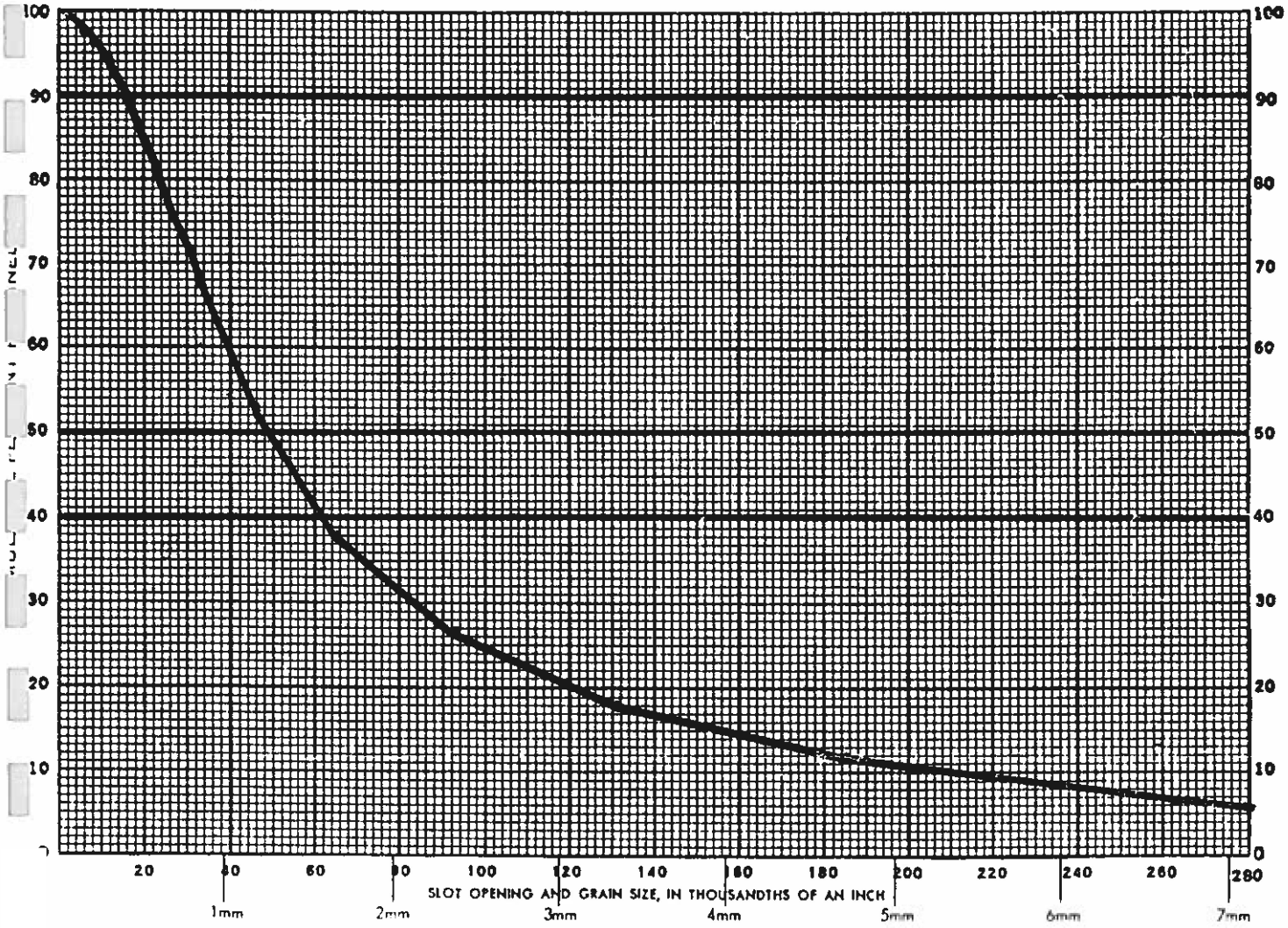
Town LIMERICK State ME. Date NOV. 16, 1994

Well Location (LIBBY SITE) OFF EMERY CORNER RD

Type of Well 12" GRAVEL WELL

Depth of Sample 30'-35'

Sample taken by S. TURNER, DRILLER - R.E. CHAPMAN CO.



Sieve Openings	Cumulative Per Cent Retained
.263	6.5
.185	11.8
.131	18.0
.093	26.5
.065	38.0
.046	52.5
.033	67.5
.023	80.4
.016	89.5
.012	93.8
.008	96.0
.006	97.3
.004	
Dust	100 -

Gravel Pack Recommended

40% = .060"

Slot Opening Recommended

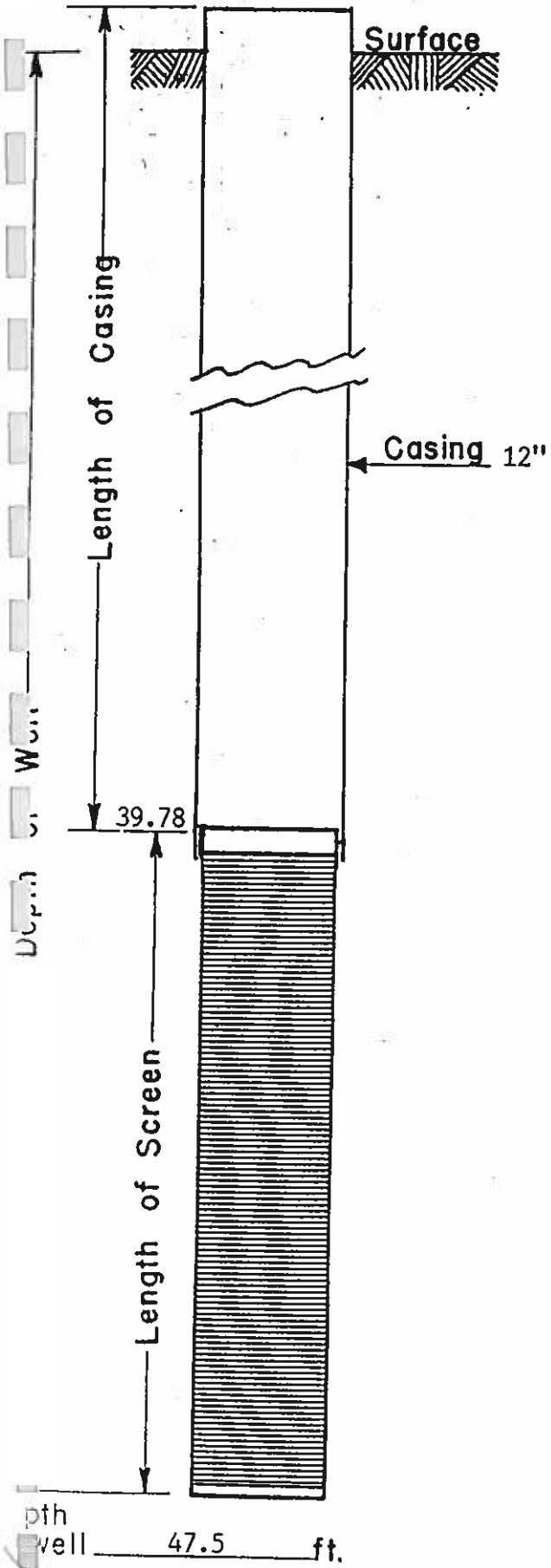
Recommended Screen Dia. ____ in. Length ____ ft.

Type Screen _____ Metal _____

By W.P.A.

R. E. CHAPMAN CO.

WELL CONSTRUCTION RECORD



WELL OWNER Limerick Water District

WELL NO. 12" Well (straight developed)

Date 12/23/94

CASING DETAILS

Length 39.78 ft.

Diameter 12 in.

Kind 3/8 steel

SCREEN DETAILS

Make Johnson

Length 10.2 ft.

Diameter 12" telescope size in.

Slot size 110

Metal Stainless steel

SCREEN FITTINGS

Top 2.8' K-packer weld on ext.

Bottom Plate bottom

PUMP TEST

Static level (see pump test) ft.

Rate ____ g.p.m.

Draw down ____ ft.

Hours pumped ____ hrs.

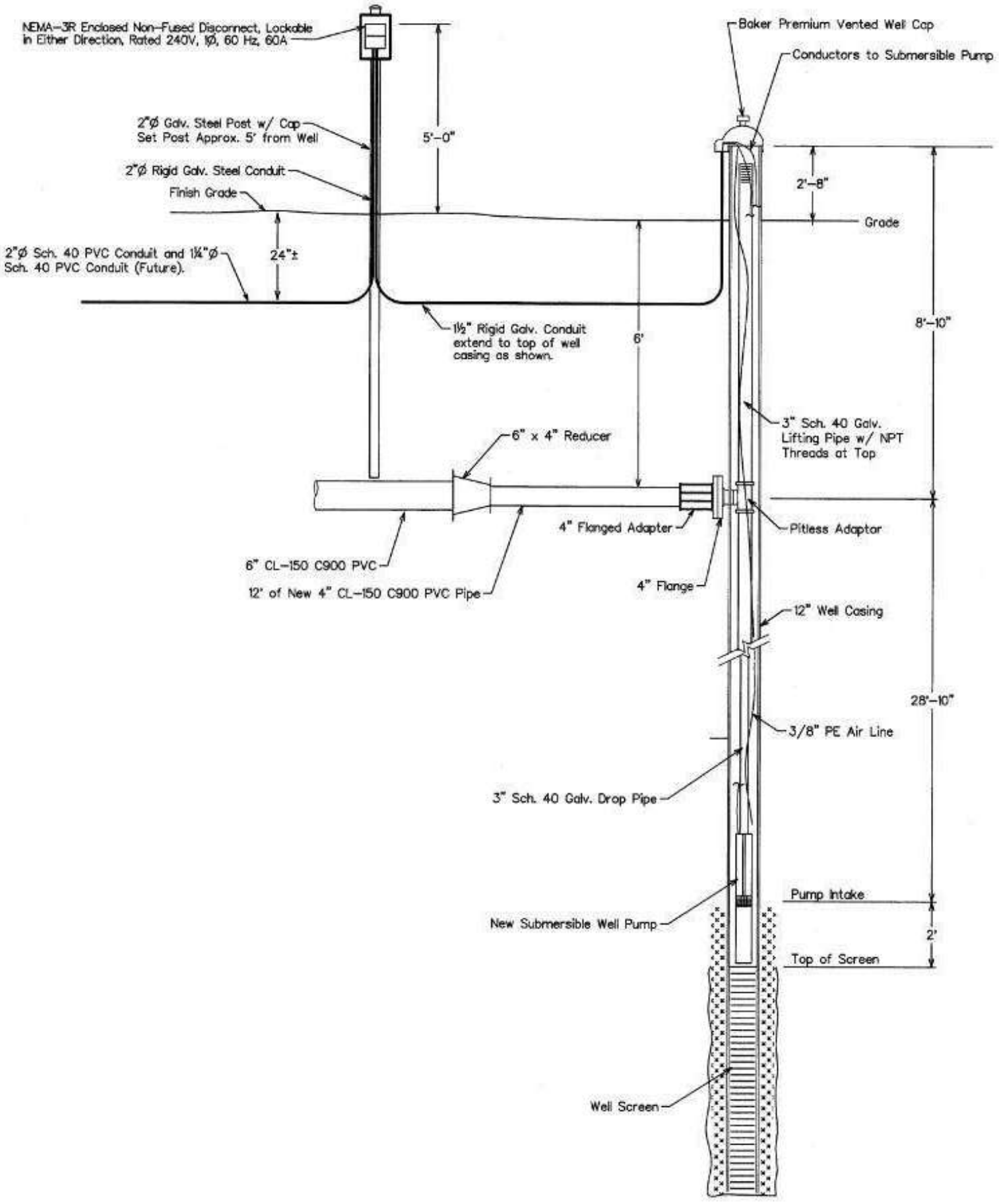
ARTIFICIALLY GRAVEL TREATED

Yes ____ No X

Thickness ____ in.

Size of gravel ____

DRILLER Stephen Turner


NEMA-3R Enclosed Non-Fused Disconnect, Lockable in Either Direction, Rated 240V, 1Ø, 60 Hz, 60A
2"Ø Galv. Steel Post w/ Cap Set Post Approx. 5' from Well
2"Ø Rigid Galv. Steel Conduit
Finish Grade
2"Ø Sch. 40 PVC Conduit and 1¼"Ø Sch. 40 PVC Conduit (Future).
24"±
5'-0"
1½" Rigid Galv. Conduit extend to top of well casing as shown.
6'
6" x 4" Reducer
6" CL-150 C900 PVC
12' of New 4" CL-150 C900 PVC Pipe
Baker Premium Vented Well Cap
Conductors to Submersible Pump
2'-8"
Grade
8'-10"
3" Sch. 40 Galv. Lifting Pipe w/ NPT Threads at Top
4" Flanged Adapter
Pitless Adaptor
4" Flange
12" Well Casing
28'-10"
3/8" PE Air Line
3" Sch. 40 Galv. Drop Pipe
Pump Intake
New Submersible Well Pump
2'
Top of Screen
Well Screen

Appendix No. 3 - Water Quality

Water Quality Analysis
12" Production Well
December 1994

Parameter	Test Well Result	Standard
Total Coliform	0/100 mg	0/100 mg
Total Hardness	36.8 mg/l	500 mg/l
Total Chloride	<10.0 mg/l	250 mg/l
Nitrite	<0.020 mg/l	1.0 mg/l
Nitrate	<0.20 mg/l	10.0 mg/l
Color	0 Units	15.0 Units
Turbidity	0.05 NTU	1.0 NTU
Copper	<0.020 mg/l	1.3 mg/l
Iron	0.03 mg/l	0.30 mg/l
Manganese	<0.01 mg/l	0.05 mg/l
Fluoride	<0.20 mg/l	4.0 mg/l
Arsenic	<0.005 mg/l	0.05 mg/l
Barium	<0.05 mg/l	2.0 mg/l
Cadmium	<0.0005 mg/l	0.010 mg/l
Chromium	<0.002 mg/l	0.10 mg/l
Lead	<0.003 mg/l	0.015 mg/l
Mercury	<0.0005 mg/l	0.002 mg/l
Selenium	<0.005 mg/l	0.05 mg/l
Silver	<0.002 mg/l	0.05 mg/l
Sodium	3.1 mg/l	100 mg/l
pH	7.3	9.5
Zinc	0.01 mg/l	5.0 mg/l
Radon	4287+/- 636 pCi/L	proposed 3,000 pCi/L
Herbicides	none detected	
Pesticides	none detected	
PCB's	none detected	

ntinued from Previous Page

Lab Sample#: *1701411-01* **Sample Address:**

Sample Matrix: DW-H20 **Sample Point:** TP-1 **Surface:**

Description: AFTER TREATMENT & BEFORE DISTRIBUTION EP (TP 1- WELL 3- **Sample Date:** 04/11/2017 **Sample Time:** 15:00:00

Test (Method)/Analyte	Result	Unit	Qualifiers	MCL	RL	High Limit	Low Limit	Analysis Date	Analyst
Color (L-10-308-00-1-A)	28	PCU		50	5			04/12/2017 14:37:40	A.B.
DW_Anions_IC (300.0)									
Sulfate	3	mg/L		250	1			04/12/2017 09:45:00	T.N.
Fluoride	<0.1	mg/L		1.7	0.1			04/12/2017 09:45:00	T.N.
Chloride	17	mg/L		250	1			04/12/2017 09:45:00	T.N.
Nitrite Nitrogen	<0.05	mg/L		1	0.05			04/12/2017 09:45:00	T.N.
Nitrate Nitrogen	<0.05	mg/L		10	0.05			04/12/2017 09:45:00	T.N.
METALS_200.8 (200.8)									
Total Hardness	41	mg/L			0			04/13/2017 09:37:00	C.S.
Antimony	<0.5	ug/L		6	0.5			04/13/2017 09:37:00	C.S.
Arsenic	3.3	ug/L		10	1			04/13/2017 09:37:00	C.S.
Barium	0.0072	mg/L		2	0.0005			04/13/2017 09:37:00	C.S.
Beryllium	<0.5	ug/L		4	0.5			04/13/2017 09:37:00	C.S.
Cadmium	<0.5	ug/L		5	0.5			04/13/2017 09:37:00	C.S.
Calcium	13	mg/L			0.05			04/13/2017 09:37:00	C.S.
Chromium	0.00085	mg/L		.1	0.0005			04/13/2017 09:37:00	C.S.
Copper	0.014	mg/L		1.3	0.0005			04/13/2017 09:37:00	C.S.
Iron	1.1	mg/L			0.05			04/13/2017 09:37:00	C.S.
Lead	1.5	ug/L		15	0.5			04/13/2017 09:37:00	C.S.
Magnesium	2.0	mg/L			0.05			04/13/2017 09:37:00	C.S.
Manganese	0.089	mg/L		.30	0.0005			04/13/2017 09:37:00	C.S.
Mercury	<0.1	ug/L		2	0.1			04/13/2017 09:37:00	C.S.
Nickel	0.00072	mg/L			0.0005			04/13/2017 09:37:00	C.S.
Selenium	<0.001	mg/L		.05	0.001			04/13/2017 09:37:00	C.S.
Silver	<0.0005	mg/L		.1	0.0005			04/13/2017 09:37:00	C.S.
Sodium	9.7	mg/L			0.05			04/13/2017 09:37:00	C.S.
Thallium	<0.0005	mg/L		.002	0.0005			04/13/2017 09:37:00	C.S.
Uranium	1.3	ug/L		30	0.5			04/13/2017 09:37:00	C.S.
Zinc	0.0075	mg/L		2	0.001			04/13/2017 09:37:00	C.S.
pH (4500-H+B)	7.1	S.U.		8.5		8.5	6.5	04/13/2017 13:55:00	J.C.
Turbidity (180.1)	4.2	NTU			0.6			04/12/2017 17:13:00	M.C.

A&L LABORATORY
A DIVISION OF GRANITE STATE ANALYTICAL SERVICES, LLC
155 Center Street, Building C Auburn, Maine 04210
Phone: 207-784-5354 | website: www.allaboratory.com

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 02/27/2020

CLIENT NAME: Maine Coast Lab

PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 2002-02381-001

SAMPLED BY: Ray Bates

LOCATION: DS-1 DISTRIBUTION SYSTEM, Limerick Water District

MORE LOC INFO:

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▽
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED: 02/26/2020 10:25AM

DATE AND TIME RECEIVED: 02/27/2020 7:00AM

ANALYSIS PACKAGE: A & L Tannins-ME

RECEIPT TEMPERATURE: 20° CELSIUS

CLIENT JOB # LWD02262020 O&M

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Tannin	<1.0	mg/L			1	No Limit	HACH	JR-ME	02/27/20 8:40AM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: None

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

This analysis meets State of Maine requirements except as noted.
State Certifications: | A & L Laboratory: ME ME00021 | Granite State Analytical Services LLC: NH NH00003 |
This certificate shall not be reproduced, except in full, without the written approval of Granite State Analytical Services, LLC

A & L LABORATORY

A DIVISION OF GRANITE STATE ANALYTICAL SERVICES, LLC

155 Center Street, Building C Auburn, Maine 04210

Phone: 207-784-5354 | website: www.allaboratory.com

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED:	10/23/2019
CLIENT NAME:	Maine Coast Lab
PWSID#:	ME0090850
CLIENT ADDRESS:	47 Gardiner Rd Wiscasset, ME 04578
SAMPLE ID#:	1910-01530-001
SAMPLED BY:	Ray Bates
LOCATION:	DS-1 DISTRIBUTION SYSTEM, Limerick WD 55 Washington St 2
MORE LOC INFO:	

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▽
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED:	10/10/2019 10:00AM
DATE AND TIME RECEIVED:	10/11/2019 7:00AM
ANALYSIS PACKAGE:	THM 524.3/HAA5 DBP
RECEIPT TEMPERATURE:	ON ICE 4° CELSIUS
CLIENT JOB #	LWD10102019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Bromodichloromethane*	5.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 6:33PM
Bromoform*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 6:33PM
Chloroform*	63	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 6:33PM
Dibromochloromethane*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 6:33PM
Total THMs*	68	ug/L	✓		0.5	80 ug/L	EPA 524.3	DD-NH	10/16/19 6:33PM
1,2-Dichlorobenzene-d4	101	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	10/16/19 6:33PM
4-Bromofluorobenzene	96	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	10/16/19 6:33PM
Methyl tert-Butyl Ether-d3	97	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	10/16/19 6:33PM
Date Extracted	-					No Limit	EPA 552.2	TA-NH	10/17/19 9:00AM
Dibromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:07PM
Dichloroacetic Acid*	18	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:07PM
Monobromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:07PM
Monochloroacetic Acid*	<2	ug/L			2	No Limit	EPA 552.2	KV-NH	10/18/19 7:07PM
Total Haloacetic Acids*	55	ug/L	✓		1	60 ug/L	EPA 552.2	KV-NH	10/18/19 7:07PM
Trichloroacetic Acid*	37	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:07PM
2,3-Dibromopropionic Acid	115	%	✓			70-130%	EPA 552.2 - SS	KV-NH	10/18/19 7:07PM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: None

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

This analysis meets State of Maine requirements except as noted.
State Certifications: | A & L Laboratory: ME ME00021 | Granite State Analytical Services LLC: NH NH00003 |
This certificate shall not be reproduced, except in full, without the written approval of Granite State Analytical Services, LLC

A&L LABORATORY

A DIVISION OF GRANITE STATE ANALYTICAL SERVICES, LLC

155 Center Street, Building C Auburn, Maine 04210

Phone: 207-784-5354 | website: www.allaboratory.com

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 10/23/2019

CLIENT NAME: Maine Coast Lab

PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 1910-01530-002

SAMPLED BY: Ray Bates

LOCATION: DS-1 DISTRIBUTION SYSTEM, Limerick
WD 52 Main St 1

MORE LOC INFO:

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▽
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED: 10/10/2019 10:25AM

DATE AND TIME RECEIVED: 10/11/2019 7:00AM

ANALYSIS PACKAGE: THM 524.3/HAA5 DBP

RECEIPT TEMPERATURE: ON ICE 4° CELSIUS

CLIENT JOB # LWD10102019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Bromodichloromethane*	7.1	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 7:43PM
Bromoform*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 7:43PM
Chloroform*	78	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 7:43PM
Dibromochloromethane*	0.8	ug/L			0.5	No Limit	EPA 524.3	DD-NH	10/16/19 7:43PM
Total THMs*	86	ug/L	⊗		0.5	80 ug/L	EPA 524.3	DD-NH	10/16/19 7:43PM
1,2-Dichlorobenzene-d4	101	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	10/16/19 7:43PM
4-Bromofluorobenzene	97	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	10/16/19 7:43PM
Methyl tert-Butyl Ether-d3	97	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	10/16/19 7:43PM
Date Extracted	-					No Limit	EPA 552.2	TA-NH	10/17/19 9:00AM
Dibromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:48PM
Dichloroacetic Acid*	3.1	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:48PM
Monobromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:48PM
Monochloroacetic Acid*	<2	ug/L			2	No Limit	EPA 552.2	KV-NH	10/18/19 7:48PM
Total Haloacetic Acids*	18	ug/L	✓		1	60 ug/L	EPA 552.2	KV-NH	10/18/19 7:48PM
Trichloroacetic Acid*	15	ug/L			1	No Limit	EPA 552.2	KV-NH	10/18/19 7:48PM
2,3-Dibromopropionic Acid	110	%	✓			70-130%	EPA 552.2 - SS	KV-NH	10/18/19 7:48PM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: None

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

This analysis meets State of Maine requirements except as noted.
State Certifications: | A & L Laboratory: ME ME00021 | Granite State Analytical Services LLC: NH NH00003 |
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A & L LABORATORY

A DIVISION OF GRANITE STATE ANALYTICAL SERVICES, LLC

155 Center Street, Building C Auburn, Maine 04210

Phone: 207-784-5354 | website: www.allaboratory.com

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED:	01/29/2020
CLIENT NAME:	Maine Coast Lab
CLIENT ADDRESS:	47 Gardiner Rd Wiscasset, ME 04578
SAMPLE ID#:	2001-02461-001
SAMPLED BY:	Ray Bates
LOCATION:	DBP-1 52 MAIN STREET, Limerick WD 52 Main Street
MORE LOC INFO:	

PWSID#: ME0090850

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▽
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED:	01/23/2020 10:10AM
DATE AND TIME RECEIVED:	01/24/2020 7:30AM
ANALYSIS PACKAGE:	THM 524.3/HAA5 DBP
RECEIPT TEMPERATURE:	ON ICE 4° CELSIUS
CLIENT JOB #	LWD01232020

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Bromodichloromethane*	6.4	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:20PM
Bromoform*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:20PM
Chloroform*	80	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:20PM
Dibromochloromethane*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:20PM
Total THMs*	86	ug/L	⊗		0.5	80 ug/L	EPA 524.3	DD-NH	01/27/20 9:20PM
1,2-Dichlorobenzene-d4	100	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	01/27/20 9:20PM
4-Bromofluorobenzene	94	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	01/27/20 9:20PM
Methyl tert-Butyl Ether-d3	89	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	01/27/20 9:20PM
Date Extracted	-					No Limit	EPA 552.2	TA-NH	01/27/20 8:50AM
Dibromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 7:54AM
Dichloroacetic Acid*	7.1	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 7:54AM
Monobromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 7:54AM
Monochloroacetic Acid*	<2	ug/L			2	No Limit	EPA 552.2	KV-NH	01/28/20 7:54AM
Total Haloacetic Acids*	37	ug/L	✓		1	60 ug/L	EPA 552.2	KV-NH	01/28/20 7:54AM
Trichloroacetic Acid*	30	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 7:54AM
2,3-Dibromopropionic Acid	110	%	✓			70-130%	EPA 552.2 - SS	KV-NH	01/28/20 7:54AM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: None

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

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CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 01/29/2020
CLIENT NAME: Maine Coast Lab
CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578
SAMPLE ID#: 2001-02461-002
SAMPLED BY: Ray Bates
LOCATION: DBP-2 55 WASHINGTON STREET, Limerick WD 55 Washington
MORE LOC INFO:

PWSID#: ME0090850

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▽
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED: 01/23/2020 9:55AM
DATE AND TIME RECEIVED: 01/24/2020 7:30AM
ANALYSIS PACKAGE: THM 524.3/HAA5 DBP
RECEIPT TEMPERATURE: ON ICE 4° CELSIUS
CLIENT JOB # LWD01232020

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Bromodichloromethane*	5.9	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:44PM
Bromoform*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:44PM
Chloroform*	80	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:44PM
Dibromochloromethane*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	01/27/20 9:44PM
Total THMs*	86	ug/L	⊗		0.5	80 ug/L	EPA 524.3	DD-NH	01/27/20 9:44PM
1,2-Dichlorobenzene-d4	101	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	01/27/20 9:44PM
4-Bromofluorobenzene	96	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	01/27/20 9:44PM
Methyl tert-Butyl Ether-d3	90	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	01/27/20 9:44PM
Date Extracted	-					No Limit	EPA 552.2	TA-NH	01/27/20 8:50AM
Dibromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 8:35AM
Dichloroacetic Acid*	15	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 8:35AM
Monobromoacetic Acid*	<1	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 8:35AM
Monochloroacetic Acid*	<2	ug/L			2	No Limit	EPA 552.2	KV-NH	01/28/20 8:35AM
Total Haloacetic Acids*	51	ug/L	✓		1	60 ug/L	EPA 552.2	KV-NH	01/28/20 8:35AM
Trichloroacetic Acid*	36	ug/L			1	No Limit	EPA 552.2	KV-NH	01/28/20 8:35AM
2,3-Dibromopropionic Acid	107	%	✓			70-130%	EPA 552.2 - SS	KV-NH	01/28/20 8:35AM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: None

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

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CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 12/27/2019

CLIENT NAME: Maine Coast Lab

PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 1912-01849-001

SAMPLED BY: Ray Bates

LOCATION: WL-1 EP (WELL 1 - 500'), Emergency Well

MORE LOC INFO:

Legend
- Passes ✓
- Fails EPA Primary ⊗
- Fails EPA Secondary ▼
- Fails State Guideline ✕
- Attention ⚠

DATE AND TIME COLLECTED: 12/18/2019 1:45PM

DATE AND TIME RECEIVED: 12/19/2019 7:30AM

ANALYSIS PACKAGE: VOC524.3-ME

RECEIPT TEMPERATURE: ON ICE 6° CELSIUS

CLIENT JOB # LWD12182019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
1,1,1,2-Tetrachloroethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,1,1-Trichloroethane*	<0.5	ug/L	✓		0.5	200 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,1,2,2-Tetrachloroethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,1,2-Trichloroethane*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,1-Dichloroethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,1-Dichloroethylene*	<0.5	ug/L	✓		0.5	7 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,1-Dichloropropylene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2,3-Trichlorobenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2,3-Trichloropropane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2,4-Trichlorobenzene*	<0.5	ug/L	✓		0.5	70 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2,4-Trimethylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2-Dibromo-3-chloropropane	<0.5	ug/L			0.5	0.2 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2-Dibromoethane	<0.5	ug/L			0.5	0.05 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2-Dichlorobenzene*	<0.5	ug/L	✓		0.5	600 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2-Dichloroethane*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2-Dichloropropane*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,3,5-Trimethylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,3-Dichlorobenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,3-Dichloropropane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
1,4-Dichlorobenzene*	<0.5	ug/L	✓		0.5	75 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
2-Chlorotoluene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
4-Chlorotoluene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
4-Isopropyltoluene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Benzene*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Bromobenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Bromochloromethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Bromodichloromethane*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Bromoform*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Bromomethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Carbon disulfide	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Carbon tetrachloride*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Chlorobenzene*	<0.5	ug/L	✓		0.5	100 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM

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CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 12/27/2019

CLIENT NAME: Maine Coast Lab

PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 1912-01849-001

SAMPLED BY: Ray Bates

LOCATION: WL-1 EP (WELL 1 - 500'), Emergency Well

MORE LOC INFO:

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▼
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED: 12/18/2019 1:45PM

DATE AND TIME RECEIVED: 12/19/2019 7:30AM

ANALYSIS PACKAGE: VOC524.3-ME

RECEIPT TEMPERATURE: ON ICE 6° CELSIUS

CLIENT JOB # LWD12182019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Chloroform*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Chloromethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
cis-1,2-Dichloroethylene*	<0.5	ug/L	✓		0.5	70 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
cis-1,3-Dichloropropylene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Dibromochloromethane*	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Dibromomethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Dichlorodifluoromethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Diethyl ether	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Diisopropyl ether (DIPE)	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Ethyl tert-butyl ether (ETBE)	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Ethylbenzene*	<0.5	ug/L	✓		0.5	700 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Hexachlorobutadiene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Hexachloroethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Isopropylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
m&p-Xylenes	<1	ug/L			1	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Methyl tert-butyl ether (MTBE)*	<0.5	ug/L	✓		0.5	35 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Methylene chloride*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Naphthalene	<0.5	ug/L	✓		0.5	100 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
n-Butylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
n-Propylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
o-Xylene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
sec-Butylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Styrene*	<0.5	ug/L	✓		0.5	100 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
tert-Amyl methyl ether (TAME)	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
tert-Butyl alcohol (TBA)	<10	ug/L			10	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
tert-Butylbenzene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Tetrachloroethylene*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Tetrahydrofuran (THF)	<10	ug/L			10	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Toluene*	<0.5	ug/L	✓		0.5	1000 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Total THMs*	<0.5	ug/L	✓		0.5	80 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Total xylenes*	<0.5	ug/L	✓		0.5	10000 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
trans-1,2-Dichloroethylene*	<0.5	ug/L	✓		0.5	100 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM

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CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 12/27/2019

CLIENT NAME: Maine Coast Lab

PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 1912-01849-001

SAMPLED BY: Ray Bates

LOCATION: WL-1 EP (WELL 1 - 500'), Emergency Well

MORE LOC INFO:

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▼
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED: 12/18/2019 1:45PM

DATE AND TIME RECEIVED: 12/19/2019 7:30AM

ANALYSIS PACKAGE: VOC524.3-ME

RECEIPT TEMPERATURE: ON ICE 6° CELSIUS

CLIENT JOB # LWD12182019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
trans-1,3-Dichloropropylene	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Trichloroethylene*	<0.5	ug/L	✓		0.5	5 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
Trichlorofluoromethane	<0.5	ug/L			0.5	No Limit	EPA 524.3	DD-NH	12/23/19 8:09PM
Vinyl chloride*	<0.5	ug/L	✓		0.5	2 ug/L	EPA 524.3	DD-NH	12/23/19 8:09PM
1,2-Dichlorobenzene-d4	109	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	12/23/19 8:09PM
4-Bromofluorobenzene	97	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	12/23/19 8:09PM
Methyl tert-Butyl Ether-d3	107	%	✓		0.5	70-130%	EPA 524.3 - SS	DD-NH	12/23/19 8:09PM

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: H = Hold time non-compliant.

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

This analysis meets State of Maine requirements except as noted.
State Certifications: | A & L Laboratory: ME ME00021 | Granite State Analytical Services LLC: NH NH00003 |
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PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 1912-01849-002

SAMPLED BY: Ray Bates

LOCATION: WL-1 EP (WELL 1 - 500'), Emergency Well

MORE LOC INFO:

Legend
Passes ✓
Fails EPA Primary ⊗
Fails EPA Secondary ▽
Fails State Guideline ✕
Attention ⚠

DATE AND TIME COLLECTED: 12/18/2019 1:45PM

DATE AND TIME RECEIVED: 12/19/2019 7:30AM

ANALYSIS PACKAGE: A & L-IC-IOC Compliance

RECEIPT TEMPERATURE: ON ICE 6° CELSIUS

CLIENT JOB # LWD12182019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed
Turbidity*	1.8	NTU	✓		0.5	5 NTU	EPA 180.1	DR-NH	12/20/19 9:54AM
Calcium*	37.4	mg/L			1	No Limit	EPA 200.7	JLR-NH	12/23/19 12:43PM
Iron*	1.08	mg/L	▽		0.01	0.3 mg/L	EPA 200.7	JLR-NH	12/23/19 1:10PM
Magnesium*	5.8	mg/L			1	No Limit	EPA 200.7	JLR-NH	12/23/19 12:43PM
Sodium*	9.4	mg/L			1	No Limit	EPA 200.7	JLR-NH	12/23/19 12:43PM
Antimony*	<0.001	mg/L	✓		0.001	0.006 mg/L	EPA 200.8	CW-NH	12/27/19 11:24AM
Arsenic*	0.0129	mg/L	⊗		0.001	0.010 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Barium*	0.0105	mg/L	✓		0.001	2.00 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Beryllium*	<0.001	mg/L	✓		0.001	0.004 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Cadmium*	<0.001	mg/L	✓		0.001	0.005 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Chromium*	0.0014	mg/L	✓		0.001	0.1 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Copper*	0.0011	mg/L	✓		0.001	1.3 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Lead*	<0.001	mg/L	✓		0.001	0.015 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Manganese*	0.0071	mg/L	✓		0.001	0.05 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Mercury*	<0.0001	mg/L	✓		0.0001	0.002 mg/L	EPA 200.8	JLR-NH	12/26/19 10:51AM
Nickel*	<0.001	mg/L			0.001	No limit	EPA 200.8	JLR-NH	12/26/19 12:44PM
Selenium*	<0.001	mg/L	✓		0.001	0.05 mg/L	EPA 200.8	CW-NH	12/27/19 11:24AM
Silver*	<0.001	mg/L	✓		0.001	0.1 mg/L	EPA 200.8	CW-NH	12/27/19 11:24AM
Thallium*	<0.001	mg/L	✓		0.001	0.002 mg/L	EPA 200.8	CW-NH	12/27/19 11:24AM
Uranium*	16.0	ug/L	✓		1	30 ug/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Zinc*	0.0818	mg/L	✓		0.001	5 mg/L	EPA 200.8	JLR-NH	12/26/19 12:44PM
Uranium	10.7	pCi/L	✓		0.67	20 pCi/L	EPA 200.8 Calc.	JLR-NH	12/26/19 12:44PM
Chloride*	32	mg/L	✓		2	250 mg/L	EPA 300.0	JR-ME	12/19/19 2:05PM
Fluoride*	0.26	mg/L	✓		0.2	4.0 mg/L	EPA 300.0	JR-ME	12/19/19 2:05PM
Nitrate as N*	0.62	mg/L	✓		0.2	10 mg/L	EPA 300.0	JR-ME	12/19/19 2:05PM
Nitrite as N*	<0.2	mg/L	✓		0.2	1 mg/L	EPA 300.0	JR-ME	12/19/19 2:05PM
Sulfate*	12	mg/L	✓		2	250 mg/L	EPA 300.0	JR-ME	12/19/19 2:05PM
Color	<5	CPU	✓		5	15 CPU	SM 2120B	DR-NH	12/20/19 9:50AM
Hardness (calc.)*	117	mg CaCO3/L			2	No Limit	SM 2340 B	JLR-NH	12/23/19 12:43PM
pH*	7.97	SU	✓	H	--	6.5 - 8.5 SU	SM 4500-H+ B	JR-ME	12/19/19 1:49PM

A&L LABORATORY
A DIVISION OF GRANITE STATE ANALYTICAL SERVICES, LLC
155 Center Street, Building C Auburn, Maine 04210
Phone: 207-784-5354 | website: www.allaboratory.com

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 12/27/2019

CLIENT NAME: Maine Coast Lab

PWSID#: ME0090850

CLIENT ADDRESS: 47 Gardiner Rd
Wiscasset, ME 04578

SAMPLE ID#: 1912-01849-002

SAMPLED BY: Ray Bates

LOCATION: WL-1 EP (WELL 1 - 500'), Emergency Well

MORE LOC INFO:

Legend	
Passes	✓
Fails EPA Primary	⊗
Fails EPA Secondary	▼
Fails State Guideline	✕
Attention	⚠

DATE AND TIME COLLECTED: 12/18/2019 1:45PM

DATE AND TIME RECEIVED: 12/19/2019 7:30AM

ANALYSIS PACKAGE: A & L-IC-IOC Compliance

RECEIPT TEMPERATURE: ON ICE 6° CELSIUS

CLIENT JOB # LWD12182019

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	Limit	Method	Analyst	Date-Time Analyzed

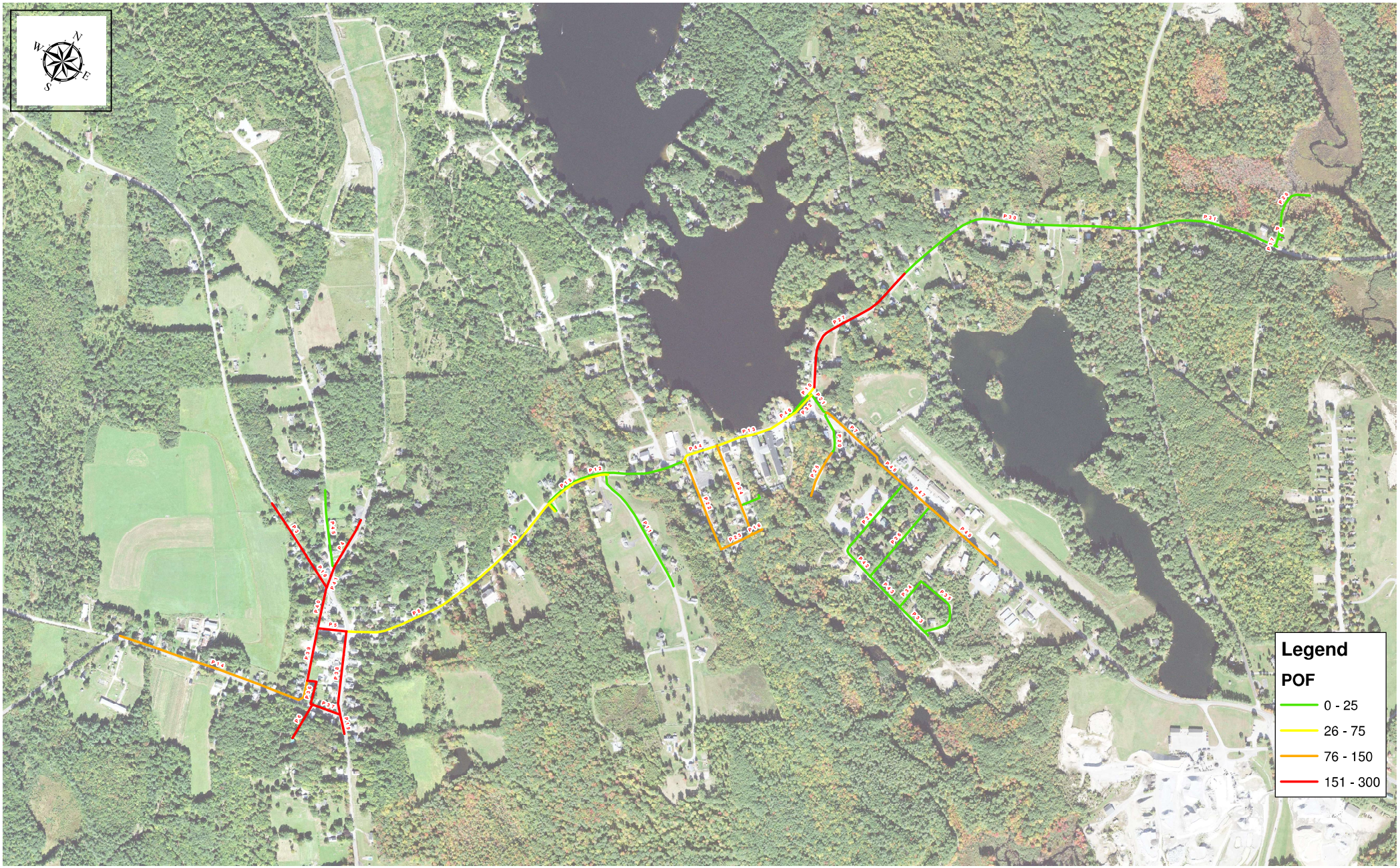
The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.
The thermal preservation requirement of 4ºC for nitrate & nitrite has been waived by the Maine CDC for all samples submitted to the Drinking Water Program.
Data Qualifier (DQ) Flags: H = Hold time non-compliant.

*** ME Certified Analysis**

Rebecca L. Labranche
Laboratory Director

This analysis meets State of Maine requirements except as noted.
State Certifications: | A & L Laboratory: ME ME00021 | Granite State Analytical Services LLC: NH NH00003 |
This certificate shall not be reproduced, except in full, without the written approval of Granite State Analytical Services, LLC

Appendix No. 4 - Risk Assessment Map and Spreadsheet


N
W
E
S
Legend
POF
0 - 25
26 - 75
76 - 150
151 - 300
0
270
540
1,080
1,620
2,160
Feet

Water Mains

Pipe_ID	POF	Diameter	Type	Length	Street	Start Intersection	End Intersection	Length	Diameter (in)	Material	Hazen-Williams C	Install Year	RUL Calc	RUL	POF	Customer Criticality	Land Use	Material	Traffic	Cost	Demand	PIC	POF
P26	8	6	PVC	815	Hillview Avenue	Central Avenue/Hillview Avenue	Hillview Avenue/Allaire Drive	815	6	Ductile Iron	120	1997	77	77	1	1	1	1	1	2	2	8	8
P33	8	6	DI	360	Allaire Drive	Allaire Drive	Allaire Drive	360	6	Ductile Iron	120	1997	77	77	1	1	1	1	1	2	2	8	8
P34	8	6	DI	298	Allaire Drive	Allaire Drive	Allaire Drive	298	6	Ductile Iron	120	1997	77	77	1	1	1	1	1	2	2	8	8
P35	8	2	CTS	713	Allaire Drive	Allaire Drive	Allaire Drive	713	2	CTS	130	1997	77	77	1	1	1	1	1	2	2	8	8
P42	8	6	DI	264	Dora Lane	Dora Lane	Dora Lane/Hillview Avenue	264	6	Ductile Iron	120	1997	77	77	1	1	1	1	1	2	2	8	8
P43	8	6	DI	381	Allaire Drive	Hillview Avenue/Allaire Drive	Allaire Drive	381	6	Ductile Iron	120	1997	77	77	1	1	1	1	1	2	2	8	8
P45	8	2	PVC	700	Cannon Hill Road	Cannon Hill Road/Sokokis Trail North	Cannon Hill Road	700	2	PVC	130	1975	55	55	1	1	1	1	1	2	2	8	8
P29	10	6	DI	823	Dora Lane	Central Avenue/Dora Lane	Dora Lane/Allaire Drive	823	6	Ductile Iron	120	2006	86	86	1	1	3	1	1	2	2	10	10
P11	11	8	DI	1182	John and Marie Drive	Washington Street/John and Marie Drive	John and Marie Drive	1182	8	Ductile Iron	120	1999	79	79	1	1	2	1	1	3	3	11	11
P28	20	6	PVC	589	ECR Pump Station	PS Building	Well Line	589	6	PVC	130	1994	74	74	1	5	5	2	1	2	5	20	20
P20	21	12	DI	390	Prospect Street	Central Avenue/Prospec t Street	Prospect Street/Pine Street	390	12	Ductile Iron	120	2001	81	81	1	1	4	1	5	5	5	21	21
P21	21	12	DI	236	Central Avenue	Emery Corner Road/Central Ave	Central Avenue/Prospec t Street	236	12	Ductile Iron	120	2001	81	81	1	1	4	1	5	5	5	21	21
P1	22	6	DI	35	ECR Pump Station	PS Building	Well Line	35	6	Ductile Iron	120	1994	74	74	1	5	5	1	1	5	5	22	22
P2	22	6	DI	36	ECR Pump Station	PS Building	Well Line	36	6	Ductile Iron	120	1994	74	74	1	5	5	1	1	5	5	22	22
P17	22	8	DI	56	ECR Pump Station	PS Building	ECR/Pump Station	56	8	Ductile Iron	120	1994	74	74	1	5	5	1	1	5	5	22	22
P30	24	12	DI	2250	Emery Corner Road	Emery Corner/Cottage Road	Emery Corner /Pickerel Pond Road	2250	12	Ductile Iron	120	1994	74	74	1	5	5	1	3	5	5	24	24
P31	24	12	DI	1292	Emery Corner Road	Emery Corner/Pickerel Pond Road	Emery Corner/Pump Station	1292	12	Ductile Iron	120	1994	74	74	1	5	5	1	3	5	5	24	24
P12	26	12	DI	1416	Washington Street	Washington@ Reservoir	Washington/We scott Street	1416	12	Ductile Iron	120	1999	79	79	1	5	5	1	5	5	5	26	26
P8	26	12	DI	1329	Washington Street	Washington/Bur bank/Main Street	Town Office	1329	12	Ductile Iron	120	1999	79	79	1	5	5	1	5	5	5	26	26
P10	26	12	DI	79	Emery Corner Road	Emery Corner/Central Ave	Emery Corner Road	79	12	Ductile Iron	120	2000	80	80	1	5	5	1	5	5	5	26	26
P13	26	12	DI	636	Washington Street	Washington/Ma ple Street	Washington/Pep permill	636	12	Ductile Iron	120	1999	79	79	1	5	5	1	5	5	5	26	26
P15	26	8	DI	698	Washington Street	Washington/Res ervoir	Washington/Joh n and Marie Drive	698	8	Ductile Iron	120	2000	80	80	1	5	5	1	5	5	5	26	26
P32	26	16	DR9 HDPE	233	Lake Crossing	Washington Street	Emery Corner Road/Central Ave	233	16	HDPE	130	2001	81	81	1	5	5	1	5	5	5	26	26
P44	26	12	DI	344	Washington Street	Washington/We scott Street	Washington/Ma ple Street	344	12	Ductile Iron	120	2000	80	80	1	5	5	1	5	5	5	26	26
P49	26	12	DI	111	Washington Street	Peppermill/Was hington	Washington/Lak e Crossing	111	12	Ductile Iron	120	2000	80	80	1	5	5	1	5	5	5	26	26
P9	26	12	DI	893	Washington Street	Washington@ Reservoir	Town Office	893	12	Ductile Iron	120	2000	80	80	1	5	5	1	5	5	5	26	26
P22	120	6	CI	855	Wescott Street	Wescott Street/Washington Street	Wescott/Maple	855	6	Cast Iron	75	1945	0	0	10	1	1	5	1	2	2	12	120
P23	120	6	CI	315	Maple Street	Maple Street	Maple Street/Wescott Street	315	6	Cast Iron	75	1945	0	0	10	1	1	5	1	2	2	12	120
P24	120	6	CI	854	Maple Street	Washington Street/Maple Street	End of Maple Street	854	6	Cast Iron	75	1945	0	0	10	1	1	5	1	2	2	12	120
P25	120	6	CI	427	Prospect Street	Prospect Street/Pine Street	End of Prospect Street	427	6	Cast Iron	75	1945	0	0	10	1	1	5	1	2	2	12	120
P16	140	8	CI	94	Off Maple Street	Maple Street	Maple Street	94	8	Cast Iron	75	1925	-20	0	10	1	5	5	1	1	1	14	140
P7	147	8	CI	573	Central Avenue	Central Avenue/Prospect Street	Central Avenue/Pine/Park	573	8	Cast Iron	75	1955	10	10	7	1	4	5	5	3	3	21	147
P46	147	8	CI	375	Central Avenue	Central Avenue/Pine/Pa rk	Central Avenue/Dora Lane	375	8	Cast Iron	75	1955	10	10	7	1	4	5	5	3	3	21	147
P47	147	8	CI	311	Central Avenue	Central/Dora Lane	Central/Hillview Avenue	311	8	Cast Iron	75	1955	10	10	7	1	4	5	5	3	3	21	147
P48	147	8	CI	782	Central Avenue	Central/Hillview Avenue	Central Avenue	782	8	Cast Iron	75	1955	10	10	7	1	4	5	5	3	3	21	147
P3	160	6	DI	610	Parsonsfield Road	Parsonsfield Road	Parsonsfield Road	610	6	Cast Iron	75	1925	-20	0	10	1	1	5	3	3	3	16	160
P18	160	6	CI	286	Parsonsfield Road	Parsonsfield Road/School Street	Parsonsfield Road	286	6	Cast Iron	75	1925	-20	0	10	1	3	5	1	3	3	16	160
P41	160	8	CI	116	School Street	School Street/Parsonsfi eld Road	School Street/Sokokis Trail North	116	8	Cast Iron	75	1925	-20	0	10	1	1	5	3	3	3	16	160
P4	170	6	CI	567	Sokokis Trail North	Cannon Hill Road/Sokokis Trl North	Sokokis Trail North	567	6	Cast Iron	75	1925	-20	0	10	1	1	5	5	3	2	17	170
P36	180	8	CI	304	Cross Country	Cross and School Streets	Elm Street @ Tank	304	8	Cast Iron	75	1925	-20	0	10	3	1	5	3	3	3	18	180
P37	180	8	CI	262	Elm Street	Elm Street @ Tank	Elm Street/Main Street	262	8	Cast Iron	75	1925	-20	0	10	3	1	5	3	3	3	18	180
P14	190	6	CI	1891	Elm Street	Elm Street/Stone Hill Road	Elm Street/Cross Street/School Street	1891	6	Cast Iron	75	1925	-20	0	10	1	1	5	5	5	2	19	190
P38	200	8	CI	749	Main Street	Elm Street/Main Street	Burbank/Washin gton/Main Street	749	8	Cast Iron	75	1925	-20	0	10	3	1	5	5	3	3	20	200
P6	220	8	CI	347	Tank	Elm Street @ Tank	Tank	347	8	Cast Iron	75	1925	-20	0	10	5	5	5	1	3	3	22	220
P39	220	8	CI	478	School Street	School Street/Cross Street	School Street/Burbank Street	478	8	Cast Iron	75	1925	-20	0	10	3	5	5	3	3	3	22	220
P40	220	8	CI	372	School Street	School Street/Burbank Street	School Street/Parsonsfi eld Road	372	8	Cast Iron	75	1925	-20	0	10	3	5	5	3	3	3	22	220
P5	280	8	CI	259	Burbank Street	School Street/Burbank Street	Main Street/Burbank Street	259	8	Cast Iron	75	1925	-20	0	10	3	5	5	5	5	5	28	280
P19	280	6	CI	177	Main Street	Main Street/Elm Street	Main Street	177	6	Cast Iron	75	1925	-20	0	10	3	5	5	5	5	5	28	280
P27	280	6	CI	1398	Emery Corner Road	Central/Washing ton/Emery Corner	Emery Corner/Cottage Road	1398	6	Cast Iron	75	1945	0	0	10	5	5	5	3	5	5	28	280

Appendix No. 5 – Cost Estimates and CIP

Summary of Cost Opinion				
Short Term Improvements (2020-2025)				
	Const.	Contingency (20%)	Other (20%)	Total
1 Maint. Items	$15,000.00	$0.00	$0.00	$15,000.00
2 New Well Source	$257,000.00	$50,000.00	$61,400.00	$368,400.00
3 SCADA Upgrades	$60,000.00	$12,000.00	$14,400.00	$86,400.00
4 Upgrade Bedrock Well	$30,400.00	$6,000.00	$7,280.00	$43,680.00
5 Meter Replacement	$17,187.50	$3,437.50	$0.00	$20,625.00
6 Piping Upgrades	$217,500.00	$43,500.00	$52,200.00	$313,200.00
	$597,087.50	**$114,937.50**	**$135,280.00**	**$847,305.00**
Mid Term Improvements (2025-2035)				
	Const.	Contingency (20%)	Other (20%)	Total
1 Standby Generator	$47,000.00	$9,400.00	$11,280.00	$67,680.00
3 Looping Projects	$165,000.00	$33,000.00	$39,600.00	$237,600.00
4 Piping Upgrades	$435,000.00	$87,000.00	$104,400.00	$626,400.00
5 Meter Replacement	$34,375.00	$6,875.00	$0.00	$41,250.00
6 Mills Res. Mixing	$60,000.00	$10,200.00	$12,240.00	$82,440.00
7 Wash. St. PS Repairs	$15,000.00	$0.00	$0.00	$15,000.00
8 Wash St. Office Roof	$5,000.00	$0.00	$0.00	$5,000.00
	$647,000.00	**$129,400.00**	**$155,280.00**	**$1,075,370.00**
Long Term Improvements (2035-2040)				
	Const.	Contingency (20%)	Other (20%)	Total
1 Village Tank	$678,150.00	$130,000.00	$161,630.00	$969,780.00
2 Emery Corner PS Roof	$5,000.00	$0.00	$0.00	$5,000.00
3 Meter Replacement	$17,187.50	$3,437.50	$0.00	$20,625.00
4 Piping Upgrades	$217,500.00	$43,500.00	$52,200.00	$313,200.00
	$917,837.50	**$176,937.50**	**$213,830.00**	**$1,308,605.00**

Cost Opinion - Annual Piping						
No		**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
	1	Water Main	LF	260	$125.00	$32,500.00
	2	Valves	ea	2	$2,500.00	$5,000.00
	3	Hydrants	ea	1	$6,000.00	$6,000.00
	4	Contingency (20%)	LS	1	$8,700.00	$8,700.00
						$52,200.00
	1	Other Project Costs (20%)				**$10,440.00**
		TOTAL				**$62,640.00**

Cost Opinion - Annual Meters						
No		**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
	1	iPERL Meters	ea	12.5	$125.00	$1,562.50
	2	Installation	ea	12.5	$150.00	$1,875.00
	4	Contingency (20%)	LS	1	$687.50	$687.50
						$4,125.00
	1	Other Project Costs (0%)				**$0.00**
		TOTAL				**$4,125.00**

Cost Opinion - New Well Sites

Site A - Emery Corner Property

No	Item	Unit	Qty.	Unit Price	Estimate
1	Land Purchase	LS	0	125,000.00	$0.00
2	Test Drilling	LS	1	20,000.00	$20,000.00
3	Production Well	LS	1	75,000.00	$75,000.00
4	Hydrogeology	LS	1	20,000.00	$20,000.00
5	Water Main	LF	600	120.00	$72,000.00
6	Power	LF	600	25.00	$15,000.00
7	Site Work	LS	1	5,000.00	$5,000.00
8	Access Road	LF	125	40.00	$5,000.00
9	Well Pump/Pitless	LS	1	20,000.00	$20,000.00
10	Pump Station Upgrades	LS	1	25,000.00	$25,000.00
11	Contingency (20 %)	LS	1	50,000.00	$50,000.00
					$307,000.00
1	Other Project Costs (20%)				$61,400.00
	TOTAL				**$368,400.00**

Site B - Quarry Road

No	Item	Unit	Qty.	Unit Price	Estimate
1	Land Purchase	LS	1	125,000.00	$125,000.00
2	Test Drilling	LS	1	20,000.00	$20,000.00
3	Production Well	LS	1	75,000.00	$75,000.00
4	Hydrogeology	LS	1	20,000.00	$20,000.00
5	Water Main	LF	3000	150.00	$450,000.00
6	Power	LF	2500	40.00	$100,000.00
7	Site Work	LS	1	25,000.00	$25,000.00
8	Access Road	LF	200	40.00	$8,000.00
9	Well Pump/Pitless	LS	1	20,000.00	$20,000.00
10	Pump Station	LS	1	400,000.00	$400,000.00
11	Contingecy (20%)	LS	1	$245,000.00	$240,000.00
					$1,483,000.00
1	Other Project Costs (20%)				$296,600.00
	TOTAL				**$1,779,600.00**

Site C - Pleasant Hill					
No	**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
1	Land Purchase	LS	1	125,000.00	$125,000.00
2	Test Drilling	LS	1	20,000.00	$20,000.00
3	Production Well	LS	1	75,000.00	$75,000.00
4	Hydrogeology	LS	1	20,000.00	$20,000.00
5	Water Main	LF	6600	135.00	$891,000.00
6	Power	LF	2500	40.00	$100,000.00
7	Site Work	LS	1	25,000.00	$25,000.00
8	Access Road	LF	200	40.00	$8,000.00
9	Well Pump/Pitless	LS	1	20,000.00	$20,000.00
10	Pump Station	LS	1	400,000.00	$400,000.00
11	Contingency (20%)	LS	1	336,000.00	$336,000.00
					$2,020,000.00
1	Other Project Costs (20%)				$404,000.00
	TOTAL				**$2,424,000.00**

Site D - Brown Brook South					
No	**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
1	Land Purchase	LS	1	125,000.00	$125,000.00
2	Test Drilling	LS	1	20,000.00	$20,000.00
3	Production Well	LS	1	75,000.00	$75,000.00
4	Hydrogeology	LS	1	20,000.00	$20,000.00
5	Water Main	LF	3500	120.00	$420,000.00
6	Power	LF	2500	40.00	$100,000.00
7	Site Work	LS	1	25,000.00	$25,000.00
8	Access Road	LF	2500	40.00	$100,000.00
9	Well Pump/Pitless	LS	1	20,000.00	$20,000.00
10	Pump Station	LS	1	400,000.00	$400,000.00
11	Contingency (20%)	LS	1	255,000.00	$255,000.00
					$1,560,000.00
1	Other Project Costs (20%)				$312,000.00
	TOTAL				**$1,872,000.00**

Site E - Brown Brook North					
No	**Item**	Unit	Qty.	Unit Price	Estimate
1	Land Purchase	LS	1	125,000.00	$125,000.00
2	Test Drilling	LS	1	20,000.00	$20,000.00
3	Production Well	LS	1	75,000.00	$75,000.00
4	Hydrogeology	LS	1	20,000.00	$20,000.00
4	Water Main	LF	12000	150.00	$1,800,000.00
5	Power	LF	2500	40.00	$100,000.00
6	Site Work	LS	1	25,000.00	$25,000.00
7	Access Road	LF	250	40.00	$10,000.00
8	Well Pump/Pitless	LS	1	20,000.00	$20,000.00
9	Pump Station	LS	1	400,000.00	$400,000.00
10	Contingency	LS	1	515,000.00	$515,000.00
					$3,110,000.00
1	Other Project Costs (20%)				$622,000.00
	TOTAL				**$3,732,000.00**

Cost Opinion - Bedrock Well Upgrades					
No	**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
1	Well Evaluation	LS	1	$1,200.00	$1,200.00
2	Water Quality Analyses	LS	1	$1,400.00	$1,400.00
3	Well Level Monitor	LS	1	$2,000.00	$2,000.00
4	Extend Well Casing	LS	1	$1,300.00	$1,300.00
5	Electrical/Controls (No SCADA)	LS	1	$2,500.00	$2,500.00
6	Contact Tanks/Plumbing	LS	1	$6,500.00	$6,500.00
7	Chlorine Pump/Tank	LS	1	$1,500.00	$1,500.00
8	Chlorine Monitor	LS	1	$2,000.00	$2,000.00
9	General Demo	LS	1	$2,500.00	$2,500.00
10	Manganese Greensand Filter	LS	1	$6,000.00	$6,000.00
11	Stone Disposal Bed	LS	1	$3,500.00	$3,500.00
12	Contingency (20%)	LS	1	$6,000.00	$6,000.00
					$36,400.00
1	Other Project Costs (20%)				**$7,280.00**
	TOTAL				**$43,680.00**

Cost Opinion - Iron/Manganese Treatment						
No	**Item**	**Unit**	**Qty.**		**Unit Price**	**Estimate**
1	Water Quality Testing Allowance	LS		1	5000	$5,000.00
2	Building Expansion	LS		1	40000	$40,000.00
3	Iron/MangneseFilter System Components	LS		1	100000	$100,000.00
4	Iron/Manganese Filter System Installation	LS		1	50000	$50,000.00
5	Pump Station & Filter Control Upgrades	LS		1	50000	$50,000.00
6	Reclaim Tank, Pump, etc.	LS		1	20000	$20,000.00
7	Contingency (20%)	LS		1	53000	$53,000.00
						$318,000.00
1	Other Project Costs (20%)					**$63,600.00**
	TOTAL					**$381,600.00**

Cost Opinion - Gravel Well Carbon Filtration						
No	**Item**	**Unit**	**Qty.**		**Unit Price**	**Estimate**
1	Water Quality Testing Allowance	LS		0	5000	$0.00
2	Building Expansion	LS		1	20000	$20,000.00
3	Carbon Filter System Components	LS		1	100000	$100,000.00
4	Carbon Filter System Installation	LS		1	50000	$50,000.00
5	Pump Station & Filter Control Upgrades	LS		1	10000	$10,000.00
6	Reclaim Tank, Pump, etc.	LS		0	20000	$0.00
7	Bag Filters & Housing	LS		1	25000	$25,000.00
7	Contingency (20%)	LS		1	40000	$40,000.00
						$245,000.00
1	Other Project Costs (20%)					**$49,000.00**
	TOTAL					**$294,000.00**

Cost Opinion - Standby Generator

Starts Well Pump (3HP) and one High Lift (5HP) + 15 KW allowance

No	Item	Unit	Qty.	Unit Price	Estimate
1	60 KW, 1 Ph Gen Set	LS	1	25000	$25,000.00
2	Pad/Installation	LS	1	20000	$20,000.00
3	200 Amp Transfer Switch	LS	1	2000	$2,000.00
4	Contingency (20%)	LS	1	9400	$9,400.00
					$56,400.00
1	Other Project Costs (20%)				**$11,280.00**
	TOTAL				**$67,680.00**

Cost Opinion - Control Upgrades					
No	**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
1	HMI/Computer/Software @ Office	Ea	1	15000	$15,000.00
2	RTU - Emery Corner PS	Ea	1	10000	$10,000.00
3	RTU - Washington St PS	Ea	1	10000	$10,000.00
4	RTU - Mills Reservoir	Ea	1	10000	$10,000.00
5	RTU - Village tank	Ea	1	15000	$15,000.00
6	Contingency (20%)	LS	1	12000	$12,000.00
					$72,000.00
1	Other Project Costs (20%)				**$14,400.00**
	TOTAL				**$86,400.00**

Cost Opinion - Mills Reservoir Piping					
No	**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
1	Concrete Coring	LS	1	$7,500.00	$7,500.00
2	8" Check Valves	ea	2	$2,500.00	$5,000.00
3	12" Gate Valves	ea	1	$3,500.00	$3,500.00
4	Valve pit modifications	LS	1	$10,000.00	$10,000.00
5	External Piping	LS	1	$25,000.00	$25,000.00
7	Contingency (20%)	LS	1	$10,200.00	$10,200.00
					$61,200.00
1	Other Project Costs (20%)				**$12,240.00**
	TOTAL				**$73,440.00**

Cost Opinion - Looping Projects

Locust Hill

No	Item	Unit	Qty.	Unit Price	Estimate
1	8-inch Water Main	LF	550	100	$55,000.00
2	8-inch Gate Valves	Ea	4	2000	$8,000.00
3	12-inch Gate Valves	Ea	2	2500	$5,000.00
4	Hydrant Assembly	Ea	1	7500	$7,500.00
5	Water Services	Ea	5	3000	$15,000.00
6	Paving	Ton	90	150	$13,500.00
7	Contingency (20%)	LS	1	$21,000.00	$21,000.00
					$125,000.00
1	Other Project Costs (20%)	LS	1	$25,000.00	**$25,000.00**
	TOTAL				**$150,000.00**

Main Street Cannon Hill to Burbank

1	8-inch Water Main	LF	400	100	$40,000.00
2	8-inch Gate Valves	Ea	6	2000	$12,000.00
3	Paving	Ton	60	150	$9,000.00
4	Contingency (20%)	LS	1	$12,000.00	$12,000.00
					$73,000.00
1	Other Project Costs (20%)	LS	1	$14,600.00	**$14,600.00**
	TOTAL				**$87,600.00**

Cost Opinion - 300,000 Gallon Concrete In-Ground Reservoir					
No	**Item**	**Unit**	**Qty.**	**Unit Price**	**Estimate**
1	Site Work	ls	1	100000	$100,000.00
2	Cast in Place Concrete (300,000 gal.)	CY	600	550	$330,000.00
3	Pre-Cast Top	CY	150	825	$123,750.00
4	Hypalon Cover	SF	4800	3	$14,400.00
5	Access Road	LF	1000	30	$30,000.00
6	Power	LF	1000	25	$25,000.00
7	12 x 12 Valve Building	LS	1	30000	$30,000.00
8	Tank demo	LS	1	25000	$25,000.00
9	Contingency (20%)	LS	1	$130,000.00	$130,000.00
					$808,150.00
1	Other Project Costs (20%)	LS			**$161,630.00**
	TOTAL				**$969,780.00**

Appendix 5 20-Year Capital Improvements Plan (in 2020 dollars)

Project	Description/Reason	Recommended Time Frame			
		2020-2025	2025-2030	2030-2035	2035-2040
Maintainance Items					
Misc. Maint. Items	Instrumentation, calibration, sanitary survey items	$ 15,000	$ -		$ -
Subtotal		**$ 15,000**	**$ -**	**$ -**	**$ -**
Replace Gravel Well					
New Well Source	New Well at Emery Corner Road	$ 368,400	$ -		$ -
Subtotal		**$ 368,400**	**$ -**	**$ -**	**$ -**
Upgrade Bedrock Well					
Bedrock Well	Upgrade to Permanent Status	$ 43,680			
Subtotal		**$ 43,680**	**$ -**	**$ -**	**$ -**
Standby Generator					
Stand by Generator	Emery Corner PS		$ 67,680		
Subtotal		**$ -**	**$ 67,680**	**$ -**	**$ -**
SCADA/Controls					
Meters	Replace 12.5/Year	$ 20,625	20625	20625	$ 20,625
Subtotal		**$ 20,625**	**$ 20,625**	**$ 20,625**	**$ 20,625**
Meters					
SCADA Upgrade	Office and 4 RTU's	$ 86,400			
Subtotal		**$ 86,400**	**$ -**	**$ -**	**$ -**
Distribution System					
Looping Projects			$ 150,000	$ 87,600	
Piping Upgrades	Replace an average of 260' per year	$ 313,200	$ 313,200	$ 313,200	$ 313,200
Subtotal		**$ 313,200**	**$ 463,200**	**$ 400,800**	**$ 313,200**
Buildings					
Emery Corner PS	Replace Roof				$ 5,000
Washington St. PS	Interior clean up, re-pointing, etc.		$ 15,000		
Washington St. Office	Replace Roof			$ 5,000	
Subtotal		**$ -**	**$ 15,000**	**$ 5,000**	**$ 5,000**
Mill Reservoir					
Tank Mixing	In-ground 300,000 gallons			$ 82,440	
Subtotal		**$ -**	**$ -**	**$ 82,440**	**$ -**
Village Tank					
Replace Tank	In-ground 300,000 gallons				$ 969,780
Subtotal		**$ -**	**$ -**	**$ -**	**$ 969,780**
Total Estimated CIP Costs		**$ 847,305**	**$ 566,505**	**$ 508,865**	**$ 1,308,605**
Average Annual Expenses in 5-year increments		**$807,820**			
Average Annual Expense over 20 years		**$161,564**			

Dirigo Engineering

