TECHNICAL MEMORANDUM

Client:	Lake Limerick Water System		
Project:	Water System Evaluation		
Project File:	LLWS 21.0119	Project Manager:	David Matz, PE
Composed by:	Jared Ribail, EIT		
Reviewed by:	Geoff Dillard, PE and Harley Sandoval, PE		
Subject:	Hydraulic Analysis		
Date:	August 2, 2021		

Signed: 08/02/21

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Executive Summary

The Lake Limerick Water System (LLWS) requires an assessment of its existing water system capabilities and capacities. LLWS has elected to evaluate its water system's distribution and pumping capacities following two events in which a fire hydrant was operated, and distribution pressure dropped below 30 pounds per square inch (psi). The LLWS water system evaluation includes data collection, field testing, and hydraulic analysis and is an effort to better understand and develop a water system hydraulic model to be used in the evaluation of water system improvements.

Introduction

This Technical Memorandum (Memo) by RH2 Engineering, Inc., (RH2) summarizes the information for data collection and verification of LLWS's existing water system operation. LLWS, with the assistance of Northwest Water Systems, Inc., is currently updating its *Water System Plan* (WSP). LLWS provides water service to the Lake Limerick Country Club community that is located north of Shelton in unincorporated Mason County, Washington. LLWS has had difficulties providing reliable fire flow due to delayed pump response.

Project Background and Description

Background and System Planning Data

This section is intended to provide technical background and information regarding LLWS's existing water system. LLWS provides water for an area of approximately 1.25 square miles. The WSP describes approximately 66 percent of water service connections as being full time residences and a total of 1,201 service connections as shown in **Table 1**.

Table 1

Existing Water Service Connections

	2020
Full Time Residential Services	793
Total Number of Services [1]	1,201
Population Served	1,967
ERU [2]	941
ERU/Service Connection	0.8

(1) The number of service connections shown is from LLWS's draft WSP. Current number of metered connections as of 5/2/2021 is 1,215 with new connections being added regularly.

(2) An Equivalent Residential Unit (ERU) is the typical quantity of water consumed by the single-family residential customer. **Table 4** shows reported ERU projections.

LLWS was designed and constructed in the late 1960s and early 1970s, and consists of primarily 4- and 6-inch piping. **Table 2** summarizes the various diameters of pipe throughout LLWS's distribution system as documented in the WSP.

Table 2

Existing Pipe Diameters

Nominal Pipe Size (inches)	Approximate Length (ft)
2	2,006
4	52,310
6	20,041
8	973
Total	**75,330**

LLWS currently operates as a closed pressure zone with multiple pumping facilities maintaining the system's hydraulic grade line. LLWS has six facility sites consisting of seven wells, four tanks, and four booster pump stations. **Figure 1** shows the location of the existing facilities and water main. A summary of the facilities is shown in **Table 3**.

Table 3
Existing Facilities

Site	Well	Well Pump Capacity (gpm) [1]	Pumps To	Booster Pump	Pump On (psi) [2]	Pump Off (psi) [2]	Pump On HGL (ft) [3]	Pump Off HGL (ft) [3]	Typical Booster Pump Capacity (gpm) [1]	Overall Facility Capacity (gpm)
1	Well 1	70	Tank 1	Booster 1	51	61	398	421	68	68
2	Well 2 [4]	--	Distribution	--	--	--	--	--	--	--
3A	Well 3A	157	Tank 3	Booster 3A	45	56	396	421	95	95
3B	Well 3B	200		Booster 3B	52	53	412	414	95	95
4	Well 4	65	Tank 4	Booster 4	48	57	396	417	40	40
5	Well 5	34	Distribution	--	63	70	421	437	--	34
6 [5]	Well 6	110	Tank 6	Booster 6A	50	60	386	409	206	110
				Booster 6B	46	55	376	397	194	
Total		**636**	--						**698**	**442**

gpm = gallons per minute

(1) The WSP shows historical well and booster pump capacities but have been recently updated. Typical flow rates for the pumps in gpm were provided by LLWS staff and are approximate based on distribution pressure at the time of the pump test.

(2) Pump on and off set points were provided by LLWS staff and change regularly to achieve turn over in the tanks.

(3) The target hydraulic grade line (HGL) shown corresponds to the pressure set points shown.

(4) Well No. 2 is not currently operational due to installation of pump equipment. This well has a high level of manganese and has historically been used seasonally.

(5) The capacity at Site No. 6 is limited by the well pump. This is accommodated at the booster pumps by limiting their speed.

The WSP provides a description of historical and projected water demands. The water demands for 2020, 2040, and buildout conditions from the current draft WSP were adopted for this analysis. **Table 4** shows the Average Day Demand (ADD), Max Day Demand (MDD), and Peak Hour Demand (PHD) for various conditions.

Table 4
Water System Demands

	2020	2040	Buildout
ADD (gpd/ERU)	212	212	212
MDD (gpd/ERU)	488	488	488
PHD (gpm)	604	614	802
ERU	941	957	1,250

gpd = gallons per day

According to the WSP, LLWS has adopted Mason County fire flow standards. Mason County fire flow standards require that purveyors provide 500 gpm for 30 minutes for existing residential developments and 1,000 gpm for 120 minutes for new residential developments (**Appendix A**). The undersized water mains throughout the distribution system and delayed pump response make it challenging to reliably open fire hydrants without resulting in high flow velocities and significant pressure drops. In addition to significant pressure losses, high flow velocities can cause impaired water quality and customer service issues.

Project Description

The purpose of this Memo is to identify the needs for water system improvements relating to capacity and reliability to meet existing and future water system demands. The specific tasks of this Memo include:

- Collect water system data;
- Develop the hydraulic model and verify field operations;
- Utilize the hydraulic model to identify system limitations and deficiencies such as available pressure and fire flow;
- Make water system improvement recommendations to improve water system capacity and reliability.

Field Testing and Hydraulic Analysis

Field Testing and Data Collection

The purpose of this section is to present the data collection and field testing that was completed for model operation verification. With the assistance of LLWS staff, RH2 was able to complete fire hydrant testing on February 25, 2021. This testing included deployment of multiple pressure transducers and operation of three fire hydrants throughout the distribution system. **Figure 2** shows the fire hydrants that were operated during the testing, these are denoted in blue with a FH-#. Also shown in **Figure 2** are the locations with deployed pressure transducers shown in black.

Before operating the hydrants, Sites 4 and 5 had pumps operating. Once the fire hydrant port was completely open, all six facilities had pumps running. The hydrant tested first, FH-1, was opened at least partially for approximately 20 minutes with RH2's Hose Monster assembly attached where the pressure and flow measurements were taken. The Hose Monster was coupled to three hydrants that were operated. **Table 5** illustrates the resulting pitot pressure and flow rate that was measured at FH-1, FH-2, and FH-3 shown on **Figure 2**.

Table 5

Fire Hydrant Flow Test Results

Date	Time Start	Time Stop	Run Time	Flow Hydrant Location	Port Size (in)	Pitot (psi)	Flow Rate (gpm) [1]	Total Flow (gal)
2/25/2021	12:05:00 PM	12:25:00 PM	20	FH-1	2.5	18	716	14,310
2/25/2021	1:18:00 PM	1:26:00 PM	8	FH-2	2.5	9	506	4,048
2/25/2021	12:53:00 PM	1:03:00 PM	10	FH-3	2.5	12	584	5,842

(1) The flow rate was determined using the Hose Monster Flow Chart included as **Appendix B**. If pitot pressures were not shown on the table, then table values were interpolated.

Analysis

The purpose of this section is to present the results of the hydraulic analysis completed as part of the evaluation. For analysis of the water system, a steady-state hydraulic model was built using Version 10.02 of Bentley's WaterCAD software. The hydraulic model consists of the existing pipe network, tanks, wells, and pumping facilities. The pipe and junction data used as input for the hydraulic model is shown in the pipe and junction data table included as **Appendix C** and shown in **Figure 3**. Information regarding the existing facilities and pipe diameters was extracted from the draft WSP, which is included as **Appendix D**.

Field data from the hydrant flow testing and pressure transducers was utilized for verification of the hydraulic model. The verification includes adjusting pipe friction coefficients to represent field conditions and reviewing facility operations during various flow conditions. The data from the pressure transducers for the duration of their deployment is included as **Appendix E**. A summary of the field measured pressures and flows are shown in **Table 6**.

Table 6

Field Measured Pressure and Estimated Flow

RH2 Transducer Number	Location	Total Demand (gpm) [1]	Field Measured Pressure (psi) [2]	Total Demand (gpm) [3]	Field Measured Residual Pressure (psi)
No. 11	E Road of Tralee	139	66	723	55
No. 12	Corner of E Ballantrae Dr and St Andrews Dr N	139	75	854	69
No. 13	E Ballycastle Way	139	61	854	45

(1) The system demand shown was assumed to be equivalent to ADD as shown above and in the WSP.

(2) The pressure shown is the pressure prior to the operation of the fire hydrant. Since the system operates as a closed zone and there are pumps constantly operating, there are no static conditions.

(3) Total demand shown is equivalent to ADD plus the flow from a tested hydrant.

The hydraulic model is in fair agreement with the field-testing data. The model does not replicate response time during dynamic flow conditions, and further model development is needed to adequately reflect some of the system's dynamic hydraulic conditions. The modeled system pressures are predominantly greater than 30 psi, except for a few junctions at facilities where the pressure is dependent on the tank levels which are feeding the suction piping of the booster pump facilities. **Figures 4** and **5** depict the system pressure during ADD and PHD. The completed hydraulic modeling also included analyzing available fire flow during MDD. The available fire flow throughout the system is illustrated in **Table 7** and shown in **Figure 6**.

Table 7
Available Fire Flow

Available Fire Flow (gpm) [1]	% Nodes Within Flow Range
200 to 500 gpm	76%
500 to 1,000 gpm	20%
> 1,000 gpm	4%

(1) Assumes that the existing pumps can operate along their pump curve provided in the WSP. Available fire flow was not field verified at all existing hydrants.

Conclusion and Recommendations

LLWS was able to provide approximately 500 gpm at the fire hydrants that were operated throughout its distribution system with properly executed pump operations. An operator and Fire Department personnel should be aware of fire hydrant operation and ensure that they are opened slowly and to allow the pumps time to react. RH2's electrical and control group is currently investigating the existing pump controls and variable frequency drives (VFD) to improve pump operations and reliability.

LLWS can improve the water system's capacity and reliability by operating as an open pressure zone. LLWS is currently operating as a closed pressure zone which relies on pump operations to maintain system pressure and the distribution network is essentially a large enclosed pressure vessel. An open pressure zone maintains pressure within a water system by relying on gravity to supply water to the system from an elevated storage facility. Operating as an open zone could only be accomplished by adding an elevated storage facility. This allows a large volume of water to be available for use without relying on multiple pumping facilities competing with each other and operating all at once to maintain pressure in the system.

The LLWS can provide more reliable available fire flow by improving pump controls, replacing undersized pipes, installing looped water mains, installing a fire pump somewhere in the system, or constructing an elevated storage facility. **Figure 7** illustrates locations where additional water main looping should be evaluated to provide improved water system reliability. For a short-term solution, LLWS can install additional piping and appurtenant valves from one of the tanks to fill a tank truck in emergency situations. LLWS should also evaluate the need for water treatment capabilities to prevent future water quality issues. The water system improvements that may improve water system capacity and reliability are shown in **Table 8**, along with the associated costs.

Table 8

Water System Improvements

Water System Improvement	Project Description	Engineer's Opinion of Probable Cost ($) [1]	
W1	Pump Station Improvements [2]	$	3,000,000
W2	Disinfection/Chlorination Injection Equipment [3]	$	120,000
W3	Distribution Main Improvement/Replacement [4]	$	10,900,000
W4	Storage Facility and Reconfigured Pumping Facilities [5]	$	2,200,000
Total		$	16,220,000

(1) The planning-level cost estimates shown do not include engineering or SCADA/operating costs and are presented 2020 dollars.

(2) This estimate includes replacing aging pumping facilities and increasing capacity.

(3) Includes a metering pump, injection appurtenances, and an analyzer board at all six facility sites for reference.

(4) These improvements assume that all 4-inch and 6-inch water mains are upsized to 8-inch water mains (assumes 96 percent or 72,000 linear feet of water main). This does not include meter and hydrant replacement.

(5) Includes constructing an elevated storage facility and improves pump operations and decreases power costs.

Figures

Figure 1 – Existing Water System

Figure 2 – Fire Hydrant Testing Locations

Figure 3 – Pipe and Junction Data

Figure 4 – ADD Pressure

Figure 5 – PHD Pressure

Figure 6 – MDD + FF Available Fire Flow

Figure 7 – Potential Water System Looping Locations

Appendices

Appendix A – Mason County Fire Flow Requirements

Appendix B – Hose Monster Flow Chart

Appendix C – Junction and Pipe Data Table

Appendix D – Draft Water System Plan

Appendix E – Pressure Transducer Data

Figures

J:\DATA\LLWS\21-0119\GIS\MAP\FIGURE 1_LLWS_EXWATERSYSTEM.MXD BY: JRIBAIL PLOT DATE: MAR 23, 2021 COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

This map is a graphic representation derived from the Lake Limerick Water System Geographic Information System. It was designed and intended for Lake Limerick Water System staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

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PRELIMINARY

Vicinity Map

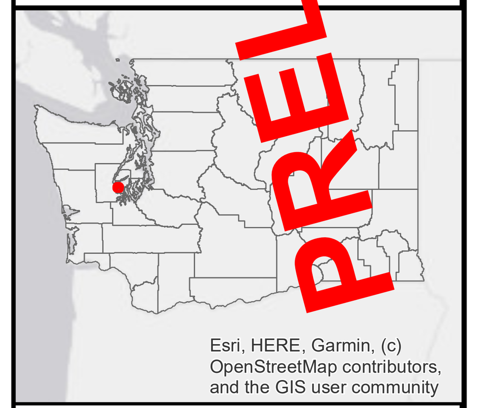

Figure 1
Existing Water System

Lake Limerick Water System
Water System Evaluation

LAKE LIMERICK COUNTRY CLUB est. 1966 LIFE IS BETTER AT LAKE LIMERICK

1 inch = 400 feet

0 200 400 800 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

RH2

NORTH

This map is a graphic representation derived from the Lake Limerick Water System Geographic Information System. It was designed and intended for Lake Limerick Water System staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

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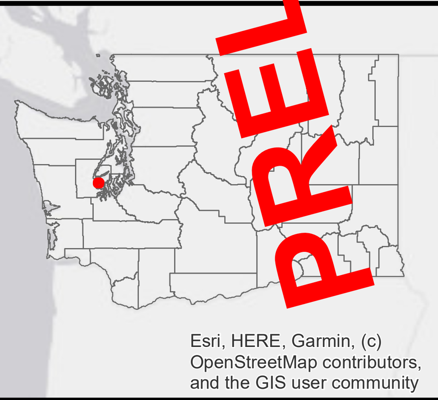
PRELIMINARY

Vicinity Map



COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

Figure 2

Fire Hydrant Testing Locations

Lake Limerick Water System
Water System Evaluation

LAKE LIMERICK COUNTRY CLUB est. 1966 LIFE IS BETTER AT LAKE LIMERICK

1 inch = 400 feet

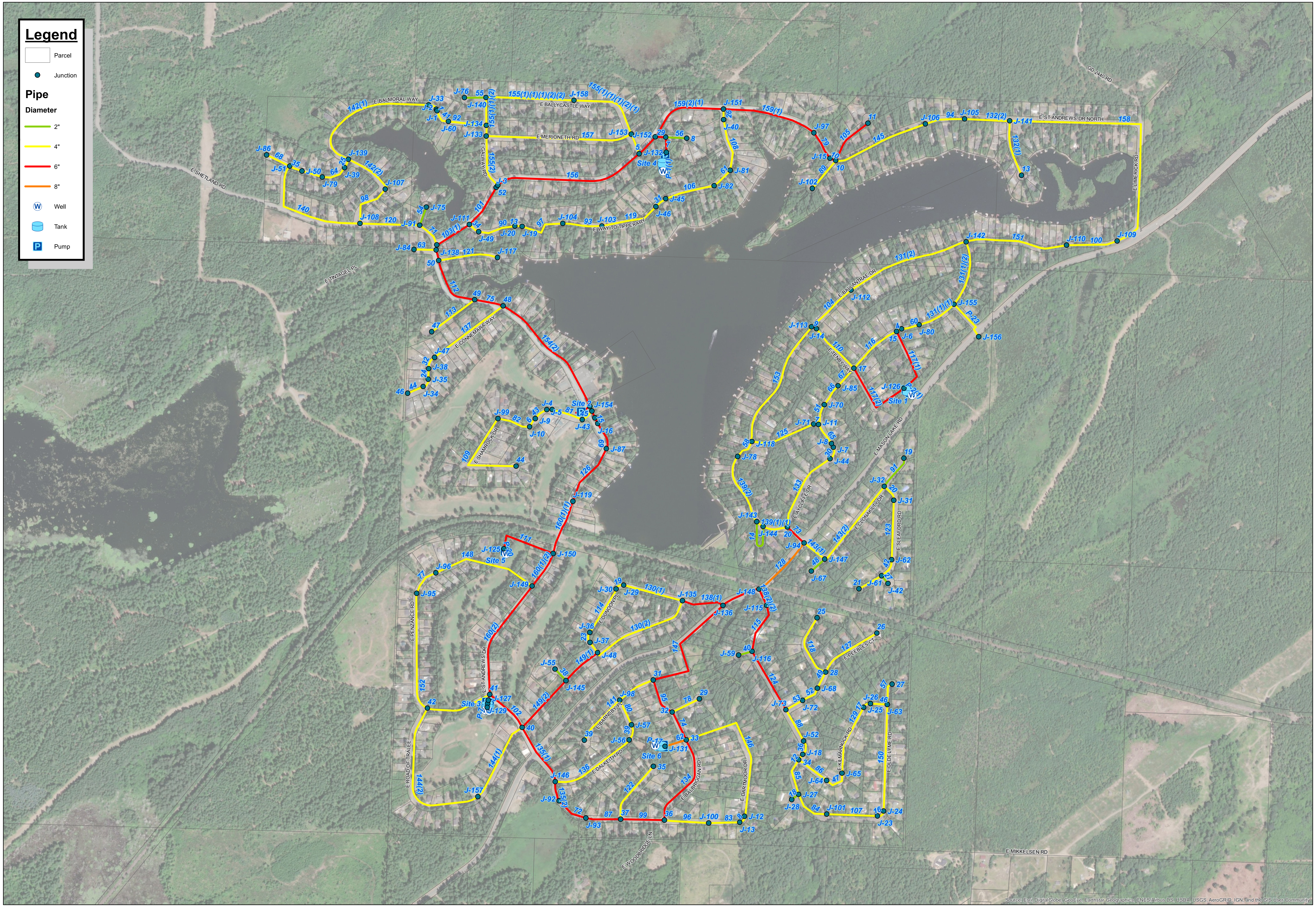
0 200 400 800 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

RH2

NORTH

J:\DATA\LLWS\21-0119\GIS\MAP\FIGURE 2_LLWS_HYDRANT_TESTING.MXD BY: JRIBAIL PLOT DATE: MAR 23, 2021



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PRELIMINARY

Vicinity Map

Figure 3
Pipe and Junction Data
Lake Limerick Water System
Water System Evaluation

Lake Limerick Country Club
est. 1966
Life is better at Lake Limerick

1 inch = 400 feet

0 200 400 800 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

RH2

NORTH

J:\DATA\LLWS\21-0119\GIS\MAP\FIGURE 3_LLWS_JUNCTIONS.MXD BY: JRIBAIL PLOT DATE: MAR 23, 2021 COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

J:\DATA\LLWS\21-0119\GIS\MAP\FIGURE 4_LLWS_ADD_PRESSURE.MXD BY: JRIBAIL PLOT DATE: MAR 23, 2021 COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

PRELIMINARY

Vicinity Map

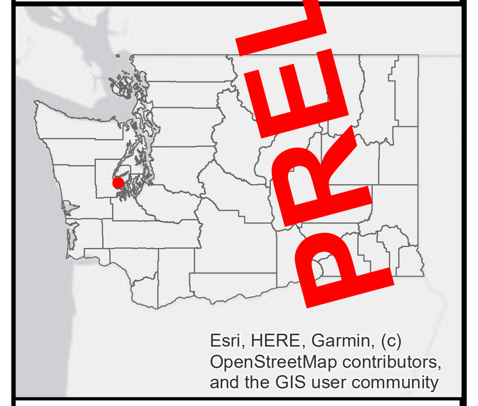


Figure 4
ADD Pressure

Lake Limerick Water System Water System Evaluation

LAKE LIMERICK COUNTRY CLUB est. 1966 LIFE IS BETTER AT LAKE LIMERICK

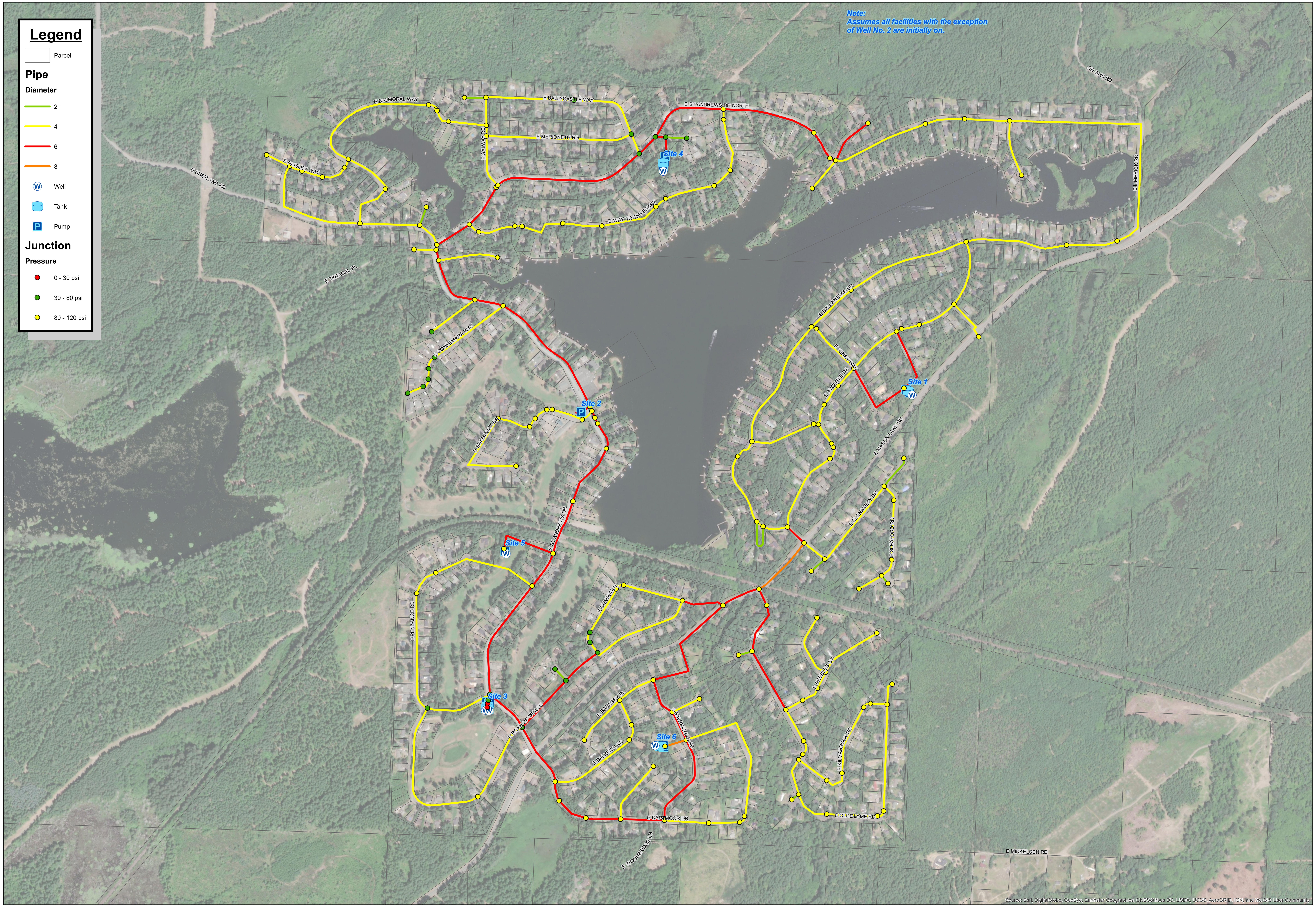
1 inch = 400 feet

0 200 400 800 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

RH2

NORTH



PRELIMINARY

Vicinity Map

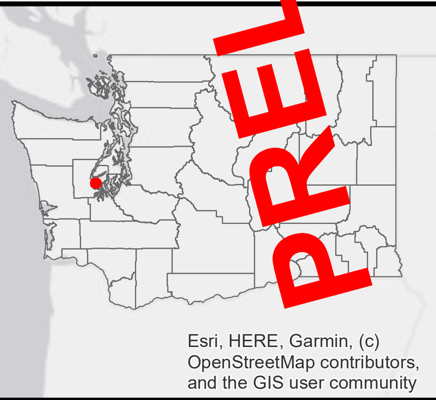


Figure 5
PHD Pressure

Lake Limerick Water System
Water System Evaluation

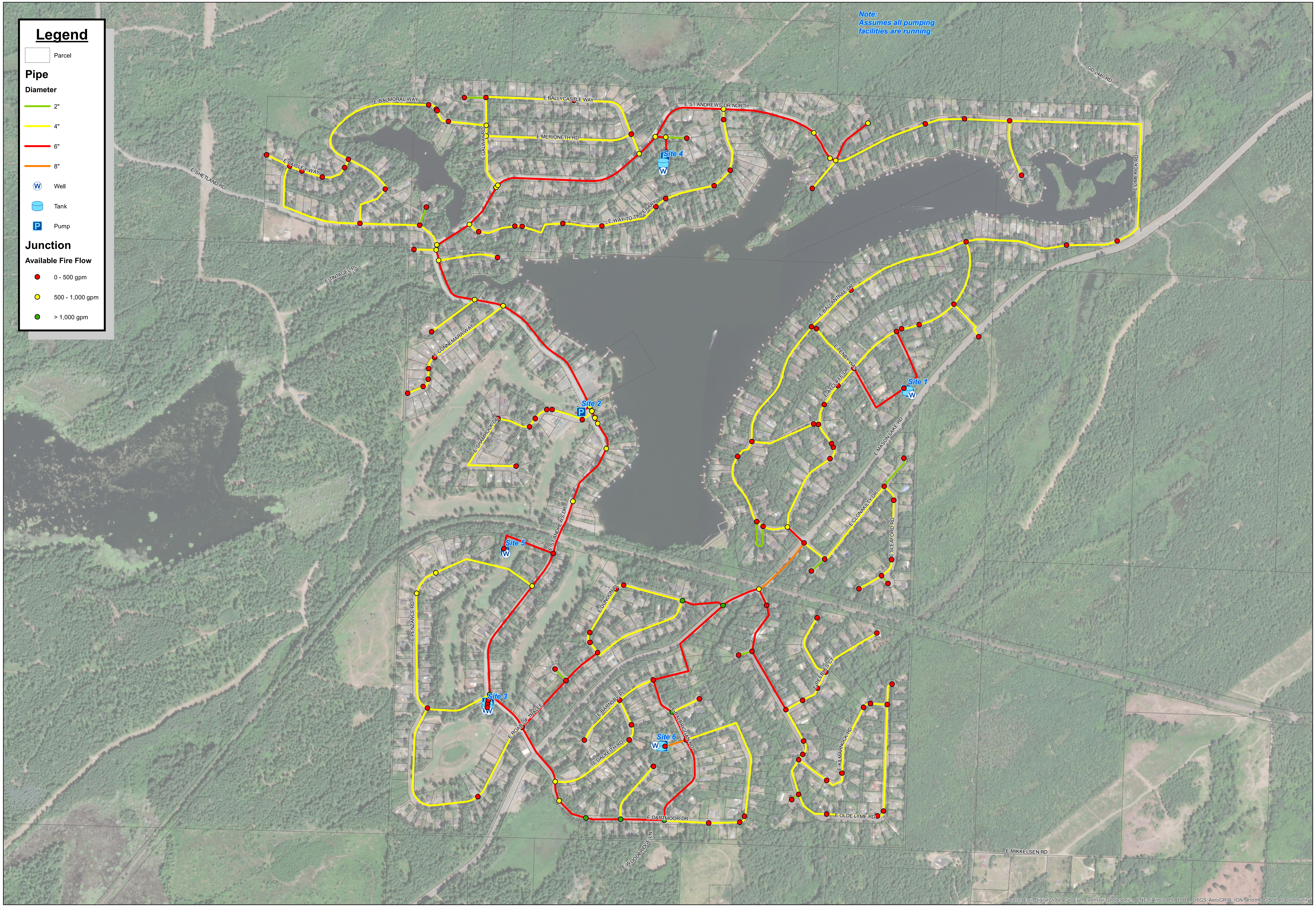
1 inch = 400 feet

0 200 400 800 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

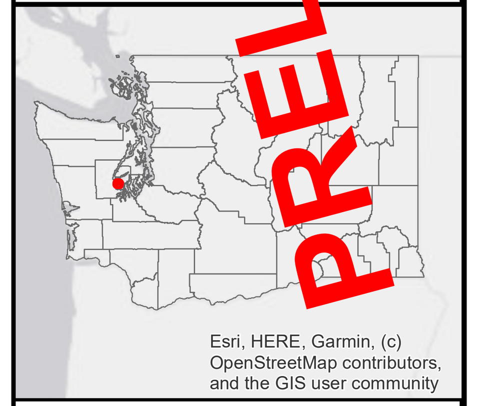
NORTH

J:\DATA\LLWS\21-0119\GIS\MAP\FIGURE 5_LLWS_PHD_PRESSURE.MXD BY: JRIBAIL PLOT DATE: MAR 23, 2021 COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET



PRELIMINARY

Vicinity Map



Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Figure 6

MDD Available Fire Flow

Lake Limerick Water System
Water System Evaluation

LAKE LIMERICK COUNTRY CLUB
est. 1966
LIFE IS BETTER AT LAKE LIMERICK

1 inch = 400 feet

0 200 400 800 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

RH2

NORTH

J:\DATA\LLWS\21-0119\GIS\MAP\FIGURE 6_LLWS_MDD+FF.MXD BY: JRIBAIL PLOT DATE: MAR 23, 2021 COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

Appendices

Appendix A

Mason County, WA
Code of Ordinances

‹ 14.17.200 - Street or road signs. Chapter 14.19 - SALE AND DISCHARGE OF FIREWORKS ›

Chapter 14.18 - INTERIM FIRE FLOW STANDARDS FOR GROUP A WATER SYSTEMS

14.18.010 - Applicability.

These interim standards shall be applied to all new or expanding Group A community water systems (as defined in WAC 246-290) only and will apply until final standards are adopted as part of a coordinated water system plan for Mason County.

(Ord. 46-07, Attach. A (part), 2007).

14.18.020 - Definitions.

For the purposes of this chapter:

"Existing residential development" means and includes property that is currently developed, supplied by a water system and a service area has been delineated to accommodate the maximum number of lots/residences to be served by the system design.

"Expansion" means additions, extensions, changes or alterations to an existing source, transmission, storage or distribution facilities that will allow the system to increase in size its existing service area and/or number of approved service connections.

Exceptions:

(1) A system that connects new approved individual retail or direct service connections onto an existing distribution system within an existing service area; or

(2) A distribution system extension in an existing service area identified in a current and approved water system plan or project report.

"Group A water systems" means a public water system providing service such that it meets the definition of a public water system provided in the 1996 amendments to the Federal Safe Drinking Water Act (Public Law 104-182, Section 101, subsection b).

Group A water systems are further defined as:

"Community water system" means any Group A water system providing service to fifteen or more service connections used by year-round residents for one hundred eighty or more days within a calendar year, regardless of the number of people, or regularly serving at least twenty-five year-round (i.e., more than one hundred eighty days per year) residents.

(Examples of a community water system might include a municipality, subdivision, mobile home park, apartment complex, college with dormitories, nursing home, or prison.)

"Nested storage" means one component of storage is contained within the component of another.

"New residential development" means and includes improvements to vacant land, such as all activities associated with the subdivision of property (including short- and large-lot subdivisions), construction of new residential dwelling units (single-family or multifamily), mobile/manufactured home park or similar residential uses.

"Standby storage" means the volume of stored water available for use during a loss of source capacity, power, or similar short-term emergency.

The standby storage component or the fire suppression storage component, whichever volume is smaller, can be excluded from a water system's total storage requirement providing that such practice is not prohibited by:

(1) A locally developed and adopted coordinated water system plan;

(2) Local ordinance; or

(3) The local fire protection authority or county fire marshal (See WAC 246-290-235(4)).

"Service area boundary." A service area boundary of a public water system holds within it (1) its existing service area (RCW 70.116.030 (6) and WAC 246-293-110 (11)) and (2) its future service area (WAC 246-293-110 (12)). Generally, a public water system's service area encompasses those areas that are currently being provided service, as well as those areas where the public water system is planning on providing service in the future.

Purpose. Delineation of service areas helps to prevent overlapping or redundant services, which can be costly to the utility and its customers. Clear identification of areas of responsibilities allows for consistent and logical planning. The assumption is made that a utility has the ability to provide service in a timely and reasonable manner within its service area boundaries and is provided the right of first refusal. Service area boundaries are delineated during the development or revision of an ACWSP. Service areas that are larger than the system's existing service area allow for future system expansion.

(Ord. 46-07, Attach. A (part), 2007).

14.18.030 - New residential development.

(a) New Residential Development Without Alternative Measures to Reduce Flow Requirements. New residential developments with their own sources of public water supply shall have a minimum of one hundred twenty thousand gallons of water storage dedicated for fire suppression available at all times. This volume of storage shall be in addition to any volumes required by DOH for approval of a public water system. This standard comes from the International Fire Code (IFC) requirement of one thousand gallons per minute flow for one hundred twenty minutes.

(b) New Residential Development with Alternative Measures to Reduce Flow Requirements. Reductions in fire suppression storage or fire flow requirements may be allowed if the development has instituted certain measures that make it possible for reduced demands for fire suppression purposes. Such measures as density of development, types of construction, increased building setbacks could allow for reductions in the fire storage or needed fire flows. The Mason County fire marshal shall review any proposals for reductions in fire suppression capacity on a case-by-case basis prior to an approval for fire storage or flow reductions.

(c) Fire Hydrant Spacing Requirements. The hydrant spacing for all residential developments shall be in accordance with the IFC requirement of one hydrant for every five hundred feet, or less.

(d) Minimum Distribution System Pressures During Active Fire Suppression Activities. The State Department of Health requires that a minimum pressure of twenty PSI shall be maintained throughout the water distribution system under the hydraulic condition of concurrent maximum day flow plus fire flow. This minimum pressure shall apply at the point where the designed volume of equalizing storage and fire suppression storage has been depleted. See Chapter 246-290-230(6) WAC - Distribution Systems for this requirement (in the state drinking water system rules).

(e) Transmission Lines. Transmission lines shall meet the current minimum pressure requirements of WAC 246-290.

(f) Minimum Pipe Size. The IFC requires a minimum eight-inch diameter pipe for nonlooped lines, and six-inch diameter pipes for looped lines, for new or replacement distribution mains.

(g) New Residential Development with Variances for Residential In-House Fire Sprinkler Systems. Developments with ordinances, by-laws, or other governing controls requiring all residences to be constructed with internal fire sprinkler systems may have their fire suppression storage reduced to a minimum of sixty thousand gallons, in accordance with allowance proved by the IFC. Additional reductions are allowed for "FIREWISE" designs and/or use of alternate fire resistant construction materials. Conservation of water may also provide for additional reductions for fire suppression storage or the fire flow requirements. The Mason County fire marshal should be contacted on a case-by-case basis to see what levels of reduced fire storage may be associated with such elements as availability of emergency water sources, alternate emergency egress capacity, combustible materials management, and use of alternate construction materials.

(Ord. 46-07, Attach. A (part), 2007).

14.18.040 - Existing residential development.

The requirements of the IFC, as given above, also apply to facility improvements or upgrades to Group A community water systems within existing residential developments, except as follows:

(1) System distribution main expansions or replacements shall be designed to meet the current minimum standards as outlined in WAC 246-290.

(2) Fire suppression storage shall be based on a minimum of five hundred gallons per minute (gpm) flow for thirty minutes duration, which equates to fifteen thousand gallons for fire protection, and is also consistent with stipulations in the State Water System Coordination Act. The minimum dedicated fire suppression storage volume at any time shall not be less than fifteen thousand gallons. This minimum would be in addition to other storage volumes required for public water systems under the state drinking water rules and design requirements.

(3) If water is provided from other sources for fire control purposes, the gallon requirements for fire storage requirement may be redu twenty-five percent.

(4) Draft fire hydrants may be permitted only with approval by the Mason County fire marshal.

(5) An additional twenty-five percent reduction in fire suppression storage may be granted for use of "FIREWISE" design throughout the development, and/or if alternate fire-resistant construction materials have been used for residential housing construction.

(6) Nested storage may be allowed; however, the Mason County fire marshal shall review all proposals for nested storage to ensure that under no conditions shall the volume of fire storage be reduced below a minimum of fifteen thousand gallons per five hundred gpm for thirty minutes (unencumbered).

(7) Expansion of an existing Group A community water system beyond the existing established service area shall be reviewed by the Mason County fire marshal and applicable area fire district to determine impacts and availability of water in the system to adequately serve additional connections.

(Ord. 46-07, Attach. A (part), 2007).

‹ 14.17.200 - Street or road signs.

Chapter 14.19 - SALE AND DISCHARGE OF FIREWORKS ›

Appendix B

2"

Pitotless Nozzle™ THD

FLOW CHART

FM APPROVED

HOSE MONSTER

10 - 40 PSI	2 1/2" Hose Monster Model II	Open Atmosphere
PSI	GPM	GPM
10	521	529
11	547	555
12	571	579
13	594	603
14	617	626
15	638	648
16	659	669
17	679	689
18	699	709
19	718	729
20	737	748
21	755	766
22	773	784
23	790	802
24	807	819
25	824	836
26	840	853
27	856	869
28	872	885
29	887	900
30	903	916
31	918	931
32	932	946
33	947	960
34	961	975
35	975	989
36	989	1003
37	1002	1017
38	1016	1031
39	1029	1044
40	1042	1057

41 - 70 PSI	2 1/2" Hose Monster Model II	Open Atmosphere
PSI	GPM	GPM
41	1055	1071
42	1068	1084
43	1081	1096
44	1093	1109
45	1106	1122
46	1118	1134
47	1130	1146
48	1142	1158
49	1154	1170
50	1165	1182
51	1177	1194
52	1188	1206
53	1200	1217
54	1211	1229
55	1222	1240
56	1233	1251
57	1244	1262
58	1255	1273
59	1266	1284
60	1277	1295
61	1287	1306
62	1298	1317
63	1308	1327
64	1318	1338
65	1329	1348
66	1339	1358
67	1349	1369
68	1359	1379
69	1369	1389
70	1379	1399

Key Flow Test Points	2 1/2" Hose Monster Model II	Open Atmosphere
GPM	PSI	PSI
500	9.5	9.1
562.5	11.7	11.3
750	20.7	20.1
1000	36.8	35.8
1125	46.6	45.3
1500	82.8	80.5

The readings on this chart are based on which device the Pitotless Nozzle is connected to.

It is the user's responsibility to verify that the correct chart and column is being used.

- **2 ½" Hose Monster Model II or Flusher with flow splitter (HM2H, HM2HF).** Use this column if the Pitotless Nozzle is connected to the 2 ½" Hose Monster or Flusher. The built-in pitot or flow splitter must be installed for accuracy. If you do not have the built-in pitot or flow splitter, please contact us.
- **Open Atmosphere.** Use this column when the Pitotless Nozzle is connected directly to a test header or hydrant flowing openly to atmosphere.

This chart is FM Approved for flow rate accuracy. Please call us or instruct the Authority Having Jurisdiction to call us if there are any questions. Additional copies of flow charts are available at: www.hosemonster.com/literature.html

Updated Feb. 2011

U. S. Patent # 6,874,375

HYDRO FLOW PRODUCTS, INC.

MANUFACTURED BY:
Hydro Flow Products, Inc.
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Appendix C

Label	Demand (gpm)	Pressure (psi)	Elevation (ft)	Is Active?	Notes	Hydraulic Grade (ft)
10	1	77	238.28	TRUE		416.94
11	1	72	249.44	TRUE		416.94
13	1	81	230	TRUE		416.79
15	1	62	272.72	TRUE		416.68
17	1	63	270	TRUE		416.68
19	1	63	270	TRUE		416.68
20	1	75	243.53	TRUE		416.79
21	1	70	254.53	TRUE		416.67
25	1	75	243	TRUE		416.69
26	1	71	252.87	TRUE		416.69
27	1	66	263.34	TRUE		416.52
28	1	74	245.15	TRUE		416.69
29	1	64	270	TRUE		417.17
31	1	73	249.21	TRUE		417.12
32	1	70	256.2	TRUE		417.17
33	1	71	253.6	TRUE		417.21
34	1	88	213.67	TRUE		416.56
35	1	67	262.33	TRUE		417.39
36	1	68	260	TRUE		417.31
37	1	70	256.15	TRUE		417.39
39	1	65	266.17	TRUE		417.12
40	1	58	284.22	TRUE		417.75
41	1	55	291.81	TRUE		418.21
42	1	57	285.1	TRUE		417.75
44	1	71	253.3	TRUE		418.28
45	1	79	235.55	TRUE		418.32
46	1	59	281.31	TRUE		417.54
47	1	61	275.91	TRUE		417.46
48	1	62	274.14	TRUE		417.59
49	1	70	256.72	TRUE		417.46
5	1	56	287.34	TRUE		417.01
50	1	73	248.3	TRUE		417.23
52	1	65	267.82	TRUE		417.06
7	1	58	283.5	TRUE		417
8	1	59	280.53	TRUE		416.99

J-1	1	69	257.83	TRUE		417
J-10	1	74	247.34	TRUE		418.29
J-100	1	81	230.19	TRUE		417.27
J-101	1	93	200.6	TRUE		416.53
J-102	1	79	234.76	TRUE		416.94
J-103	1	69	257.59	TRUE		417
J-104	1	69	257.89	TRUE		417.01
J-105	1	70	254.55	TRUE		416.82
J-106	1	69	257.4	TRUE		416.85
J-107	1	64	268.15	TRUE		417.02
J-108	1	64	269.05	TRUE		417.04
J-109	1	79	233	TRUE	No. 12	416.72
J-11	1	71	252	TRUE		416.7
J-110	1	78	236.82	TRUE		416.7
J-111	1	70	254.97	TRUE		417.1
J-112	1	73	247.17	TRUE		416.68
J-113	1	75	242.23	TRUE		416.68
J-115	1	82	227.15	TRUE		416.81
J-116	1	85	220.94	TRUE		416.76
J-117	1	80	233.43	TRUE		417.23
J-118	1	77	238.59	TRUE		416.7
J-119	1	75	246.68	TRUE		419.08
J-12	1	88	214.41	TRUE		417.25
J-125	0	66	269.06	TRUE	Facility	421.54
J-126	0	59	280	TRUE	Facility	416.68
J-127	0	55	291.85	TRUE	Facility	418.21
J-129	0	10	291.66	TRUE	Facility	315
J-13	1	87	216.42	TRUE		417.26
J-130	0	10	290.77	TRUE	Facility	315
J-131	0	65	268.07	TRUE	Facility	417.21
J-132	0	57	284.14	TRUE	Facility	417
J-133	1	71	252.68	TRUE		417.01
J-134	1	72	250	TRUE		417.01
J-135	1	69	257.9	TRUE		417.07
J-136	1	84	221.92	TRUE		417
J-137	1	68	260.4	TRUE		417.17
J-138	1	69	257.17	TRUE		417.19
J-139	1	67	263.08	TRUE		417.01

J-14	1	74	244.99	TRUE		416.68
J-140	1	70	254.48	TRUE		417.01
J-141	1	75	242.42	TRUE		416.8
J-142	1	75	243.73	TRUE		416.69
J-143	1	77	237.82	TRUE		416.76
J-144	1	77	237.91	TRUE		416.77
J-145	1	54	293.83	TRUE	FH - 2	417.6
J-146	1	67	262.67	TRUE	FH - 3	417.58
J-147	1	69	257.74	TRUE		416.77
J-148	1	87	214.89	TRUE		416.83
J-149	0	65	269.22	TRUE		419.09
J-15	1	77	238.95	TRUE		416.94
J-150	0	73	249.89	TRUE		419.5
J-151	0	75	243.43	TRUE	FH - 1	416.97
J-152	0	58	282.11	TRUE		417
J-153	0	60	278.73	TRUE		417.01
J-154	0	79	234.85	TRUE		418.3
J-155	0	61	274.88	TRUE		416.68
J-156	0	59	280	TRUE		416.68
J-157	0	64	270	TRUE	No. 11	417.75
J-158	0	61	275	TRUE	No. 13	417.01
J-16	1	80	233.28	TRUE		418.42
J-17	1	80	233.96	TRUE		418.37
J-18	1	88	214.32	TRUE		416.57
J-19	1	69	257.21	TRUE		417.04
J-2	1	69	257.95	TRUE		417
J-20	1	69	258.09	TRUE		417.05
J-23	1	79	234.63	TRUE		416.52
J-24	1	77	237.93	TRUE		416.52
J-25	1	67	262.18	TRUE		416.52
J-26	1	66	264.1	TRUE		416.52
J-27	1	95	197.14	TRUE		416.54
J-28	1	97	191.35	TRUE		416.53
J-29	1	67	262.1	TRUE		417.22
J-3	1	64	268.67	TRUE		417.06
J-30	1	67	261.53	TRUE		417.25
J-31	1	63	269.94	TRUE		416.69
J-32	1	68	260.2	TRUE		416.7

J-33	1	69	256.6	TRUE		417
J-34	1	60	279.36	TRUE		417.54
J-35	1	58	282.95	TRUE		417.54
J-36	1	54	291.53	TRUE		417.41
J-37	1	54	292.24	TRUE		417.45
J-38	1	56	288.98	TRUE		417.55
J-39	1	64	268.02	TRUE		417.01
J-4	1	75	244.64	TRUE		418.29
J-40	1	74	245.97	TRUE		416.97
J-42	1	65	266.58	TRUE		416.66
J-43	1	79	236.56	TRUE		418.31
J-44	1	67	262.62	TRUE		416.72
J-45	1	66	263.6	TRUE		416.98
J-46	1	69	256.97	TRUE		416.98
J-47	1	55	290	TRUE		417.55
J-48	1	56	287.78	TRUE		417.51
J-49	1	69	257.34	TRUE		417.09
J-5	1	74	246.15	TRUE		418.29
J-50	1	64	268.57	TRUE		417.01
J-51	1	66	264.11	TRUE		417.01
J-52	1	89	210.25	TRUE		416.61
J-55	1	52	298.48	TRUE		417.59
J-56	1	64	270.21	TRUE		417.56
J-57	1	68	261.35	TRUE		417.56
J-59	1	85	220	TRUE		416.75
J-6	1	62	273.06	TRUE		416.68
J-60	1	72	250	TRUE		417
J-61	1	67	261.79	TRUE		416.67
J-62	1	69	256.32	TRUE		416.67
J-63	1	63	270	TRUE		416.52
J-64	1	88	212.01	TRUE		416.54
J-65	1	81	230.27	TRUE		416.53
J-67	1	69	256.86	TRUE		416.76
J-68	1	78	236.56	TRUE		416.7
J-7	1	67	262.3	TRUE		416.71
J-70	1	68	260	TRUE		416.69
J-71	1	72	250	TRUE		416.7
J-72	1	85	219.98	TRUE		416.7

J-73	1	88	213.91	TRUE		416.71
J-75	1	67	262.91	TRUE		417.11
J-76	1	66	264.51	TRUE		416.99
J-78	1	79	233.83	TRUE		416.71
J-79	1	64	270	TRUE		417.01
J-8	1	68	259.17	TRUE		416.71
J-80	1	61	274.94	TRUE		416.68
J-81	1	75	243.18	TRUE		416.97
J-82	1	70	254.77	TRUE		416.97
J-84	1	62	273.68	TRUE		417.19
J-85	1	65	265.92	TRUE		416.69
J-86	1	65	265.74	TRUE		417.01
J-87	1	79	236.99	TRUE		418.61
J-9	1	74	247.75	TRUE		418.29
J-91	1	65	268.02	TRUE		417.12
J-92	1	72	251.75	TRUE		417.53
J-93	1	72	250	TRUE		417.46
J-94	1	78	237.51	TRUE		416.81
J-95	1	65	269.03	TRUE		418.67
J-96	1	65	269.41	TRUE		418.75
J-97	1	79	235.41	TRUE		416.95
J-98	1	67	262.81	TRUE		417.56
J-99	1	72	251.51	TRUE		418.28

Hydraulic Model Piping						
Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Is Active?
P-19	23	Well No. 5	Well No. 5	6	Ductile Iron	TRUE
P-20	24	Well No. 5	J-125	6	Ductile Iron	TRUE
P-13	19	BPS No. 6B	J-131	8	Ductile Iron	TRUE
P-14	15	J-131	BPS No. 6A	8	Ductile Iron	TRUE
P-15	22	BPS No. 6B	Tank 6	8	Ductile Iron	TRUE
P-16	23	Tank 6	BPS No. 6A	8	Ductile Iron	TRUE
P-17	38	Well No. 6	Well No. 6	8	Ductile Iron	TRUE
P-18	16	Well No. 6	Tank 6	8	Ductile Iron	TRUE
62	201	33	J-131	8	PVC	TRUE
128	586	J-148	J-94	8	PVC	TRUE
2	24	52	J-3	6	Asbestos Cement	TRUE
10	56	10	J-15	6	Asbestos Cement	TRUE
11	58	J-16	J-17	6	Asbestos Cement	TRUE
15	68	J-17	45	6	Asbestos Cement	TRUE
29	95	J-152	7	6	Asbestos Cement	TRUE
69	253	J-87	J-16	6	Asbestos Cement	TRUE
72	298	J-92	J-93	6	Asbestos Cement	TRUE
73	209	J-94	20	6	Asbestos Cement	TRUE
74	281	33	32	6	Asbestos Cement	TRUE
75	264	49	48	6	Asbestos Cement	TRUE
79	274	J-15	J-97	6	Asbestos Cement	TRUE
87	315	J-93	37	6	Asbestos Cement	TRUE
95	355	31	32	6	Asbestos Cement	TRUE
99	396	36	37	6	Asbestos Cement	TRUE
101	417	J-3	J-111	6	Asbestos Cement	TRUE
102	423	41	40	6	Asbestos Cement	TRUE
105	457	10	11	6	Asbestos Cement	TRUE
111	575	J-150	J-125	6	Asbestos Cement	TRUE
112	539	50	49	6	Asbestos Cement	TRUE
115	462	J-115	J-116	6	Asbestos Cement	TRUE
124	611	J-116	J-73	6	Asbestos Cement	TRUE
126	577	J-119	J-87	6	Asbestos Cement	TRUE
134	852	36	33	6	Asbestos Cement	TRUE
147	1106	J-136	31	6	Asbestos Cement	TRUE
156	1378	52	5	6	Asbestos Cement	TRUE

117(1)	605	15	J-126	6	Asbestos Cement	TRUE
117(2)	716	J-126	17	6	Asbestos Cement	TRUE
P-2(1)	31	Well No. 1	Well No. 1	6	Asbestos Cement	TRUE
P-2(2)	24	Well No. 1	Tank 1	6	Asbestos Cement	TRUE
P-3	20	Tank 1	BPS No. 1	6	Ductile Iron	TRUE
P-4	20	BPS No. 1	J-126	6	Ductile Iron	TRUE
45(1)	20	BPS No. 3A	J-129	6	Ductile Iron	TRUE
45(2)(1)	20	BPS No. 3A	J-127	6	Ductile Iron	TRUE
45(2)(2)	54	J-127	41	6	Asbestos Cement	TRUE
P-5	20	J-129	BPS No. 3B	6	Ductile Iron	TRUE
P-6	20	BPS No. 3B	J-127	6	Ductile Iron	TRUE
P-7	17	Well No. 3A	Well No. 3A	6	Ductile Iron	TRUE
P-8	15	Well No. 3A	J-130	6	Ductile Iron	TRUE
P-9	16	Well No. 3b	Well No. 3B	6	Ductile Iron	TRUE
P-10	19	Well No. 3B	J-130	6	Ductile Iron	TRUE
P-11	18	J-129	Tank 3	6	Asbestos Cement	TRUE
P-12	18	J-130	Tank 3	6	Asbestos Cement	TRUE
P-1(1)	43	Well No. 4	Well No. 4	6	Ductile Iron	TRUE
P-1(2)	31	Well No. 4	Tank 4	6	Ductile Iron	TRUE
50(1)	61	Tank 4	BPS No. 4	6	Asbestos Cement	TRUE
50(2)(1)	39	BPS No. 4	J-132	6	Asbestos Cement	TRUE
50(2)(2)	136	J-132	7	6	Asbestos Cement	TRUE
P-21	46	Well No. 2	Well No. 2	6	Ductile Iron	FALSE
P-22	92	Well No. 2	J-154	6	Ductile Iron	FALSE
138(1)	382	J-135	J-136	6	Asbestos Cement	TRUE
103(1)	348	J-111	J-137	6	Asbestos Cement	TRUE
103(2)(1)	45	J-137	J-138	6	Asbestos Cement	TRUE
103(2)(2)	99	J-138	50	6	Asbestos Cement	TRUE
149(1)	383	J-48	J-145	6	Asbestos Cement	TRUE
149(2)	580	J-145	40	6	Asbestos Cement	TRUE
135(1)	581	40	J-146	6	Asbestos Cement	TRUE
135(2)	180	J-146	J-92	6	Asbestos Cement	TRUE
138(2)(1)	368	J-136	J-148	6	Asbestos Cement	TRUE
138(2)(2)	162	J-148	J-115	6	Asbestos Cement	TRUE
160(2)	1111	J-149	41	6	Asbestos Cement	TRUE
160(1)(1)	507	J-119	J-150	6	Asbestos Cement	TRUE
160(1)(2)	352	J-150	J-149	6	Asbestos Cement	TRUE
159(1)	861	J-97	J-151	6	Asbestos Cement	TRUE

159(2)(1)	747	J-151	J-152	6	Asbestos Cement	TRUE
159(2)(2)	212	J-152	5	6	Asbestos Cement	TRUE
154(1)	45	45	J-154	6	Asbestos Cement	TRUE
154(2)	1228	J-154	48	6	Asbestos Cement	TRUE
1	15	J-1	J-2	4	Asbestos Cement	TRUE
3	50	J-4	J-5	4	Asbestos Cement	TRUE
4	52	15	J-6	4	Asbestos Cement	TRUE
5	38	J-7	J-8	4	Asbestos Cement	TRUE
6	91	J-9	J-10	4	Asbestos Cement	TRUE
7	44	J-11	J-71	4	Asbestos Cement	TRUE
8	77	J-12	J-13	4	Asbestos Cement	TRUE
9	49	J-113	J-14	4	Asbestos Cement	TRUE
12	60	J-18	34	4	Asbestos Cement	TRUE
13	66	J-19	J-20	4	Asbestos Cement	TRUE
16	81	J-23	J-24	4	Asbestos Cement	TRUE
17	77	J-25	J-26	4	Asbestos Cement	TRUE
19	86	J-29	J-30	4	Asbestos Cement	TRUE
20	158	J-31	J-32	4	Asbestos Cement	TRUE
21	88	J-2	J-33	4	Asbestos Cement	TRUE
22	93	J-34	J-35	4	Asbestos Cement	TRUE
23	98	J-36	J-37	4	Asbestos Cement	TRUE
24	94	J-35	J-38	4	Asbestos Cement	TRUE
25	84	J-139	J-39	4	Asbestos Cement	TRUE
26	97	J-151	J-40	4	Asbestos Cement	TRUE
28	117	45	J-43	4	Asbestos Cement	TRUE
30	117	J-44	J-7	4	Asbestos Cement	TRUE
31	115	J-45	J-46	4	Asbestos Cement	TRUE
32	124	J-38	J-47	4	Asbestos Cement	TRUE
33	117	J-37	J-48	4	Asbestos Cement	TRUE
34	108	J-49	J-111	4	Asbestos Cement	TRUE
35	120	J-50	J-51	4	Asbestos Cement	TRUE
36	136	J-52	J-18	4	Asbestos Cement	TRUE
39	147	J-56	J-57	4	Asbestos Cement	TRUE
41	159	J-60	J-1	4	Asbestos Cement	TRUE
42	183	J-61	J-62	4	Asbestos Cement	TRUE
43	133	J-5	J-9	4	Asbestos Cement	TRUE
44	152	46	J-34	4	Asbestos Cement	TRUE
46	153	J-26	J-63	4	Asbestos Cement	TRUE

47	230	J-64	J-65	4	Asbestos Cement	TRUE
49	162	J-68	28	4	Asbestos Cement	TRUE
51	219	J-70	J-71	4	Asbestos Cement	TRUE
52	183	J-72	J-68	4	Asbestos Cement	TRUE
53	174	J-73	J-72	4	Asbestos Cement	TRUE
57	207	J-63	27	4	Asbestos Cement	TRUE
58	198	J-118	J-78	4	Asbestos Cement	TRUE
59	192	J-79	J-50	4	Asbestos Cement	TRUE
60	164	J-6	J-80	4	Asbestos Cement	TRUE
61	203	J-81	J-82	4	Asbestos Cement	TRUE
63	200	J-138	J-84	4	Asbestos Cement	TRUE
64	235	J-39	J-79	4	Asbestos Cement	TRUE
65	210	J-8	J-11	4	Asbestos Cement	TRUE
66	213	J-85	J-70	4	Asbestos Cement	TRUE
67	213	17	J-85	4	Asbestos Cement	TRUE
68	233	J-51	J-86	4	Asbestos Cement	TRUE
71	242	J-137	J-91	4	Asbestos Cement	TRUE
76	237	21	J-61	4	Asbestos Cement	TRUE
77	267	J-95	J-96	4	Asbestos Cement	TRUE
78	273	32	29	4	Asbestos Cement	TRUE
80	246	J-57	J-98	4	Asbestos Cement	TRUE
81	286	J-43	J-4	4	Asbestos Cement	TRUE
82	301	J-10	J-99	4	Asbestos Cement	TRUE
83	282	J-13	J-100	4	Asbestos Cement	TRUE
84	347	J-27	J-101	4	Asbestos Cement	TRUE
85	341	34	J-27	4	Asbestos Cement	TRUE
86	313	34	J-64	4	Asbestos Cement	TRUE
88	324	J-73	J-52	4	Asbestos Cement	TRUE
89	329	J-102	10	4	Asbestos Cement	TRUE
90	338	J-20	J-49	4	Asbestos Cement	TRUE
92	345	J-134	J-60	4	Asbestos Cement	TRUE
93	355	J-103	J-104	4	Asbestos Cement	TRUE
94	360	J-105	J-106	4	Asbestos Cement	TRUE
96	401	J-100	36	4	Asbestos Cement	TRUE
97	426	J-104	J-19	4	Asbestos Cement	TRUE
98	445	J-107	J-108	4	Asbestos Cement	TRUE
100	463	J-109	J-110	4	Asbestos Cement	TRUE
104	491	J-112	J-113	4	Asbestos Cement	TRUE

106	454	J-82	J-45	4	Asbestos Cement	TRUE
107	458	J-101	J-23	4	Asbestos Cement	TRUE
108	472	J-40	J-81	4	Asbestos Cement	TRUE
109	938	J-99	44	4	Asbestos Cement	TRUE
110	493	J-14	17	4	Asbestos Cement	TRUE
113	484	49	47	4	Asbestos Cement	TRUE
114	460	J-30	J-36	4	Asbestos Cement	TRUE
116	514	17	15	4	Asbestos Cement	TRUE
118	600	25	28	4	Asbestos Cement	TRUE
119	538	J-46	J-103	4	Asbestos Cement	TRUE
120	540	J-91	J-108	4	Asbestos Cement	TRUE
121	539	50	J-117	4	Asbestos Cement	TRUE
122	587	37	35	4	Asbestos Cement	TRUE
123	538	J-62	J-31	4	Asbestos Cement	TRUE
125	596	J-71	J-118	4	Asbestos Cement	TRUE
127	594	28	26	4	Asbestos Cement	TRUE
129	641	J-65	J-25	4	Asbestos Cement	TRUE
133	761	20	J-44	4	Asbestos Cement	TRUE
136	795	J-146	J-56	4	Asbestos Cement	TRUE
137	776	J-47	48	4	Asbestos Cement	TRUE
140	1092	J-51	J-108	4	Asbestos Cement	TRUE
141	844	39	31	4	Asbestos Cement	TRUE
145	884	J-106	10	4	Asbestos Cement	TRUE
146	1355	33	J-12	4	Asbestos Cement	TRUE
148	958	J-96	J-149	4	Asbestos Cement	TRUE
150	965	J-24	J-63	4	Asbestos Cement	TRUE
151	924	J-110	J-142	4	Asbestos Cement	TRUE
152	1677	41	J-95	4	Asbestos Cement	TRUE
153	1291	J-118	J-113	4	Asbestos Cement	TRUE
157	1322	J-153	J-133	4	Asbestos Cement	TRUE
158	2348	J-141	J-109	4	Asbestos Cement	TRUE
155(2)	481	J-133	52	4	Asbestos Cement	TRUE
155(1)(2)	96	J-134	J-133	4	Asbestos Cement	TRUE
130(1)	548	J-29	J-135	4	Asbestos Cement	TRUE
130(2)	963	J-135	J-48	4	Asbestos Cement	TRUE
142(1)	1282	J-33	J-139	4	Asbestos Cement	TRUE
142(2)	454	J-139	J-107	4	Asbestos Cement	TRUE
155(1)(1)(2)	252	J-140	J-134	4	Asbestos Cement	TRUE

132(1)	513	13	J-141	4	Asbestos Cement	TRUE
132(2)	407	J-141	J-105	4	Asbestos Cement	TRUE
131(2)	1138	J-142	J-112	4	Asbestos Cement	TRUE
139(2)	658	J-143	J-78	4	Asbestos Cement	TRUE
139(1)(1)	226	20	J-144	4	Asbestos Cement	TRUE
139(1)(2)	72	J-144	J-143	4	Asbestos Cement	TRUE
143(1)	235	J-94	J-147	4	Asbestos Cement	TRUE
143(2)	861	J-147	J-32	4	Asbestos Cement	TRUE
155(1)(1)(1)(1)	191	5	J-153	4	Asbestos Cement	TRUE
131(1)(1)	371	J-80	J-155	4	Asbestos Cement	TRUE
131(1)(2)	603	J-155	J-142	4	Asbestos Cement	TRUE
P-23	395	J-155	J-156	4	Ductile Iron	TRUE
144(1)	755	40	J-157	4	Asbestos Cement	TRUE
144(2)	1438	J-157	42	4	Asbestos Cement	TRUE
155(1)(1)(1)(2)(1)	696	J-153	J-158	4	Asbestos Cement	TRUE
155(1)(1)(1)(2)(2)	804	J-158	J-140	4	Asbestos Cement	TRUE
14	429	J-144	J-143	2	Ductile Iron	TRUE
18	78	J-27	J-28	2	Ductile Iron	TRUE
27	90	J-61	J-42	2	Ductile Iron	TRUE
38	143	J-145	J-55	2	Ductile Iron	TRUE
40	125	J-116	J-59	2	Ductile Iron	TRUE
48	163	J-147	J-67	2	Ductile Iron	TRUE
54	175	J-91	J-75	2	Ductile Iron	TRUE
55	194	J-140	J-76	2	Ductile Iron	TRUE
56	190	7	8	2	Ductile Iron	TRUE
91	321	J-32	19	2	Asbestos Cement	TRUE

Appendix D

Water System Plan Update
For The
Lake Limerick Water System
WSID: 44150-T

EXECUTIVE SUMMARY:

The Lake Limerick Water System (DOH ID 44150) is submitting a Water System Plan (WSP) Update. This 10-year plan amendment is required for compliance with the Washington Administrative Code. Note that this is a change from the previous 6-year planning cycle. This document will serve to provide the necessary technical information to administer and operate this system. The Lake Limerick Water System is currently an approved Group A Community water system approved for 1,250 connections. No changes are desired in the number of connections at this time.

Population:	1,967
Sources:	7 Groundwater sources totaling 944 gpm[1].
Storage:	4 Reservoirs totaling 478,800 gallons
Pressurization:	Booster pump and well pump driven
Distribution	Primarily Asbestos Cement installed in the late 1960's. Small portions of PVC installed during repairs and replacements of sections. 2,006' 2" 52,310' 4" 20,041' 6" 973' 8"
Water Rights	890 gpm, 446 acre-feet per year
ADD/ERU	212 gpd
MDD/ERU	488 gpd
Current PHD	604 gpm
20 Yr PHD	613 gpm
Fire Flow Requirements	The system was installed prior to adoption of Mason County fire flow standards. Future waterline replacements are planned that are adequate to support 1,000 gpm.
Management	Satellite Management Agent: Northwest Water Systems

Lake Limerick is a well-equipped system that requires no urgent upgrades or modifications. No significant operational, technical, or financial deficiencies exist at this time. The system is advised to begin a significant capital reserve program to replace waterlines over the next 20 to 40 years to maintain existing service levels.

[1] S02 is only used for flushing and fire-fighting events due to relatively poor water quality. Without S02 total source capacity is 744 gpm.

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Acronyms

ADD	Average Daily Demand
C	Coefficient of Friction
DSL	Distribution System Leakage
ERU	Equivalent Residential Unit
GWI	Groundwater Under the Influence of Surface Water
HGL	Hydraulic Grade Line
MCL	Maximum Contaminant Level
MDD	Maximum Daily Demand
MPA	Microscopic Particulate Analysis
NTNC	Non-Transient Non-Community
PHD	Peak Hourly Demand
ppb	Parts per Billion
ppm	Parts per Million
RSA	Retail Service Area
SMA	Satellite Management Agency
SWL	Static Water Level
SWSMP	Small Water System Management Program
UTC	Utilities and Transportation Commission
WDM	Water Distribution Manager
WFI	Water Facilities Inventory (form)
WSDM	Water System Design Manual
WSDOH	Washington State Department of Health
WSP	Water System Plan
WUE	Water Use Efficiency

Chapter 1 System Description

1.1 Ownership and Management

The Lake Limerick water system is owned and operated by the Lake Limerick Country Club, Inc. (LLCC), a non-profit corporation chartered to care for the public amenities in the development of the same name. Water service is provided to customers in the Lake Limerick Country Club community in unincorporated Mason County, Washington. The community stretches around its namesake lake in Township 21 North, Range 3 West, W.M. and occupies Section 27 as well as portions of the southeast quarter of Section 21, the southern half of Section 22, and the southwest quarter of Section 23. Specific data about the system can be found in the Water Facilities Inventory included in Section 10.7. Pertinent information about the water system is summarized below:

Water System Name:	Lake Limerick Water
System Type:	Group A Community Water System
WSDOH ID Number:	44150-T
Location:	Mason County, Washington
Source:	Groundwater
Type of Ownership:	Non-Profit Corporation
Service Connections:	1,201
Population Served:	1,967
Type of Management:	Satellite Management Agency (SMA)
Name of SMA:	Northwest Water Systems
SMA Contact:	Kevin Odegard, Operations Supervisor
SMA Address:	PO Box 123 Port Orchard WA 98366
SMA Phone:	(360) 876-0958

1.1.1 Association Responsibilities

The Lake Limerick Country Club Board of Directors, composed of nine members serving 3-year terms each, manages and controls the affairs and business of the corporation and exercises ownership authority and control over all of the common properties and assets of the corporation.

To fulfill the responsibility of operating and maintaining the water system, the Lake Limerick Board of Directors created a six-member Water Committee in 1976. The Water Committee's structure and responsibilities are outlined in the Water Department Bylaws (see attachment 10.13). Terms are staggered so that two members are elected to the Water Committee each year for a 3-year term. The Water Committee monitors and administers routine financial responsibilities of the Lake Limerick water system and implements planning and capital improvements.

The Lake Limerick Country Club employs one staff person dedicated to the water system who also serves as the on-site contact for the Lake Limerick Water Department. This role is currently filled by Doug Carothers.

1.1.2 SMA Responsibilities

Northwest Water Systems (NWS) has been contracted by Lake Limerick Country Club to serve as the water system's satellite management agency (SMA). In this capacity, NWS provides routine operation and maintenance services including 24-hour emergency response, coordination of repairs, development and implementation of the cross-connection control program, water quality monitoring, and oversight of other regulatory compliance topics. The SMA provides certified operations and management services meeting the requirements for Group A water systems. On-site operation and maintenance activities are coordinated with the Lake Limerick on-site staff person. A copy of the contract for SMA services is included in Appendix 10.19.

1.2 System History and Background

The Lake Limerick Country Club (LLCC) was incorporated in 1966 as a non-profit maintenance corporation chartered to care for the public amenities in the development, located in Mason County about 5 miles northeast of Shelton WA. The land was developed as 1,397 residential lots and a nine-hole golf course in 5 divisions. A public water system was developed to supply the domestic needs of the community, with the first 4 groundwater wells drilled between 1966 and 1969, each with an associated water right. Engineering for the system was approved in June of 1968, and the LLCC board approved completion of all waterline installation in all divisions in 1970.

Waterline installation was completed in the early 1970's. Small problems were fixed, initial configurations were tuned, and the system achieved normal operations by the middle of the 1970s. A letter from 1977 notes that the final cost of the system was $230,592.48, of which $31,541.89 was for well drilling and equipment, and $199,050.50 for waterline installation. The source and purpose of the note are unexplained, but are interesting historical record. In comparison, waterline replacement today is anticipated to cost approximately $5,300,000, with an additional $3,000,000 in wells, reservoirs, booster pumps and other ancillary equipment.

By the beginning of the 1980s concerns regarding system capacity induced the community to explore options for additional capacity. A groundwater resources study was commissioned recommending that the system increase its source capacity, by drilling one source into a deeper aquifer. Through the 1980's the system drilled 3 additional sources, two drilled to the upper aquifer near 150' below grade, and one to an aquifer located near 450'. The community also installed its first two reservoirs. Supplemental water rights applications were filed for 2 of the 3 sources in the 1980s, with a third application filed in 1997 for Well 3B. All of the water rights except the application for Well 3B have been perfected to certificates.

In the 1990s and 2000s, source capacity issues had been largely resolved and the system focused on operational upgrades. The most recent two reservoirs were added, and a Supervisory Control and Data Acquisition System (SCADA) was installed to control and coordinate operation at the various sites located throughout the community, and backup power generating capacity was installed at the two most critical sites in the community. Touch read service meters were installed in the late 1990s and were updated to radio read meters between 2010 and 2013. In 2020, a new Badger Beacon Analytics application and meter reading hardware and software were implemented to improve the efficiency of reading service meters and identifying leaks or meter problems.

At this time the community is approaching complete build-out, and additional capacity is unlikely to be required. System management has been automated from the wellheads to customer meters, sources are redundant and very reliable, storage is more than sufficient and backup power is available at multiple sites. Forward planning should focus on maintaining this state and preparing for future replacements as waterlines and other key infrastructure elements age.

The community was platted at a far higher density than permitted under current county zoning, but was completed prior to Mason County comprehensive planning. As a result, lots are "grandfathered", but cannot be subdivided. Factoring consolidation of lots and building site requirements it is estimated that the water system serving the development will have 1,250 connections at maximum build out. The golf course is irrigated with water pumped from Lake Limerick under separate surface water rights and does not affect water system operations.

1.2.1 Existing Facilities

The system's source of potable water is entirely from groundwater. The golf course is irrigated using surface water from Lake Limerick. With this irrigation system in place, no potable water is used in the irrigation of the golf course. The irrigation system is not physically connected to the potable water system, and its operation is fully independent of the water system, with its own source, pumps, waterlines, and water rights. It therefore does not factor into the capacity of the potable water supply, except that it reduces demand from the golf course that would otherwise be drawn from the water system. This effect is considered in the capacity analysis in Chapter 3.

Groundwater is withdrawn from 7 wells located on 6 separate sites. The wells were drilled between 1966 and 1988. Most of the sources are completed between 110 and 180 feet, although the latest source (Well 6) was drilled to a depth of over 430 feet. The total pumping capacity of all sources is 944 gpm (complete analysis is available in Chapter 3). Several sources are infrequently used, and one (Well 2) is currently only used for flushing and during firefighting activities.

The water system is comprised of multiple groundwater sources, storage, pressure boosting pumps, and waterlines. Backup power is available at two of the source and boosting stations, providing multiple redundancies. Control and monitoring are provided by a SCADA system connecting and coordinating the operation of the 6 sites from the water office.

1.3 Related Plans

The following documents were consulted in the preparation of this Water System Plan:

- *Mason County Comprehensive Plan*, updated 2017, and
- *WRIA Watershed Management Plan, Kennedy-Goldsborough Watershed,* Final Draft, February 2006.

Mason County maintains a *Comprehensive Plan* which was last updated in 2017. This document was developed to comply with the State's Growth Management Act (GMA). The *Comprehensive Plan* provides guidance on which the planning and land use projections within this WSP are based.

Lake Limerick is within the Kennedy-Goldsborough watershed (WRIA 14). In 2006, planning efforts lead by Mason County resulted in a final draft watershed management plan that has not been officially adopted. The draft plan addresses water quality, conservation, and environmental resource issues.

No inconsistencies or objections to the Water System Plan have been identified at the time of writing.

There are no adjacent water systems with which to coordinate in regard to water system planning; the nearest water systems are Rainbow Lake and Emerald lake which are approximately 0.5 miles south and 1 mile northeast of Lake Limerick's service area boundaries, respectively.

1.4 Service Area, Maps, and Land Use

The Lake Limerick retail service area encompasses an area of approximately 875 acres. A map of the Retail Service Area (RSA) is shown in Figure 1-2. Detailed system maps are included in Appendix 10.1.

1.4.1 Retail Service Area

The retail service area is where a municipal water supplier has a duty to serve connections under the conditions described in Section 1.6. For the Lake Limerick Water System, the retail service area is identical to the existing service area.

1.4.2 Future Service Area

No increase in the system's service area is anticipated; all growth on the water system in the future is expected to be from the infill of empty lots within the existing service area.

1.4.3 Service Area Agreements

The community has never formed any service area agreements with outside utilities. No competing utilities have registered service areas within the bounds of the existing or future service areas proposed by Lake Limerick; therefore, no utility coordination is required.

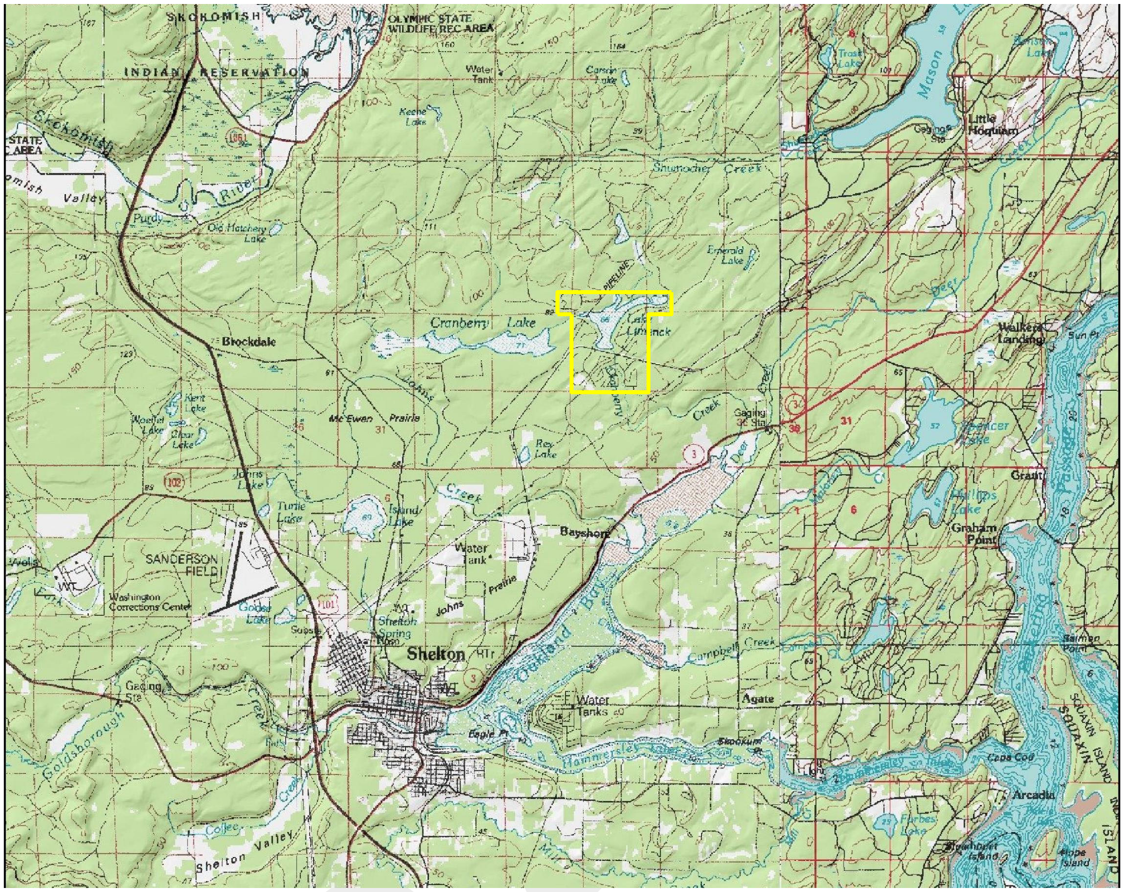


Figure 1-1: Lake Limerick Water System vicinity map.

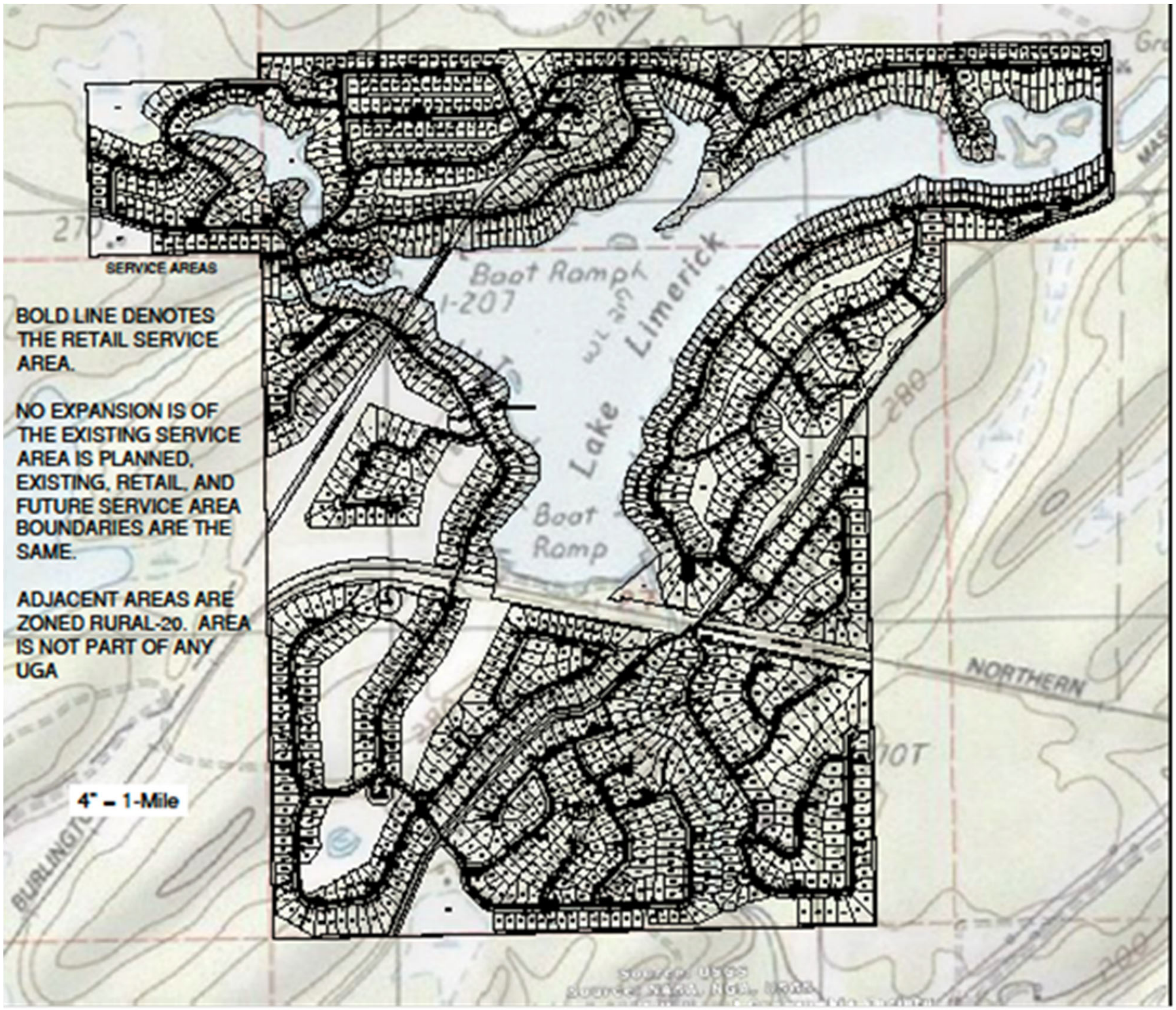


Figure 1-2: Lake Limerick Water System Service Area Boundaries

1.4.4 Land Use and Zoning

Zoning within the Lake Limerick community is shown on maps prepared by Mason County (see maps included in Appendix 10.8). The area is zoned primarily for Rural Residential development with a density of one home per 5 acres. Other zoning designations in the Lake Limerick area include Rural Tourist/Recreational Area (the golf course) and Rural Commercial. Single-family residential land use makes up over 90 percent of the Lake Limerick total land area. One small area of rural commercial development is located at the southern edge of community. Lands identified as Rural Commercial serve neighboring residences with quick shopping or other services compatible with neighboring uses.

1.5 System Policies

The Lake Limerick water system, in its commitment to provide dependable water service in accordance with all applicable regulatory rules and regulations, observes the following general policies.

1.5.1 Annexation

Annexation will not serve as a condition for providing service.

1.5.2 Direct Connection and Satellite/Remote Systems

Future direct connections to the Lake Limerick water system will occur as a result of infill within the retail service area.

Satellite systems are noncontiguous or separate water systems that use separate facilities and infrastructure and may be served by a different source. Lake Limerick does not operate nor has responsibilities associated with any satellite water systems.

1.5.3 Design and Performance Standards

All design and construction shall be completed under the direction of the Lake Limerick Country Club. Standards and details for pipe replacement and new service connection details are included in Section 7.

1.5.4 Outside Customers and Improvement Districts

The system will not serve any outside customers or districts.

1.5.5 Urban Growth Area

The system is not located within an urban growth area.

1.5.6 Late-Comer Agreements

Late-comer agreements do not apply to the system.

1.5.7 Oversizing

The existing distribution system is capable of serving the entire existing service area. The community has chosen to increase looped lines to 6” and dead-end lines over 250 feet in length with 8” main-lines whenever they are replaced so that fire flow may eventually be supported.

1.5.8 Cross-Connection Control Program (CCCP)

Lake Limerick has adopted a cross-connection control policy statement and developed a cross-connection control program and backflow incident response plan (see Appendix 10.12). In accordance with these documents, the installation or maintenance of a cross connection is prohibited. Cross connections that cannot be eliminated shall require the installation of an approved backflow protection device and shall be annually inspected and tested in accordance with the Lake Limerick cross-connection control program.

Services are connected to the watermains in pairs. A misinterpretation of Cross Connection Control regulations led the community to install a single Double Check Valve Assembly (DCVA) on every pair of services at the service lateral. As configured the main distribution lines are fully protected from a backflow incident; however, none of the individual properties were protected from their neighbor. As a result, no one on the system was fully protected from backflow hazards; although the effect of a backflow incident would be greatly limited in scope. The CCCP program has been re-evaluated and redefined to only require installation of DCVAs or other backflow devices on connections identified in hazard surveys conducted every 3 to 5 years.

1.5.9 Extension

No extensions are anticipated nor proposed.

1.6 Duty to Serve

The Lake Limerick water system has a duty to serve all new connections located within its Retail Service Area, so long as the following four threshold factors are met, as described in Washington Administrative Code (WAC) 246-290-106:

1. *Lake Limerick has sufficient capacity to provide water in a safe and reliable manner.*
   Lake Limerick holds a GREEN operating permit with no restrictions on expansion up to the allowed number of connections established by the DOH.
2. *The service request is consistent with state and local regulations.*
   The provision of service within the Retail Service Area is considered to be consistent with the *Mason County Comprehensive Land Use Plan*.
3. *Lake Limerick has sufficient water rights to provide service.*
   The Water Rights Self-Assessment forms included in the Water System Plan (see Appendix 10.9) show that the system has sufficient water rights to meet the water right criteria through build-out.
4. *Lake Limerick can provide service in a timely and reasonable manner.*
   Any applicant requesting water service with the Lake Limerick water system will be required to submit a written request to the Lake Limerick Water Committee. The written request shall include the name and address of the applicant, location of premises where water service is requested, and the purpose for which water is requested. The Lake Limerick Water Committee will respond to service requests with a determination of water availability within 60 days of receipt of the written application.

   For planning purposes, "timely service" is defined as receiving water service within 120 calendar days plus construction time. If the extent of water service requested requires construction of major facilities such as the replacement or installation of new storage tanks, wells, booster pumps or distribution mains, the time associated with construction may be added to the 120 days.

   The provision of new water service is "reasonable" if:

   - The conditions of service are consistent with local land use plans and development regulations.
   - The conditions of service and associated costs are consistent with those documented in the water system plan, and
   - The conditions of service and associated costs are consistent with the water system's standard practice experienced by other applicants requesting similar water service.

1.7 Local Government Consistency

In accordance with the Municipal Water Law, Lake Limerick Country Club is working on obtaining a signed consistency statement from Mason County to document that this WSP is consistent with local area planning. A copy of the Mason County consistency statement will be included in Section 10.17 of the WSP.

1.8 Watershed Plan Consistency

As discussed in Section 1.3 above, Lake Limerick is within the Kennedy-Goldsborough watershed (WRIA 14). The *WRIA 14 Watershed Management Plan, Kennedy-Goldsborough Watershed* was consulted in preparation of this Water System Plan. The watershed management plan addresses water quality, conservation, and environmental resource issues. No inconsistencies between the watershed management plan and this Water System Plan were identified.

Chapter 2 Basic Planning Data

2.1 Current Population, Service Connections, and Equivalent Residential Units (ERUs)

2.1.1 Population and Demographics

The Lake Limerick Community Club is a residential community comprised of full-time residences, seasonal residences, recreational services, and commercial services. The community includes a 9-hole golf course and recreational lake, 17 community parks, a restaurant, and a pro-shop for golfing supplies. The breakdown of services is as follows:

- 793 Full-time Residences
- 66 Seasonal Residences
- 333 Recreational Service
- 9 Commercial Services

The 2010 census data suggests that the Mason County households in unincorporated areas have on average 2.48 people her household. Based on this, there are estimated to be 1,967 full time residents living in the 793 full time residences. The seasonal residences tend to be occupied by retired couples and individuals. The average Part-Time residential population is therefore estimated based on 2 persons per residence during the summer months, with a peak of 132 residents. The 333 vacation properties see occupancy ranging from a handful to many dozens of persons per day. See the WFI in Appendix 10.7 for monthly transient population estimates. As of July 2020, there are approximately 22 full and part-time non-resident employees of Lake Limerick present throughout the year, and 1 seasonal non-resident employee.

2.1.2 ERU Analysis

For the purpose of this report, one ERU is defined as the equivalent usage of a single-family residence occupied full time. The commercial services on average exhibit usage patterns that are reasonably similar to the typical residential use on the system; therefore, they are each counted as a single ERU.

Seasonal residences are counted as a single ERU during the months when they are occupied, and zero ERU for non-occupancy months. The occupancy of the homes begins in April when seasonal residents begin returning from warmer climates, and rises to a peak in July and August, before falling back off. Meter Data sheets show the estimated number of ERU contributed by the seasonal connections varying from 0 to 66 ERU.

Recreational properties are generally owned by people who live nearby and use the property more frequently, and more irregularly than the seasonal population. These properties tend to be used throughout the year, as golfing and fishing amenities are available nearby. Based on meter data, these properties each use an average of 22% of the full-time residences throughout the year. On this basis, the recreational properties account for 0.22 ERU each.

ERU per class was evaluated and characterized for the winter and summer to determine the maximum and minimum ERU on the system. Since seasonal residences cause the total system ERU to vary over the course of the year, summertime system ERU is different than winter. The system's average ERU is used in calculating average day demand, and the peak ERU is used to estimate demand during the summer months.

Table 2-1: ERU Analysis

Class	Services	ERU
Full Time Residences	793	793
Seasonal Residences	66	0 – 66[1]
Recreational Services	333	73
Commercial Services	9	9
Total, Average	1,201	900
Total, Peak	1,201	941

*See footnotes below

2.2 Water Production and Usage

2.2.1 Meter Data

The community has record of production meter data going back over 20 years in one form or another. The community keeps service meter data; however, given the sheer volume of data collected, only the summarizing results are shown. Charts shown in this section were generated using data available in Appendix 10.6. Overall, water use has declined over the past 20 years, as shown in Figure 2-1. However, total usage has increased somewhat since 2013 and has not followed the trend projected in the previous WSP. Note that the high use in 2019 was due to several substantial leaks that were repaired near the end of 2019, and annual water use is expected to return to pre-2019 levels during 2020. Despite annual water usage increasing since 2013, the average and maximum daily demands per ERU have decreased, due to an increase in the number of ERUs and a decrease in maximum daily demand.

Meter data for the past 20 years shows the combined effects of community growth and of water use efficiency and leak detection efforts on the part of the community. The community has grown from approximately 1,016 connections in 1999 to 1,201 today, but water use overall has fallen. Meter data in Figure 2-1 shows a 33% reduction in water use from 98 million gallons pumped in 1999 to approximately 66 million gallons over the past five years (excluding significant leaks in 2019). Figure 2-2 shows quarterly consumption data for the past 6 years. The third quarter (July – September) has the highest usage, averaging 25 million gallons over the three-month period.

[1] Seasonal Residences are generally unoccupied from November to March, with occupancy increasing April through June to a peak in July and August, and back down through October. The average number of ERU is the weighted average throughout the year

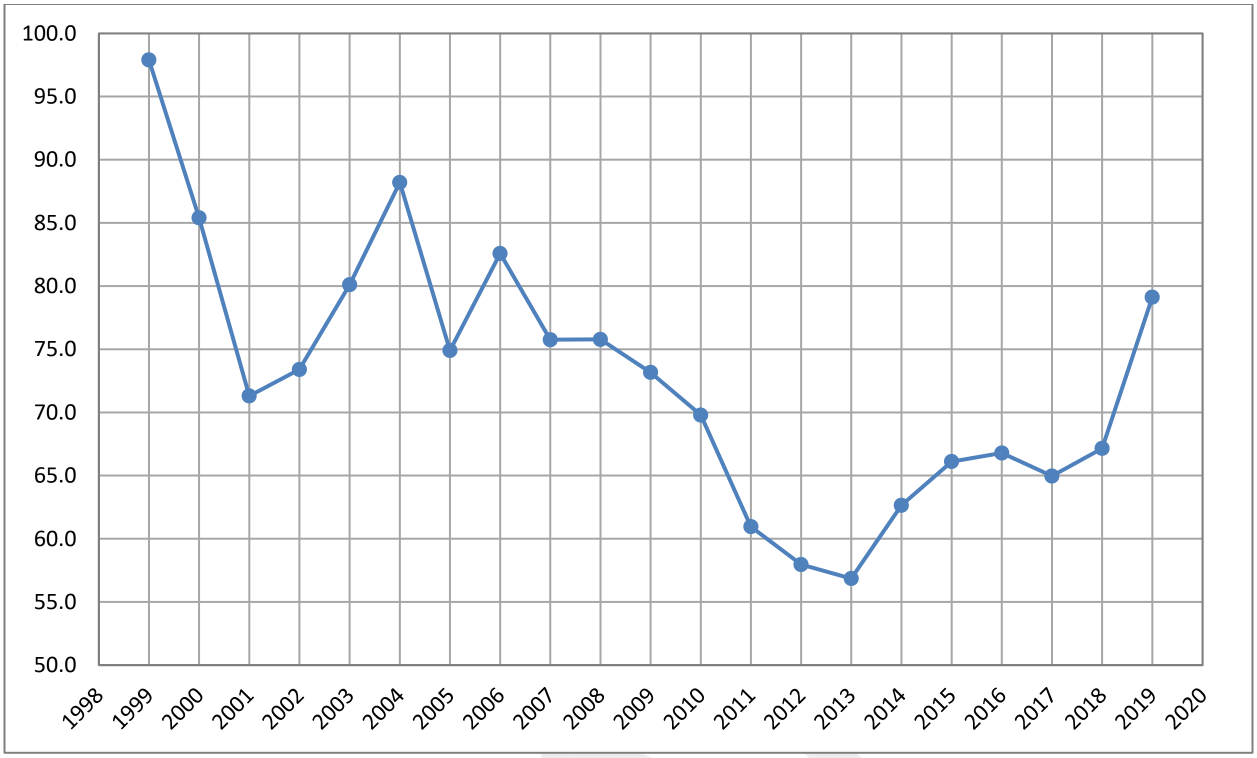


Figure 2-1: Annual Source Production from 1999 to 2019, MGY

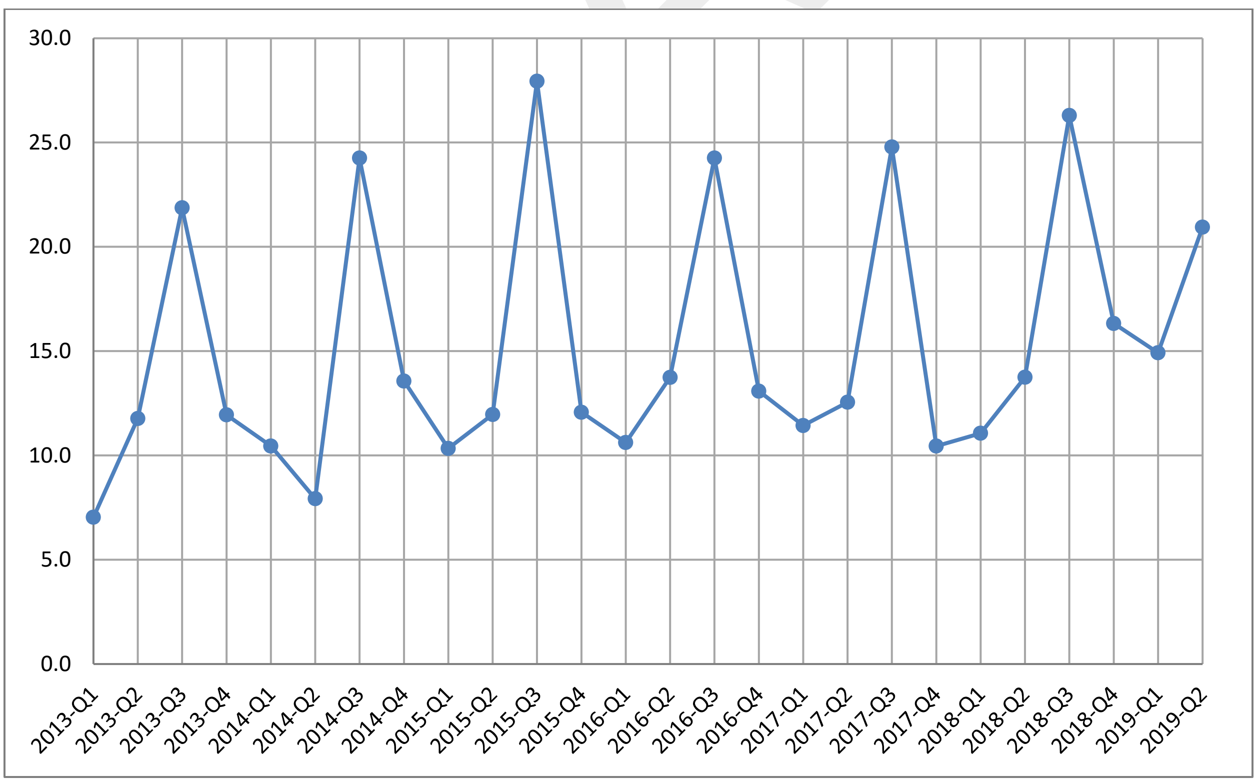


Figure 2-2: Quarterly Consumption in Millions of Gallons

2.2.2 Usage by Customer Class

The system serves the following four classes of customers:

1) Full-time Residential
2) Seasonal Residential
3) Recreational Services
4) Commercial Services

As noted in Section 1.2.1, irrigation of the golf course is fully independent of and separate from the potable water system.

The full-time residential users are the predominant share of connections with 793 connections, accounting for 66% of the connections, and are the basis for the Equivalent Residential Units (ERU). Seasonal connection usage is essentially indistinguishable from full time residences when occupied, and zero when not occupied. The recreational properties are used for recreational vehicle hookups, water access when camping, and washing boats and other recreational gear. There are nine active commercial services, with average annual usage similar to full-time residential connections.

2.2.3 System Parameters: ADD, MDD, and PHD

The system's metered source production over the past 4 years divided by the system's average ERU yields an average day demand (ADD) of 212 gpd/ERU, which includes distribution system leakage. Over this same period, the maximum daily demand (MDD) was recorded as 488 gpd/ERU. The source meters are read daily which allowed for a direct measurement of MDD. Comparing this measured MDD value of 488 gpd/ERU to the maximum month average demand (MMAD) of 354 gpd/ERU yields a system peaking factor of just under 1.4. This is similar to - and slightly more conservative than - the recommended peaking factor of 1.35 for systems serving greater than 1,000 people. The system's MDD/ERU is significantly lower than reported in the 2012 WSP as a result of a reduction in the maximum daily demand and an increase in the number of ERUs.

When calculating flow rates during fire flow conditions, MDD in terms of gpm/ERU is a useful parameter. This is a simple conversion from days to minutes:

$$MDD = \frac{488\ gal}{day} * \frac{1\ day}{1{,}440\ minutes} = 0.339\ gpm/ERU$$

The peak hourly demand (PHD) may be found with MDD using Equation 3-1 of the WSDM. PHD is calculated for the existing community's peak summertime flow, when 941 ERU of demand is expected.

$$PHD_{exist} = \frac{MDD}{1440}\big((C)(N) + F\big) + 18 = \frac{488}{1440}\big((1.6)(941) + 225\big) + 18 = 604\ gpm$$

Table 2-2: Summary of Current Systems Design Parameters

Existing ERU	900 - 941
ADD/ERU	212 gpd
MDD/ERU	488 gpd
PHD	604 gpm
PHD w/1,250 ERU	802 gpm

Based on the available Water Use Efficiency (WUE) reports, distribution system leakage (DSL) historically has been between 4% and 7% DSL, or about 3 and 5 million gallons per year over the past 10 years.[1] Since there are 525,600 minutes per year, DSL is estimated at between 6 and 10 gpm on average. Since the above calculations are derived from production rather than consumption meter data, DSL is not further evaluated for the purpose of capacity.

2.2.4 Pressure Zones

The system is comprised of a single pressure zone. The elevations in the community range from 210’ to 295’ based on data obtained from the Puget Sound LIDAR Consortium (PSLC). As a common reference point, the lake is located at 224’ of elevation in this data. The system’s booster pumps and those wells pumping directly to distribution provide pressure to the system. By matching of the pressure settings of the 6 sites throughout the community, an overall average hydraulic grade line (HGL) of approximately 443’ elevation is maintained. Hydraulic analyses at PHD and other conditions are included in Appendix 10.1 showing pressure at various points around the system.

2.3 Distribution System Leakage

Lake Limerick tracks annual source and service meter data and compares them to determine leakage. The system has exhibited average Distribution System Leakage (DSL) of 10.6% over the past three years due to several significant leaks in 2019. However, looking back over the past ten years, the historical leakage is substantially less than 10%. From 2010-2018, the average annual leakage was only 5.2%. The leaks in 2019 have been repaired and it is anticipated that leakage will return to normal levels during 2020. The year by year leakage is shown in Table 2-3 below.

[1] This does not include 2019 which saw 22.7% leakage (18 million gallons) due to several large and long-lasting leaks. These leaks have since been repaired and DSL is expected to return to normal levels in 2020.

Table 2-3: Distribution System Leakage and Volume

Year	Pumped	Sold	Lost	Loss (%)	Loss (ERUs)
2010	69,790,309	66,840,300	2,950,009	4.2%	38.1
2011	60,958,882	56,483,665	4,475,217	7.3%	57.8
2012	57,963,886	54,775,298	3,188,588	5.5%	41.2
2013	56,859,553	54,275,297	2,584,256	4.5%	33.4
2014	62,649,611	60,973,228	1,676,383	2.7%	21.7
2015	66,109,416	61,749,171	4,360,245	6.6%	56.3
2016	66,784,811	62,157,037	4,627,774	6.9%	59.8
2017	64,963,044	62,010,322	2,952,722	4.5%	38.2
2018	67,149,235	64,162,480	2,986,755	4.4%	38.6
2019	79,119,500	61,189,708	17,929,792	22.7%	231.7
Average (2017-19)	**70,410,593**	**62,454,170**	**7,956,423**	**10.6%**	**102.8**
Average (2010-18)	**63,692,083**	**60,380,755**	**3,311,328**	**5.2%**	**42.8**

Converting the gallons lost per year into a more familiar unit of gallons per minute, we find that the average leak rate for Lake Limerick during a typical year is 6.3 gpm, but averaged 15.1 gpm over the last three years. The previous WSP compared the Lake Limerick leak rate to the permissible leak rate as recommended by the AWWA Manual for Pipeline Install Practices, M-23 document. However, this is not an accurate metric for comparison. The manual that was previously referenced is intended to provide guidance on new installation of PVC pipeline. The Lake Limerick distribution system is primarily composed of asbestos cement pipe installed in the late 1960's making it neither new nor mostly PVC.

Instead of comparing to the AWWA document, the leakage should be evaluated based on the DOH Water System Design Manual and WAC 246-290-820. Using these standards, municipal water suppliers with distribution system leakage of ten percent or less for the last three-year average are considered in compliance. Lake Limerick's leakage has historically been well below this threshold, which is evidence of the effectiveness of the system's commitment to addressing leaks. The major leaks in 2019 bumped the leak rate above 10% for the most recent three-year average, and will likely cause the running three-year average for the next two years to be higher as well. However, the substantial leaks have been repaired and the system intends to continue their successful leak detection and repair program which should result in the annual leak rate returning to around the 5% mark for 2020 and the following years.

2.4 Water Supply Characteristics

The Lake Limerick water system is supplied from 7 groundwater wells, drilled between 1966 and 1988. These wells are geographically disperse and draw from 2 distinct aquifers. This provides a great deal of reliability and redundancy. Most of the wells have been in continuous use for the past 3-4 decades and there have not been any problems with availability of water from the sources, which indicates a high level of sustainability. Additionally, water use efficiency measures over the past 20 years have resulted in lower overall water use, and therefore lower demand on the sources of supply. The system intends to install water level sensors in each of the wells and integrate them with the SCADA system so that the aquifer levels may be monitored and tracked over time to identify seasonal and long-term trends.

2.5 Water Supply Reliability Evaluation

The Lake Limerick community enjoys a remarkable level of reliability. The community is served water from 7 geographically disperse sources drawing from 2 distinct aquifers. These sources have a combined capacity that is sufficient to serve PHD at build-out for the entire community without any reservoir storage. In addition to this the community has 206,086 gallons of reservoir capacity allocated for equalizing storage. The community has sufficient backup power installed at redundant sites to provide service to the entire community during sustained power outages. Well site #3 in particular has sources drilled into distinct aquifers and backup power. With all of these factors, it is important to realize that it would take an extraordinary confluence of events or major regional disaster to disrupt water service to the Lake Limerick water system.

2.5.1 Interties

No interties with other systems exist or are proposed for the Lake Limerick Water System.

2.6 Future Population Projections and Land Use

The community was originally developed with 1,397 lots and the golf course. At this time, 1,201 services are active. The system's 2012 Water System Plan projected service connection counts through 2033, and projected that 1,220 services would be active in 2020. The old Water System Plan anticipated a build-out capacity of approximately 1,250 services. There have been no significant changes to the community or plans in the intervening 8 years, and the projection for maximum build-out is still expected to be correct. However, growth of new lots has been slower than previously estimated as the majority of new full-time connections have been conversions from existing seasonal or part-time connections. An updated 20-year projection is shown in Figure 2-3.

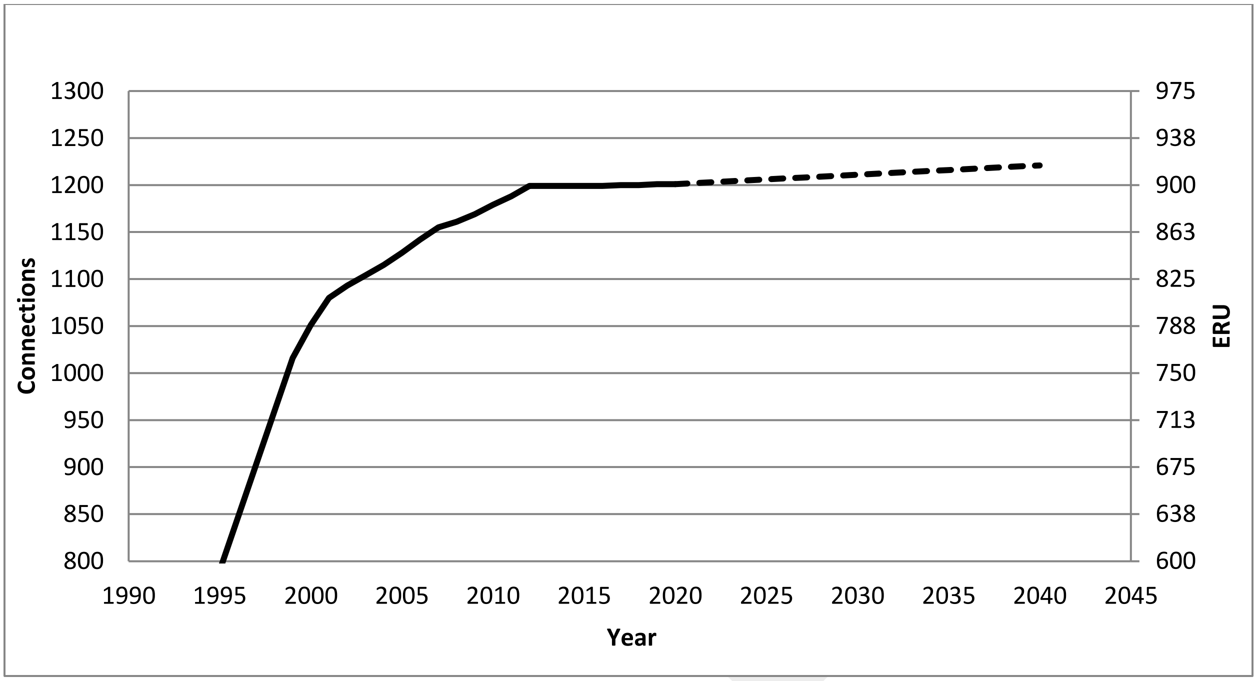


Figure 2-3: Historic and Projected Connections and ERU

The nearby golf course, lake amenities, and character of the area are likely to continue to attract retired and part time residents well into the future. For that reason, it is likely that there will continue to be some number of part-time connections for the foreseeable future. However, the general trend in recent years is toward an increasing ratio of full-time to part-time connections, leading to a gradual increase in the number of ERU's. It is critical to acknowledge that the system must plan for peak demands based on the busy summer-time occupancy.

At the time of writing of the next water system plan update, it will be useful to evaluate in more detail the number of full-time and part-time residents to determine what changes there are in demographics over time. The system has historically grown rapidly enough for increased connections to overcome changes in the relative number of full time and part time homes. However, during this most recent planning period, the majority of growth has been in changes from part-time to full-time connections, while the total number of active services has increased only slightly. As the 1,250-connection projected build-out is approached, changes in water use will likely become even more closely tied to changes in the full-time/part-time ratio.

2.6.1 Land Use and Zoning

The community was platted for relatively high density rural residential homes, and the golf course. The community is approaching completion of this plan with over 95% of the likely lots already connected. The land use and zoning for the community are therefore not expected to change over the next 10 to 20 years.

2.7 Future Water Demand

The community has a tiered water rate and has maintained a fairly consistent leakage rate for the past decade, save for 2019 when several substantial leaks all occurred in the same year. The community is comprised of largely modern homes with low flow indoor plumbing. It is therefore likely that future conservation efforts will yield less impressive results than seen previously. The figure below shows the projected water demand both with no improvement in conservation and with a maximum 4% reduction in per/ERU water usage over the next 20 years. It is not likely that the community will be able to exceed this level of conservation.

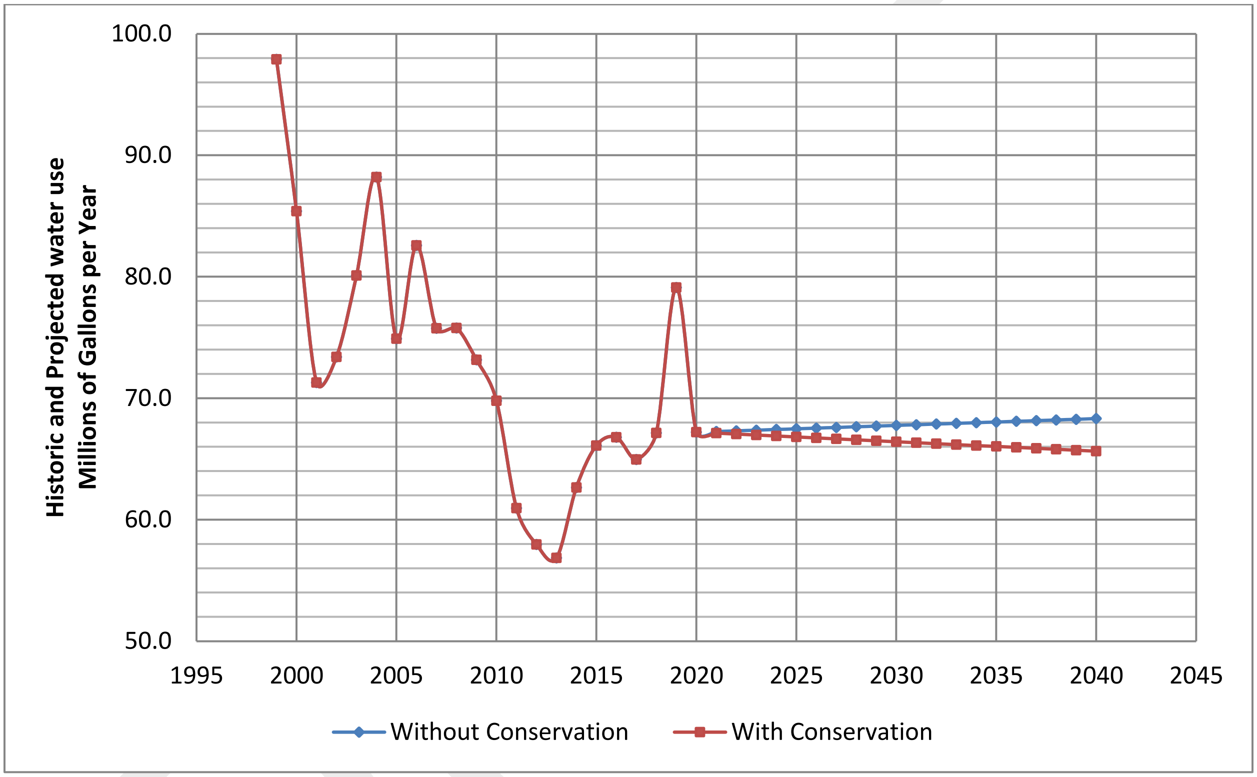


Figure 2-4: Historic and Projected Water Use

2.7.1 Other Systems

No interties exist or are planned to the Lake Limerick water system within the next 20 years. No water use by other systems is therefore considered.

Chapter 3 System Inventory and Analysis

3.1 System Design Standards

All design and future construction shall be completed in accordance with the Washington State Department of Health Water System Design Manual (Design Manual). The following is a brief summary of relevant standards set forth in the Design Manual:

Water Demand	Chapter	3
PHD	Equation	3-1
Capacity Analysis	Chapter	4
Distribution System	Chapter	6
Hydraulic Analysis	Section	6.1

Over the next 20 years the system does not anticipate growing beyond its existing service area. There are various sizes and types of waterline in service today. The distribution and pumping systems provide sufficient capacity to meet residential peak demands for the community well beyond build-out; however, they do not meet fire flow requirements. Two of the system's six sites (Site 3 and 6) have automatic backup power installed on site to provide service in the event of power failure. Either of these sites is capable of providing average daily demand. There is also a backup generator at Site 2, but it is too old to be maintained adequately. A new backup generator at Site 4 is proposed.

3.2 System Inventory and Asset Condition Assessment

3.2.1 Overview

The community is served water by infrastructure located at 6 sites and the distribution system. Four of these sites include a reservoir and booster station, while two sites consist of wells inside small buildings. All of the sites are tied to the main office by the SCADA system. Each of the sites contain one well, except for site 3 which incorporates wells 3A and 3B. The sites without reservoirs pump directly to distribution. All of the sites are monitored and controlled by Remote Telemetry Units (RTUs) which are essentially Programmable Logic Controllers (PLCs) with communications hardware. These RTUs communicate with a central PLC and Master Telemetry Unit (MTU) from which the entire system may be monitored and controlled. Most of the sites use licensed serial radios; site 6 however, uses an unlicensed 900-mhz serial modem. Table 3-1 lists the sites and associated hardware.

Table 3-1: Summary of Sites

Well Site	Well(s)	DOH Source Number	Booster Pumps	Backup Power	Reservoir
1	Well 1	SO5	Booster 1	None	Tank 1: 84,600 Gallons
2	Well 2	SO2	None	Gen. 2[1]	None
3	3A and 3B	SO3 and S06	3A and 3B	Gen. 3	Tank 3: 158,600 Gallons
4	Well 4	SO4	Booster 4	None[1]	Tank 4: 77,000 Gallons
5	Well 5	SO7	None	None	None
6	Well 6	SO8	6A and 6B	Gen. 6	Tank 6: 158,600 Gallons

The community's distribution system consists of an array of 2", 4", 6" and 8" waterline. Waterlines are looped throughout the community, including a complete loop around the lake and several subsidiary loops. A summary of pipe sizes and quantities in service are shown in Table 3-2.

Table 3-2: Pipe Inventory

Nominal Pipe Size	Installed Length
2"	2,006 feet
4"	52,310 feet
6"	20,041 feet
8"	973 feet
Total	**75,330 feet**

The community's sources and services are all metered. The service meters are all radio-read capable to allow drive-by meter reading and can provide hourly logs for the month if a customer desires detailed logs. Additional hardware and software improvements in 2020 consisted of Badger Beacon Analytics software and a Dell rugged laptop mounted in the pickup truck for performing meter reads. These upgrades make additional information available in the management reports and allow meters with potential customer-side leaks to be identified readily during meter reading. The service meters are read and billed monthly.

3.2.2 Sources

Lake Limerick has seven wells located at six sites. The pump curves and well logs are given for each site in Appendix 10.3. A summary of the wells is shown in Table 3-3.

[1] Site 2 is not generally used due to poor water quality and is instead reserved as an emergency source. Generator 2 is not connected and is too old to be maintained adequately. Installation of a new backup generator at Site 4 is proposed.

Table 3-3: Summary of Sources

Well	Elevation	Well Depth	Static Water Level[1]	Capacity (gpm)	Pumps To	Controlled By
1	275	116	62.0	49	Tank 1	Water Level
2	240	121	14.5	200	Distribution	Pressure
3A	300	148	62.0	144	Tank 3	Water Level
3B	300	177	64.8	194	Tank 3	Water Level
4	270	111	55.2	74	Tank 4	Water Level
5	275	130	38.0	35	Distribution	Pressure
6	270	434	218.3	248	Tank 6	Water Level

The combined source capacity for the system is approximately 944 gpm. Well 6 is the highest capacity well on the system with an instantaneous capacity of 248 gpm. In the absence of this well the system is still able to produce 696 gpm. Well 2 is only used for routine flushing and maintenance.

3.2.3 Water Rights and Capacity

Table 3-4 summarizes the system's water rights and pumping capacities. The water rights self-assessment tables and copies of the water right certificates can be found in Appendix 10.9. The system is within their water rights based on annual usage, and based on water use projections, it is expected that the water rights are sufficient throughout buildout. Unfortunately, the instantaneous withdrawals do not match the well capacities, with some wells having substantially more capacity than the associated water right and others significantly less. During the preparation of the 2013 WSP, a preliminary investigation was performed to determine what it would take to consolidate the water rights across all the wells. However, system decided that the time and expense of this process would not be the worth the benefit it provided to the them operationally.

Table 3-4: Water Rights and Pumping Capacities

Well	Certificate Number	Priority Date	Qi[2] (gpm)	Qa[3] (acft/yr)	Current Capacity (gpm)
1	5566	4/19/1966	100	117	49
2	5887	6/30/1967	200	166	200[4]
3A / 3B	5888	6/30/1967	100	84	338
4	7012	11/19/1968	100	79	74
5	2-27215C	11/17/1987	190	152[5]	35
6	G2-27443C	10/26/1988	200	160[1]	248
Total			890	446	944

[1] Static water level measurements last made November 2018
[2] Qi is defined as the maximum instantaneous withdrawal rate allowed by water rights.
[3] Qa is defined as the maximum annual withdrawal allowed by water rights
[4] Well 2 is not used for day-to-day operations.
[5] The annual water rights for Wells 5 and 6 are supplemental to previous water rights and therefore not included in the total annual water rights.

3.2.4 Storage

The system's four reservoirs are summarized in Table 3-5. All of the tanks are round concrete structures located on site. Reservoir fill elevations governing the operational storage may be adjusted by the SCADA control interface located in the main water office. Reservoir fill levels are stopped 3.5 feet below the overflow elevation, effectively making that storage inaccessible. Water cannot be withdrawn below the 6" mud-ring level, leaving a total of 4' of dead storage volume in each of the reservoirs.

Table 3-5: Storage Summary

Tank Name	Dimensions (Feet)		Volumes (Gallons)				
	Height	Diameter	Volume	Gallons per Foot	Operational Storage	Inaccessible and Dead Storage	Remaining Volume
Tank 1	24	25	84,600	3,525	17,625	14,100	52,875
Tank 3	30	30	158,600	5,287	29,079	21,148	108,374
Tank 4	30	21	77,000	2,567	10,268	10,268	56,464
Tank 6	30	30	158,600	5,287	29,079	21,148	108,374
Total			**478,800**		**86,050**	**66,664**	**326,086**

3.2.5 Booster Pumps

Lake Limerick has six booster pumps. Sites 1 and 4 each have one booster pump, while Sites 3 and 6 each have two. The booster pump curves are provided in Appendix 10.4. Booster pumps at sites 1, 3 and 4 are controlled by pressure settings in the distribution system at the respective sites. These pressure settings may be adjusted remotely as necessary from the water office. The system booster pumps are configured to maintain an HGL of approximately 443'. These elevations are measured with a sea level datum, from which the water surface elevation for Lake Limerick is 224'.

Table 3-6: Booster Pump Summary

Booster Pump	Capacity (gpm)	Backup Power Source
1	130	No
3A	210	Generator 3
3B	210	Generator 3
4	150	No[1]
6A	200	Generator 6
6B	200	Generator 6
Total	**1,100**	**Partial**

The system retains 820 gpm of booster pump capacity during a power outage, and 400 gpm if either of the generator stations fails to operate when called on. Both generators are protected from the weather, and one generator is housed in a heated building. Generator 3 is plumbed into utility natural gas giving it an indefinite potential operating capacity. Generator 6 has a 250-gallon propane fuel tank that is topped

[1] As noted previously, a new backup generator at Site 4 is being considered. This would add 150 gpm of booster pump capacity.

off when the level approaches 50%. Both generators automatically exercise for a set period each month. Given this maintenance regimen it is extremely unlikely that simultaneous generator and power failures will occur.

3.2.6 Buildings

Most of the Lake Limerick Water System's wells and all of the booster pumps and controls are located within buildings. These buildings are summarized in Table 3-7.

Table 3-7: Summary of Buildings

Site	Building Size	Year Constructed	Notes
1	12' x 9'	1969	
2	9.5' x 20'	1967	
3	6.5' x 9'	1967	Well + Controls
3	9.5' x 9'	1967	Booster Pumps
4	8' x 18.5'	1968	
5	9.5' x 11.5'	1968	
6	17.4' x 26'	2004	Generator Inside

Several roofs have been replaced within the last 5 – 10 years; in general, the building's roofs appear to be functional for another 10 years. The smaller building for Well 3B is in need of replacement, as the walls have deteriorated.

3.3 Capacity Analysis

Service Area

The system does not intend to expand its service area. All growth is anticipated to come from infill within the existing service area. The original plat provisioned 1,397 lots, although combinations and combined ownership will likely prevent the system from ever reaching this number of services. The previous two water system plans projected a maximum build-out of 1,250 lots, because many of the lots are unfavorable to site development, while others have been combined. Since there have been no significant changes in site development requirements, this maximum build-out projection is still considered valid.

$$N_{service\ area} = 1{,}250\ ERU$$

Water Rights

The system's water right is limited to 890 gpm and 446 acre-feet per year (See Appendix 10.9). Reservoir storage could be increased to serve as many ERU as the instantaneous water right permits be pumped at MDD. Therefore, the number of ERU's that may be served by the system's permitted withdrawal under MDD conditions are considered.

$$N_{wr,instant} = \frac{890\,\frac{gal}{min} * 1{,}440\,\frac{min}{day}}{488\,\frac{gpd}{ERU}} = 2{,}626\ ERU$$

From Table 2-2 ADD is 212 gpd/ERU, or multiplying by 365 days per year and converting to acre-feet, a typical ERU uses 0.237 acre-feet per year. Therefore, annual water rights limit the system as follows:

$$N_{wr,annual} = \frac{446\ acft/yr}{0.237\ acft/yr} = 1{,}878\ ERU$$

Source Capacity

Reservoir storage can be used to increase the capacity of the system to serve instantaneous demand of the system. The sources must still provide sufficient capacity for the maximum daily demands. Peak daily production is found by taking the product of the instantaneous capacity for each well, the number of minutes in the day, and the percentage of the day that the wells may be operated. In general wells should not be pumped for more than 50% of the day at their peak capacity year-round; however, on peak demand days they may be pumped up to 20 hours (roughly 83% of the day). Using this ratio, the source capacity from each well is as follows:

Table 3-8: Daily Source Capacities

Well	Pumping Capacity
1	58,800 gpd
2	240,000 gpd
3A	172,800 gpd
3B	232,800 gpd
4	88,800 gpd
5	42,000 gpd
6	297,600 gpd
Total	**1,132,800 gpd**

The source capacity in terms of the number of ERUs that may be served is then calculated using the MDD of 488 gpd/ERU as follows:

$$N_{source} = \frac{1{,}132{,}800\ gal}{488\ gpd/ERU} = 2{,}321\ ERU$$

Pressure Pumps

The booster pumps listed in Section 3.2.5 have a total combined capacity of 1,100 gpm. Both Well 2 and Well 5 pump directly to distribution at pressure and may be added to the total pressure supply capacity. Wells 2 and 5 have 200 and 35 gpm capacity respectively. In all, the system can deliver 1,335 gpm to the distribution system between the two wells and 6 booster pumps. Using the rearranged PHD equation for ERU, the booster pump limits the system to:

$$N_{booster} = \frac{\left(\frac{1{,}440(1{,}335 - 18)}{488} - 225\right)}{1.6} = 2{,}288\ ERU$$

Storage

As noted in Section 3.2.4 the system has storage located at 4 sites totaling 478,800 gallons. Typical set points reduce the available usable volume of the reservoir. Although this could be readily adjusted, it is included since it is the current operating condition. Table 3-5 gives the sum of unusable volumes for the system: 66,664 gallons.

Given the flow rates from each of the well pumps throughout the system (all of which are under 250 gpm), none of the reservoirs should require more than 1,000 gallons of operational storage; however, additional storage is allocated by control settings. To promote additional turnover of water in the reservoirs, the SCADA control settings are configured to draw down as much as 5 feet prior to starting well pumps. The operational storage shown in Table 3-5 was calculated from the typical control settings, which provide operational storage greatly exceeding that required by the WSDM. From this table, 86,050 gallons are allocated to operational storage.

Fire flow is not provided by the Lake Limerick Water System. Although the pumping system is adequate to provide fire flow, and portions of the water system could also support fire flow, a large portion of the distribution system cannot. Notice was provided during the preparation of an early water system plan to the Mason County Fire Marshall specifically instructing them not to use the system for fire flow. When the distribution system has been upgraded and hydrants installed to support fire flow, current fire code effective in Mason County would require 120,000 gallons of fire suppression storage. The system is not required to maintain this volume at this time because the distribution system is inadequate, but it is provisioned in this analysis to establish its inclusion will not become a limiting factor once fire flow is provided by the distribution system. It is anticipated that the county fire marshal will allow stacking of fire suppression storage and standby storage.

Standby storage is required for community water systems and is intended to provide continued water supply during electrical or mechanical failures, source contamination, etc. Equation 7-2 in the Design Manual provides a starting point for calculating standby volume:

$$SB = (N)(SB_i)(T_d)$$

Where N is the number of ERUs, SB_i is the standby volume in gallons per day per ERU, and T_d is the number of days standby storage will be available. This equation calculates standby volume as 458,697 gallons, the system's MDD.

This volume may then be adjusted based on factors specific to the water system. Since the system has multiple reliability measures, the alternative minimum of 200 gpd per connection may be used. As noted in Section 3.2.5 the system has several independent sites with backup power generation. Each of the backup power systems are well maintained, and two of them include boosting systems capable of delivering ADD flow to the community. The daily capacity of each site to deliver water to (1) the reservoir, and (2) the distribution system are shown in Table 3-9.

Table 3-9: Capacity of sites with standby power

Site	Source Capacity	Notes
Site 2	288,000 gpd	Existing, but no longer maintained
Site 3	486,720 gpd	Existing and regularly maintained
Site 4	106,560 gpd	Proposed new generator to replace Site 2
Site 6	357,120 gpd	Existing and regularly maintained

Both of the sites with existing and maintained generators could provide more than the 200 gpd required per service, and once all three sites are operational (Site 3, 4, and 6), PHD could be provided by standby power alone. The community has never needed to draw on standby storage. For this reason, no standby storage is provided by the reservoirs.

The only remaining use for the reservoir is equalization storage, providing additional capacity to the system during PHD. WSDM equation 7-1 is solved for PHD, then substituted into equation 3-1 and solved for the number of ERU to determine the limitation imposed by equalizing storage. Table 3-5 indicates a remaining volume of 326,086 gallons after accounting for operational and dead storage. Reserving 120,000 gallons of fire suppression storage leaves a volume of 206,086 gallons available for Equalizing storage. The value used for source capacity, Qs, is the capacity of all sources less Well 2, which is generally not used except for flushing and fire prevention.

$$ES = (PHD - Qs)(150\text{min}) \rightarrow PHD = \frac{206{,}086gal}{150min} + 744gpm = 2{,}117\ gpm$$

Rearranging equation 3-1 of the WSDM to obtain ERU from PHD:

$$PHD = \frac{MDD}{1440}\big((C)(N) + F\big) + 18 \rightarrow N = \frac{\left(\frac{1440(PHD - 18)}{MDD} - F\right)}{C}$$

$$N_{Reservoir} = \frac{\left(\frac{1440(2{,}117\ - 18)}{488} - 225\right)}{1.6} = 3{,}730\ ERU$$

Dead storage, operational storage, and fire suppression storage do not constrain the reservoir's capacity to serve. Standby storage is not provided by the reservoirs, but rather by multiple redundant, geographically dispersed backup power and pumping systems, so it is also not a limiting factor. Therefore, the limiting factor for the reservoir is the ability to provide equalization storage. The reservoirs can serve 3,730 ERU as configured and are therefore more than adequate.

The table below provides a summary of the total storage volume allocation. Note that Fire Suppression Storage is not currently required but is accounted for in the reservoir volume so that it does not impact the limiting factors analysis once the distribution system can support fire flow. Standby volume is not provided by the reservoirs, as discussed above.

Table 3-10: Summary of Reservoir Volume Allocations

Storage Component	Volume (gal)
Dead Storage	66,664
Operational Storage	86,050
Fire Suppression Storage	120,000
Standby Storage (stacked with FSS)	120,000
Equalization Storage	206,086
Total Storage	478,800

Distribution System

Maximum PHD that the current distribution system can support was determined by configuring a base demand at each of the 62 nodes in the hydraulic model, and iteratively increasing flow rates until the worst-case node fell to 30 psi. The flow required to reach this amount of friction loss was found to be 3,968 gpm. Using this in the rearranged Equation 3-1 from the WSDM as used above yields the distribution system limitation.

$$N_{Distribution} = \frac{\left(\frac{1440(3{,}968 \; - 18)}{488} - 225\right)}{1.6} = 7{,}144 \; ERU$$

The system cannot provide fire flow with the existing distribution system; therefore, no resulting limitations were evaluated.

Summary

The current systems limits are shown in Table 3-11.

Table 3-11: System Capacity Summary

Limitation	Maximum ERU
Service Area	1,250
Water Rights, Instantaneous withdrawal	2,626
Water Rights, Annual withdrawal	1,878
Total Source Production	2,321
Booster Pumps	2,288
Reservoirs	3,730
Distribution System	7,144
Most Limiting Factor: Annual Water Rights[1]	**1,878**

[1] While service area expectations are important, the annual water rights are considered the true limiting factor, as future re-zoning, system expansion, or use of ADU's could potentially increase the number of connections above 1,250.

3.3.1 Water Rights Self-Assessment

See completed Water Rights Self-Assessment documents in Appendix 10.9 for existing status and 20-year forecast.

3.3.2 Source of Supply Analysis

The water system is served by 7 groundwater sources tapping into two distinct aquifers. As established in Section 3.2.2, the systems sources have more than adequate capacity to serve the community. Even with the loss of one or more sources, the system would have adequate supply to meet all demands. The system is projected to never require full exertion of its annual permitted water right. There is therefore no reason to expect any applications for additional water capacity to be necessary for the community.

3.4 Distribution System Analysis

3.4.1 Model Description

The hydraulic model that was developed for the 2012 Water System Plan is no longer available to be used and modified. Rather than re-create the model for new analysis scenarios, the system demand parameters were evaluated to determine whether a new hydraulic analysis would be necessary. It was found that the system MDD and estimated PHD values have decreased since the previous analysis was performed in 2012. Therefore, the results of the original analysis are sufficient (and conservative) for estimating system pressures and line velocities and a new hydraulic analysis is not required. The following narrative explains how the original model and scenarios were developed.

The system hydraulic analysis was prepared using WaterCAD software. The model was comprised of a 69-node system. 62 nodes are distributed to represent the system's lot distribution and are assigned a unit demand. 7 nodes are placed for pipe intersections and given zero demand because of close proximity to other nodes that would have exaggerated the demand for a given region. System records were examined to determine the appropriate pipe size and material for the model. Google Earth, PLSC, and system pressure measurements were reconciled to provide the most accurate elevation model feasible. The node map, pipe inventory, and model results for the various scenarios evaluated are included in Appendix 10.1.

Pump stations are modeled as reservoirs with a set free surface elevation designed to model the set points for the booster stations, the points with the highest hydraulic grade. The system elevations and pressure measurements show that the system maintains an HGL of 443' under normal operations using Puget PSLC and Google Earth data. For comparison to previous hydraulic analysis of the system, this dataset gives a mean water surface of Lake Limerick at 224'. The HGL was selected to match the set point pressures on the system. The booster pump capacities listed in Section 3.2.5 are evaluated assuming water service is provided at this pressure. There is one pressure zone in the water system.

3.4.2 Scenarios

The system does not provide fire flow; therefore, only the capacity to serve PHD and Static conditions were evaluated. Demand was assigned by multiplying the unit demand at the node by a demand adjustment factor. For PHD this model was run using 2012 conditions (817 ERU), the original 20-year projection (845 ERU), and for complete build-out with full occupancy (1,250 ERU). The static condition was evaluated by setting the demand adjustment factor to zero, which gives zero system demand and maximum pressures.

The community does not plan on replacing significant portions of waterlines within the 10-year planning period; however, the community has chosen to increase looped lines to 6" and dead-end lines over 250 feet in length with 8" main-lines whenever they are replaced. This is being done so that the system will eventually meet fire flow standards. A scenario was prepared that showed that this level of upgrade will be sufficient to meet fire flow requirements.

3.4.3 Model Results

Model results show that the system exhibits minor friction losses, with pressure differences largely driven by elevation. The system will be able to deliver water to every point in the system at PHD with just 4.5 feet of head loss due to friction to the worst-case locations (both located at extreme ends of long lines). Excluding waterlines from the booster stations to the distribution system, the maximum velocity at PHD will be 1.49 ft/s throughout the water system. The current projection for minimum system pressure throughout the system at build-out PHD is 57.5 psi, and the maximum is 101.2 psi.

Table 3-12: Summary of Distribution Model Results

	2012 Model Results				Current (2020) Projections		
Parameter	2013	2019	2033	Build Out	2020	2040	Build Out
ERU	817	830	852	1,250	941	957	1,250
PHD (gpm)	792	794	815	1,142	604	614	802
PHD Low Pressure (psi)	57.5	57.5	57.5	57.4	57.5	57.5	57.5
High Pressure (psi)	101.2	101.2	101.2	101.2	101.2	101.2	101.2
Peak Line Velocity (ft/s)	1.46	1.46	1.51	2.10	1.12	1.13	1.49

Static conditions were evaluated assuming maximum pressure set points for booster pumps are reached. This occurs at 444 feet HGL, giving a peak distribution pressure of 101.2 psi along East Olde Lyme Road as it follows a small valley at the south east of the lake. Public water systems typically maintain pressures below 80 psi; however, the system has operated in this manner for over a decade without experiencing problems or complaints from customers. No operational changes are proposed to change the peak pressures in Division 5.

3.5 Summary of System Deficiencies

The system has no significant hydraulic capacity limitations. Modeling suggests that the system will be able to provide adequate flow and pressure through any likely level of community build out and occupancy. The distribution system is not currently capable of providing fire flow, but this is not considered a deficiency because it is not required, due to the system being grandfathered in under the old regulations. However, upgrading the distribution system to support fire flow is listed as an improvement item as the community plans to increase mainline sizing when it is replaced so that fire flow may eventually be provided.

The previous WSP update, prepared in 2012, recommended one other significant improvement, which was to address the miss-matching of water rights to the sites. Annual water production is, and is projected to remain, significantly lower than the annual water right available; however, the instantaneous permitted flows at several of the sites significantly exceeds the installed pump capacity, while at other sites the installed capacity exceeds the legally permitted right. These discrepancies can be clearly seen in Table 3-4.

An ideal water rights change would permit the same overall instantaneous use of 890 gpm, but would permit the water to be withdrawn more flexibly from any combination of sites. This would allow the system to use its SCADA control software to limit the overall output of the wells to match the permitted water right. As configured, there is no way to accomplish this, as several of the wells simply pump at greater instantaneous rates than permitted. Note that overall production, and thereby impact on the region aquifers, would not be changed as a result of the change application. The key change this would have would be to make it possible to use the SCADA control system to meet legal appropriation limits.

Unfortunately, the process to consolidate the water rights is more complicated and expensive than had been originally expected and would require hydrogeological testing and potentially a cost reimbursement agreement. Because overall water use is substantially lower than the total allowed under the existing water rights and the system can continue to operate with the water rights as-is, the board has decided that the benefits of a consolidation do not outweigh the cost and complexity.

Chapter 4 Water Use Efficiency Program

In 2003, the Washington State Legislature passed Engrossed Second Substitute House Bill 1338, known as the Municipal Water Law, to address increasing demand on the state's water resources. The law established that all municipal water suppliers must use water more efficiently in exchange for water right certainty and flexibility to help them meet future demand. The Legislature directed the Department of Health to oversee and enforce a WUE program to help support the collective goal of ensuring a safe and reliable drinking water supply. The WUE program seeks to support this goal in the following ways:

- Contribute to long-term water supply reliability and public health protection,
- Promote good stewardship of the state's water resources, and
- Ensure efficient operation and management of water systems.

This program became effective on January 22, 2007 and established certain responsibilities that water suppliers must fulfill. Fundamental elements include the following:

- Water use efficiency program,
- Distribution leakage standard,
- Goal-setting and performance reporting, and
- Metering requirements

The requirements and deadlines are listed below and in order of due date for Group A municipal water suppliers.

Table 4-1: Summary of WUE Program Requirements

Requirement	Deadline for MWS with 1,000 or more connections
Include WUE program in planning documents	January 22, 2008
Submit first annual WUE report	July 1, 2008
Submit service meter installation schedule	July 1, 2008
Set your own WUE goals	July 1, 2009
Meet distribution leakage standard (based on 3-year rolling average)	July 1, 2010, or 3 years after installing all service meters
Complete installation of all service meters	January 22, 2017

This chapter summarizes Lake Limerick's compliance with conservation planning requirements including the actions taken to promote water use efficiency, and the conservation program that Lake Limerick will implement. The applicable WUE program requirements and guidelines are contained in *Water Use Efficiency Guidebook*, Third Edition, January 2017 (DOH 331-375).

4.1 Source and Service Metering

4.1.1 Source Meters

All sources are metered. Any additional sources developed in the future will be metered when installed.

4.1.2 Service Meters

The system is fully metered. Lake Limerick replaced "touch read" service meters with "radio read" meters between 2010 and 2013. The new meters are read and billed monthly. The system billing software provides month by month total usage reports which are used for calculating distribution system leakage. The individual meters record data on an hourly basis, permitting the detection of leaks on private residences as well.

4.2 Distribution System Leakage

If a system's distribution system leakage exceeds 10 percent, the conservation program must also provide an implementation program that includes leak detection and repair, and other measures to reduce water loss. Lake Limerick's distribution system leakage has averaged 5.2% over the past decade but was 22.7% in 2019 due to several large leaks. These leaks have been repaired and annual leakage is expected to return to normal levels in 2020.

Lake Limerick maintains this low level of leakage with a continuous leak detection program. On-site staff have training and equipment to respond to leak reports from customers generally within a few hours of the report. Significant discrepancies between service meter and source meter records are investigated. In an effort to improve customer side efficiency, the system operator performs on site leak detection and education for the customers. The effectiveness of these efforts is shown in the community's historically low rate of DSL.

4.3 Water Use Efficiency Program

4.3.1 Current Program

The Lake Limerick board of directors recognizes that water is a valuable commodity and the wise and efficient use of water is a goal that is in the best interests of its customers.

4.3.2 Goals

State regulation (WAC 246-290-830) requires the governing body of the municipal water system (the Lake Limerick Board of Directors in this case) to develop the water use efficiency goals through a public process. The previous WUE goal was considered in a public meeting held on November 23, 2011. An updated WUE goal will be considered in a public meeting and added to the WSP after the meeting. The new goal will need to be a measurable goal over the 10-year planning period.

The system had seen significant year-over-year improvements in consumption leading up to the 2012 WSP. Annual water use has since increased somewhat from the 2013 low as a result of adding connections and part-time users becoming full-time users. However, the average daily demand per ERU has actually decreased slightly from 224 gpd/ERU to 212 gpd/ERU. The stated WUE goal as of the last public meeting was to maintain the per-ERU average usage; the community has been successful in meeting and exceeding this goal.

The proposed goal to be achieved during the next 10 years is as follows:

____

4.3.3 Measures

As part of a water system plan, DOH regulations also require the implementation of a specified number of water use efficiency measures. With over 1,000 connections (859 residential, 342 recreational or commercial) Lake Limerick is required to evaluate or implement five WUE measures. Lake Limerick has implemented the following five water use efficiency measures:

1. A conservation rate structure encourages people to track and reduce their usage.
2. Service invoices include water usage history.
3. The systems service meters provide hourly data permitting the operator to identify leaks within private residences.
4. Customer leak detection information is mailed to customers annually.
5. The community provides an annual water usage education forum

4.3.4 Reclaimed Water

Systems serving more than 1,000 connections are required to evaluate reclaimed water opportunities. The Lake Limerick system is comprised of properties that have private septic systems, and therefore would not be able to implement a sewer treatment plant for reclaimed water use. However, the golf course is irrigated from the lake under a separate water right (certificate number 10661) rather than from the potable water system, which is a more efficient use of water resources and saves potable water for drinking water purposes.

4.3.5 Consumer Education Program

Lake Limerick is required to provide general education to its customers on the importance of using water efficiently on an annual basis. Water conservation information is included in the annual consumer confidence report provided to all Lake Limerick customers in order to meet the annual customer education requirement.

If customer education is provided more than once a year, then conservation education may be counted as one of the required measures. Conservation reminders are regularly included in the Lake Limerick Country Club monthly newsletter. The water system operator and manager also present a public forum at Lake Limerick annually regarding leak detection and water conservation.

4.3.6 Annual Reports

Lake Limerick collects meter data and reports total production, in gallons, from all sources for the year and total authorized consumption, in gallons, from all customers for the year to DOH in their annual Water Use Efficiency Report.

4.3.7 Water Rates

According to WAC 246-290-100(4)(j)(iv)(B) and 246-290-105(4)(l), LLWS is required to evaluate a rate structure that promotes water conservation.

The community currently operates on a simple base-rate plus overage fee structure. The base charge for 2020 is $30 per month for use of up to 10,000 gallons, and $2.00 per month for every 1,000 gallons over 10,000 gallons. Meters are read and billed on a monthly basis.

A rate study was performed in 2020, however, which resulted in recommended modifications to the existing rate structure. The primary changes proposed are to move to a fully tiered water rate (as opposed to the existing simple base charge plus excessive use fee) and to adjust the charges such that overall revenue will increase in order to adequately fund long-term reserves for future replacement of the water lines. This is discussed in more detail in Chapter 9.

4.4 Water Use Efficiency Savings

Most of the water savings has come from an aggressive leak fixing program implemented between 2005 and 2010. During this period, annual water production dropped from over 75 million gallons per year to under 60 million gallons per year. The leak program and replacement of service meters are likely to be the last major efficiency improvements that are possible. Future reductions in consumption are likely to be driven by customer behavior, which is primarily influenced by demographics, rate structures, and customer education programs. Although demographics cannot be directly controlled by the water system, providing customer education and maintaining tiered water rates can both be controlled.

The community has tracked electrical consumption and compared it to production to determine the effectiveness of water delivery. It has found that the system overall delivers between 270 and 436 gallons of water per kilowatt hour (kWh) of energy input. The effectiveness varies significantly between summer and winter as higher heating costs combine with smaller demand to reduce the water delivered per kWh of energy input. As an annual average, the system overall can deliver 347 gallons per kWh. Using this delivery effectiveness measure, and the average electrical rate of about 10 cents per kWh, the system can evaluate the cost-benefit of prospective water use efficiency measures. Two useful metrics are that the system saves $1,000 per 3.5 million gallons conserved, or the system can save up to one dollar for every 4 gpd conserved by residential customers. There are other more intricate cost savings associated with reduced demand, such as pump lifespan. However, this is dependent on a number of other factors and operational conditions, which makes the exact impact difficult to calculate. Reduction in electrical usage is straightforward to relate to water use efficiency and provides a ballpark number for cost reduction.

Using this basis, it can be seen that the leak detection and correction project is saving the community about $2,500 per year, a price that is likely to show some benefit over the long term. In order for the $1,500 estimated cost of the current WUE measures to be financially viable, they must result in at least 5.2 million gallons of water savings. In a community using just 212 gpd per home, additional measures are unlikely to yield a significant reduction in water use and would be difficult for the community to justify internally funding. However, state and federal programs are available that may provide funding for additional WUE efforts. The WUE Guidebook (DOH 331-375) lists several of these funding options. It is recommended that the community consider what further WUE measures may be of benefit, such as offering faucet replacement incentives, installing zone metering, etc., and investigate possible grant money to cover the costs of these projects.

Chapter 5 Source Water Protection

5.1 Wellhead Protection

The wellhead protection program has been developed in conjunction with the WSP. The following susceptibility assessment, protection area, and contamination source inventory will provide the necessary documentation to make educated management and land use decisions to prevent aquifer contamination.

5.1.1 Susceptibility Assessment

Ground Water Contamination Susceptibility Assessment forms for each source for the Lake Limerick Water System are included in Appendix 10.10. The results of the assessment are summarized in this Chapter.

5.1.2 Wellhead Protection Area

A map showing the 100-foot protected radii and the 6-month, 1-year, 5-year, and 10-year ground water travel radii is given in Appendix 10.10. The well protection radii are calculated using the formula found in the susceptibility assessment as provided by the WSDOH.

5.1.3 Contamination Source Inventory

The following are potential sources of contamination within the 10-year travel time radii:

1. Residential Septic Systems
2. Residential Chemical Applications (Pesticides, herbicides, etc)
3. Private and County Roadways
4. Pesticide and Herbicide application on golf course fairways

Since land use and zoning throughout the service area is unlikely to change, changes in, or addition of, sources of contamination are unlikely.

5.1.4 Notification of Findings

The following agencies will be provided with a letter (see Appendix 10.10 for a copy of the notification letter) requesting information about any potential sources of contamination within the Wellhead Protection Radii:

Mason County Health Department
Mason County Department of Community Development
Emergency Services (911)

All the homeowners with lots within the 10-year radii will also be sent a notification letter. See Appendix 10.10 for copies of the notification letters.

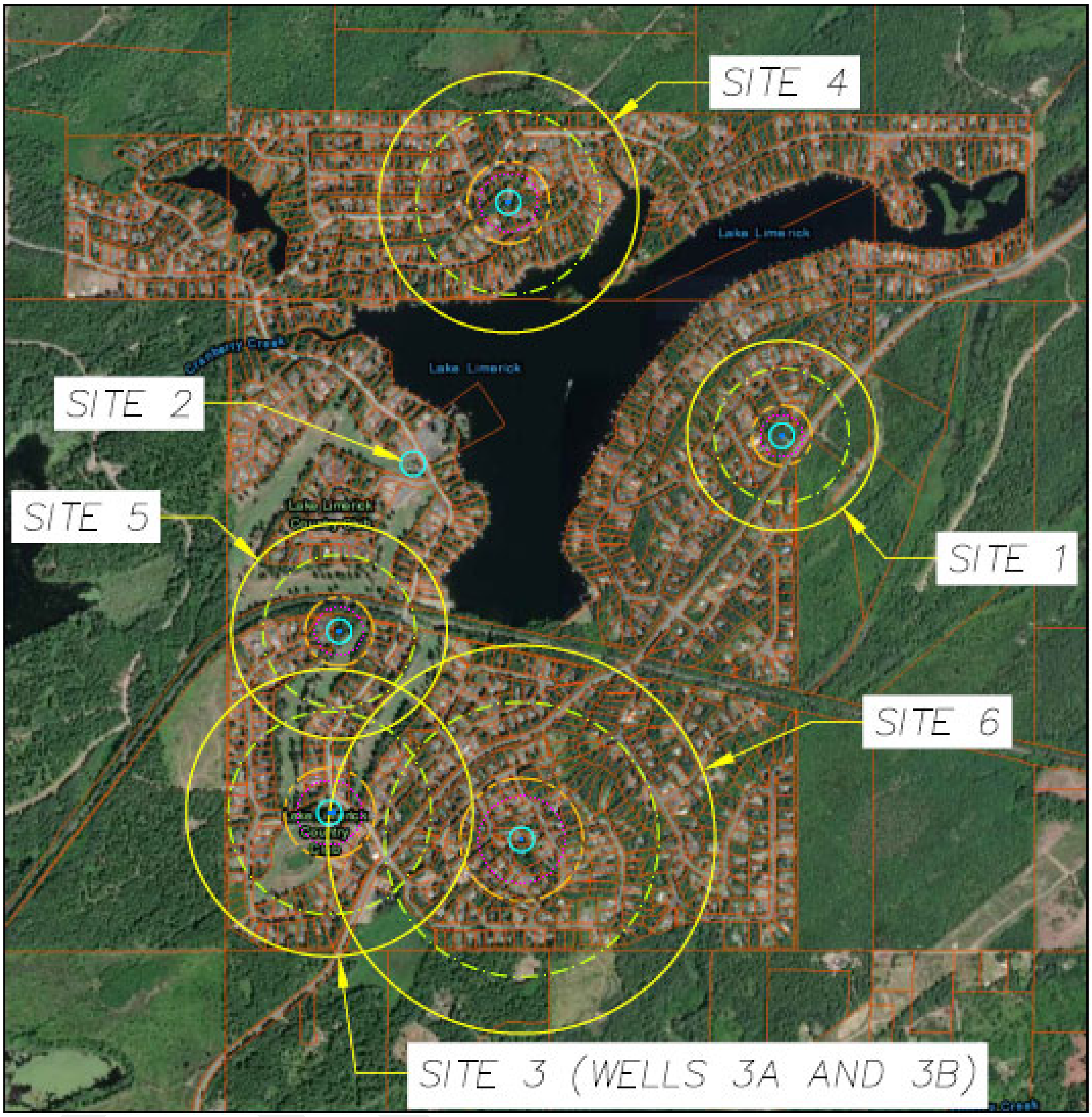


Figure 5-1: Wellhead Protection Areas

5.1.5 Contingency Planning

The community has sufficient source redundancy to lose several groundwater sources to contamination and maintain service. In the event of contamination, the source would be taken offline while the source of contamination was located and corrected. Since the sources are approximately a quarter of one mile from each other, it is unlikely that anything short of intentional contamination would affect more than one source at once.

In the extraordinarily unlikely event that both aquifers were completely contaminated and groundwater was inaccessible to the community, boil water notification and lake water could be used on a short term interim basis while emergency responders took action. The possibility of this action being required is extremely remote.

5.2 Water Quality Analysis

5.2.1 Asbestos

Asbestos levels in the water system's samples were below the state reporting limit in the most recent round of sampling, which was performed in November of 2018.

5.2.2 Bacteriological Testing

The system tests two samples from the distribution system for coliform bacteria each month. In the past 5 years there have been 7 coliform violations. These were in samples taken September 20th, 2018, October 17th and 21st, 2019, and January 14th and 20th, 2020. The system has historically been sampled from hosebibs throughout the community, which are prone to producing false positives. The system is currently in the process of installing dedicated sample stations to reduce the false-positive detection rate. The Coliform Monitoring Plan is included in Appendix 10.11.

5.2.3 Inorganic Chemicals (IOC)

IOC samples have been taken from each source on the system over the past 5 years. No EPA-regulated primary contaminant has exceeded the states Maximum Contaminant Level (MCL). Only Well 2 has exceeded any MCL, with Iron levels of 0.6 mg/L and Manganese levels of 0.066 mg/L. Well 2 is not used in day-to-day operations, and has pressure set points that prevent it from starting unless auxiliary capacity is required. Therefore, no treatment is proposed for the well.

5.2.4 Lead and Copper

The system performs routine lead and copper sampling every 3 years from the distribution system. Lead and copper have been present in the samples above the minimum detection limits; however, none have exceeded the action level of the Lead/Copper rule so no treatment is required. The Lead and Copper Monitoring Plan is included in Appendix 10.11.

5.2.5 Nitrates

Annual Nitrate testing is performed at each of the systems sources. As of the most recent sampling in 2019, five of the seven wells have no detectable nitrates in the source water. One well has nitrate levels near the lower limit of lab detection, at 0.32 mg/L, and one well had a sample of 0.86 mg/L. The worst sample taken in the past 5 years was only 1/10th the MCL.

5.2.6 Radionuclides

In radionuclides samples taken between June 2015 and August 2016, no Radium or Alpha particle emission was detectable.

5.2.7 VOCs and SOCs

Samples have been tested for volatile organic compounds (VOCs) from each source in the past 6 years with no samples showing any detectable compounds from any of the system's 7 sources. Samples for synthetic organic compounds (SOCs) have had some detectible compounds but none above the MCL.

Chapter 6 Operations and Maintenance

6.1 Water System Management and Personnel

The authority for the water system is vested in the Board of Directors. The board of directors created a six-member Water Committee in 1976 to oversee the operation and maintenance of the water system. The six members of the water committee serve 3-year terms. The terms are staggered such that two new committee-people are elected at each annual membership meeting, so that there is never a complete change of the water committee during any single year.

At the behest of the Water Committee, the Lake Limerick Country Club general manager provides billing and financial management services for the water system. Systems operations planning, scheduling, and oversight are provided by Northwest Water Systems, the Satellite Management Agency (SMA) selected by Lake Limerick to replace their outgoing manager in 2011. William Douglas (Doug) Carothers (WDM-2) is directly employed by the Lake Limerick Country Club and performs many of the day-to-day operations of the water system under the oversight of NWS, and is the Primary Contact for the system.

6.1.1 Operator Certification

Lake Limerick Country Club has a population of approximately 2,000. The Washington Administrative Code requires systems with populations between 1,500 and 15,000 to be managed by a Water Distribution Manager with a Level 2 certification (WDM-2). NWS provides Lake Limerick with operators holding WDM-3, several WDM-2, Cross Connection Control Specialists, and professional engineering services. Additionally, the onsite manager, Mr. Carothers, has WDM-2 certification.

Table 6-1: Summary of Certified Operators

Name	Position	Certifications	Number	Expiration Date
Kevin Odegard	NWS Operations Supervisor	WDM-3, CCS, WDS, WTPO 1	006962	Dec-2022
Jen Trenary	NWS CCC Program Manager	WDM-2, CCS, WTPO 1	013460	Dec-2022
Sean Burns	NWS Operations Assistant and Lead Field Technician	WDM-2, CCS	012946	Dec-2022
Doug Carothers	LLCC Water Master	WDM-2, WTPO 4	015123	

6.2 Operations and Preventative Maintenance

Most routine operations are performed by the onsite operator, Mr. Carothers, who takes daily source meter readings, reservoir checks, equipment inspections, and the monthly service meter readings. Mr. Carothers responds to concerns regarding leaks, high and low-pressure issues, and performs system maintenance. Billing issues are addressed by Rhonda Hunt. If field work is required, such as confirmation of a meter reading, it is completed by Mr. Carothers.

NWS prepares schedules of major system tasks, coordinates sampling, maintenance, system operations and responds to after-hours emergencies. NWS provides on average one to two days per week of on-site support in managing and administrating the system. NWS has coordinated work to revise and implement cross connection control program, has assisted in correcting several problems with the Supervisory

Control and Data Acquisition (SCADA) system that coordinates the 6 well sites, and now provides emergency notification for the community. NWS provides an elastic supply of management expertise to the community, allowing Lake Limerick to make full use of Mr. Carothers while having sufficient technical and personnel resources to complete tasks requiring more in-depth expertise or a larger workforce.

6.2.1 Normal Operating Conditions and Settings

Well and booster pump operation is governed by the SCADA system and can be controlled remotely from the water office. Table 6-2 outlines the normal setpoints for the well pumps, reservoirs levels, and booster pumps.

Table 6-2: Normal Operating Conditions

Site	Well	Pumps To	On Level	Off Level	Booster Pump	Pressure at Entry to Distribution
1	Well 1	Tank 1	15.5 ft	20.5 ft	Booster 1	73 psi
2	Well 2	Distribution				88 psi
3	Well 3A/3B	Tank 3	21.0 ft	26.5 ft	Booster 3A/3B	62 psi
4	Well 4	Tank 4	22.5 ft	26.5 ft	Booster 4	75 psi
5	Well 5	Distribution				73 psi
6	Well 6	Tank 6	21.0 ft	26.5 ft	Booster 6A/6B	75 psi

6.2.2 Preventative Maintenance Schedule

The regular maintenance program is shown in Table 6-3, showing the task, frequency, and lead party. Those listed with both parties are done jointly, or by either party. NWS assists with other tasks as necessary. Some functions have also been taken over by the SCADA system, such as pump runtime, pressure, and tank level monitoring. Routine maintenance is coordinated using a calendar and coding system developed for the system. A card file is maintained with instructions for performing various routine tasks and is sorted by code. A calendar located in the water office is marked with these codes. On any particular day that a code is marked with a code sequence, the code may be looked up and the card-file used to provide instructions for performing the task required.

Table 6-3: O&M Schedule

Task	Scheduled Frequency	Lead Party
Record Pump Hour Meters	Realtime, SCADA	Automatic
Record Reservoir Levels	Realtime, SCADA	Automatic
Record of System Pressures	Realtime, SCADA	Automatic
Read Source Meters	Daily	LLCC
Visual Inspection of stations	Daily	LLCC
Prepare Report to Water Committee	Monthly	NWS
Read Service Meters	Monthly	LLCC
Water use Calculations	Monthly	NWS / LLCC
Billing	Monthly	LLCC
Clean / Sweep Pumphouses	Monthly, as needed	LLCC
Check Pressure Tank Pre-charges	Semi-Annual	LLCC
Exercise Generators	Monthly	Automatic
Inspect / Clean Generators	Quarterly	LLCC/NWS
Flushing	Quarterly	LLCC/NWS
Exercising Valves	Quarterly	LLCC/NWS
Hydrant inspection and testing	Quarterly	LLCC/NWS
Rotate Logbooks	Annual	LLCC/NWS
Air Release Valve Inspection	Annual	NWS
Clean Reservoirs	Annual	NWS Coordinates
Check Static Water Levels	Annual	LLCC
Cross-Connection Control:	Annual assembly testing, surveys performed on 5-year cycle	NWS
Budget Evaluation	Annual	NWS / LLCC
Send Consumer Confidence Report	Annual	NWS
Prepare WUE report	Annual	NWS
WSP Updates	10-Year – Next update 2030	LLCC Initiates
Renew Radio License	Every 10-years, next renewal 2025	NWS

6.2.3 Equipment and Supplies

Lake Limerick maintains a selection of equipment and supplies for performing routing operations and maintenance tasks. Notable components are listed in Table 6-4.

Table 6-4: Equipment and Supplies

Item	Task Used For
Dell Rugged Laptop	Drive-by meter reading
Badger Beacon Analytics Software	Meter reading and reporting
General Office Supplies	Billing, customer notification

6.3 Comprehensive Water Quality Monitoring

Mr. Carothers and Northwest Water Systems coordinates sampling from day to day based on availability. Two coliform samples are taken every month, except in the event of a failure, when the coliform monitoring plan is used to determine the location and number of repeat samples to be taken. The system is sampled in accordance with its Water Quality Monitoring Schedule (WQMS). The current WQMS Report (Appendix 10.11) provides the sample schedule, which is summarized below in Table 6-5.

Table 6-5: Sampling Schedule

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Coliform	Coli	Distribution	Monthly
Asbestos	ASB	Distribution	9 year
Lead and Copper	LCR	Distribution	3 year
Nitrate	NIT	All Sources	Annual
Complete Inorganic Chemicals	IOC	All Sources	Waiver – 9 year
Iron	IOC	S02	3 year
Manganese	IOC	S02, S05, S07	3 year
Volatile Organic Contaminants	VOC	All Sources	Waiver – 6 year
Herbicides	Herb	All Sources	Waiver – 9 year
Pesticides	Pest	All Sources	Waiver – 3 year
Soil Fumigants	Fumigant	All Sources	Waiver – 3 year
Radionuclide / Gross Alpha	RAD 228	All Sources	6 year

6.3.1 Coliform Monitoring Plan and Map

The coliform monitoring plan was prepared by the system operator and the Satellite Management Agency. The coliform monitoring plan can be found in Appendix 10.11. The system takes two routine samples per month from distribution. If there are any failures, repeat distribution samples and a source sample are taken per this plan. See the Coliform Monitoring Plan for details.

6.3.2 Disinfection Byproducts

Non-applicable for the Lake Limerick Water System.

6.3.3 Water Treatment Monitoring

Non-applicable for the Lake Limerick Water System.

6.4 Emergency Response Program

Northwest Water Systems is the primary contact for after-hours water emergencies. NWS has prepared a comprehensive emergency response program which is included in Appendix 10.2. NWS main phone number may be called 24/7 to report any water emergency. In the event of a call NWS evaluates the nature of the call and determines a best course of action. Emergency contact information is included in all NWS communications with the community, including Consumer Confidence Reports and Cross Connection Control Surveys. The contact list for the system is shown in Table 6-6.

Lake Limerick has enrolled in an emergency call system called the Rapid Notification System that is capable of delivering hundreds of notices per hour. This automated dialer will contact individuals on the system, assess whether a live person or answering machine has been reached, and plays back a recorded message prepared by water system personnel. The system provides detailed reporting of who has and has not been reached, whether a person answered the phone or not, and whether the message was heard in its entirety. Water system personnel are trained in the use of the Rapid Notification System and can access the system to issue urgent notices at any time.

Table 6-6: Water System Contacts

Emergency contact	Phone number(s)	Emergency contact	Phone number(s)
Mason County Fire/Police/Medical	911	Electrician: Arcadia Drilling	888-426-3395
Mason County Emergency Management	360-427-9670 x811	DOH regional engineer	360- 236-3035
County environmental health	360-427-9670 x293	DOH emergency After hours #	877-481-4901
Department of Ecology Spill Response SW Regional Office	360-407-6300	Water Committee Chairperson (Contact LLCC Office for contact details)	360-426-4563
Engineering consultant Northwest Water	360-876-0958	Water Department Manager: Doug Carothers	360-507-6258
Electric utility: Mason Co. PUD 3	360-426-8255	Management Agency: NWS	360-876-0958
Pump service: Arcadia Drilling	888-426-3395	Water Office	360-426-4563
DOH Coliform Water Quality Monitoring: Charese Gainor	360-236-3045	LLCC Office	360-426-3581
DOH Chemical Water Quality Monitoring: Sophia Petro	360-236-3046		

6.4.1 Vulnerability Assessment

Earthquake – No practical degree of protection against catastrophic earthquakes can be supplied; however, the system has numerous redundant sources, a large volume of water storage, control valves to disable sections of the system, and on-site backup power facilities at 3 of its sites. The system is therefore expected to be able to withstand typical minor earthquake events. After an earthquake has occurred, the system shall be carefully inspected and an inventory of all damages shall be made. Additional water quality testing will be performed in consultation with the WSDOH.

Fire – In the event of a fire in a pumphouse, 911 shall be notified. Once the emergency responders have deemed the area safe to enter, the site is to be disabled during inspection. If it is found to be safe after inspection, the site may be re-enabled. If minor repairs are necessary Arcadia drilling will be contacted for a service call. The system will operate without problem with any of the 6 sites offline, down-time at any single site can be tolerated for extended periods for repairs. If extensive damage has been done and the site must be replaced, the system may take the opportunity to re-engineer the site if damage from the fire could have been averted through practical measures.

Flood – The system is located surrounding a lake; however, none of the streams are of sufficient size to indicate a likely flood risk. All sources are above the 100-year floodplain. Primary risks from flooding would be washed-out culverts, which could cause a waterline break. In the event of a flood related break, the area would be disabled by valve, the waterline repaired and chlorinated, and the system may be placed on precautionary boil water advisory while the extent of potential contamination from surface water is evaluated.

Power Outages – The system's 2 primary sites with backup power will prevent power outages from disabling the community sources or pressure systems.

Vandalism/Terrorism – Small water systems are potential targets of vandalism and terrorism. Fortunately, most small water systems also attract little attention. Wellheads, pumphouses, and reservoirs[1] are secured with locks or fences with locked gates. Any evidence of vandalism shall be investigated and water quality samples shall be taken if there appears to be any evidence of tampering with the wellheads, pumphouse, or other point at which contaminants could enter the system. After-hours security patrols are aware of the locations of water sources and provide a deterrent for vandals.

Volcanic Activity – Because of the system's location, vulnerability to volcanic activity is very low. The most likely impact of volcanic activity would be ash fallout from a regional event. This fallout could potentially impact water quality of open reservoirs; however, all of the reservoirs serving Lake Limerick are concrete silos with enclosed roofs, locked sealed lids, and downward facing screened vents. Volcanic ash is therefore unlikely to present any problem for the system.

Public Health Crisis / Pandemic – Public water systems require ongoing maintenance and operational oversight by on-site personnel. Typically, administrative and operational duties are spread among several individuals, with many possible shared spaces and surfaces (i.e. offices, break rooms, restrooms, maintenance shop, etc.). In the event of a public health crisis or pandemic, it may be necessary to operate the system while preventing direct or indirect interaction between system employees and customers. The SCADA system allows for routine monitoring to be performed from the central office, and source redundancy provides flexibility in performing maintenance and repairs. Additionally, the system has implemented drive-by meter reading technology. Vulnerability to public health crises is therefore low, as the system would be able to maintain normal service while abiding by social distancing measures and minimizing the spread of pathogens between surfaces. Furthermore, there is no threat to the drinking water, as there is no natural pathway for viruses or bacteria to enter the water supply.

[1] The reservoir at Site 3 has a fence that needs to be completed. This is part of the improvement program discussed in Chapter 8.

Personal Safety – Water system personnel should be aware of potential hazards related to the water system and ensure the appropriate safety measures are in place. Pumphouses have moving equipment and high voltage power supply, however, they are well protected. Power to pumps, controllers, or any other electrical equipment should be physically disconnected before repairing or replacing any equipment. Electrical panel and motor control covers should be kept in place at all times. Reservoirs can pose a fall concern, but are equipped with locked climbing cages and guardrails, and are fenced off from the public. Reservoirs and vaults are considered and confined spaces and should only be entered by persons who have received confined spaces training. Additional confined space information is available at osha.gov. The Lake Limerick main office is equipped with a first aid kit; additionally, NWS employees receive emergency training and their vehicles are equipped with first aid kits.

6.5 Cross Connection Control

The system has an adopted Cross Connection Control Program that is being implemented by their SMA. The cross connection control policy, program, and list of backflow devices can be found in Appendix 10.12.

6.6 Sanitary Survey Findings

The latest Sanitary Survey was performed in October 2018. There were no significant deficiencies or significant findings identified during the survey. An observation was made that the walls of the booster station at Site 5 appeared to be mildewed and there was some insulation on the floor. Cleaning and repair of the pumphouse has been added to the list of improvement items in Chapter 8. The complete sanitary survey is included in Appendix 10.16.

6.7 Record Keeping, Reporting, and Customer Complaint Program

The system generates a number of different types of records that must be kept. The water system maintains these records. The records and the periods over which records are maintained are shown in Table 6-7, Table 6-8, and Table 6-9.

Table 6-7: Billing Records

Type of Record	Time Kept	Reporting
Utility Billing Records	3 years	n/a
Receipts	3 years	n/a
Power Bills	3 years	n/a
Check Registers	3 years	n/a
Taxes and Financial Reports	7 years	n/a

Table 6-8: Planning and Administrative Records Maintained

Type of Record	Time Kept	Reporting
System Planning Documents	Until Irrelevant	As Requested
Engineering Drawings	Indefinitely	As Requested
WFI	Current	Annually
Contracts	as necessary	n/a
Work Orders	3 years	n/a
Operating Permit	Current	n/a
Correspondence with Customers	3 years	Upon Request
Correspondence with Government	3 years	n/a
Correspondence RE: Sanitary Surveys	10 years	Upon Request
Record of Action to Correct Violations	3 years	Upon Request
Misc. Correspondence	3 years	Upon Request
Consumer Confidence Reports	3 years	Annually
Site Visit Reports	1 year	Upon Request
Record of Public Notices	3 Years	Upon Request

Table 6-9: Water Quality Records

Type of Record	Time Kept	Reporting
Bacteriological Tests	1 year	Monthly
Coliform Monitoring Plans	5 years after retirement	As Requested
CCC Documents	3 years	Upon request
Exemptions and Variances	5 years after expiration	As Requested
Nitrate Tests	5 years	Annually
IOC	Indefinitely	Upon testing
VOC/SOC	Indefinitely	Upon testing
Radionuclide	5 years	Upon testing
Lead and Copper	12 years	Upon testing
Other Water Quality	5 years	Upon testing
Backflow Testing	1 year	Upon request
Site Visit Reports	1 year	upon request
Work Orders	3 years	n/a
Water Well Reports	Indefinitely	Upon request
Drawdown Tests	Indefinitely	Upon request
Static Water Levels	20 years	Upon request
Source Meter Readings	3 years	Upon request

6.7.1 Customer Complaints

Complaints regarding water service issues may be directed to the water office during regular business hours or to the SMA in the event of after-hours emergencies. The SMA is available on a 24-hour basis for emergency response. The SMA investigates each complaint and maintains records describing the nature of the complaint and the steps taken to resolve it. The SMA coordinates with the Lake Limerick Water Committee and the Board of Directors to ensure that the water system owner is aware of any issues and their resolution.

6.8 Summary of O&M Deficiencies

The system has sufficient capacity to provide water service through full build-out of the community, including the possible eventuality of all the homes becoming full time residences. The system has excellent water quality, and water use efficiency efforts have yielded significant savings for the community. Overall, the system is well maintained and repairs and upgrades are routinely made. Portions of the SCADA system, which was identified as a deficiency in the 2012 WSP, have been upgraded and additional improvements are planned. No significant system deficiencies were identified during the most recent Sanitary Survey. However, several “minor” deficiencies have been identified and are listed below.

6.8.1 Service Meter Data Accuracy

In preparing the current water system plan, the system’s service meter records were analyzed to determine the current ERU count and average demand values. This analysis requires thorough investigation of all customer usage records. While the vast majority of the records appear “normal” and in-line with what we would expect, there are a handful of accounts that have blatant inaccuracies in the data reported from the Utility Management Solutions (UMS) software. For example, certain accounts show negative water use for the billing period, while others show exorbitant values that are several orders of magnitude larger than realistically possible (i.e. millions of gallons per month). These errors occur in multiple customer accounts and over several years of records, indicating that no audits are being performed to verify the accuracy of the records.

NWS recommends performing a quarterly review of the service meter records to identify and correct these errors. Creating a simple scatter plot will quickly reveal the outlying data points. Erroneous records should then be flagged and corrected in the database, and notes made to explain the corrections.

6.8.2 Clean and Repair Pumphouse 5

As noted above in Section 6.6, the Sanitary Survey found that some cleaning and repairs in Pumphouse 5 should be done.

6.8.3 Complete Fence Around Reservoir 3

The fence around the reservoir at Site 3 is incomplete and should be finished to prevent trespassing.

6.8.4 Install Dedicated Sample Stations for Bacteriological Testing

The system has historically sampled from hosebibs throughout the community, which are prone to producing false positives. Dedicated sample stations should be installed to reduce the potential for false positives.

6.8.5 Install New Backup Generator at Site 4

The existing generator at Site 2 is too old to be adequately maintained. The system has proposed replacing it with a new generator at Site 4.

6.8.6 Replace Well 5 Pump

The pump installed in Well 5 is not well suited for its operating condition. The pump is designed for operation above 150 gpm, but as configured it pumps at a higher pressure and only at 35 gpm. This causes the pump to operate at significantly reduced efficiency. Although this does not directly impact water service to customers, it is recommended that replacement of the pump be reviewed to determine if the electrical savings of a more appropriately sized pump justifies replacement prior to the existing pump's end of life.

6.8.7 Distribution System and Fire Hydrant Replacement

The existing fire hydrants throughout the system are no longer manufactured, meaning that direct replacement will not be possible. Although fire flow is not currently required, the community has chosen to increase looped lines to 6" and dead-end lines over 250 feet in length with 8" main lines whenever they are replaced so that fire flow may eventually be supported. Therefore, the hydrants should continue to be maintained, and replaced when they reach the end of their service life. NWS recommends replacing the existing hydrants with M&H Reliant Style 929, Mueller Centurion, or Clow Medallion when necessary.

Chapter 7 Distribution Facilities Design and Construction Standards

The Lake Limerick Water System desires exemption from project report and construction document submittal per WAC 246-290-125 for distribution main projects. All distribution replacements, upgrades, and modifications shall comply with the standards and details contained herein. The Water System Service Area Maps are available in Appendix 10.1 as they exist in July of 2020. In requesting these exemptions, the Lake Limerick Water System will:

- Maintain an approved Water System Plan with the Department of Health that includes standard construction specifications for distribution mains and an analysis of the hydraulic capacity of the basic distribution main configuration.
- Maintain a project summary file and construction documentation for each system improvement under this exception. This summary file will be available to the Department of Health upon request, and will include as-built drawings and a completed *Construction Completion Report for Distribution Main Projects* signed by the design engineer.

The community shall upgrade waterlines as they are replaced. At this time no large single replacement project is proposed. The community instead intends to replace sections of lines as they begin to fail. The system plans to replace all of its waterline over the course of 30 years, and then to begin a program of preventative replacement on a 60 to 80-year schedule after the initial phase of replacement is completed. As it is replaced, the distribution system shall be resized to support fire flow. All looped waterline shall be replaced with 6” PVC, and all dead-ends over 300 feet in length shall be replaced by 8” waterline.

7.1 Project Review Procedures

All distribution projects shall be designed and stamped by a professional engineer. All projects not included in the submittal exception shall be submitted to the WSDOH for their review and approval. Any construction begun prior to WSDOH approval may be subject to fines.

The following projects do not require a project report and may be completed at the system’s discretion, as long as the work is consistent with the standards set forth in this design.

- Addition of valves, fittings, service connection, meters
- Repair or replacement of any components with like components
- Maintenance of existing components
- Construction of any component not in contact with potable water

All construction of new or replacement facilities shall be subject to the following specifications:

- The current Standard Specifications of the Washington State Department of Transportation
- American Water Works Association (AWWA) standards
- Applicable standards adopted under Washington Administrative Code
- Mason County road and utility installation standards
- Standard plans and details adopted by the Lake Limerick Water System.

The system will require plans and specifications for any new project not described here to be prepared in writing under the supervision of a registered professional engineer and approved by the State Department of Health prior to construction. Future reports prepared and stamped by a licensed professional engineer may modify these standards. All projects shall be reviewed and certified by the design engineer. These standards and details supersede the corresponding details and standards from the 2012 Water System Plan.

7.2 Policies and Requirements for Outside Parties

No outside parties are permitted to work on the system unless specifically contracted to complete work under the direct supervision and direction of the system.

7.2.1 Design Documents

All design documents shall be completed and stamped by a professional engineer and submitted to the WSDOH for review and approval. Designs shall specify materials and methods conforming to the WAC, WSDOH, AWWA, and WSDOL professional standards. Special attention shall be paid to the WSDOH Design Manual, applicable AWWA Manuals, and 10 States Standards. In the event that conflicting standards are presented the most conservative standard shall be adopted. If a standard other than the most conservative standard is proposed engineering justification for the more lenient standard must be provided. All system components in contact with potable water shall conform to NSF 61 standards.

7.2.2 System Hydraulics

- The system shall be designed such that all lines are looped whenever possible.
- All dead-end lines shall have blow-off assemblies.
- The system high point shall have an air release valve.
- Pressures throughout the system shall be maintained between 30 and 100 psi.
- Pipe flow velocities shall remain below 2 ft/sec, unless higher flow rates can be justified.
- All designs shall take into consideration the possibility of future expansion.

7.2.3 Redundancy

Redundancy shall be provided for source and pressurization of water service. Redundant features include:

- Multiple wells and well pumps
- Multiple reservoirs and booster pumps
- Multiple backup generators

7.3 Construction and Design Standards

All construction shall be completed according to the standards set forth in the WAC, WSDOH, AWWA, and 10 States Standards. In the event that conflicting standards are presented the most conservative standard shall be adopted. If a standard other than the most conservative standard is proposed, engineering justification for the more lenient standard must be provided.

The following specific standards must be maintained:

- Pipe sizes under 4-inch shall be a minimum of Schedule 40 PVC or DR 11 HDPE
- Pipe sizes 4-inch and above shall be a minimum of AWWA C900
- All valves and fittings shall be the same size as the run of pipe they are serving
- All blow-offs, service connections, and trench details shall at a minimum conform to the "standard details" as shown in Appendix 10.20
- Trench depths shall be no more than 4-feet
- Disinfection shall be followed according to the standard details as shown Appendix 10.20

7.3.1 Construction and Design Standards for Water Mains

Standard details and drawings for water main installation are included in Appendix 10.20

7.3.2 Construction and Design Standards for Reservoirs and Booster Pump Stations

The Lake Limerick Water System is not requesting submittal exception for distribution related projects, such as reservoirs and booster pump stations. Construction and design standards for these elements are not included in this water system plan.

7.4 Construction Certification

The design engineer will inspect and certify construction at all applicable phases to ensure the project is constructed in accordance with the construction standards. These phases shall include:

- Completion of Trenches
- Pipe Installation
- Disinfection
- Pressure Testing
- Final Inspection
- Water Quality Sampling

Some of these inspections may be combined into a single visit, if applicable.

The water system will maintain a project file to include all design and constriction record drawings.

Following construction completion, the certifying engineer shall submit a construction completion report to the WSDOH.

- The *Construction Completion Report Form DOH 331-121* shall be used for normal projects that underwent DOH review and approval and was constructed in accordance with the DOH-approved design.
- The *Construction Completion Report for Distribution Main Projects DOH 331-147* shall be used only for distribution main projects not requiring prior written approval from DOH. This from does not have to be submitted to DOH following construction completion, but the water system must maintain a competed form on file and make it available to DOH upon request.

Any deviations from the submitted design shall be addressed and documented by the submitting engineer in the design report. If completion of the project changes any information on the Water Facilities Inventory (WFI), the system must submit and updated WFI with the signed construction completion report.

Chapter 8 Capital Improvement Program

8.1 Prioritization Criteria

Improvements are prioritized according to the following criteria listed from highest to lowest in importance:

1. Public Health Risks
2. Adequate Supply
3. WSDOH Operation and Design Standards
4. Achieving Conservation Goals
5. Regularly Scheduled Improvements
6. Aesthetic and Optional Improvements

8.2 Prioritized List of Improvements

The system has no significant public health risks, has more than adequate supply, and meets or exceeds all WSDOH guidelines for operation and design standards. Therefore, the highest three prioritization criteria are already met and the following improvements are prioritized based on the remaining criteria (4-6) as well as project scope and cost.

1. Improve Service Meter Data Accuracy
2. SCADA System Improvements
3. Clean and Repair Pumphouse at Site 5
4. Complete Fence around Site 3 Reservoir
5. Install Dedicated Sample Stations for Bacteriological Testing
6. Install Backup Generator at Site 4
7. Add Low-Level Chlorination to System
8. Replace Pump in Well 5
9. Upgrade Distribution to Support Fire Flow
10. Replace Fire Hydrants

8.3 Assessment of Improvements

8.3.1 Improve Service Meter Data Accuracy

The service meter records from recent years contain occasional erroneous readings, such as negative water use or amounts that are several orders of magnitude larger than should be expected. This may be corrected for future meter reads by performing regular “audits” of the data or setting filters in the reporting software to automatically flag outlying data points. Ensuring data accuracy will allow for a more accurate summary of monthly and annual water use and more efficient analysis for future design or planning documents.

8.3.2 SCADA System Improvements

In 2018 the SCADA system PC was upgraded to a new Dell workstation running Windows 10 Pro, and the Wonderware SCADA software was upgraded to version 2017. The system has indicated their desire to make some additional improvements. The current SCADA system monitors and controls pump runtime, pressure, and reservoir levels. The system would like to incorporate real-time source meter readings and aquifer levels into the SCADA program, as well as a setting to automatically turn off well site booster pumps if the reservoirs reach low level. This will allow for increased awareness of instantaneous and historical well performance to help identify seasonal or long-term trends and catch operational errors early on.

8.3.3 Clean and Repair Pumphouse at Site 5

The latest Sanitary Survey, performed in October 2018, found that the pumphouse at Site 5 appeared to have mildewed walls and pieces of insulation on the floor. This could indicate that the pumphouse is not sealed adequately, leading to a buildup of moisture and potential access to rodents. The system should take action to seal the pumphouse to protect from rodents and moisture intrusion, and clean or replace the affected walls.

8.3.4 Complete Fence Around Site 3 Reservoir

The fence around the reservoir at Site 3 needs to be completed in order to prevent trespassing. It is expected this will be completed within the coming year.

8.3.5 Install Dedicated Sample Stations for Bacteriological Testing

As noted in Chapter 5, bacteriological samples have historically been taken from outdoor hosebibs, which a prone to producing false positives. Dedicated sample stations will be installed in order to reduce the number of false positives.

8.3.6 Install Backup Generator at Site 4

The system currently has three backup generators, one each at Site 2, Site 3, and Site 6. However, the generator at Site 2 is too old to be adequately maintained. A new generator at Site 4 is proposed as a replacement.

8.3.7 Add Low-Level Chlorination to the System

The Lake Limerick Water System is not required to chlorinate any of their sources. However, the board would like to pursue installation of chlorination equipment to maintain a low-level residual throughout the system. The scope and schedule of this project has not yet been determined, but is mentioned here for the sake of completeness. It is recommended that the system consult with an engineer and the Department of Health prior to beginning any treatment project.

8.3.8 Replace Pump in Well 5

Water is pumped from Well 5 by a 10-HP well pump designed for operation above 150 gpm. At higher pressure the pump delivers lower flows rates at reduced efficiency. The well pump is rated for efficiencies above 65%, but is likely operating at just 30% efficiency as configured. The well pump delivers approximately 10 to 15% of total production; assuming a new pump would operate at twice the efficiency, thereby requiring half the electrical usage, a savings of $1,000 – $1,500 per year in electrical costs could be expected. With an estimated remaining life of 14 years and replacement cost of $20,000, it may be nominally cost effective to proactively replace the pump. However, it is unlikely that the electrical savings would be substantially more than the replacement cost. Therefore, pump replacement is not anticipated within the 10-year planning horizon. The pump should be reviewed by an engineer, and a more appropriately sized pump should be specified prior to replacement.

8.3.9 Distribution Line Replacement

The community is currently served by over 78,000 feet of waterline, almost all of which is asbestos cement. Most of the waterline was installed in the 1960s and 1970s, and will likely be nearing the end of its useful life in the next couple of decades. The waterline will likely require significant portions or even complete replacement within the next 20-25 years. The community should continue to fund a capital reserve program that will be capable of replacing the waterlines within that time frame. The total cost of distribution system replacement is anticipated to be approximately $5,300,000 in present day dollars.

20-25 years is only a best estimate of the remaining useful life of the waterline. It is possible that the distribution system will develop significant leak problems and require replacement before this period. It is also possible that the system could out-live this estimate. The most likely outcome is that portions of the system will require replacement sooner than others and that work may be spread over several projects performed over a number of years.

Since it is not always possible to know ahead of time where replacements will be required first, the community should set a reserve budget that can accommodate the complete replacement of the system in 25 years. With these funds on hand, the system can conduct regular evaluations of the waterline condition and use these capital reserves to replace the system as necessary. The best way to assess the condition of the system and determine where replacement will likely be necessary next is to monitor the frequency and location of breakages and the overall leakage rates. Installation of zone meters can also be useful in determining the vicinity of leaks and pipe condition in certain areas of the distribution system. If at any time the need to replace exceeds the community's financial capacity, federal, state, and private loan programs are available that could be used to complete the project. When waterlines are replaced, they will be sized to support fire flow, and asbestos cement pipe will be replaced with C900 PVC.

8.3.10 Replace Fire Hydrants

The model of the existing fire hydrants is no longer manufactured. Although fire flow is not currently required, the system will be upgrading the distribution system when it is replaced to support fire flow. Therefore, the fire hydrants should be replaced when they reach the end of their service life. NWS recommends replacing the existing hydrants with M&H Reliant Style 929, Mueller Centurion, or Clow Medallion. It is anticipated that the hydrants will be replaced within the next 20 years, but not within the next 10-year planning cycle.

8.4 Improvement Program Summary and Schedule

The community will perform all of the upgrades proposed in section 8.3. Only the first three improvement projects are anticipated within the next 10 years, with the remaining improvements being made when the existing equipment is replaced at the end of its service life. While the last three upgrades are not anticipated within the 10-year planning period, the financial program shall be prepared to adequately plan for these future projects.

Table 8-1 provides an overview of the likely schedule for capital improvements projects. See Chapter 9 for details of the financial program.

Table 8-1: Improvement Schedule

Improvement	Estimated Cost (2020 dollars)	Schedule	Source of Funds
1. Improve Service Meter Data Accuracy	$0	2021	N/A
2. SCADA System Improvement	$40,000	2022	Reserves
3. Clean and Repair Pumphouse 5	$500	2021	Reserves
4. Complete Fence at Site 3 Reservoir	$2,500	2021	Reserves
5. Install Dedicated Sample Stations	$10,000	2022	Reserves
6. Install Backup Generator at Site 4	$40,000	2022	Reserves
7. Install Chlorination Equipment	Scope and schedule not yet determined		
8. Well 5 Pump Replacement	$20,000	2034	Reserves
9. Distribution Replacement	$5,300,000	2042	Reserves[1]
10. Fire Hydrant Replacement	$270,000	2040	Reserves

[1] Capital reserve program shall be established to provide sufficient funds to replace the distribution system in 20-25 years; should replacement become necessary prior to this time, a one-time community assessment, or loans through federal and state programs may be used to supplement the reserves as necessary.

Chapter 9 Financial Program

The Lake Limerick water system is operated as a financial subcomponent of the broader Lake Limerick Country Club. The system collects revenue from metered water rates, unmetered lots (ready to serve fees), locked meter fees, disconnection charges, excessive use charges, new connection fees, and interest from long term investments. Rates for the 2019-2020 fiscal year are as follows (per user):

Table 9-1: Current Rate and Fee Structure

Metered Lot (10,000 gallons per month base allocation)	$30.00/month
Locked Meter	$16.00/month
Unmetered Lot	$16.00/month
Half-Lot, Metered (5,000 gallons per month base allocation)	$14.00/month
Half-Lot, Unmetered	$8.00/month
Excessive Use (Over Base Allocation)	$2.00/1,000 gallons
New Valve and Meter Installation (includes water spigot upon request)	$1,000.00
Spigot Installation (customer side, past meter and backflow devices)	$175.00
Lockout (reduces monthly fee to $16.00)	$60.00
Return to Service (increases monthly fee to $30.00)	$60.00
Hose Bib Lock	$15.00

A rate increase is proposed in order to adequately fund the long-term asset reserves for future waterline replacement. The waterlines are expected to need replacement within the next 22 years. Current funding rates of the long-term reserve would not be adequate to cover the expected cost of mainline replacement without the use of loans or special assessments. Since the current water rate is relatively low, a rate increase and adjustment to the rate structure to a more tiered approach is proposed, along with ongoing adjustments each year to keep pace with inflation. This is expected to provide adequate funding for mainline replacement without the use of loans.

Table 9-2: Recommended Rate Structure

Tier	Use Range	Rate	Estimated Average Fee
Base Rate	0 - 6,000 gal	$40.00	$40.00
Tier 1	6,001 - 10,000 gal	$2.75 / gal	$2.53
Tier 2	10,001 - 15,000 gal	$3.75 / gal	$2.04
Tier 3	above 15,000 gal	$4.75 / gal	$4.04
Total			**$48.61**

The financial analysis in this chapter has been prepared upon the assumption that the recommended rates will be implemented and ongoing annual inflation adjustments of 3%. It has also been assumed that the community will invest its long-term replacement reserves in accounts earning 0.5% less than inflation, as a conservative estimate. The model is prepared using estimated life spans shown in the system inventory in Appendix 10.5.

9.1 Financial Viability

In order to remain financially viable, water systems must commit to identifying the full cost of providing water service, recovering that cost through service rates and fees, and maintaining adequate reserve funds. Without adequate financial capacity, it become difficult or impossible to maintain adequate operational and managerial capacity to provide a safe and reliable water supply. Lake Limerick has detailed income and expense records and develops a balanced operational budget for each fiscal year. The following sections address each of these elements and provide information on how to maintain an appropriate level of funding for both ongoing and long-term expenses.

9.2 Income and Expenses

9.2.1 Income

The existing fee structure described above is anticipated to result in approximately $495,900 of system revenue this year. Following the rate increase in 2021, system revenue will be approximately $700,000. The system should then increase its rates in accordance with its actual annual increases in operating expense; it is assumed that 3% annual rate increases will be sufficient to meet this need. The projected revenue based on 3% growth in expenses for the system over the next 10 years is shown in Table 9-3. Actual growth in expenses will be monitored on an annual basis and adjusted by the water committee.

Table 9-3: Lake Limerick Water System Revenue

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Water Rates - Metered	$566,400	$583,392	$600,894	$618,921	$637,488	$656,613	$676,311	$696,601	$717,499	$739,024
Water Rates - Unmetered	$ 2,500	$ 2,575	$ 2,652	$ 2,732	$ 2,814	$ 2,898	$ 2,985	$ 3,075	$ 3,167	$ 3,262
Disconnect, Lockout, and Locked Meter fees	$ 3,000	$ 3,090	$ 3,183	$ 3,278	$ 3,377	$ 3,478	$ 3,582	$ 3,690	$ 3,800	$ 3,914
Excessive Use Fees	$124,100	$127,823	$131,658	$135,607	$139,676	$143,866	$148,182	$152,627	$157,206	$161,922
New Connection Fees	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159	$ 1,194	$ 1,230	$ 1,267	$ 1,305	$ 1,344
Miscellaneous Revenue	$ 2,000	$ 2,060	$ 2,122	$ 2,185	$ 2,251	$ 2,319	$ 2,388	$ 2,460	$ 2,534	$ 2,610
Total	$699,030	$720,001	$741,601	$763,849	$786,764	$810,367	$834,678	$859,719	$885,510	$912,076

9.2.2 Expenses

Table 9-4 shows the operating expenses anticipated by the system over the next 10 years. Fees are assumed to increase at 3% per year in accordance with inflation. Sampling and engineering expenses tend to be quite variable, for example over a decade most of the engineering fees will be incurred during preparation of the Water System Plan; and IOC sample expenses incurred when taken from all wells; however, in any individual year there may only be coliform sampling, which will cause specific years to deviate from the average. The amortized average annual cost for these variable fees has been included in the table rather than making specific provisions for any specific year or project.

Table 9-4: System Expenses

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Automobile Expenses	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	20,159
Bank Service Charges	1,236	1,273	1,311	1,351	1,391	1,433	1,476	1,520	1,566	1,613
Computer and Internet	515	530	546	563	580	597	615	633	652	672
Dues and Subscriptions	2,060	2,122	2,185	2,251	2,319	2,388	2,460	2,534	2,610	2,688
Employee Expenses	136,063	140,145	144,349	148,680	153,140	157,734	162,466	167,340	172,361	177,531
Equipment Rental	4,120	4,244	4,371	4,502	4,637	4,776	4,919	5,067	5,219	5,376
General Liability	21,115	21,748	22,401	23,073	23,765	24,478	25,212	25,969	26,748	27,550
Interest Expense	1,100	700	300	0	0	0	0	0	0	0
License and Permits	2,266	2,334	2,404	2,476	2,550	2,627	2,706	2,787	2,871	2,957
Meals and Entertain.	309	318	328	338	348	358	369	380	391	403
Merchant Acct Charges	2,472	2,546	2,623	2,701	2,782	2,866	2,952	3,040	3,131	3,225
NSF Check Fees	309	318	328	338	348	358	369	380	391	403
Office Supplies	824	849	874	900	927	955	984	1,013	1,044	1,075
Office Expense	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	2,016
Postage and Delivery	4,635	4,774	4,917	5,065	5,217	5,373	5,534	5,700	5,871	6,048
Professional Fees	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239
Repairs and Maint.	20,000	20,600	21,218	21,855	22,510	23,185	23,881	24,597	25,335	26,095
Service Contracts	3,296	3,395	3,497	3,602	3,710	3,821	3,936	4,054	4,175	4,301
Small Tools and Equip.	4,120	4,244	4,371	4,502	4,637	4,776	4,919	5,067	5,219	5,376
Supplies	12,360	12,731	13,113	13,506	13,911	14,329	14,758	15,201	15,657	16,127
Taxes - Property	100	103	106	109	113	116	119	123	127	130
Taxes - Public Utility	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	20,159
Telephone	1,957	2,016	2,076	2,138	2,203	2,269	2,337	2,407	2,479	2,553
Travel Expense	515	530	546	563	580	597	615	633	652	672
Uniforms	1,030	1,061	1,093	1,126	1,159	1,194	1,230	1,267	1,305	1,344
Utilities	21,630	22,279	22,947	23,636	24,345	25,075	25,827	26,602	27,400	28,222
Water Testing	5,150	5,305	5,464	5,628	5,796	5,970	6,149	6,334	6,524	6,720
General Expense Total	**329,627**	**339,083**	**348,834**	**358,990**	**369,760**	**380,853**	**392,278**	**404,047**	**416,168**	**428,653**

9.3 Balanced Operational Budget

The components of the operational budget (Income, Expenses, and Reserve Funding) are discussed in Sections 9.2 and 9.4, and therefore not repeated here. The complete budget may be found in Appendix 10.14.

9.4 Reserve Accounts

Reserve budgets are shown in Table 9-5. Note that payments to the emergency reserve are designed to allow it to grow with inflation, while payments to the short-lived replacements reserve are set so that they meet the anticipated need. Capital reserve (long-term asset) payments are made such that all waterline replacements may be performed out of pocket after 22 years.

Table 9-5: Reserve Accounts

Reserve	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Operating Reserve										
Beginning Balance	$ 58,252	$ 60,000	$ 61,800	$ 63,654	$ 65,564	$ 67,531	$ 69,556	$ 71,643	$ 73,792	$ 76,006
Contribution	$ 1,748	$ 1,800	$ 1,854	$ 1,910	$ 1,967	$ 2,026	$ 2,087	$ 2,149	$ 2,214	$ 2,280
Ending Balance	$ 60,000	$ 61,800	$ 63,654	$ 65,564	$ 67,531	$ 69,556	$ 71,643	$ 73,792	$ 76,006	$ 78,286
Emergency Reserve										
Beginning Balance	$ 97,087	$ 100,000	$ 103,000	$ 106,090	$ 109,273	$ 112,551	$ 115,927	$ 119,405	$ 122,987	$ 126,677
Contribution	$ 2,913	$ 3,000	$ 3,090	$ 3,183	$ 3,278	$ 3,377	$ 3,478	$ 3,582	$ 3,690	$ 3,800
Ending Balance	$ 100,000	$ 103,000	$ 106,090	$ 109,273	$ 112,551	$ 115,927	$ 119,405	$ 122,987	$ 126,677	$ 130,477
Short-term Asset Reserve										
Beginning Balance	$ 244,660	$ 294,660	$ 346,160	$ 399,205	$ 453,842	$ 510,117	$ 568,081	$ 627,783	$ 156,790	$ 220,129
Contribution	$ 50,000	$ 51,500	$ 53,045	$ 54,636	$ 56,275	$ 57,964	$ 59,703	$ 61,494	$ 63,339	$ 65,239
Withdrawal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 532,487	$ -	$ -
Ending Balance	$ 294,660	$ 346,160	$ 399,205	$ 453,842	$ 510,117	$ 568,081	$ 627,783	$ 156,790	$ 220,129	$ 285,367
Long-term Asset Reserve										
Beginning Balance	$ 350,000	$ 665,789	$ 928,001	$ 1,278,058	$ 1,662,824	$ 2,067,793	$ 2,493,789	$ 2,941,663	$ 3,372,049	$ 3,851,984
Contribution	$ 315,000	$ 324,450	$ 334,184	$ 344,209	$ 354,535	$ 365,171	$ 376,126	$ 387,410	$ 399,033	$ 411,004
Withdrawal	$ 15,450	$ 84,872	$ 15,298	$ -	$ -	$ -	$ -	$ 39,270	$ 13,048	$ 362,857
Accrued Interest	$ 16,239	$ 22,634	$ 31,172	$ 40,557	$ 50,434	$ 60,824	$ 71,748	$ 82,245	$ 93,951	$ 97,503
Ending Balance	$ 665,789	$ 928,001	$ 1,278,058	$ 1,662,824	$ 2,067,793	$ 2,493,789	$ 2,941,663	$ 3,372,049	$ 3,851,984	$ 3,997,634

9.5 Water Rate Evaluation

9.5.1 Affordability

The per-user financial obligation to the water system is shown over the next 10 years. Because of the lack of treatment, solid planning practices, and high density of services relative to waterline, the system is relatively affordable in comparison to many systems in Washington State. The Washington State Department of Health recommends that water rates not exceed 1.5% of median household income. The average rate charged for the system is projected to be around 1% of the median household income for Mason County.

Table 9-6: End User Average Water Rates

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Annual Rate	$ 581.77	$ 598.36	$ 615.45	$ 633.14	$ 651.59	$ 670.58	$ 690.13	$ 710.24	$ 730.94	$ 752.25
Monthly Rate	$ 48.48	$ 49.86	$ 51.29	$ 52.76	$ 54.30	$ 55.88	$ 57.51	$ 59.19	$ 60.91	$ 62.69

9.5.2 Rates in Support of Water Use Efficiency

The recommended rate structure is a tiered structure with increasing usage fees for each tier of usage. The structure provides for an average use of approximately 200 gallons per day under the base rate. The increasing cost per gallon for tiers above the base amount encourage customers to conserve water and provides additional revenue for the system. If implementation of the proposed water rates causes a significant reduction in water use, and therefore a reduction in revenue from the usage tiers, the base rate may need to be further increased to compensate and ensure financial viability for the system.

Chapter 10 Appendices and Supporting Documents

10.1 Site Plans and Hydraulic Analysis
10.2 Emergency Response Plan and Public Notices
10.3 Well Logs and Pumping Equipment
10.4 Booster Pump Curves
10.5 System Inventory
10.6 Meter Data
10.7 Water Facilities Inventory
10.8 Zoning Maps
10.9 Water Rights
10.10 Wellhead Contamination Susceptibility Assessments
10.11 Water Quality Monitoring Programs
10.12 Cross Connection Control Program
10.13 Articles and Bylaws
10.14 10-Year Budget
10.15 Consumer Confidence Report
10.16 Sanitary Survey
10.17 Consistency Statements
10.18 SEPA
10.19 SMA Contract
10.20 Construction Standards
10.21 WSP Adoption and General Correspondence

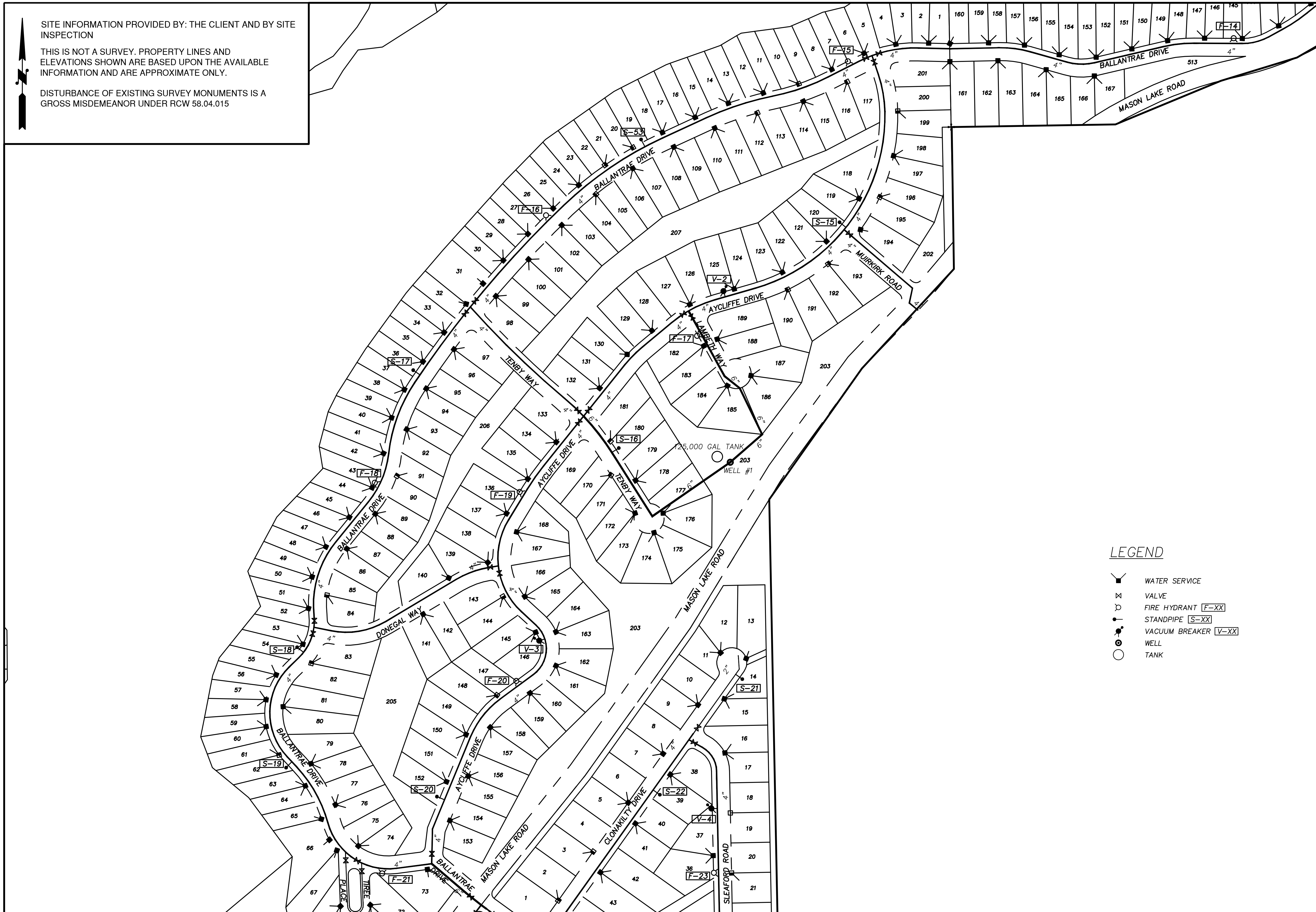
Appendix 10.1
Site Plans and Hydraulic Analysis

Site Plans
Hydraulic Analysis Scenarios

SITE INFORMATION PROVIDED BY: THE CLIENT AND BY SITE INSPECTION

THIS IS NOT A SURVEY. PROPERTY LINES AND ELEVATIONS SHOWN ARE BASED UPON THE AVAILABLE INFORMATION AND ARE APPROXIMATE ONLY.

DISTURBANCE OF EXISTING SURVEY MONUMENTS IS A GROSS MISDEMEANOR UNDER RCW 58.04.015



LEGEND

- WATER SERVICE
- VALVE
- FIRE HYDRANT F-XX
- STANDPIPE S-XX
- VACUUM BREAKER V-XX
- WELL
- TANK

SYSTEM: LAKE LIMERICK

OWNER: LAKE LIMERICK COUNTRY CLUB

FILE NO.: 120805

FILE NAME: SITE PLAN

SHEET NO.: DIV 1

DATE: MARCH 12, 2013

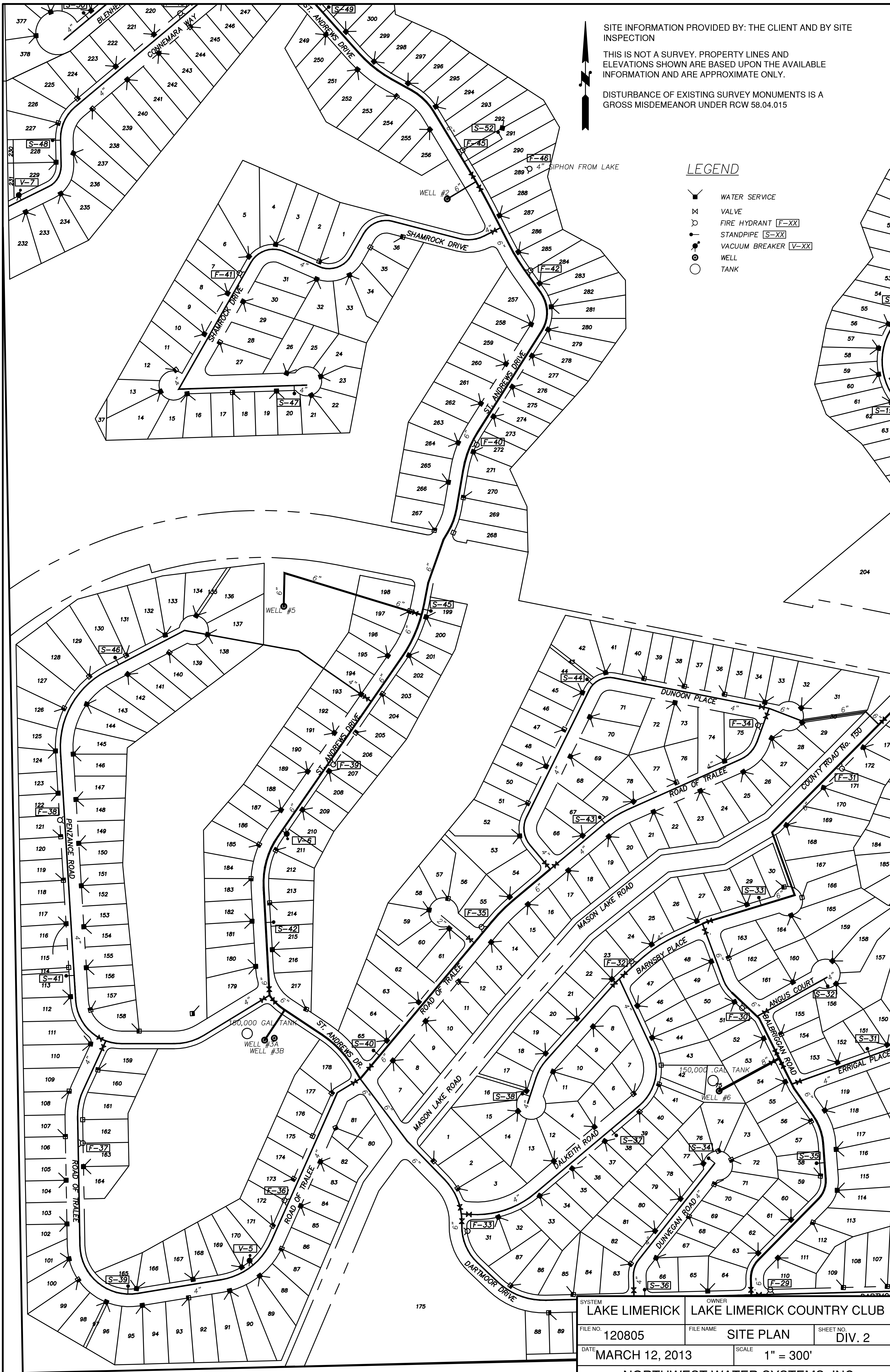
SCALE: 1" = 300'

NORTHWEST WATER SYSTEMS, INC.
DESIGN - CONSULTING - MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958

SITE INFORMATION PROVIDED BY: THE CLIENT AND BY SITE INSPECTION

THIS IS NOT A SURVEY. PROPERTY LINES AND ELEVATIONS SHOWN ARE BASED UPON THE AVAILABLE INFORMATION AND ARE APPROXIMATE ONLY.

DISTURBANCE OF EXISTING SURVEY MONUMENTS IS A GROSS MISDEMEANOR UNDER RCW 58.04.015



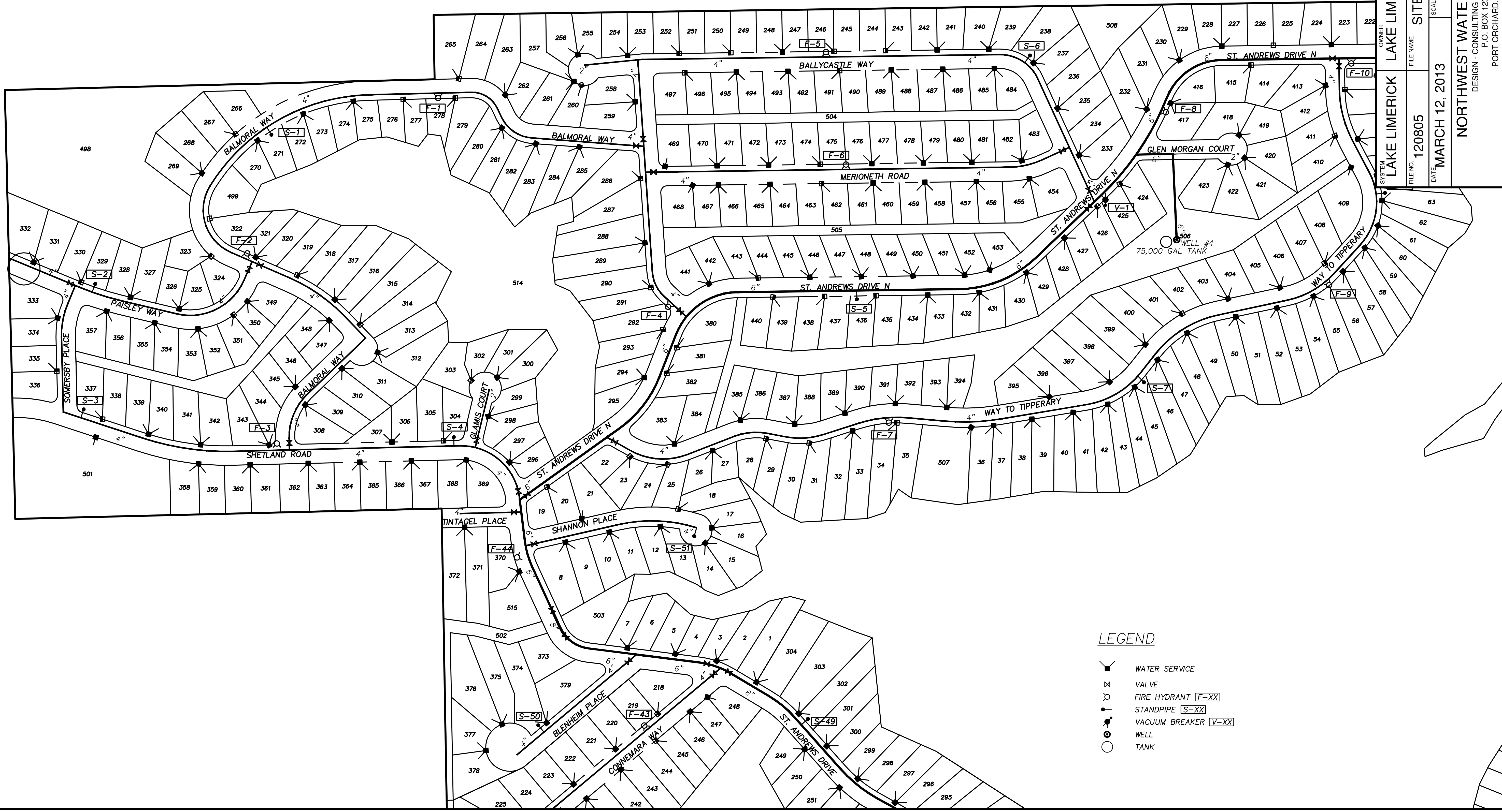
SYSTEM LAKE LIMERICK	OWNER LAKE LIMERICK COUNTRY CLUB		
FILE NO. 120805	FILE NAME SITE PLAN	SHEET NO. DIV. 2	
DATE MARCH 12, 2013	SCALE 1" = 300'		

NORTHWEST WATER SYSTEMS, INC.
DESIGN - CONSULTING - MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958

SITE INFORMATION PROVIDED BY: THE CLIENT AND BY SITE INSPECTION

THIS IS NOT A SURVEY. PROPERTY LINES AND ELEVATIONS SHOWN ARE BASED UPON THE AVAILABLE INFORMATION AND ARE APPROXIMATE ONLY.

DISTURBANCE OF EXISTING SURVEY MONUMENTS IS A GROSS MISDEMEANOR UNDER RCW 58.04.015



OWNER: LAKE LIMERICK COUNTRY CLUB

SYSTEM: LAKE LIMERICK

FILE NAME: SITE PLAN

SHEET NO.: WEST DIV 3

FILE NO.: 120805

SCALE: 1" = 300'

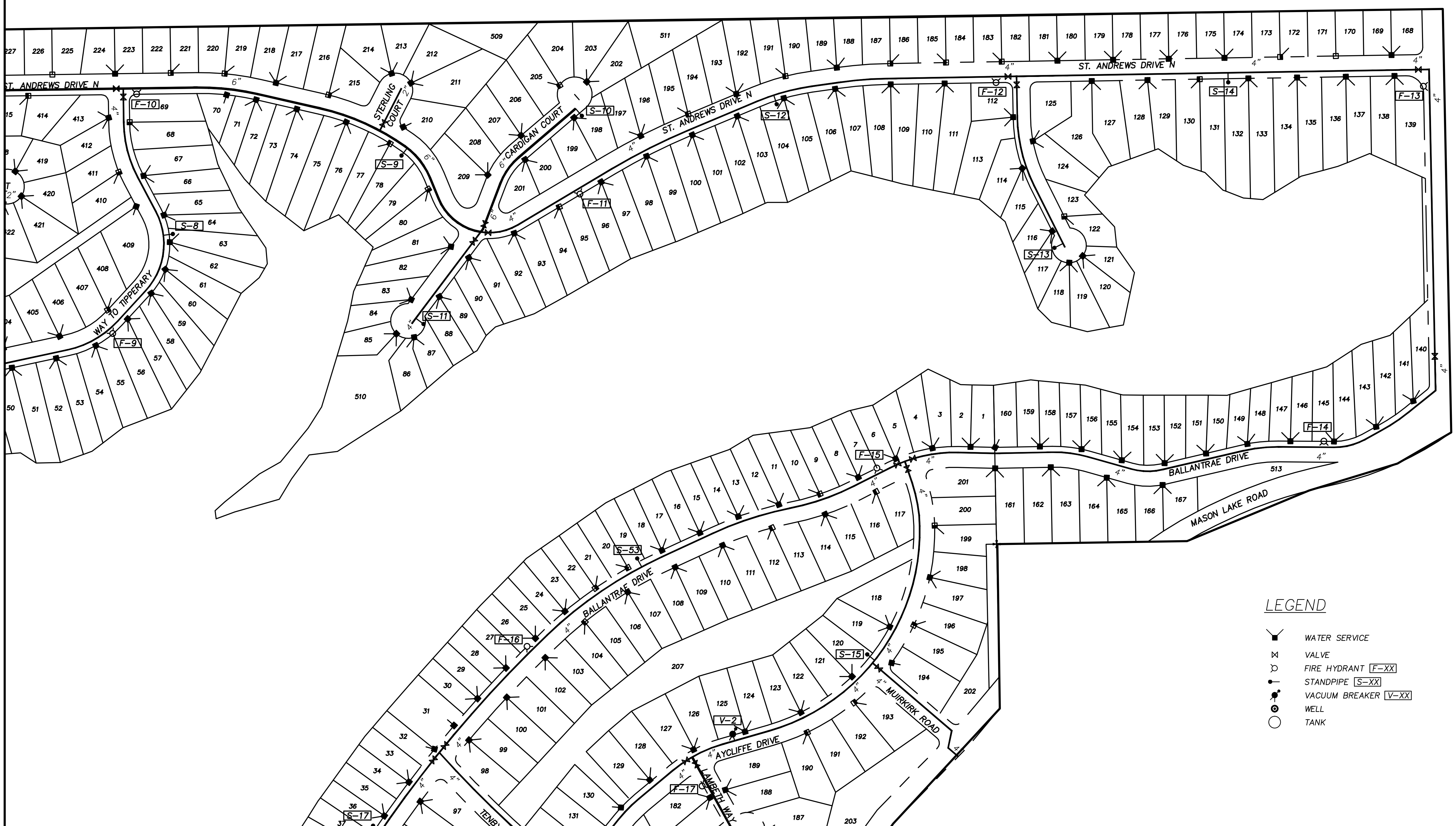
DATE: MARCH 12, 2013

NORTHWEST WATER SYSTEMS, INC.
DESIGN - CONSULTING - MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958

SITE INFORMATION PROVIDED BY: THE CLIENT AND BY SITE INSPECTION

THIS IS NOT A SURVEY. PROPERTY LINES AND ELEVATIONS SHOWN ARE BASED UPON THE AVAILABLE INFORMATION AND ARE APPROXIMATE ONLY.

DISTURBANCE OF EXISTING SURVEY MONUMENTS IS A GROSS MISDEMEANOR UNDER RCW 58.04.015



SYSTEM LAKE LIMERICK

OWNER LAKE LIMERICK COUNTRY CLUB

FILE NO. 120805

FILE NAME SITE PLAN

SHEET NO. EAST DIV 3

DATE MARCH 12, 2013

SCALE 1" = 300'

NORTHWEST WATER SYSTEMS, INC.
DESIGN - CONSULTING - MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958

SITE INFORMATION PROVIDED BY: THE CLIENT AND BY SITE INSPECTION

THIS IS NOT A SURVEY. PROPERTY LINES AND ELEVATIONS SHOWN ARE BASED UPON THE AVAILABLE INFORMATION AND ARE APPROXIMATE ONLY.

DISTURBANCE OF EXISTING SURVEY MONUMENTS IS A GROSS MISDEMEANOR UNDER RCW 58.04.015

LEGEND

- WATER SERVICE
- VALVE
- FIRE HYDRANT F–XX
- STANDPIPE S–XX
- VACUUM BREAKER V–XX
- WELL
- TANK

OWNER LAKE LIMERICK COUNTRY CLUB

FILE NAME SITE PLAN

SHEET NO. DIV 4

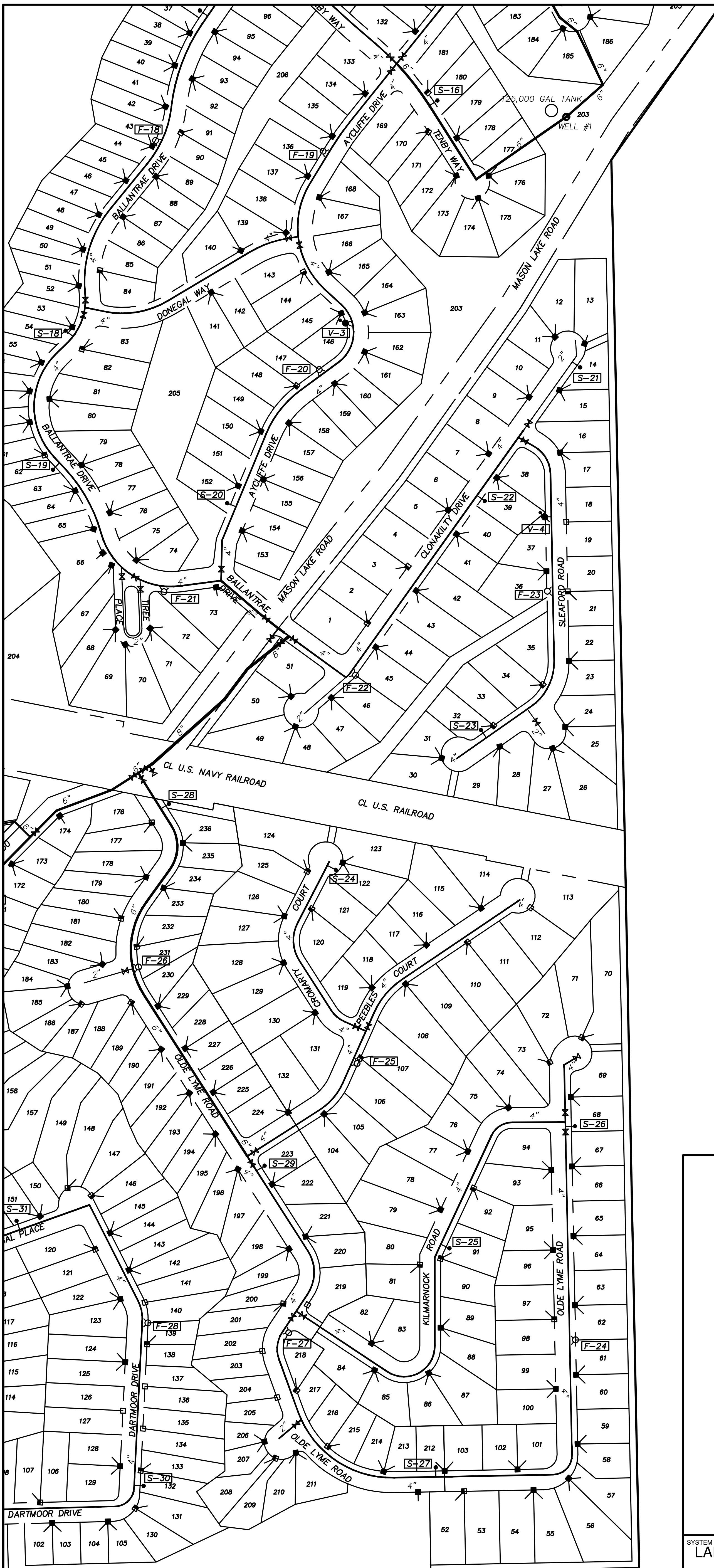
SCALE 1" = 300'

SYSTEM LAKE LIMERICK

FILE NO. 120805

DATE MARCH 12, 2013

NORTHWEST WATER SYSTEMS, INC.
DESIGN - CONSULTING - MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958



SITE INFORMATION PROVIDED BY: THE CLIENT AND BY SITE INSPECTION

THIS IS NOT A SURVEY. PROPERTY LINES AND ELEVATIONS SHOWN ARE BASED UPON THE AVAILABLE INFORMATION AND ARE APPROXIMATE ONLY.

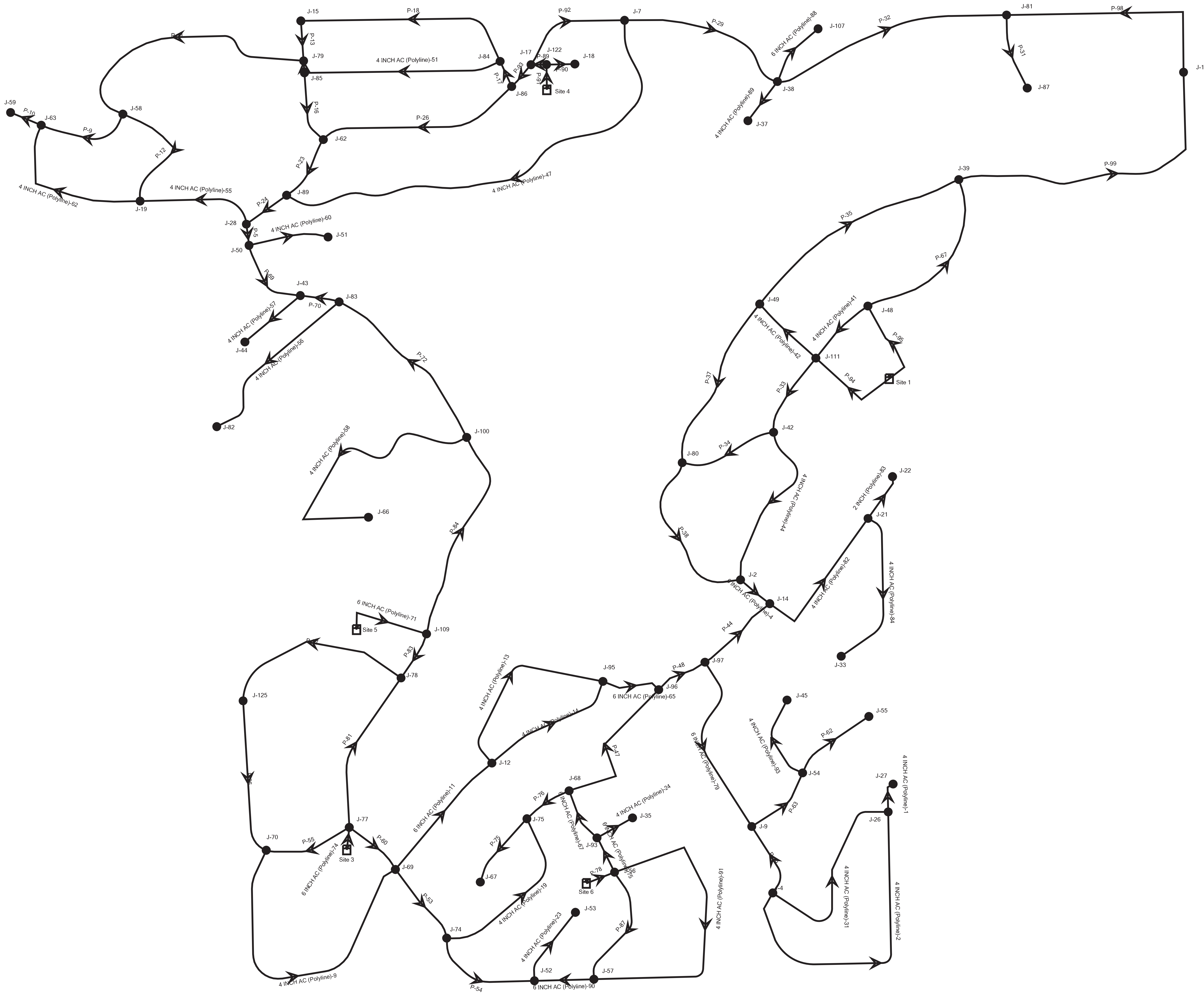
DISTURBANCE OF EXISTING SURVEY MONUMENTS IS A GROSS MISDEMEANOR UNDER RCW 58.04.015

LEGEND

- WATER SERVICE
- VALVE
- FIRE HYDRANT F–XX
- STANDPIPE S–XX
- VACUUM BREAKER V–XX
- WELL
- TANK

SYSTEM: LAKE LIMERICK	OWNER: LAKE LIMERICK COUNTRY CLUB
FILE NO. 120805	FILE NAME: SITE PLAN — SHEET NO. DIV. 5
DATE: MARCH 12, 2013	SCALE: 1" = 300'

NORTHWEST WATER SYSTEMS, INC.
DESIGN - CONSULTING - MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958


J-15
P-18
P-13
J-79
J-85
4 INCH AC (Polyline)-51
J-84
P-16
P-26
J-62
P-23
J-89
4 INCH AC (Polyline)-47
J-17
J-122
P-89
J-18
P-90
P-91
P-17
J-86
Site 4
P-92
J-7
P-29
6 INCH AC (Polyline)-88
J-107
J-38
4 INCH AC (Polyline)-89
J-37
P-32
J-81
P-98
P-31
J-87
J-126
P-99
J-39
J-59
P-10
J-63
P-9
J-58
P-12
4 INCH AC (Polyline)-62
J-19
4 INCH AC (Polyline)-55
P-24
J-28
P-5
J-50
4 INCH AC (Polyline)-60
J-51
P-69
J-43
P-70
J-83
4 INCH AC (Polyline)-57
J-44
4 INCH AC (Polyline)-56
J-82
P-72
J-100
4 INCH AC (Polyline)-58
J-66
P-84
6 INCH AC (Polyline)-71
Site 5
J-109
P-83
J-78
J-125
P-81
J-77
Site 3
P-55
J-70
6 INCH AC (Polyline)-74
P-60
J-69
4 INCH AC (Polyline)-9
P-53
J-74
P-54
6 INCH AC (Polyline)-90
J-52
J-57
4 INCH AC (Polyline)-23
J-53
P-87
4 INCH AC (Polyline)-91
6 INCH AC (Polyline)-11
J-12
4 INCH AC (Polyline)-13
4 INCH AC (Polyline)-14
J-95
J-96
6 INCH AC (Polyline)-65
P-48
J-97
P-47
J-68
P-76
J-75
P-75
J-67
4 INCH AC (Polyline)-19
6 INCH AC (Polyline)-67
J-93
4 INCH AC (Polyline)-24
J-35
P-78
Site 6
J-56
P-35
P-67
J-49
J-48
4 INCH AC (Polyline)-41
4 INCH AC (Polyline)-42
J-111
P-95
P-94
Site 1
P-37
P-33
J-42
P-34
J-80
4 INCH AC (Polyline)-4
P-38
J-2
J-14
P-44
2 INCH (Polyline)-83
J-22
J-21
4 INCH AC (Polyline)-82
4 INCH AC (Polyline)-84
J-33
6 INCH AC (Polyline)-79
J-45
4 INCH AC (Polyline)-93
J-55
P-62
J-54
P-63
J-9
J-27
4 INCH AC (Polyline)-1
J-26
4 INCH AC (Polyline)-31
4 INCH AC (Polyline)-2

STATIC CONDITION: NO FLOW, MAXIMUM PUMP SETTING

FlexTable: Junction Table (Hydro.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
151	J-77	295.00	0	444.00	64.5
45	J-12	290.00	0	444.00	66.6
136	J-69	285.00	0	444.00	68.8
137	J-70	285.00	0	444.00	68.8
161	J-82	285.00	0	444.00	68.8
167	J-86	285.00	0	444.00	68.8
53	J-17	280.00	0	444.00	71.0
54	J-18	280.00	0	444.00	71.0
164	J-84	280.00	0	444.00	71.0
331	J-122	280.00	0	444.00	71.0
365	J-125	278.34	0	444.00	71.7
95	J-44	275.00	0	444.00	73.1
101	J-48	275.00	0	444.00	73.1
56	J-19	270.00	0	444.00	75.3
67	J-26	270.00	0	444.00	75.3
68	J-27	270.00	0	444.00	75.3
81	J-35	270.00	0	444.00	75.3
152	J-78	270.00	0	444.00	75.3
162	J-83	270.00	0	444.00	75.3
217	J-111	270.00	0	444.00	75.3
60	J-22	265.00	0	444.00	77.4
119	J-59	265.00	0	444.00	77.4
127	J-63	265.00	0	444.00	77.4
133	J-67	265.00	0	444.00	77.4
146	J-74	265.00	0	444.00	77.4
147	J-75	265.00	0	444.00	77.4
59	J-21	260.00	0	444.00	79.6
70	J-28	260.00	0	444.00	79.6
108	J-52	260.00	0	444.00	79.6
109	J-53	260.00	0	444.00	79.6
115	J-56	260.00	0	444.00	79.6
116	J-57	260.00	0	444.00	79.6
118	J-58	260.00	0	444.00	79.6
125	J-62	260.00	0	444.00	79.6
184	J-95	260.00	0	444.00	79.6
50	J-15	255.00	0	444.00	81.8
78	J-33	255.00	0	444.00	81.8
92	J-42	255.00	0	444.00	81.8
94	J-43	255.00	0	444.00	81.8
131	J-66	255.00	0	444.00	81.8
181	J-93	255.00	0	444.00	81.8
97	J-45	250.00	0	444.00	83.9
105	J-50	250.00	0	444.00	83.9
112	J-54	250.00	0	444.00	83.9
113	J-55	250.00	0	444.00	83.9
134	J-68	250.00	0	444.00	83.9
154	J-79	250.00	0	444.00	83.9

FlexTable: Junction Table (Hydro.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
165	J-85	250.00	0	444.00	83.9
172	J-89	250.00	0	444.00	83.9
213	J-109	250.00	0	444.00	83.9
30	J-2	245.00	0	444.00	86.1
38	J-7	245.00	0	444.00	86.1
210	J-107	245.00	0	444.00	86.1
396	J-131	244.30	0	444.00	86.4
48	J-14	240.00	0	444.00	88.3
86	J-38	240.00	0	444.00	88.3
88	J-39	240.00	0	444.00	88.3
103	J-49	240.00	0	444.00	88.3
159	J-81	240.00	0	444.00	88.3
368	J-126	240.00	0	444.00	88.3
85	J-37	235.00	0	444.00	90.4
106	J-51	235.00	0	444.00	90.4
156	J-80	235.00	0	444.00	90.4
192	J-100	235.00	0	444.00	90.4
169	J-87	230.00	0	444.00	92.6
185	J-96	220.00	0	444.00	96.9
33	J-4	215.00	0	444.00	99.1
188	J-97	215.00	0	444.00	99.1
41	J-9	210.00	0	444.00	101.2

NODE REPORT FOR PHD IN 2012 OF 844 GPM
(PHD CALCULATED IN 2020 IS 604 GPM)

FlexTable: Junction Table (Hydro.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
151	J-77	295.00	13.83	427.79	57.5
45	J-12	290.00	13.83	427.01	59.3
161	J-82	285.00	13.83	426.76	61.3
167	J-86	285.00	13.83	426.97	61.4
136	J-69	285.00	13.83	427.47	61.6
137	J-70	285.00	13.83	427.57	61.7
54	J-18	280.00	13.83	426.64	63.4
164	J-84	280.00	13.83	426.70	63.5
53	J-17	280.00	0.00	427.17	63.7
331	J-122	280.00	0.00	427.46	63.8
365	J-125	278.34	13.83	427.57	64.6
95	J-44	275.00	13.83	426.76	65.7
101	J-48	275.00	13.83	427.74	66.1
68	J-27	270.00	13.83	423.71	66.5
67	J-26	270.00	13.83	423.74	66.5
56	J-19	270.00	13.83	426.15	67.6
162	J-83	270.00	13.83	426.97	67.9
81	J-35	270.00	13.83	427.37	68.1
217	J-111	270.00	13.83	427.55	68.2
152	J-78	270.00	13.83	427.79	68.3
60	J-22	265.00	13.83	422.97	68.3
119	J-59	265.00	13.83	426.05	69.7
127	J-63	265.00	0.00	426.09	69.7
133	J-67	265.00	13.83	426.91	70.1
147	J-75	265.00	13.83	427.00	70.1
146	J-74	265.00	13.83	427.46	70.3
59	J-21	260.00	13.83	424.42	71.1
118	J-58	260.00	13.83	426.11	71.9
184	J-95	260.00	13.83	426.30	72.0
70	J-28	260.00	0.00	426.66	72.1
125	J-62	260.00	13.83	426.66	72.1
109	J-53	260.00	13.83	427.41	72.4
108	J-52	260.00	13.83	427.50	72.5
116	J-57	260.00	13.83	427.60	72.5
115	J-56	260.00	13.83	427.84	72.6
78	J-33	255.00	13.83	424.23	73.2
50	J-15	255.00	13.83	426.39	74.2
92	J-42	255.00	13.83	426.40	74.2
94	J-43	255.00	0.00	426.85	74.3
181	J-93	255.00	13.83	427.41	74.6
131	J-66	255.00	13.83	427.47	74.6
97	J-45	250.00	13.83	423.93	75.2
113	J-55	250.00	13.83	423.93	75.2
112	J-54	250.00	13.83	424.03	75.3
154	J-79	250.00	13.83	426.39	76.3
165	J-85	250.00	13.83	426.43	76.3
172	J-89	250.00	13.83	426.66	76.4

FlexTable: Junction Table (Hydro.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
105	J-50	250.00	13.83	426.67	76.4
134	J-68	250.00	13.83	427.01	76.6
213	J-109	250.00	13.83	427.82	76.9
30	J-2	245.00	13.83	425.80	78.2
210	J-107	245.00	13.83	426.28	78.4
38	J-7	245.00	13.83	426.71	78.6
396	J-131	244.30	0.00	427.80	79.4
48	J-14	240.00	0.00	425.77	80.4
159	J-81	240.00	13.83	425.81	80.4
368	J-126	240.00	13.83	425.92	80.4
86	J-38	240.00	13.83	426.29	80.6
88	J-39	240.00	13.83	426.80	80.8
103	J-49	240.00	13.83	426.85	80.8
85	J-37	235.00	13.83	426.24	82.7
156	J-80	235.00	13.83	426.30	82.8
106	J-51	235.00	13.83	426.58	82.9
192	J-100	235.00	13.83	427.79	83.4
169	J-87	230.00	13.83	425.72	84.7
185	J-96	220.00	13.83	426.23	89.2
33	J-4	215.00	13.83	424.03	90.4
188	J-97	215.00	13.83	425.77	91.2
41	J-9	210.00	13.83	424.69	92.9

FlexTable: Pipe Table (Hydro.wtg)
PIPE REPORT FOR PHD IN 2012 OF 844 GPM
Current Time: 0.000 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
P-86	170	Site 4	J-122	6.0	Asbestos Cement	140.0	197.06	2.24
P-14	105	J-17	J-122	6.0	Asbestos Cement	140.0	-183.23	2.08
P-36	259	J-56	J-93	6.0	Asbestos Cement	140.0	136.72	1.55
P-84	152	Site 3	J-77	6.0	Asbestos Cement	140.0	124.85	1.42
P-15	335	J-21	J-22	2.0	PVC	150.0	13.83	1.41
P-83	190	J-122	J-18	2.0	PVC	150.0	13.83	1.41
P-37	204	J-56	Site 6	8.0	PVC	150.0	-214.17	1.37
P-74	368	J-96	J-97	6.0	Asbestos Cement	140.0	117.98	1.34
P-80	586	J-111	J-42	4.0	Asbestos Cement	140.0	52.08	1.33
P-111	153	Site 2	J-131	6.0	Ductile Iron	130.0	113.07	1.28
P-46	376	J-68	J-93	6.0	Asbestos Cement	140.0	-109.06	1.24
P-13	196	J-17	J-86	6.0	Asbestos Cement	140.0	105.00	1.19
P-68	186	J-86	J-84	4.0	Asbestos Cement	140.0	44.43	1.13
P-110	938	J-131	J-83	6.0	Asbestos Cement	140.0	98.37	1.12
P-75	1,265	J-97	J-9	6.0	Asbestos Cement	140.0	96.81	1.10
P-30	524	J-49	J-111	4.0	Asbestos Cement	140.0	-42.40	1.08
P-11	1,053	J-14	J-21	4.0	Asbestos Cement	140.0	41.49	1.06
P-6	514	J-9	J-4	4.0	Asbestos Cement	140.0	41.49	1.06
P-7	515	J-9	J-54	4.0	Asbestos Cement	140.0	41.49	1.06
P-54	424	J-77	J-69	6.0	Asbestos Cement	140.0	90.44	1.03
P-47	1,074	J-68	J-96	6.0	Asbestos Cement	140.0	89.04	1.01
P-82	648	Site 1	J-111	6.0	Asbestos Cement	140.0	86.78	0.98
P-4	783	J-7	J-17	6.0	Asbestos Cement	140.0	-78.23	0.89
P-28	1,210	J-48	J-39	4.0	Asbestos Cement	140.0	31.48	0.80
P-26	265	J-43	J-83	6.0	Asbestos Cement	140.0	-70.71	0.80
P-8	967	J-12	J-69	6.0	Asbestos Cement	140.0	-70.43	0.80
P-9	961	J-12	J-95	4.0	Asbestos Cement	140.0	30.79	0.79
P-87	610	Site 1	J-48	6.0	Asbestos Cement	140.0	66.84	0.76
P-17	804	J-28	J-19	4.0	Asbestos Cement	140.0	28.30	0.72
P-21	1,183	J-38	J-7	6.0	Asbestos Cement	140.0	-60.32	0.68
P-72	1,332	J-95	J-12	4.0	Asbestos Cement	140.0	-25.81	0.66

FlexTable: Pipe Table (Hydro.wtg)

Current Time: 0.000 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
P-59	81	J-79	J-85	4.0	Asbestos Cement	140.0	-25.48	0.65
P-31	540	J-50	J-43	6.0	Asbestos Cement	140.0	-56.88	0.65
P-1	1,174	J-2	J-42	4.0	Asbestos Cement	140.0	-25.16	0.64
P-85	603	Site 5	J-109	6.0	Asbestos Cement	140.0	54.69	0.62
P-66	490	J-85	J-62	4.0	Asbestos Cement	140.0	-24.08	0.61
P-29	1,216	J-49	J-80	4.0	Asbestos Cement	140.0	23.56	0.60
P-39	846	J-57	J-56	6.0	Asbestos Cement	140.0	-52.58	0.60
P-60	1,168	J-80	J-2	4.0	Asbestos Cement	140.0	22.82	0.58
P-89	2,108	J-126	J-39	4.0	Asbestos Cement	140.0	-22.66	0.58
P-38	400	J-57	J-52	6.0	Asbestos Cement	140.0	49.80	0.57
P-81	499	J-111	J-48	4.0	Asbestos Cement	140.0	-21.53	0.55
P-52	1,209	J-74	J-75	4.0	Asbestos Cement	140.0	21.48	0.55
P-55	601	J-77	J-70	4.0	Asbestos Cement	140.0	20.92	0.53
P-67	1,383	J-86	J-62	6.0	Asbestos Cement	140.0	46.74	0.53
P-73	403	J-95	J-96	6.0	Asbestos Cement	140.0	42.77	0.49
P-61	1,639	J-81	J-38	4.0	Asbestos Cement	140.0	-18.83	0.48
P-3	1,375	J-4	J-26	4.0	Asbestos Cement	140.0	15.54	0.40
P-64	1,505	J-84	J-15	4.0	Asbestos Cement	140.0	15.37	0.39
P-65	1,326	J-84	J-85	4.0	Asbestos Cement	140.0	15.23	0.39
P-10	254	J-14	J-2	6.0	Asbestos Cement	140.0	-34.15	0.39
P-16	208	J-26	J-27	4.0	Asbestos Cement	140.0	13.83	0.35
P-71	274	J-93	J-35	4.0	Asbestos Cement	140.0	13.83	0.35
P-20	330	J-37	J-38	4.0	Asbestos Cement	140.0	-13.83	0.35
P-25	486	J-43	J-44	4.0	Asbestos Cement	140.0	13.83	0.35
P-27	602	J-45	J-54	4.0	Asbestos Cement	140.0	-13.83	0.35
P-32	540	J-50	J-51	4.0	Asbestos Cement	140.0	13.83	0.35
P-33	554	J-52	J-53	4.0	Asbestos Cement	140.0	13.83	0.35
P-19	1,104	J-33	J-21	4.0	Asbestos Cement	140.0	-13.83	0.35
P-77	1,909	J-100	J-66	4.0	Asbestos Cement	140.0	13.83	0.35
P-63	1,231	J-82	J-83	4.0	Asbestos Cement	140.0	-13.83	0.35

FlexTable: Pipe Table (Hydro.wtg)

Current Time: 0.000 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
P-44	223	J-63	J-59	4.0	Asbestos Cement	140.0	13.83	0.35
P-69	519	J-87	J-81	4.0	Asbestos Cement	140.0	-13.83	0.35
P-34	596	J-54	J-55	4.0	Asbestos Cement	140.0	13.83	0.35
P-45	536	J-67	J-75	4.0	Asbestos Cement	140.0	-13.83	0.35
P-88	1,314	J-125	J-78	4.0	Asbestos Cement	140.0	-13.72	0.35
P-58	1,823	J-79	J-58	4.0	Asbestos Cement	140.0	13.19	0.34
P-24	668	J-42	J-80	4.0	Asbestos Cement	140.0	13.09	0.33
P-18	144	J-28	J-50	6.0	Asbestos Cement	140.0	-29.22	0.33
P-57	343	J-78	J-109	6.0	Asbestos Cement	140.0	-27.89	0.32
P-2	2,179	J-4	J-26	4.0	Asbestos Cement	140.0	12.12	0.31
P-35	2,112	J-56	J-57	4.0	Asbestos Cement	140.0	11.05	0.28
P-51	757	J-74	J-52	6.0	Asbestos Cement	140.0	-22.14	0.25
P-62	1,589	J-81	J-126	4.0	Asbestos Cement	140.0	-8.83	0.23
P-43	1,118	J-63	J-19	4.0	Asbestos Cement	140.0	-7.68	0.20
P-48	2,166	J-69	J-70	4.0	Asbestos Cement	140.0	-6.98	0.18
P-40	869	J-58	J-19	4.0	Asbestos Cement	140.0	-6.79	0.17
P-109	340	J-100	J-131	6.0	Asbestos Cement	140.0	-14.70	0.17
P-53	343	J-75	J-68	4.0	Asbestos Cement	140.0	-6.18	0.16
P-41	643	J-58	J-63	4.0	Asbestos Cement	140.0	6.15	0.16
P-22	459	J-38	J-107	6.0	Asbestos Cement	140.0	13.83	0.16
P-49	582	J-69	J-74	6.0	Asbestos Cement	140.0	13.17	0.15
P-79	1,464	J-109	J-100	6.0	Asbestos Cement	140.0	12.96	0.15
P-23	1,611	J-39	J-49	4.0	Asbestos Cement	140.0	-5.01	0.13
P-5	3,160	J-7	J-89	4.0	Asbestos Cement	140.0	4.08	0.10
P-42	458	J-62	J-89	6.0	Asbestos Cement	140.0	8.83	0.10
P-76	589	J-97	J-14	8.0	PVC	140.0	7.34	0.05
P-12	269	J-15	J-79	4.0	Asbestos Cement	140.0	1.54	0.04
P-70	333	J-89	J-28	6.0	Asbestos Cement	140.0	-0.92	0.01
P-56	1,114	J-77	J-78	6.0	Asbestos Cement	140.0	-0.34	0.00
P-50	1,050	J-70	J-125	4.0	Asbestos Cement	140.0	0.11	0.00

NODE REPORT: 2012 PROJECTION FOR MAX BUILD OUT PHD OF 1,143 GPM (2020 PROJECTION FOR MAX BUILD OUT PHD IS 802 GPM)

FlexTable: Junction Table (Hydro.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
151	J-77	295.00	18.74	427.63	57.4
45	J-12	290.00	18.74	426.27	59.0
161	J-82	285.00	18.74	425.83	60.9
167	J-86	285.00	18.74	426.19	61.1
136	J-69	285.00	18.74	427.07	61.5
137	J-70	285.00	18.74	427.25	61.5
54	J-18	280.00	18.74	425.61	63.0
164	J-84	280.00	18.74	425.72	63.0
53	J-17	280.00	0.00	426.54	63.4
331	J-122	280.00	0.00	427.05	63.6
365	J-125	278.34	18.74	427.25	64.4
68	J-27	270.00	18.74	420.46	65.1
67	J-26	270.00	18.74	420.52	65.1
95	J-44	275.00	18.74	425.83	65.3
101	J-48	275.00	18.74	427.54	66.0
60	J-22	265.00	18.74	419.17	66.7
56	J-19	270.00	18.74	424.75	67.0
162	J-83	270.00	18.74	426.20	67.6
81	J-35	270.00	18.74	426.89	67.9
217	J-111	270.00	18.74	427.20	68.0
152	J-78	270.00	18.74	427.63	68.2
119	J-59	265.00	18.74	424.58	69.0
127	J-63	265.00	0.00	424.64	69.1
133	J-67	265.00	18.74	426.09	69.7
147	J-75	265.00	18.74	426.25	69.8
59	J-21	260.00	18.74	421.71	70.0
146	J-74	265.00	18.74	427.05	70.1
118	J-58	260.00	18.74	424.69	71.3
184	J-95	260.00	18.74	425.02	71.4
70	J-28	260.00	0.00	425.65	71.7
125	J-62	260.00	18.74	425.65	71.7
78	J-33	255.00	18.74	421.39	72.0
109	J-53	260.00	18.74	426.96	72.2
108	J-52	260.00	18.74	427.12	72.3
116	J-57	260.00	18.74	427.30	72.4
115	J-56	260.00	18.74	427.71	72.6
50	J-15	255.00	18.74	425.18	73.6
92	J-42	255.00	18.74	425.19	73.6
97	J-45	250.00	18.74	420.85	73.9
113	J-55	250.00	18.74	420.85	73.9
94	J-43	255.00	0.00	425.97	74.0
112	J-54	250.00	18.74	421.03	74.0
181	J-93	255.00	18.74	426.97	74.4
131	J-66	255.00	18.74	427.07	74.4
154	J-79	250.00	18.74	425.18	75.8
165	J-85	250.00	18.74	425.25	75.8
172	J-89	250.00	18.74	425.65	76.0

FlexTable: Junction Table (Hydro.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
105	J-50	250.00	18.74	425.67	76.0
134	J-68	250.00	18.74	426.27	76.3
213	J-109	250.00	18.74	427.69	76.9
30	J-2	245.00	18.74	424.14	77.5
210	J-107	245.00	18.74	424.98	77.9
38	J-7	245.00	18.74	425.74	78.2
396	J-131	244.30	0.00	427.65	79.3
48	J-14	240.00	0.00	424.09	79.6
159	J-81	240.00	18.74	424.15	79.7
368	J-126	240.00	18.74	424.35	79.8
86	J-38	240.00	18.74	425.00	80.0
88	J-39	240.00	18.74	425.90	80.4
103	J-49	240.00	18.74	425.97	80.5
85	J-37	235.00	18.74	424.91	82.2
156	J-80	235.00	18.74	425.01	82.2
106	J-51	235.00	18.74	425.51	82.4
192	J-100	235.00	18.74	427.63	83.3
169	J-87	230.00	18.74	423.99	83.9
185	J-96	220.00	18.74	424.89	88.6
33	J-4	215.00	18.74	421.03	89.1
188	J-97	215.00	18.74	424.09	90.5
41	J-9	210.00	18.74	422.19	91.8

FlexTable: Pipe Table (Hydro.wtg)
PIPE REPORT: 2012 PROJECTION OF MAX BUILD OUT PHD (1,143 GPM)
Current Time: 0.000 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
P-86	170	Site 4	J-122	6.0	Asbestos Cement	140.0	267.02	3.03
P-14	105	J-17	J-122	6.0	Asbestos Cement	140.0	-248.28	2.82
P-36	259	J-56	J-93	6.0	Asbestos Cement	140.0	185.25	2.10
P-84	152	Site 3	J-77	6.0	Asbestos Cement	140.0	169.18	1.92
P-15	335	J-21	J-22	2.0	PVC	150.0	18.74	1.91
P-83	190	J-122	J-18	2.0	PVC	150.0	18.74	1.91
P-37	204	J-56	Site 6	8.0	PVC	150.0	-290.21	1.85
P-74	368	J-96	J-97	6.0	Asbestos Cement	140.0	159.86	1.81
P-80	586	J-111	J-42	4.0	Asbestos Cement	140.0	70.57	1.80
P-111	153	Site 2	J-131	6.0	Ductile Iron	130.0	153.21	1.74
P-46	376	J-68	J-93	6.0	Asbestos Cement	140.0	-147.77	1.68
P-13	196	J-17	J-86	6.0	Asbestos Cement	140.0	142.28	1.61
P-68	186	J-86	J-84	4.0	Asbestos Cement	140.0	60.20	1.54
P-110	938	J-131	J-83	6.0	Asbestos Cement	140.0	133.29	1.51
P-75	1,265	J-97	J-9	6.0	Asbestos Cement	140.0	131.18	1.49
P-30	524	J-49	J-111	4.0	Asbestos Cement	140.0	-57.46	1.47
P-11	1,053	J-14	J-21	4.0	Asbestos Cement	140.0	56.22	1.44
P-6	514	J-9	J-4	4.0	Asbestos Cement	140.0	56.22	1.44
P-7	515	J-9	J-54	4.0	Asbestos Cement	140.0	56.22	1.44
P-54	424	J-77	J-69	6.0	Asbestos Cement	140.0	122.55	1.39
P-47	1,074	J-68	J-96	6.0	Asbestos Cement	140.0	120.65	1.37
P-82	648	Site 1	J-111	6.0	Asbestos Cement	140.0	117.58	1.33
P-4	783	J-7	J-17	6.0	Asbestos Cement	140.0	-106.01	1.20
P-28	1,210	J-48	J-39	4.0	Asbestos Cement	140.0	42.66	1.09
P-26	265	J-43	J-83	6.0	Asbestos Cement	140.0	-95.81	1.09
P-8	967	J-12	J-69	6.0	Asbestos Cement	140.0	-95.43	1.08
P-9	961	J-12	J-95	4.0	Asbestos Cement	140.0	41.72	1.07
P-87	610	Site 1	J-48	6.0	Asbestos Cement	140.0	90.58	1.03
P-17	804	J-28	J-19	4.0	Asbestos Cement	140.0	38.35	0.98
P-21	1,183	J-38	J-7	6.0	Asbestos Cement	140.0	-81.74	0.93
P-72	1,332	J-95	J-12	4.0	Asbestos Cement	140.0	-34.97	0.89

FlexTable: Pipe Table (Hydro.wtg)

Current Time: 0.000 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
P-59	81	J-79	J-85	4.0	Asbestos Cement	140.0	-34.52	0.88
P-31	540	J-50	J-43	6.0	Asbestos Cement	140.0	-77.07	0.87
P-1	1,174	J-2	J-42	4.0	Asbestos Cement	140.0	-34.09	0.87
P-85	603	Site 5	J-109	6.0	Asbestos Cement	140.0	74.10	0.84
P-66	490	J-85	J-62	4.0	Asbestos Cement	140.0	-32.63	0.83
P-29	1,216	J-49	J-80	4.0	Asbestos Cement	140.0	31.93	0.82
P-39	846	J-57	J-56	6.0	Asbestos Cement	140.0	-71.25	0.81
P-60	1,168	J-80	J-2	4.0	Asbestos Cement	140.0	30.93	0.79
P-89	2,108	J-126	J-39	4.0	Asbestos Cement	140.0	-30.70	0.78
P-38	400	J-57	J-52	6.0	Asbestos Cement	140.0	67.48	0.77
P-81	499	J-111	J-48	4.0	Asbestos Cement	140.0	-29.18	0.74
P-52	1,209	J-74	J-75	4.0	Asbestos Cement	140.0	29.10	0.74
P-55	601	J-77	J-70	4.0	Asbestos Cement	140.0	28.35	0.72
P-67	1,383	J-86	J-62	6.0	Asbestos Cement	140.0	63.33	0.72
P-73	403	J-95	J-96	6.0	Asbestos Cement	140.0	57.95	0.66
P-61	1,639	J-81	J-38	4.0	Asbestos Cement	140.0	-25.52	0.65
P-3	1,375	J-4	J-26	4.0	Asbestos Cement	140.0	21.06	0.54
P-64	1,505	J-84	J-15	4.0	Asbestos Cement	140.0	20.83	0.53
P-65	1,326	J-84	J-85	4.0	Asbestos Cement	140.0	20.63	0.53
P-10	254	J-14	J-2	6.0	Asbestos Cement	140.0	-46.28	0.53
P-16	208	J-26	J-27	4.0	Asbestos Cement	140.0	18.74	0.48
P-71	274	J-93	J-35	4.0	Asbestos Cement	140.0	18.74	0.48
P-20	330	J-37	J-38	4.0	Asbestos Cement	140.0	-18.74	0.48
P-25	486	J-43	J-44	4.0	Asbestos Cement	140.0	18.74	0.48
P-27	602	J-45	J-54	4.0	Asbestos Cement	140.0	-18.74	0.48
P-32	540	J-50	J-51	4.0	Asbestos Cement	140.0	18.74	0.48
P-33	554	J-52	J-53	4.0	Asbestos Cement	140.0	18.74	0.48
P-19	1,104	J-33	J-21	4.0	Asbestos Cement	140.0	-18.74	0.48
P-77	1,909	J-100	J-66	4.0	Asbestos Cement	140.0	18.74	0.48
P-63	1,231	J-82	J-83	4.0	Asbestos Cement	140.0	-18.74	0.48

FlexTable: Pipe Table (Hydro.wtg)

Current Time: 0.000 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
P-44	223	J-63	J-59	4.0	Asbestos Cement	140.0	18.74	0.48
P-69	519	J-87	J-81	4.0	Asbestos Cement	140.0	-18.74	0.48
P-34	596	J-54	J-55	4.0	Asbestos Cement	140.0	18.74	0.48
P-45	536	J-67	J-75	4.0	Asbestos Cement	140.0	-18.74	0.48
P-88	1,314	J-125	J-78	4.0	Asbestos Cement	140.0	-18.59	0.47
P-58	1,823	J-79	J-58	4.0	Asbestos Cement	140.0	17.87	0.46
P-24	668	J-42	J-80	4.0	Asbestos Cement	140.0	17.74	0.45
P-18	144	J-28	J-50	6.0	Asbestos Cement	140.0	-39.59	0.45
P-57	343	J-78	J-109	6.0	Asbestos Cement	140.0	-37.80	0.43
P-2	2,179	J-4	J-26	4.0	Asbestos Cement	140.0	16.42	0.42
P-35	2,112	J-56	J-57	4.0	Asbestos Cement	140.0	14.97	0.38
P-51	757	J-74	J-52	6.0	Asbestos Cement	140.0	-30.00	0.34
P-62	1,589	J-81	J-126	4.0	Asbestos Cement	140.0	-11.96	0.31
P-43	1,118	J-63	J-19	4.0	Asbestos Cement	140.0	-10.41	0.27
P-48	2,166	J-69	J-70	4.0	Asbestos Cement	140.0	-9.46	0.24
P-40	869	J-58	J-19	4.0	Asbestos Cement	140.0	-9.20	0.23
P-109	340	J-100	J-131	6.0	Asbestos Cement	140.0	-19.91	0.23
P-53	343	J-75	J-68	4.0	Asbestos Cement	140.0	-8.38	0.21
P-41	643	J-58	J-63	4.0	Asbestos Cement	140.0	8.33	0.21
P-22	459	J-38	J-107	6.0	Asbestos Cement	140.0	18.74	0.21
P-49	582	J-69	J-74	6.0	Asbestos Cement	140.0	17.84	0.20
P-79	1,464	J-109	J-100	6.0	Asbestos Cement	140.0	17.57	0.20
P-23	1,611	J-39	J-49	4.0	Asbestos Cement	140.0	-6.79	0.17
P-5	3,160	J-7	J-89	4.0	Asbestos Cement	140.0	5.53	0.14
P-42	458	J-62	J-89	6.0	Asbestos Cement	140.0	11.97	0.14
P-76	589	J-97	J-14	8.0	PVC	140.0	9.94	0.06
P-12	269	J-15	J-79	4.0	Asbestos Cement	140.0	2.09	0.05
P-70	333	J-89	J-28	6.0	Asbestos Cement	140.0	-1.24	0.01
P-56	1,114	J-77	J-78	6.0	Asbestos Cement	140.0	-0.47	0.01
P-50	1,050	J-70	J-125	4.0	Asbestos Cement	140.0	0.15	0.00

Fire Flow Node FlexTable: Fire Flow Report (Hydro.wtg)

EXISTING SYSTEM FIRE FLOW CPACITY AT 2012 MDD FLOW OF 445 GPM

Current Time: 0.000 hours (2020 MDD FLOW IS 293 GPM)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)
J-22	False	123.28	1,007.29	130.57	20.0	54.0	J-77
J-18	False	170.04	1,007.29	177.33	20.2	54.1	J-77
J-33	False	291.29	1,007.29	298.58	20.0	39.2	J-22
J-66	False	326.15	1,007.29	333.44	20.1	54.0	J-77
J-27	False	338.11	1,007.29	345.40	20.0	25.9	J-26
J-82	False	346.01	1,007.29	353.30	20.0	54.0	J-77
J-26	False	366.95	1,007.29	374.24	20.1	20.0	J-27
J-45	False	388.28	1,007.29	395.57	20.0	41.8	J-55
J-55	False	389.17	1,007.29	396.46	20.0	41.7	J-45
J-21	False	397.17	1,007.29	404.46	22.4	20.0	J-22
J-87	False	448.56	1,007.29	455.85	20.0	40.1	J-81
J-4	False	476.18	1,007.29	483.47	43.8	20.0	J-27
J-59	False	483.50	1,007.29	490.79	20.0	32.0	J-63
J-54	False	527.50	1,007.29	534.79	20.0	20.0	J-45
J-67	False	534.24	1,007.29	541.53	20.0	53.9	J-77
J-126	False	547.70	1,007.29	554.99	20.0	44.3	J-81
J-63	False	571.06	1,000.00	571.06	20.0	20.0	J-59
J-81	False	571.57	1,007.29	578.86	20.0	24.3	J-87
J-44	False	584.49	1,007.29	591.78	20.0	53.8	J-82
J-53	False	605.63	1,007.29	612.92	20.0	53.9	J-77
J-51	False	667.56	1,007.29	674.85	20.0	54.0	J-82
J-58	False	689.85	1,007.29	697.14	20.0	22.1	J-59
J-19	False	702.53	1,007.29	709.82	20.0	25.3	J-59
J-125	False	710.95	1,007.29	718.24	20.0	48.8	J-70
J-37	False	714.20	1,007.29	721.49	20.0	52.0	J-107
J-35	False	842.55	1,007.29	849.84	20.0	53.9	J-77
J-9	False	871.78	1,007.29	879.07	46.1	20.0	J-27
J-15	False	952.54	1,007.29	959.83	20.0	44.9	J-84
J-39	False	986.37	1,007.29	993.66	20.0	39.5	J-126
J-107	False	998.61	1,007.29	1,005.90	20.0	35.2	J-38
J-70	True	1,027.04	1,007.29	1,034.33	20.0	38.7	J-125
J-75	True	1,129.86	1,007.29	1,137.15	20.0	20.0	J-67
J-38	True	1,160.41	1,007.29	1,167.70	22.2	20.0	J-107
J-79	True	1,262.08	1,007.29	1,269.37	20.0	22.4	J-15
J-84	True	1,279.67	1,007.29	1,286.96	20.0	45.1	J-15
J-80	True	1,297.10	1,007.29	1,304.39	20.0	48.4	J-42
J-85	True	1,342.69	1,000.00	1,342.69	20.0	23.6	J-79
J-42	True	1,352.78	1,007.29	1,360.07	20.0	52.1	J-27
J-49	True	1,364.31	1,007.29	1,371.60	20.0	54.0	J-77
J-12	True	1,590.53	1,007.29	1,597.82	20.0	51.2	J-69
J-14	True	1,684.08	1,000.00	1,684.08	31.2	20.0	J-22
J-97	True	1,710.89	1,007.29	1,718.18	44.1	20.0	J-27
J-2	True	1,758.66	1,007.29	1,765.95	20.3	20.0	J-22
J-7	True	1,812.34	1,007.29	1,819.63	20.0	21.1	J-107
J-83	True	1,849.42	1,007.29	1,856.71	26.5	20.0	J-82
J-43	True	1,876.39	1,000.00	1,876.39	28.7	20.0	J-44
J-95	True	1,876.60	1,007.29	1,883.89	20.0	32.9	J-27
J-28	True	2,012.73	1,000.00	2,012.73	20.0	20.0	J-19
J-62	True	2,046.50	1,007.29	2,053.79	20.0	29.8	J-19
J-50	True	2,088.15	1,007.29	2,095.44	20.0	20.5	J-19
J-96	True	2,092.59	1,007.29	2,099.88	39.5	20.0	J-27
J-89	True	2,129.26	1,007.29	2,136.55	20.0	21.7	J-19
J-86	True	2,389.84	1,007.29	2,397.13	20.0	23.9	J-84
J-52	True	2,428.30	1,007.29	2,435.59	20.0	20.0	J-53

Fire Flow Node FlexTable: Fire Flow Report (Hydro.wtg)

Current Time: 0.000 hours

Label	Satisfies Fire Flow Constraints?	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)
J-48	True	2,476.41	1,007.29	2,483.70	20.0	54.0	J-77
J-17	True	2,500.00	1,000.00	2,500.00	33.8	32.6	J-86
J-56	True	2,500.00	1,007.29	2,507.29	64.0	53.6	J-77
J-57	True	2,500.00	1,007.29	2,507.29	25.6	35.0	J-53
J-68	True	2,500.00	1,007.29	2,507.29	32.4	33.3	J-67
J-69	True	2,500.00	1,007.29	2,507.29	34.0	36.1	J-12
J-74	True	2,500.00	1,007.29	2,507.29	25.3	43.6	J-12
J-77	True	2,500.00	1,007.29	2,507.29	44.3	50.3	J-12
J-78	True	2,500.00	1,007.29	2,507.29	33.8	43.5	J-125
J-93	True	2,500.00	1,007.29	2,507.29	44.7	38.2	J-35
J-100	True	2,500.00	1,007.29	2,507.29	45.8	37.1	J-66
J-109	True	2,500.00	1,007.29	2,507.29	52.1	49.4	J-78
J-111	True	2,500.00	1,007.29	2,507.29	29.4	47.8	J-42
J-122	True	2,500.00	1,000.00	2,500.00	41.9	40.9	J-86
J-131	True	3,500.00	500.00	3,500.00	50.9	39.4	J-82

Fire Flow Node FlexTable: Fire Flow Report (Hydro.wtg)

FIRE FLOW CAPACITY AFTER UPGRADE TO 6" LOOPS, 8" DEAD LINES, WITH MDD OF 632 GPM
(2020 MAX BUILDOUT PROJECTION IS MDD OF 319 GPM)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)
J-27	True	1,172.27	1,010.36	1,182.63	20.0	21.7	J-26
J-26	True	1,198.69	1,010.36	1,209.05	20.0	20.0	J-27
J-87	True	1,481.31	1,010.36	1,491.67	20.0	22.3	J-81
J-81	True	1,514.91	1,010.36	1,525.27	20.0	24.3	J-87
J-59	True	1,547.88	1,010.36	1,558.24	20.0	23.1	J-63
J-82	True	1,559.54	1,010.36	1,569.90	20.0	43.7	J-83
J-126	True	1,572.25	1,010.36	1,582.61	20.0	37.5	J-81
J-4	True	1,572.44	1,010.36	1,582.80	43.8	20.0	J-27
J-45	True	1,574.12	1,010.36	1,584.48	20.0	27.4	J-27
J-55	True	1,575.51	1,010.36	1,585.87	20.0	27.3	J-27
J-63	True	1,607.21	1,000.00	1,607.21	20.0	20.0	J-59
J-107	True	1,609.44	1,010.36	1,619.80	20.0	29.0	J-38
J-33	True	1,609.54	1,010.36	1,619.90	20.0	32.0	J-22
J-37	True	1,711.29	1,010.36	1,721.65	20.0	21.1	J-107
J-38	True	1,731.37	1,010.36	1,741.73	22.2	20.0	J-107
J-54	True	1,739.41	1,010.36	1,749.77	20.0	20.0	J-45
J-9	True	1,746.57	1,010.36	1,756.93	46.0	20.0	J-27
J-22	True	1,765.14	1,010.36	1,775.50	20.0	28.1	J-21
J-66	True	1,807.03	1,010.36	1,817.39	20.0	54.0	J-77
J-19	True	1,867.14	1,010.36	1,877.50	20.0	24.9	J-59
J-58	True	1,883.59	1,010.36	1,893.95	20.0	21.0	J-59
J-21	True	1,904.37	1,010.36	1,914.73	22.2	20.0	J-22
J-44	True	1,950.35	1,010.36	1,960.71	20.0	32.2	J-82
J-125	True	2,150.97	1,010.36	2,161.33	20.0	48.4	J-70
J-83	True	2,176.12	1,010.36	2,186.48	26.5	20.0	J-82
J-12	True	2,215.97	1,010.36	2,226.33	20.0	41.9	J-95
J-43	True	2,273.50	1,000.00	2,273.50	28.7	20.0	J-44
J-67	True	2,290.38	1,010.36	2,300.74	20.0	35.2	J-75
J-53	True	2,352.23	1,010.36	2,362.59	20.0	36.5	J-52
J-51	True	2,466.56	1,010.36	2,476.92	20.0	31.1	J-50
J-15	True	2,490.82	1,010.36	2,501.18	20.0	35.9	J-84
J-2	True	2,500.00	1,010.36	2,510.36	37.5	35.5	J-22
J-7	True	2,500.00	1,010.36	2,510.36	32.6	38.6	J-107
J-14	True	2,500.00	1,000.00	2,500.00	37.2	26.4	J-22
J-17	True	2,500.00	1,000.00	2,500.00	53.4	51.4	J-86
J-18	True	2,500.00	1,010.36	2,510.36	30.0	53.7	J-86
J-28	True	2,500.00	1,000.00	2,500.00	30.3	30.6	J-19
J-35	True	2,500.00	1,010.36	2,510.36	36.1	51.8	J-93
J-39	True	2,500.00	1,010.36	2,510.36	29.4	42.7	J-126
J-42	True	2,500.00	1,010.36	2,510.36	38.0	47.8	J-22
J-48	True	2,500.00	1,010.36	2,510.36	42.6	53.7	J-12
J-49	True	2,500.00	1,010.36	2,510.36	45.7	50.9	J-111
J-50	True	2,500.00	1,010.36	2,510.36	30.1	31.3	J-44
J-52	True	2,500.00	1,010.36	2,510.36	32.7	32.7	J-53
J-56	True	2,500.00	1,010.36	2,510.36	64.4	53.9	J-77
J-57	True	2,500.00	1,010.36	2,510.36	42.1	48.6	J-53
J-62	True	2,500.00	1,010.36	2,510.36	34.6	41.2	J-19
J-68	True	2,500.00	1,010.36	2,510.36	49.9	47.0	J-67
J-69	True	2,500.00	1,010.36	2,510.36	45.0	47.1	J-12
J-70	True	2,500.00	1,010.36	2,510.36	32.6	45.5	J-125
J-74	True	2,500.00	1,010.36	2,510.36	42.7	49.7	J-12
J-75	True	2,500.00	1,010.36	2,510.36	29.8	29.8	J-67
J-77	True	2,500.00	1,010.36	2,510.36	51.1	54.5	J-12
J-78	True	2,500.00	1,010.36	2,510.36	47.5	51.8	J-125

Fire Flow Node FlexTable: Fire Flow Report (Hydro.wtg)

Current Time: 0.000 hours

Label	Satisfies Fire Flow Constraints?	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)
J-79	True	2,500.00	1,010.36	2,510.36	34.9	35.0	J-15
J-80	True	2,500.00	1,010.36	2,510.36	41.3	47.2	J-22
J-84	True	2,500.00	1,010.36	2,510.36	29.1	38.8	J-86
J-85	True	2,500.00	1,000.00	2,500.00	36.9	37.7	J-84
J-86	True	2,500.00	1,010.36	2,510.36	37.4	40.3	J-84
J-89	True	2,500.00	1,010.36	2,510.36	37.9	38.2	J-19
J-93	True	2,500.00	1,010.36	2,510.36	51.8	45.3	J-35
J-95	True	2,500.00	1,010.36	2,510.36	26.4	22.2	J-12
J-96	True	2,500.00	1,010.36	2,510.36	55.2	36.0	J-12
J-97	True	2,500.00	1,010.36	2,510.36	48.6	24.7	J-27
J-100	True	2,500.00	1,010.36	2,510.36	50.4	41.8	J-66
J-109	True	2,500.00	1,010.36	2,510.36	65.4	53.7	J-77
J-111	True	2,500.00	1,010.36	2,510.36	47.8	52.2	J-48
J-122	True	2,500.00	1,000.00	2,500.00	55.8	53.7	J-86
J-131	True	3,500.00	500.00	3,500.00	53.2	43.2	J-82

Appendix 10.2
Emergency Response Plan and Public Notice

Emergency Response Plan
Water Shortage Plan
E. Coli MCL Violation – Public Notice
E. Coli MCL Violation – Public Notice Certification
Boil Water Door Hanger
Precautionary Boil Water Advisory
Rescinding of Precautionary Boil Water Advisory

LAKE LIMERICK WATER SYSTEM

EMERGENCY RESPONSE PROCEDURES

1.0 INTRODUCTION

Safe and reliable drinking water is vital to every community. Preparing for emergencies is a vital step in protecting the water supply and a high priority for the Lake Limerick (LLCC). LLCC has identified the following goals in emergency preparedness:

- Understand and organize a communication network
- Determine the possible emergencies and likelihood of occurrence
- Establish appropriate levels of security
- Evaluate alternative sources of water and the viability of each.

When LLCC is notified of an emergency situation at a water system, emergency procedures will be implemented to ensure that the situation is handled appropriately and with as little risk to public safety as possible. The purpose of this Emergency Response Plan is to document the procedures LLCC will implement in responding to emergency situations.

The Emergency Response Plan includes the following information:

This document should be accessible to all LLCC personnel responsible for emergency management at all times. In the event that the information below should change or become dated, i.e. contact names and numbers, this emergency plan will be updated.

2.0 PERSONNEL RESPONSIBLE FOR EMERGENCY RESPONSE

At LLCC, the staff member responsible for the emergency response plan is:

Water Master:	Doug Carothers

Within LLCC, the following chain-of-command or lines of authority exist:

LLCC Board of Directors:	Brian Smith
Water Committee:	Don Bird
Water System Management:	Northwest Water Systems (NWS)

All NWS personnel can be contacted at the following 24-hour phone number: (360) 876-0958.

3.0 CONTACTING LLCC REGARDING AN EMERGENCY

In an emergency situation, often the water system customers will be aware of a problem with their water system before LLCC is aware of the problem. All customers served by LLCC are provided with the LLCC Water Department and Office phone number. All emergency calls are directed to one of these locations.

During business hours (9:00 AM to 5:00 PM Monday through Friday, except holidays), phones at the LLCC office will be answered in person. Emergency calls will be routed to the Water Master cell phone. If the Water Master is not available, NWS is contacted and informed of the emergency.

After hours, phone calls to the Water Office are directed to an automated message directing phone calls to the Water Master and NWS representative cell phones. Should the Water Master not be available the following NWS protocol is followed:

After hours (4:30 PM to 8:30 AM) and weekend calls are directed to a voice mail system which includes an emergency voice mail box. If a message is left in the emergency voice mail box, the phone system automatically contacts the on-call NWS staff person. The weekend on-call NWS staff person is either the Operations Supervisor or a Field Technician.

4.0 LLCC EMERGENCY ASSESSMENT

After LLCC identifies an emergency or is notified of an emergency situation, the Water Master will determine whether the emergency requires an on-site presence by NWS. If needed, the Water Master will contact NWS and provide instructions for an on-site evaluation.

In assessing an emergency situation, the Water Master and/or NWS will analyze the type and severity of the emergency.

> **Level I: Normal (Routine) Emergency** - Minor failure which can be repaired within 24 hours. Water quality is not affected. Examples may include, but are not limited to: Distribution line breaks, short power outage, minor mechanical failure in pump house.
>
> **Level II: Minor Emergency (Alert Status)** – Minor disruption in supply or indication of possible contamination. Public health may be jeopardized. Minor emergencies can usually be resolved within 72 hours. Examples may include, but are not limited to: Disruption in supply such as a transmission line break, pump failure with a potential for backflow or loss of pressure; an initial unconfirmed positive fecal coliform or E. coli sample; an initial primary chemical contaminant sample.
>
> **Level III: Significant Emergency** – The system experiences significant mechanical or contamination problems where disruption in supply is inevitable and issuance of a health advisory is needed to protect public health. Major emergencies should be reported to DOH as soon as possible. Examples may include, but are not limited to: a verified acute confirmed coliform MCL or E. coli/fecal positive sample requiring immediate consideration of a health advisory notice to customers, a confirmed sample of another primary contaminant requiring immediate consideration of a health advisory notice to customers, loss of a source or reservoir, a major line break or other system failure resulting in a water shortage or requiring system shutdown, surface water contamination, or an immediate threat to public health of the customers requiring a health advisory.
>
> **Level IV: Catastrophic Disaster** – The system experiences major damage or contamination form a natural disaster, an accident or an act of terrorism. These incidents usually require immediate notification of local law enforcement and local emergency management services. Immediate issuance of health advisories and declaration of water supply emergencies are critical to protect public health.

The Water Master will contact the Water Committee and Board of Directors and communicate the recommended action. In the event of a public health emergency, if the Water Committee cannot be contacted, the Water Master will take action as necessary to protect the health of residents on the water system experiencing the emergency.

5.0 NOTIFYING RESIDENTS OR CUSTOMERS

Notify any residents or customers that may be affected as a result of the emergency situation. Depending on the type of emergency and the area affected, phone calls or door-to-door notification may be used to provide information quickly and effectively to the public.

Once the problem is resolved, the same notification procedures will be used to inform the public that the situation has passed and they can resume normal water use procedures.

The following are templates for notifications that may be needed in an emergency situation:

- E-coli MCL Violation Public Notice
- E-coli MCL Violation Public Notice Certification
- Boil Water Advisory Door Hanger (English and Spanish)
- Precautionary Boil Water Advisory (example)
- Rescinding of Boil Water Advisory

Copies of these templates are included in an appendix to the Emergency Response Plan.

6.0 NOTIFYING REGULATORS

In the event of a Level I or Level II emergency during which a drinking water system exceeds the Maximum Contaminant Level (MCL) for coliform and in all Level III and Level IV emergencies, LLCC will notify the Washington State Department of Health Office of Drinking Water (ODW). The local health jurisdiction will also be notified; however, many of the local health jurisdictions do not have after hours emergency response numbers. ODW can assist in determining the proper notification process.

Emergency contact	Phone number	Emergency contact	Phone number
Mason County Fire/Police/Medical	911	Electrician: Arcadia Drilling	800-426-3395
Mason County emergency services	911	DOH regional engineer	360- 236-3035
County environmental health contact	360-427-9670 extension 293	DOH emergency After hours #	877-481-4901
Department of Ecology Spill Response SW Regional Office	360-407-6300	Water Committee Chairperson (Contact LLCC Office for contact details)	360-426-4563
Engineering consultant Northwest Water	360-876-0958	Water Master: Doug Carothers	360-507-6258
Electric utility: Mason Co. PUD 3	360-426-8255	Management Agency: NWS	360-876-0958
Pump service: Arcadia Drilling	800-426-3395	Water Office	360-426-4563
DOH Coliform Water Quality Monitoring: Charese Gainor	360-236-3045	LLCC Office	360-426-3581
DOH Chemical Water Quality Monitoring: Sophia Petro	360-236-3046		

POWER OUTAGE

1. Contact the power company and get an estimate when power will be restored.
2. Inspect system generators for proper operation and fuel level. Monitor system pressures and reservoir levels.
3. If the time estimate for power restoration is such that it exceeds the fuel available for the emergency generators, then do the following:
   a. Contact any critical water users on the system
   b. Contact emergency personnel and notify them of the situation
   c. Secure a source of fuel and a means of delivering it to the generators
   d. Notify the public to minimize water usage
   e. If depressurization is expected to occur, follow the depressurization policy

   Manual hand pumps may also be purchased and stored ahead of time to be installed for use during an extended power outage. These are available from several manufacturers (such as EarthStraw) and are typically suitable for use in wells 25 – 150 feet deep. These pumps can provide 1.0 – 1.5 gpm and would be adequate to provide for customers' essential needs (drinking and cooking). For example, customers could be assigned a time slot and pumphouse to come retrieve water for their essential needs.

WATER MAIN BREAK

1. Evaluate the break-can it be repaired under pressure? If not and depressurization will (or has) occurred, do the following:
   a. Contact critical water users on the system
   b. Contact emergency personnel and notify them of the situation
   c. Notify the public in the affected area
2. Contact the work personnel needed to proceed with repairing the break. For small breaks this may be system employees. For larger breaks, a contractor may be required.
3. Reference the system map and locate the nearest system valves to isolate the break.
4. Evaluate break and determine whether immediate isolation is necessary.
5. Make an inventory of the parts necessary to repair the break and order parts.
6. Contact the DOH Regional Engineer and reference the AWWA Manual to determine necessary precautions to take during repairs.
7. Swab the interior of the pipe and fittings used to make repairs with a 1% hypochlorite solution before they are installed.
8. Make repairs to the water main.
9. Apply liberal quantities of hypochlorite tablets to the open trench area to lessen the danger from pollution.
10. Flush the water main after repairs are made to remove contamination introduced during repairs. If hydrant locations permit, flush toward the work location from both directions. Continue flushing for 5 minutes after all discoloration has cleared.
11. Where practical, the section of water main shall be isolated, all service connections shut off, and the section flushed and chlorinated to 300 ppm and left for a minimum of 15 minutes. After the waiting period, the main shall be flushed until no noticeable chlorine smell is noted.
12. Bacteria samples shall be taken after repairs are completed on either side of the break. If positive samples are recorded, then the situation shall be evaluated for corrective action. Daily sampling shall be continued until two consecutive negative samples are recorded.

CHEMICAL CONTAMINATION

1. Attempt to determine the specific chemical which has caused the contamination and its hazard classification. There are four broad classifications of contamination as follows:

Hazard Type	Description
Pollution Hazard	A condition through which an aesthetically objectionable or degrading material NOT dangerous to health may enter the public water system or a consumer's potable water system.
System Hazard	A condition, device, or practice posing an actual or potential threat of damage to the physical properties of the public water system or a consumer's potable water system, but will not cause an adverse health effect
Health Hazard	Any condition, device, or practice in a water supply system or its operation that creates or may create a danger to the health and wellbeing of others.
Severe Hazard	Any health hazard that could reasonably be expected to result in significant morbidity or death

2. Determine the following information:
   - Who made the first observation?
   - What is their phone number and location?
   - When did it happen?
   - What is it?
   - What are the qualities-color/taste/smell?
   - Is an MSDS (material safety data sheet) available?
   - How much of it entered the water system?
   - Where did it enter the water system?
   - Where is it now?
   - Is it isolated to one area or is it widespread?
   - What area and population are affected?
   - Can it be isolated?
   - Can depressurization and or flushing of the affected area be done quickly and without serious consequences?
3. If the contamination is classified as either a health hazard or a severe hazard, do the following:
   a. Issue a no-use water advisory immediately. A boil advisory will not be adequate for most chemical contamination-boiling the water may only serve to concentrate the contaminant.
   b. If the contaminant could cause serious illness or death, can you isolate the water supply from users?
4. If a water advisory will be issued, contact the critical water users and notify them of situation
5. Immediately contact emergency personnel and agencies and notify them of situation.
6. If possible, determine the cause and source of contamination-eliminate the source. Consider the possibility that the cause may be due to a cross-connection, backflow, or back siphonage.
7. Begin flushing the distribution system to eliminate the contaminant from the public water supply.

BACTERIOLOGICAL CONTAMINATION

1. Should any routine bacteriological sample be unsatisfactory a total of three repeat samples are required within 24 hours from the following locations:
   a. The same tap as the original sample
   b. An active service within five active connections upstream of the original sample
   c. An active service within five active connections downstream of the original sample
2. Should any repeat sample be unsatisfactory or any sample indicates the presence of fecal or E. coli; the Department of Health shall be notified.
3. Take the actions under the direction of DOH which will include, but are not limited to, and investigation of possible sources of contamination and shock chlorinating the system. System users must be notified within 24 hours of detection.
4. The month after a positive coliform sample, the water system will take five routine samples. This will include the two sites scheduled for that month, the site that tested positive the previous month, and one or more of the repeat sample sites associated with a positive result.

DISTRIBUTION SYSTEM STORAGE FAILURE

1. Isolate the reservoir from the system
2. After the reservoir is removed from the system:
   a. Open the reservoir by-pass valve and operate the submersible well pump(s) to discharge directly to the distribution system.
   b. Drain the reservoir and determine cause of failure.
   c. Make repairs, clean reservoir as needed and return to normal operation.

SUSPECTED CROSS-CONNECTION

1. Isolate suspected source of backflow
2. Sample to determine the system has become contaminated
3. Contact DOH for guidance
4. Attempt to determine the degree of health hazard based on classifications found in the contamination procedure.
5. Refer to appropriate procedure(s) based on the results of the sample analysis.
6. Complete a “Backflow Incident Response Form” to document the occurrence.

SOURCE FAILURE

The storage and well capacity of the Lake Limerick Water system allows for the loss of several sources without adversely affecting the system’s ability to serve the community. Should a source be determined to not be usable it shall be disconnected from the distribution system. The source shall be evaluated by an experienced well driller to determine if recondition or replacement is the best option.

SUSPECTED TAMPERING AT SYSTEM FACILITIES

Tampering may range from simple defacement of property to the introduction of biological or chemical agents into the water supply. These actions can be divided into several categories:

Action	Description
Vandalism	Actions that cause physical damage to property and structures, such as cutting fences to gain access to secure areas, breaking windows, and damaging or removing locks from doors or wells.
Malicious Action	Actions that, intentional or not, introduce or threaten to introduce foreign substances into a portion of the distribution system or cause damage to a portion of the public water systems infrastructure. These acts range from pranks that “go too far” to actions intended to cause a disruption to the public water supply or the introduction of toxic substances into the distribution system
Terrorism	Intentional actions introduce or threaten to introduce foreign substances into a portion of the treatment or distribution system or cause damage to a portion of the public water systems infrastructure. These acts are meant to cause harm to individuals and cause unease or panic in the general public.

1. Immediately
    a. Treat the area as a crime scene. Minimize disturbance of area to preserve evidence. Document the observed conditions, with photographs or video if possible.
    b. Contact law enforcement agencies and work with them to determine the extent of the damage.
    c. Notify system users
    d. Isolate the affected portion of the system
    e. Contact DOH and local health district.
2. Soon After
    a. If there is evidence of contamination, perform a physical check of the system and inspect structural integrity.
    b. Contact laboratories to determine if they are capable of analyzing for unknown substances
    c. If tampering resulted in probable introduction of chemical or biological contaminants into the system, proper precautions must be taken during sampling to prevent exposure to the contaminant
    d. With the consent of law enforcement, begin to repair all points of entry and facilities.

EARTHQUAKE OR REGIONAL DISASTER

1. Coordinate with authorities and emergency response as necessary. Support emergency response as primary goal.
2. Evaluate the system to determine the extent of damage.
3. Conserve resources as necessary commensurate with the disaster.
4. Plan out interim operation and a path to return to normal operations.
5. Follow the guidance for the above emergency categories as appropriate (Water Main Break, Power Outage, Source Failure, Contamination, etc.)

PUBLIC HEALTH CRISIS / PANDEMIC

The best sources of information during a public health crisis or pandemic are local, state, and national health agencies as the specific nature of the crisis will dictate the appropriate actions to take. Refer to the following agencies for guidance:

- Mason County Public Health - https://www.co.mason.wa.us/health/index.php
- Washington State Department of Health - https://www.doh.wa.gov/
- Centers for Disease Control and Prevention - https://www.cdc.gov/
- World Health Organization - https://www.who.int/

In general, the following procedures should be followed unless guidance from a health agency states otherwise:

1. Minimize personal interaction and maintain social distancing by performing administrative work from home offices. Utilize drive-by meter reading technology and remote SCADA control of the system.
2. For spaces that must be shared, schedule times for individuals to work in order to reduce or eliminate multiple people in the same space at the same time. When working in proximity of others is necessary, wear masks or facial coverings.
3. Disinfect all shared surfaces after use (printers, keyboards, door handles, vehicles, etc.)

PERSONAL SAFETY

1. Educate water system personnel on safety concerns and mitigation measures. Keep first aid kits at the main office and in service / repair vehicles.
2. Leave protective guards and covers on pumps, pump controllers, electrical panels, generators, etc. in place at all times.
3. Physically disconnect power supply from any equipment before servicing. Follow manufacturer's safety procedures.
4. Maintain fencing and gates around facilities. Ensure reservoir climbing cages are locked and in good repair.
5. Reservoirs and vaults are considered and confined spaces and should only be entered by persons who have received confined spaces training. Refer to guidance at osha.gov.

Water Shortage Plan

Section 1: Events that Cause Water Shortages

Event	Probability or Risk (High – Med – Low)	Immediate or Anticipated Event	Comments
Drought	Low	N/A	Drought is not common in this area.
Water Contamination	Low	N/A	Sources are regularly monitored for contaminants
Inadequate planning to meet demand	Low	N/A	A practice of conservative planning.
Shallow Wells	Low	N/A	Wells do not have trouble meeting demand.
Inadequate pumping equipment	Low	N/A	Pumps are adequate for demand.
Seawater Intrusion	Low	N/A	>1.5 miles from seawater to nearest and deepest well
Water waste	Medium	System leaks	Regular monitoring of DSL.

Section 2: Supply and Demand Evaluation

Source ID	Name	Well Depth	Pump Size	Capacity	Water Right Info	Notes
S05	1	116 ft	3 HP	49 gpm	Qi = 100 gpm Qa = 171 afy	
S02	2	121 ft	10 HP	200 gpm	Qi = 200 gpm Qa = 166 afy	Emergency Use
S03	3A	148 ft	7.5 HP	144 gpm	Qi = 100 gpm Qa = 84 afy	
S06	3B	177 ft	7.5 HP	194 gpm	Included in S03	
S04	4	111 ft	10 HP	74 gpm	Qi = 100 gpm Qa = 79 afy	
S07	5	130 ft	10 HP	35 gpm	Qi = 190 gpm Qa = 152 afy	
S08	6	434 ft	40 HP	248 gpm	Qi = 200 gpm Qa = 160 afy	

# Services	Estimated average gallons per day from service data	Estimated peak day gallons per day from service data	Estimated average gallons per day used per residence	Estimated peak day use per residence
1201	190,800 gpd	459,208 gpd	212 gpd/ERU	488 gpd/ERU

Section 3: Defining Stages and Criteria of a Water Shortage

Stage I: Minor Shortage - Voluntary Measures	Reducing water consumption during a potential or actual water shortage
Stage II: Moderate Shortage - Mandatory Measures	Mandatory demand reduction during an actual water shortage
Stage III: Severe Shortage - Rationing Program	Institute rationing program during long periods of drought without causing hardship

Section 4: Alternate Water Sources

Water Systems within ¼-mile of LLWS	Feasibility of Connecting
None	

Section 5: Effective Communication

In the event of a water shortage, the following message may be used to communicate a need for reduced water use:

> *The potential exists for a less-than-normal water supply. We have taken the precaution of issuing a mandatory reduction in water use effective immediately. Please use water wisely during this time. Options for alternative water sources will be explored.*

Section 6: Conservation Measures

Water Conservation Measures	Actions necessary for implementation
Voluntary Program - Limit water use.	• Prepare and post water conservation information at entrances to community

Section 7: Demand Reduction Alternatives

Stage	Criteria	Actions	Implementation
1	Potential water shortage	Reduce water consumption	Implement voluntary water use reductions, initiate a public information program
2	Actual water shortage	Mandatory demand reduction	Reduce water use for main flushing. Irrigation prohibited. Reduce in-house water use.
3	Periods of long drought	Institute rationing program	All public water uses not required for health or safety prohibited.

DRINKING WATER WARNING
E. coli MCL Violation

The Lake Limerick Water System, ID 44150T, located in Mason County is contaminated with *E. coli* bacteria.

E. coli bacteria were detected in the water supply on _________________. These bacteria can make you sick and are a particular concern for people with compromised immune systems. Boiled or purchased bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice. Boiling kills bacteria and other organisms in the water.

What should you do? **DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST**. Bring all water to a rolling boil, for 1 minute, and let it cool before using. Boiling kills bacteria and other organisms in the water.

E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes Human pathogens in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a greater health risk for infants, young children, the elderly, and people with severely compromised immune systems.

The symptoms above are not caused only by organisms in drinking water. If you experience any of these symptoms and they persist, you may want to seek medical advice. People at increased risk should seek advice about drinking water from their health care provider.

What happened? What is the suspected or known source of contamination?

The following is being done to correct the problem:

We will consult with the State Department of Health about this incident. We will provide you notification when you no longer need to boil the water. We anticipate resolving the problem by ______________________.

For more information please contact:____
(owner/operator) (phone #) (address) (email)

Please share this notice with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is sent to you by ________________________________Water System on ____/____/_____

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

PUBLIC NOTICE CERTIFICATION
E. coli-MCL Violation

Within 10 days after notifying your customers about an *E. coli*-MCL violation, you must complete this form and send it to our regional office along with a copy of each type of notice you distributed to your customers (hand-delivered notices, news releases, newspaper articles, and so on).

By completing this form, you certify that:

- You met all of the public notification requirements.
- You will meet future requirements for notifying new billing units of the violation or situation.

If the boil water advisory remains in effect more than three months, you must re-notify your water users and send another completed copy of this *Public Notice Certification* to us.

Complete the following items, sign the form and mail it to the nearest regional office, addresses below:

Water System: Lake Limerick Water System ID #44150T County: Mason

Violation Date:_____ / _____ / _____ Violation Type______________________________

This public water system certifies that it gave this public notice to water users, following state and federal requirements for delivery, content, and deadlines. ☐ **Yes** ☐ **No**

Distribution was completed Yes ☐ **No** ☐ **on ____ / ____ /____.**

Check all that apply:

☐ Hand delivery,
☐ News release (TV, radio, newspaper)
☐ Posting at________________________ (by DOH approval only),
☐ Other ___________________________ (by DOH approval only).

Were the water users notified within 24 hours? Yes ☐ **No** ☐

______________________________ ______________ ______________
Signature of owner or operator Position Date

If you need this publication in an alternative format, call 800.525.0127 (TDD/TTY call 711). This and other publications are available at www.doh.wa.gov/drinkingwater.

Northwest Regional Office:
20425 72nd Ave S Suite 310
Kent WA 98032
(253) 395-6775
Fax: (253) 395-6760
Email: dw.nwro@doh.wa.gov

Southwest Regional Office:
PO Box 47823
Olympia WA 98504-7823
(360) 236-3030
Fax (360) 664-8058
Email: swro.coli@doh.wa.gov

Eastern Regional Office:
16201 E Indiana Ave Suite 1500
Spokane Valley WA 99216
(509) 329-2100
Fax: (509) 329-2104
Email: mark.steward@doh.wa.gov

WARNING:

Do not drink tap water without boiling it first!

☐ **Fecal coliform**
☐ **E. coli bacteria**
☐ **Other: ___________________________**

were detected in the water supply on:
(date) ___________________.

Boiling kills bacteria and other organisms in the water:

- **Bring water to a rolling boil for one minute**
- **Let water cool before using**

To avoid possible illness: use boiled or purchased bottled water for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice.

Contact your doctor, if you experience one or more of these symptoms: nausea, cramps, diarrhea, jaundice, headache and/or fatigue. People with chronic illnesses, infants and the elderly may be at higher risk and should seek medical advice.

Water System: **Lake Limerick**
I.D.: **44150-T**
County: **Mason**
Contact: ____________________________
Telephone: __________________________
Date notice distributed: ________________

What is fecal coliform and E. coli?

Fecal coliform and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these waters can cause short-term effects, such as diarrhea, cramps, nausea, headaches or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

How long will this warning be in effect?

We will consult with the Washington State Department of Health about this incident. We will notify you when you no longer need to boil the water.

Vea al reverso para la versión en Español.

ADVERTENCIA:

¡No tome el agua de la llave sin antes hervirla!

☐ **Bacteria coliforme fecal**
☐ **Bacteria E. coli**
☐ **Otra: ____________________________**

fueron encontradas en su sistema de agua:
(el día)___________________.

Hervir el agua mata a las bacterias y otros organismos en el agua:

- **Ponga el agua en la estufa hasta que hierva y deje hervir el agua por un minuto**
- **Deje enfriar el agua antes de usarla**

Para evitar posibles enfermedades y hasta nuevo aviso: use agua hervida o agua potable embotellada para tomar, hacer hielo, limpiarse los dientes, lavar los platos y para preparar comidas.

Hable con su doctor si usted tiene uno o más de los siguientes síntomas: náusea, dolor estomacal, diarrea, ictericia, dolores de cabeza y/o cansancio. La gente con enfermedades crónicas, bebés y personas mayores de edad, pueden estar en situación de alto riesgo y deben consultar con su médico o proveedores de servicios médicos.

Sistema de agua: **Lake Limerick**
I.D.: **44150-T**
Condado: **Mason**
Contacto: ___________________________
Teléfono: ___________________________
Fecha de notificación: _________________

¿Qué son las bacterias coliforme fecal y E. coli?

Coliformes fecales o E. coli son bacterias cuya presencia indica que el agua esta contaminada con desechos humanos o de animales. Microbios de esos desechos pueden causar diarrea, dolor estomacal, náusea, dolores de cabeza u otros síntomas. Pueden representar un peligro para la salud de bebés, niños y niñas de corta edad y personas con sistemas inmunológicos en alto riesgo.

¿Por cuánto tiempo va a estar en efecto esta advertencia?

Vamos a consultar con el Departamento de Salud del estado de Washington acerca de este incidente. Le vamos a notificar cuando ya no sea necesario hervir el agua.

See reverse side for English version.

PRECAUTIONARY HEALTH ADVISORY

Lake Limerick Water
ID #44150 T - Mason County

____

____
(provide description of event, i.e. a water leak was reported at [time] on [date] at [address]. [number of homes] homes had to be taken out of water ro repair the water line associate with this leak.)

____(provide explanation of boil water advisory, i.e. any time there is a loss of pressure in a non-chlorinated system a 'precautionary boil water advisory' is issued.)

Effective immediately, Lake Limerick Water is advising the homes that were affected by this ______________________________ (water pressure loss, contamination event, etc.) to boil their water before consumption. Those home affected have been issued this notice.

DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST. Bring all water to a boil. Let it boil 1 minute at a rolling boil and let cool before using. Boiled or purchased, bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice. Boiling kills bacteria and other organisms in the water. If you are experiencing illness symptoms, it is recommended that you see your health care provider.

This advisory is a based on the following:

- ____ (summary of event, i.e. The system lost pressure due to necessary repairs at [address].
- ____ (action taken, i.e. A water sample will be collected after the repairs are completed and the users of the affected properties will be notified when the results of these water samples are available. This is expected to be [date] at approximately [time of day].

Follow-up will include the following:

- The water system will be disinfected and then flushed until no chlorine remains in the water system.
- Water samples will then be collected and tested.
- This advisory will not be rescinded until water sample tests have satisfactory results.
- Lake Limerick Water is working closely with the State Department of Health and will continue to do so until satisfactory samples are collected.

This advisory will remain in effect until lifted by Lake Limerick Water in consultation with the Washington State Department of Health, Office of Drinking Water.

This notice is sent to you by _________________________________Water System on ____/____/_____

PRECAUTIONARY HEALTH ADVISORY IS HEREBY RESCINDED

Lake Limerick Water
ID #44150 T - Mason County

The boil water advisory issued on ____/____/_____ is hereby rescinded. ____ investigative water samples were taken, and all of those samples have come back **free of any bacteria.** (additional information here, if relevant). You no longer need to boil your water before consumption.

If you have any questions concerning this matter, please call the water office at 360.426.4563.

This notice is sent to you by ________________________________Water System on ____/____/_____

Appendix 10.3
Well Logs and Pumping Equipment

505
Well #1

WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Application No. ____
Permit No. ____

(1) OWNER:
Name Lake Limerick Associates
Address 1132 No. 128th St
Seattle, Wn. 98133

(2) LOCATION OF WELL:
County Mason Owner's number, if any - 1
NE ¼ NE ¼ Section 27 T 22N, R 3 W. W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒
10 " Diam. from 0 ft. to 116 ft. Gage .2.279
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☐ No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☒ Yes ☐ No
Manufacturer's Name Edward E. Johnson Inc.
Type Stainless Steel Model No.
Diam. 10" Slot size .050 Set from 89' ft. to 99' ft.
Diam. 10" Slot size .020 Set from 99 ft. to 114 ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes ☐ No Size of gravel
Gravel placed from ft. to ft.
Was a surface seal provided? ☐ Yes ☒ No To what depth? ft.
Material used in seal— Drill cuttings
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 51 ft. below land surface Date 3/25/66
Artesian pressure lbs. per square inch Date
Water is controlled by (Cap, valve, etc.)

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller
Yield: 95 gal./min. with 41 ft. drawdown after 6 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level
3:10	92	3:30	72' 4"
3:15	79	3:35	71
3:20	75	3:40	70' 6"
3:25	73' 5"	3:45	69' 6"

Date of test 3/25/66
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☒ Yes ☐ No

(12) WELL LOG: Diameter of well 10 inches.
Depth drilled 116 ft. Depth of completed well 114 ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Sand, clay & gravel	0	6
Hardpan	6	27
Gravel - dry	1	28
Hardpan	20	48
Gravel	3	51
Hardpan	6	60
Gravel - some water	10	78
Sand & gravel	10	88
" " " - water bearing	13	101
Sand	5	106
" & gravel	2	108
Sand	8	116
Muddy sand & gravel		116

Work started 19 Completed 19

(13) PUMP:
Manufacturer's Name
Type H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Tyee Well Drilling Co. (Person, firm, or corporation) (Type or print)
Division Tacoma Pump & Drilling Co. Inc
Address P.O. Box 3, Allyn WA
[Signed] (Well Driller)
License No. Date 3/28/66, 19

USE ADDITIONAL SHEETS IF NECESSARY

S. F. No. 1336 (Rev. 5-62) 5-63--5M 15164

CK/WB

S02

Well 2

WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Application No. 8833
Permit No.

(1) OWNER:
Name LAKE LIMERICK COUNTRY CLUB, INCORPORATED
Address 5125 25th N.E.
SEATTLE, WN.

(2) LOCATION OF WELL: County MASON Owner's number, if any— 2
SE ¼ NW ¼ Section 27 T. 21 N R 3 W W.M.
Bearing and distance from section or subdivision corner
SOUTH & EAST OF
NW COR. SECTION 27
1905 1555

(3) TYPE OF WORK (check):
New Well X Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable X Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐
10" Diam. from 1 ft. to 103 ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes X No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed X Yes ☐ No
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No.
Diam. 10" Slot size 35 Set from 103 ft. to 121 ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes X No Size of gravel
Gravel placed from ft. to ft.
Was surface seal provided? ☐ Yes ☐ No To what depth? ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes X No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 11' ft. below land surface Date June 17-67
Artesian pressure lbs. per square inch Date
Water is controlled by (Cap, valve, etc.)

OK/PE

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? X Yes ☐ No If yes, by whom? Russell Drilling
Yield: 200 gal./min. with 84' ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level

Date of test 6/17/67
Bailer test 133 gal./min. with 24 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well 10" inches.
Depth drilled 121 ft. Depth of completed well 121 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
TopSoil Gr.	0	2
Cem. Gr.	2	10
Cem. Gr.	10	40
Cem. Gr. & clay	40	50
Cem. Gr. & clay	50	75
Clay Blue & Gray	75	78
Broken Clay & Gr.	78	85
" " "	85	95
Blue clay & sand	95	100
Blue clay & sand (water)	100	104
Sand & Gr. small streaks of clay	104	121

Work started May 3 1967 Completed May 8 1967

(13) PUMP:
Manufacturer's Name
Type: H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Russell Well Drilling Co. (Person, firm, or corporation) (Type or print)
Address P.O. Box 433 Shelton Wash
[Signed] William J. Russell (Well Driller)
License No. 223-01-5124 Date June 19, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—Rev. 9-62—8-62—5M 75108

8

SO 3

Well 3A

WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Application No. 8834
Permit No.

(1) OWNER:
Name LAKE LIMERICK COUNTRY CLUB, INCORPORATED
Address 5125 25th N.E.
Seattle, Wa.

(2) LOCATION OF WELL:
County MASON Owner's number, if any # 3
SW ¼ SW ¼ Section 27 T 21N. R 3W. W.M.
Bearing and distance from section or subdivision corner
~~1200~~ NORTH & ~~---~~ EAST OF S.W. Cor. Sec. 27
520'
1165'
El. 240' ?

(3) TYPE OF WORK (check):
New Well X Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in item 11

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐
10" Diam. from 1 ft. to 148 ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes X No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☐ No
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No.
Diam. 10" Slot size 30 Set from 131 ft. to 148 ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes X No Size of gravel
Gravel placed from ft. to ft.
Was a surface seal provided? ☐ Yes ☐ No To what depth? ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 56 ft. below land surface. Date June 17-67
Artesian pressure lbs. per square inch Date
Water is controlled by (Cap, valve, etc.)

OK/PE

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? X Yes ☐ No If yes, by whom? Russell Drilling.
Yield 90 gal./min. with 79 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level

Date of test June 17-1967
Bailer test 80 gal./min. with 60 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well 10 inches.
Depth drilled 148 ft. Depth of completed well 148 ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Fill	0	3
Cem G.	3	72
Gr Sand (water)	72	77
Cem Gr	77	79½
San Gr (water)	79½	80½
Gr Sand	80½	92
Cem Gr	92	110
Gr & Sand	110	111
Cem Gr	111	112
Gr Sand	112	113
Cem Gr	113	124
Cem Gr	124	128
Sand & Gr	128	148

Work started June 19 Completed 19

(13) PUMP:
Manufacturer's Name
Type H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Russell Drilling Co. (Person, firm, or corporation) (Type or print)
Address P.O. Box 433 Shelton Wash
[Signed] William J Russell (Well Driller)
License No. 223-01-5124 Date June 19, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—(Rev. 9-62)—8-62—5M 75166

306, Well 3D

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. ....

(1) OWNER: Name Lake Limmerick Address 90 St. Andrews Dr. Shelton, Wash.

(2) LOCATION OF WELL: County Mason #36 — SW ¼ SW ¼ Sec. 27 T. 21 N., R. 3W W.M.
Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☑ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) X (OLD #3)
New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 177 ft. Depth of completed well 177 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 8 " Diam. from 0 ft. to 177 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
Welded ☑ ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes ☐ No ☑
Type of perforator used ....
SIZE of perforations ...... in. by ...... in.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.

Screens: Yes ☑ No ☐
Manufacturer's Name Johnson SS 10'
Type #100 slot Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☐ No ☑ Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.

Surface seal: Yes ☑ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? ...... Depth of strata ......
Method of sealing strata off ......

(7) PUMP: Manufacturer's Name ......
Type: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level 240 ft.
Static level 61 ft. below top of well Date 5/4/81
Artesian pressure ...... lbs. per square inch Date ......
Artesian water is controlled by ...... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☑ If yes, by whom? ......
Yield: ...... gal./min. with ...... ft. drawdown after ...... hrs.
" " "
" " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ......
Bailer test 210 gal./min. with drawdown after 1 hrs.
Artesian flow ...... g.p.m. Date ......
Temperature of water ...... Was a chemical analysis made? Yes ☐ No ☑

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Shot clay	0	3'
Hard pan	3	72'
Gravel & sand	72	77'
hard pan	77	81'
Gravel & sand	81	95'
Hard pan	95	112'
Gravel & sand	112	120'
Cemented gravel	120	134'
Sand, gravel & water	134	150'
Hard pan	150	161'
Gravel & water	161	177'

Work started 4/28, 19...... Completed 5/4/81, 19......

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Bedell Pump & Drilling Co.
(Person, firm, or corporation) (Type or print)

Address 1583 E. Dickinson St. Shelton, Wash.

[Signed] Vern L. Bedell
(Well Driller)

License No. 0032 Date 5/26/81, 19......

10

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

S0 4, Well 4

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 9889
Permit No. 9218

(1) OWNER: Name Lake Limerick Address

(2) LOCATION OF WELL: County Mason E½ SE ¼ SW ¼ Sec. 22 T. 21 N., R. 3W W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 111 ft. Depth of completed well 111 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10" Diam. from 1 ft. to 111 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☐
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type S.S. Steel Model No.
Diam. 10" Slot size from 91 ft. to 111 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level....
Static level 54 ft. below top of well Date 8-1-68
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 8-...
Bailer test 93 gal./min. with 8' ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil	1	2
Cem Gravel	2	10
" "	10	35
" "	35	49
Cem. Gr (Blue)	49	50
" " "	50	58
Gr + Sand	58	60
Brown Clay Gr	60	70
" " " "	70	78
Blue Clay & Sand	78	88
Brown Clay	88	92
Gr + Sand	92	95
" "	95	106
" "	106	111

Work started 19 Completed 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Russell Drilling Co (Person, firm, or corporation) (Type or print)

Address P.O. Box 433 Shelton, Wash

[Signed] William J. Russell (Well Driller)

License No. 225-5144 Date 11-12 1969

OK/WRB

S. F. No. 1356 Rev (3-60)—2-60—5M. 4510.

(USE ADDITIONAL SHEETS IF NECESSARY)

S07
Well 5

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No 62-2715

(1) OWNER: Name Lake Limerick Address E. 790 St. Andrews Drive

(2) LOCATION OF WELL: County Mason — NW¼ SW¼ Sec. 27 T. 21 N., R. 3 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 5
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 130 ft. Depth of completed well 130 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10" Diam. from 0 ft. to 130 ft.
Threaded ☐ ___" Diam. from ___ ft. to ___ ft.
Welded ☒ ___" Diam. from ___ ft. to ___ ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type S.S. Model No.
Diam. 8" Slot size 30 from 110 ft. to 130 ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name
Type: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level 200 ft.
Static level 48 ft. below top of well Date 10-30-86
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ___
Bailer test 120 gal./min. with 3 ft. drawdown after 4 hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water ___ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Brown Clay & Gravel	0	27
Sand	27	59
Brown Clay + Sand	59	74
Brown Clay & Gravel	74	109
gravel + water	109	130

RECEIVED
88 AUG 10 A10:5

Work started 10-23 19 86. Completed 10-30 19 86

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Arcadia Drilling (Person, firm, or corporation) (Type or print)

Address 170 SE Walker Pk. Dr.

[Signed] William M. Neal III (Well Driller)

License No. 1455 Date 11-3, 1986

(USE ADDITIONAL SHEETS IF NECESSARY)

Well 6
508
pg 1 of 2

Page 1

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 218887

Water Right Permit No. ______

(1) OWNER: Name Lake Limerick Country Cb. Address ______

(2) LOCATION OF WELL: County Mason — SE ¼ SW ¼ Sec 27 T 21 N., R 3W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) ______

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater ☐ Industrial ☐ Test Well ☒ Municipal ☐ Other

(4) TYPE OF WORK: Owner's number of well (if more than one) #6
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 534 feet. Depth of completed well 534 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 12" Diam. from 0 ft. to 284' ft.
Welded ☒ 8" Diam. from +1' ft. to 533 ft.
Liner installed ☐ ______ " Diam. from ______ ft. to ______ ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type ______ Model No. ______
Diam. 7" Slot size 80 from 529 ft. to 534 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☒ No ☐ To what depth? 284 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☒ No ☐
Type of water? Heavy iron & H2S Depth of strata 175'
Method of sealing strata off Cased off

(7) PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 189 ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Arcadia D.
Yield: 110 gal./min. with 57 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
8! Am	199	8:05	132	9:31	189
925Am	134	10:35	137	11:00	232
12:50	232	1:05	137		

Date of test 10/[illegible]/88

Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Fill	0'	1'
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
Rocky Sand	1'	5'
Brown Hardpan	5'	16'
Brown Sandy Clay	16'	22'
Brown Rocky Clay	22'	27'
Brown Hardpan	27'	45'
Brown Rocky Clay	45'	50'
Brown Hardpan w/large Rock	50'	58'
Brown Rocky Clay	58'	64'
Brown Sandy Clay	64'	71'
Sandy Gravel - H2O	71'	72'
Brown Hardpan	72'	82'
Brown Rocky Clay	82'	89'
Brown Hardpan	89'	108'
Brown Rocky Clay	108'	120'
Brown Sandy Clay	120'	138'
Gravelly Sand H2O	138'	140'
Brown Hardpan	140'	145'
Brown Rocky Clay	145'	151'
Blue Clay	151'	161'
Blue Hardpan w/organics	161'	165'
Gray Cemented Gravel - H2O	165'	166'
Sandy Gravel	166'	175'
Blue Shale	175'	178'
Gray Gravelly Clay	178'	183'
Gray Gummy Clay	183'	190'
Black Silty Clay	190'	198'
Black Rocky Clay	198'	205'
Black Hardpan	205'	219'
Blue Clay	219'	225'
Black Silty Clay	225'	232'
Gray Gravelly Clay	232'	239'
Gray Hardpan	239'	263'

Work started 10/01/88, 19__ Completed 10/03/88, 19__

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Arcadia Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address SE 178 Walker PK Shelton
(Signed) Jack Watkins (WELL DRILLER) License No. 1465
Contractor's Registration No. ARCADDI147K1 Date 10-5-88, 19__

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

Well 6
308
Pg 2 of 2

Start Card

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 18887

Water Right Permit No. ________

(1) OWNER: Name Lake Limerick Country Club Address ________

(2) LOCATION OF WELL: County Mason SE ¼ SW ¼ Sec 27 T 21 N., R 3 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) ________

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one) ________
Abandoned ☐ New well ☐ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well ________ inches.
Drilled ________ feet. Depth of completed well ________ ft.

(6) CONSTRUCTION DETAILS:
Casing installed: ________ " Diam. from ________ ft. to ________ ft.
Welded ☐ Liner installed ☐ Threaded ☐ ________ " Diam. from ________ ft. to ________ ft.
________ " Diam. from ________ ft. to ________ ft.

Perforations: Yes ☐ No ☐
Type of perforator used ________
SIZE of perforations ________ in. by ________ in.
________ perforations from ________ ft. to ________ ft.
________ perforations from ________ ft. to ________ ft.
________ perforations from ________ ft. to ________ ft.

Screens: Yes ☐ No ☐
Manufacturer's Name ________
Type ________ Model No. ________
Diam. ________ Slot size ________ from ________ ft. to ________ ft.
Diam. ________ Slot size ________ from ________ ft. to ________ ft.

Gravel packed: Yes ☐ No ☐ Size of gravel ________
Gravel placed from ________ ft. to ________ ft.

Surface seal: Yes ☐ No ☐ To what depth? ________ ft.
Material used in seal ________
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ________ Depth of strata ________
Method of sealing strata off ________

(7) PUMP: Manufacturer's Name ________
Type: ________ H.P. ________

(8) WATER LEVELS: Land-surface elevation above mean sea level ________ ft.
Static level ________ ft. below top of well Date ________
Artesian pressure ________ lbs. per square inch Date ________
Artesian water is controlled by ________ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom? ________
Yield: ________ gal./min. with ________ ft. drawdown after ________ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ________
Bailer test ________ gal./min. with ________ ft. drawdown after ________ hrs.
Airtest ________ gal./min. with stem set at ________ ft. for ________ hrs.
Artesian flow ________ g.p.m. Date ________
Temperature of water ________ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
SANDY CLAY W/SOME GRAVEL - H2O	263'	287'
BROWN CLAY	287'	298'
GRAY SANDY CLAY	298'	306'
BROWN HARDPAN	306'	309'
GRAVELLY SANDY CLAY	309'	312'
BROWN HARDPAN	312'	316'
BROWN SANDY CLAY	316'	320'
BROWN HARDPAN	320'	324'
BROWN GRAVELLY CLAY	324'	340'
BROWN SANDY CLAY	340'	412'
BROWN HARDPAN	412'	420'
SANDY GRAVEL - H2O	420'	454'
BROWN CLAY	454	

RECEIVED OCT 7 1988

Work started 10/01/88, 19 Completed 10/03/88, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Arcadia Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address SE 170 Walker Park, Shelton
(Signed) [signature] (WELL DRILLER) License No. 1465
Contractor's Registration No. ARCADDK117KJ Date 10/5/88, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1379-

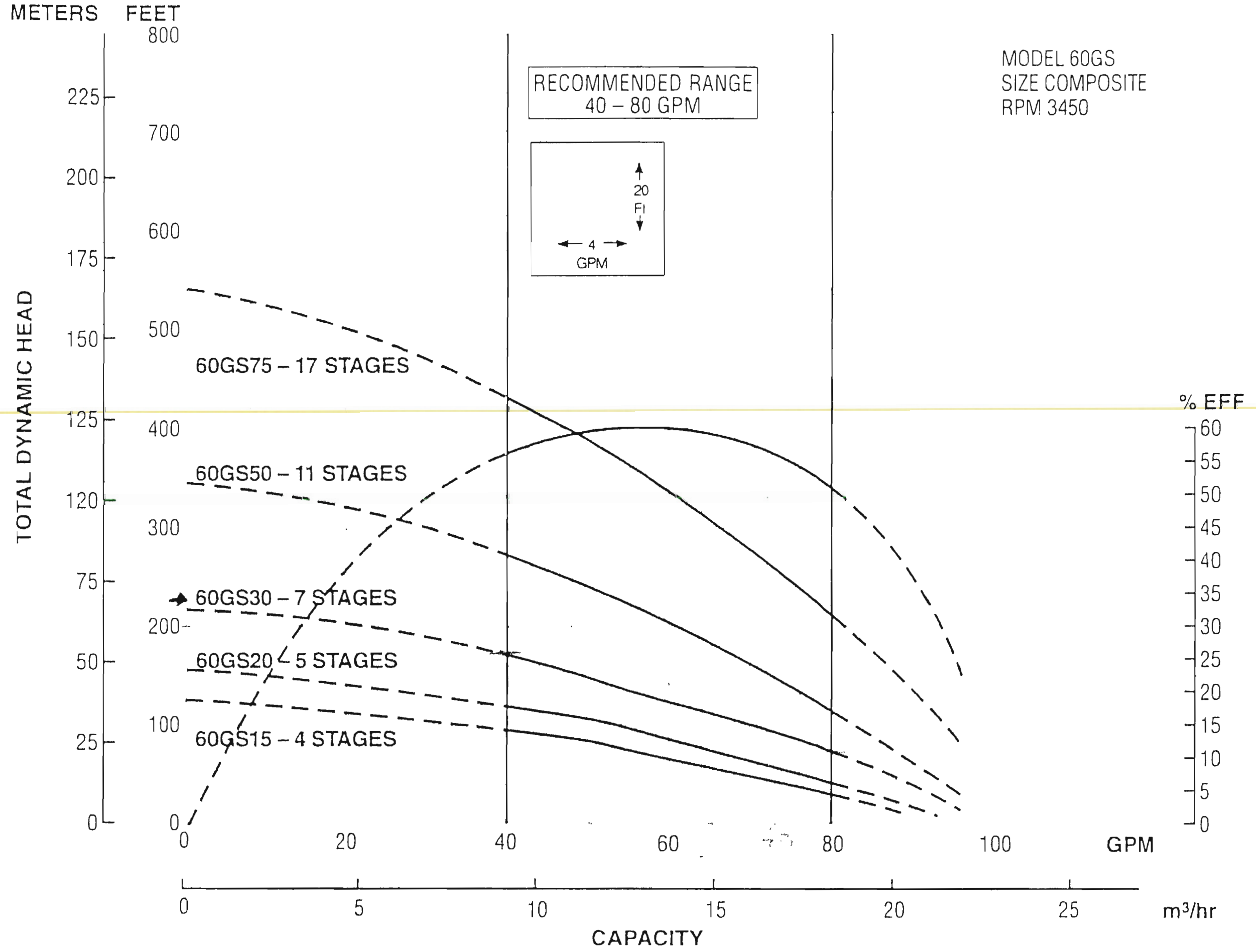
14

Well 1

Model 60GS

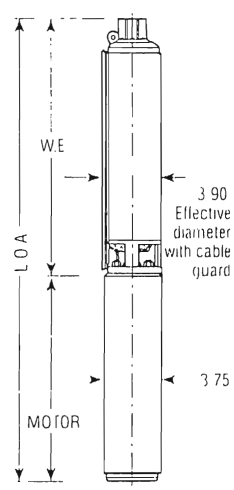
Well #1

GOULDS PUMPS



DIMENSIONS AND WEIGHTS

HP	Stages	W.E. Order No.	Motor Order No.	PH	Motor Volts	Motor Length	W.E.(1) Length	L.O.A.(2)	W.E. and Motor Weight
1½	4	60GS15	S07940	1	230	13.6	15.0	28.6	35.6
			S07978	3	200	11.8	15.0	26.8	30.6
			S07970		230				
			S07975		460				
			S07979*		575				
2	5	60GS20	S08940	1	230	15.1	17.1	32.2	38.5
			S08978	3	200	13.6	17.1	30.7	36.5
			S08970		230				
			S08975		460				
			S08979		575				
3	7	60GS30	S09940	1	230	23.5	21.2	44.7	62.2
			S09978	3	200	20.6	21.2	41.8	53.2
			S09970		230				
			S09975		460				
			S09979		575				
5	11	60GS50	S10940	1	230	29.5	30.9	60.4	83.2
			S10978	3	200	23.6	30.9	54.5	67.2
			S10970		230				
			S10975		460				
			S10979*		575				
7½	17	60GS75	S119784	3	200	29.6	43.2	72.8	85.2
			S119704		230				
			S119754		460				



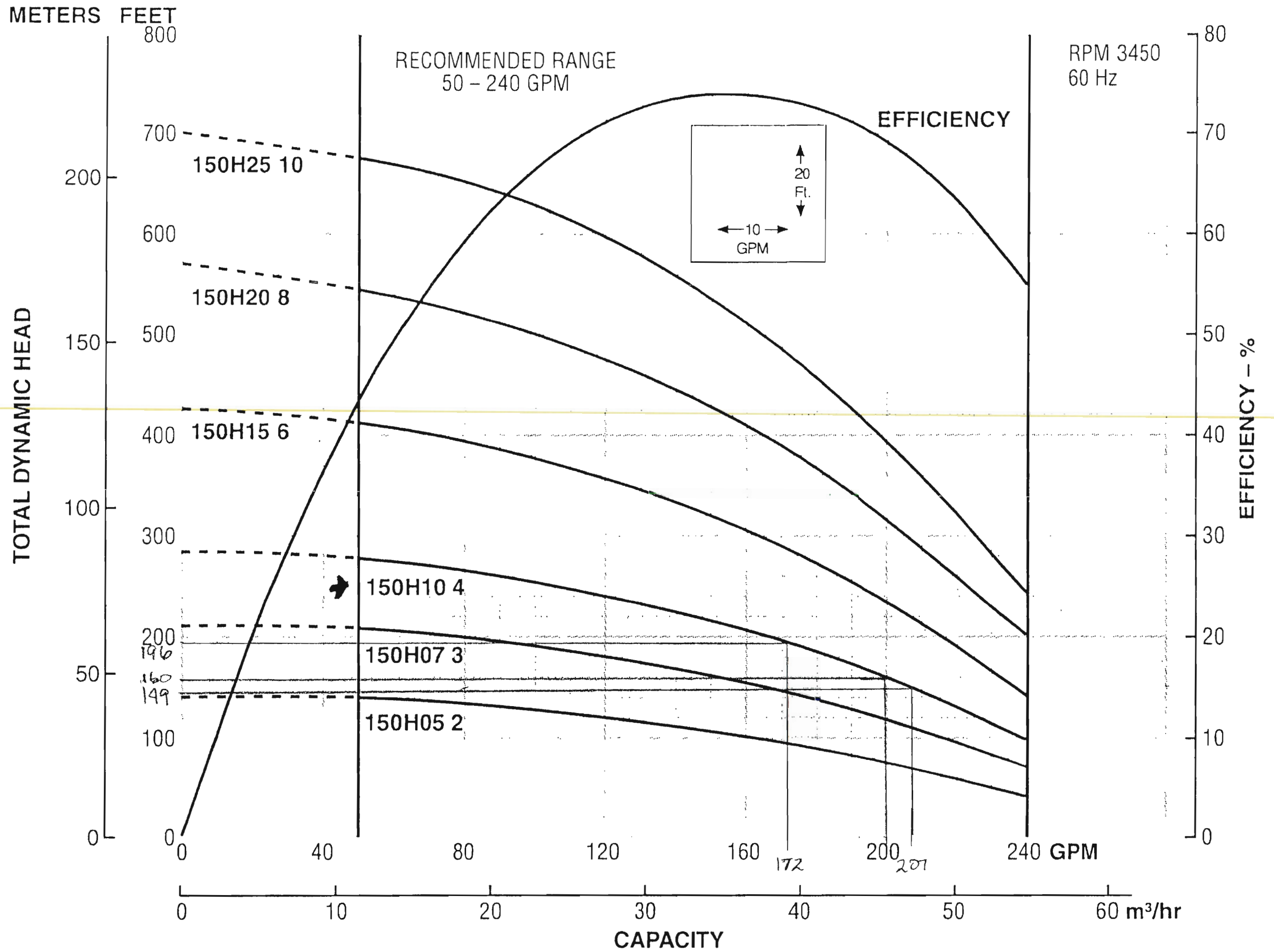
NOTES:
For complete pump, order water end and motor
(1) W.E. = water end or pump without motor
(2) L.O.A. = length of assembly – complete pump – water end and motor
* Non-stock motors have a 6 week lead time.

Well 2

Model 150H

Well #2

GOULDS PUMPS

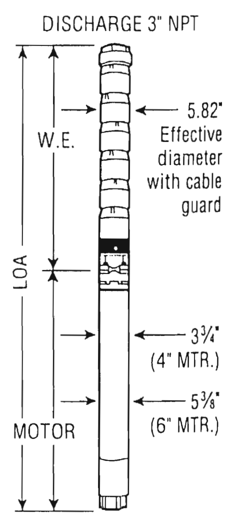


Curve Reference SU 507

DIMENSIONS AND WEIGHTS

HP	Stages	W.E. Order No.	Motor Order No.	PH	Motor Volts	Motor Lgth.	W.E. Lgth.	LOA	Wt. (lbs.)
5	2	150H05 2	S10940	1	230	29.5	18.0	47.5	95
			S10978 S10970 S10975 S10979	3	200 230 460 575	23.5	18.0	41.5	95
7.5	3	150H07 3	S11970	1	230	28.0	24.3	52.3	185
			S11978 S11971 S11972 *S11979	3	200 230 460 575	24.2	24.3	48.5	160
10	4	150H10 4	S12970	1	230	30.6	29.3	59.9	215
			S12978 S12971 S12972 *S12979	3	200 230 460 575	25.5	29.3	54.8	185

HP	Stages	W.E. Order No.	Motor Order No.	PH	Motor Volts	Motor Lgth.	W.E. Lgth.	LOA	Wt. (lbs.)
15	6	150H15 6	S13970	1	230	33.1	39.3	72.4	255
			S13978 S13971 S13972 *S13979	3	200 230 460 575	28.0	39.3	67.3	229
20	8	150H20 8	S14978 S14971 S14972 *S14979	3	200 230 460 575	30.6	49.3	79.9	274
25	10	150H25 10	S15978 S15971 S15972 *S15979	3	200 230 460 575	33.2	59.3	92.5	316



(All dimensions are in inches and weights in lbs. Do not use for construction purposes.)
*Non-stock motors have a six (6) week lead time.

Water end and motor must be ordered separately and are packaged separately.

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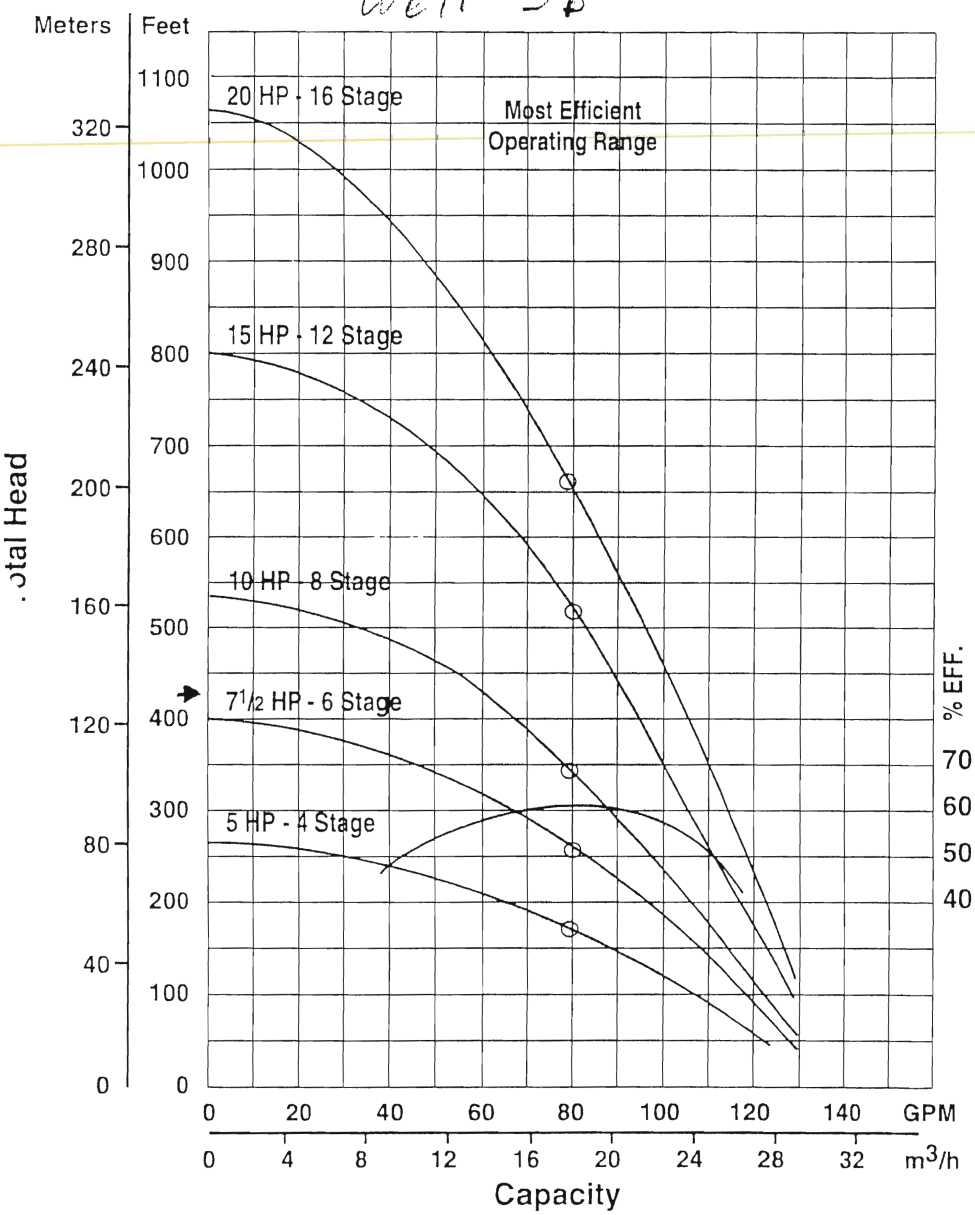
Well 3B

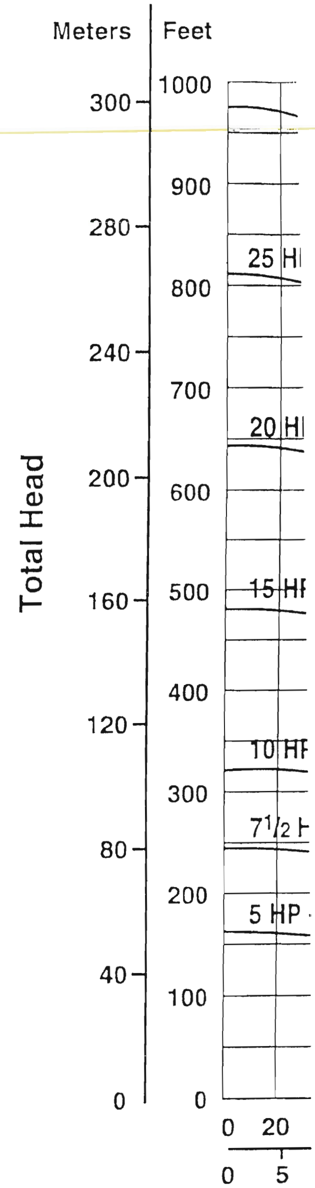
Composite Performance Curves
Minimum Well Size 6˝ ID

80 GPM • 5 thru 20 HP • 3450 RPM • 60 Hz • 6P

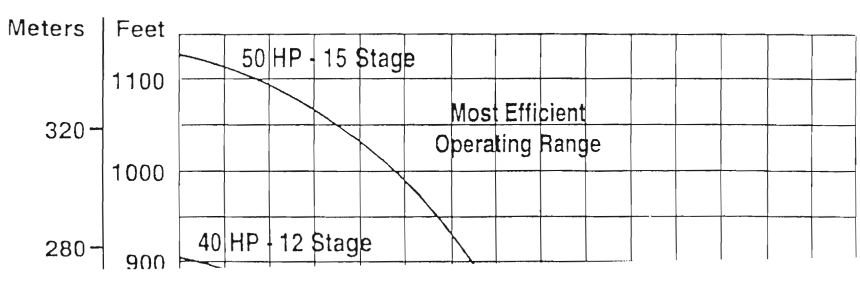
Well 3b



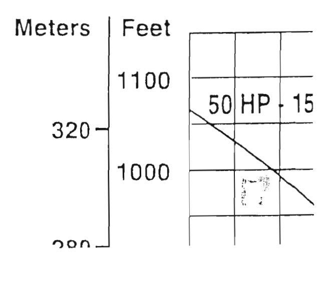
120 GPM • 5 thru



200 GPM • 5 thru 50 HP • 3450 RPM • 60 Hz • 6T



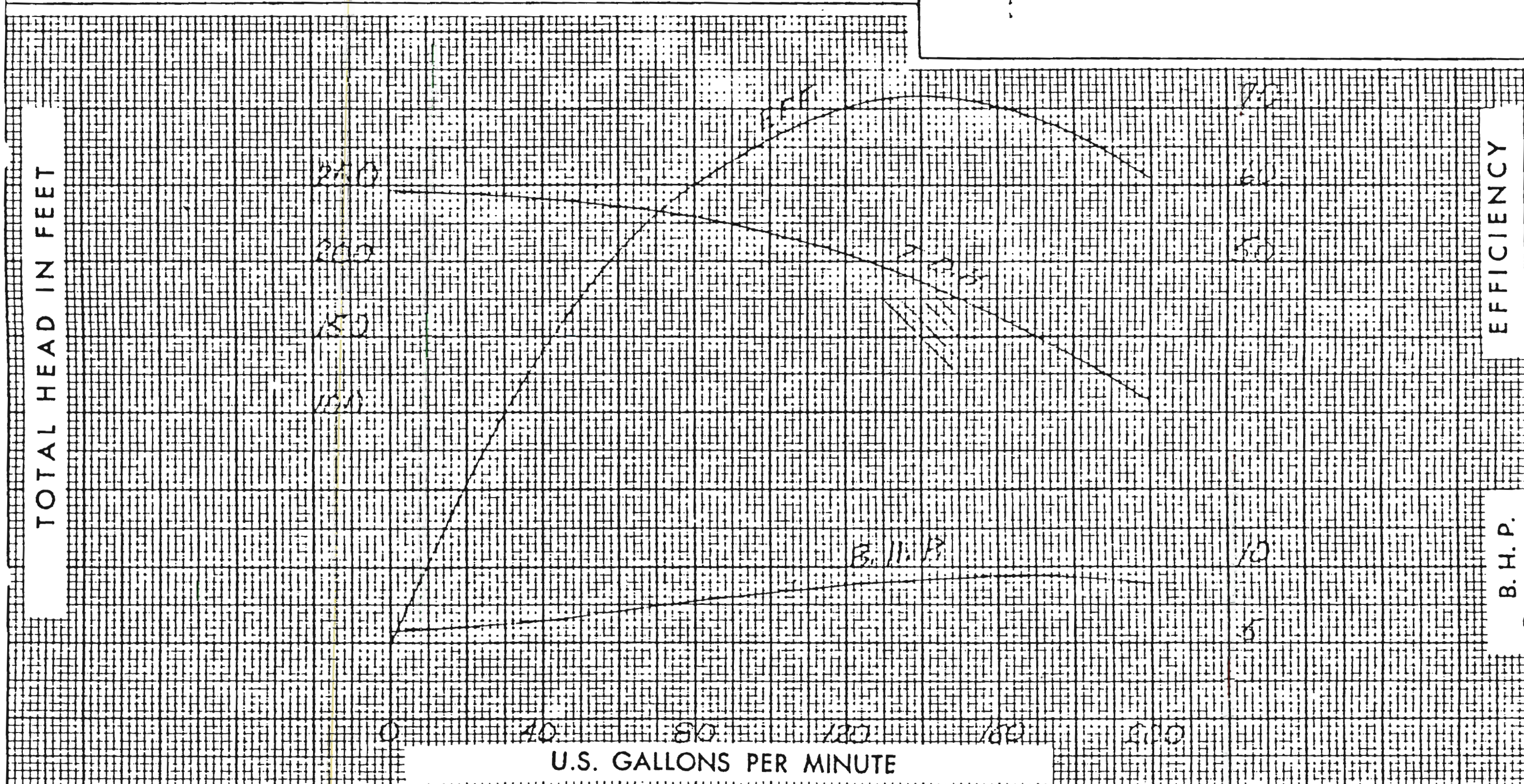
250 GPM • 5 thru



Well4

85' SETTING

10 HP DEEP WELL TURBINE PUMP



VALLEY PUMP SERVICE
1408 18TH AVENUE N. W.
PUYALLUP, WASHINGTON

FLOWAY PUMPS, INC., FRESNO, CALIF.

TYPE 6 JOLL
NO. OF STAGES 4
R.P.M. 3475
PUMP SERIAL NO. 68-3977

WELL NO. 4

DWN. BY D. Z. DATE 1-11-73

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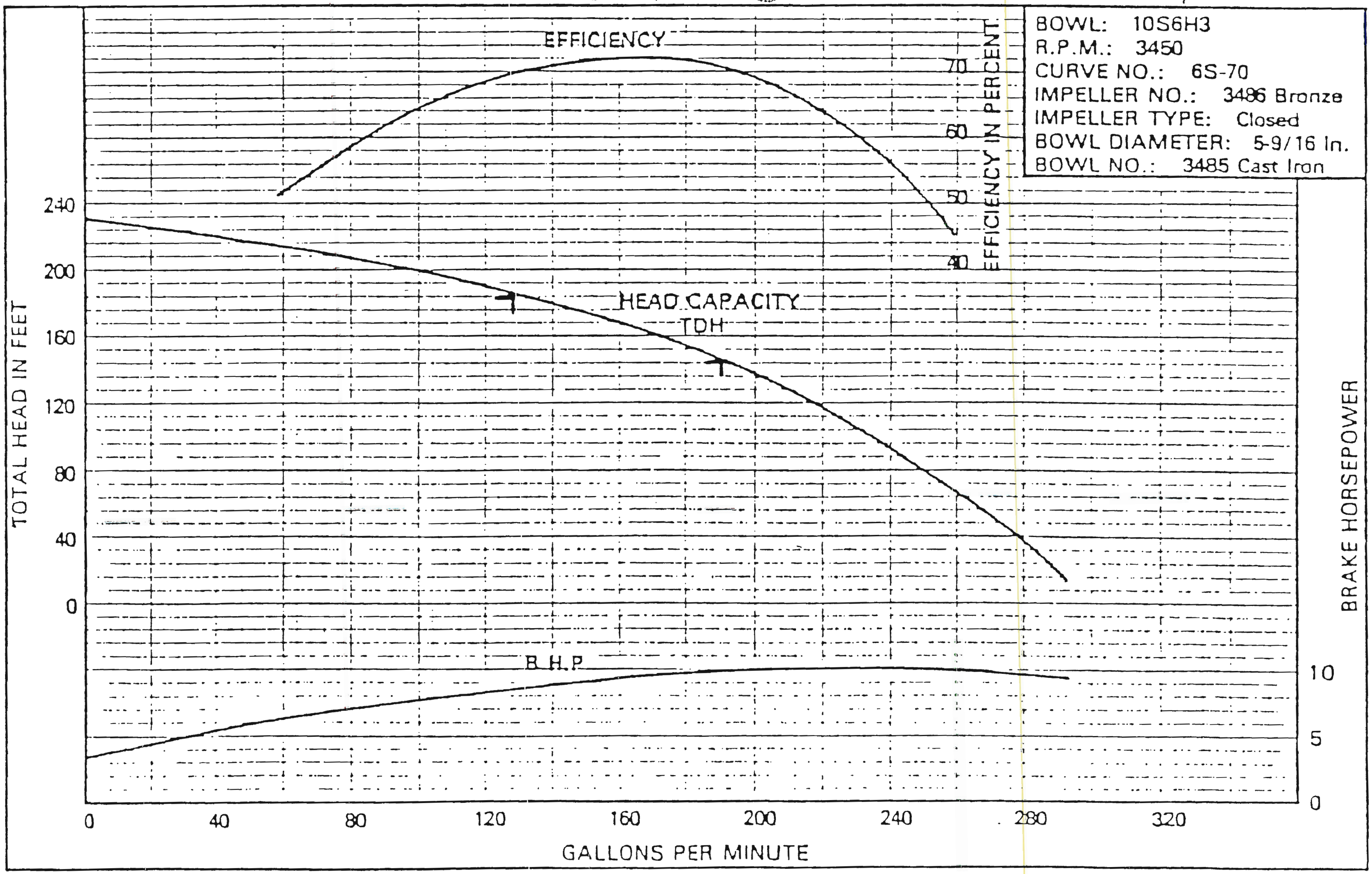
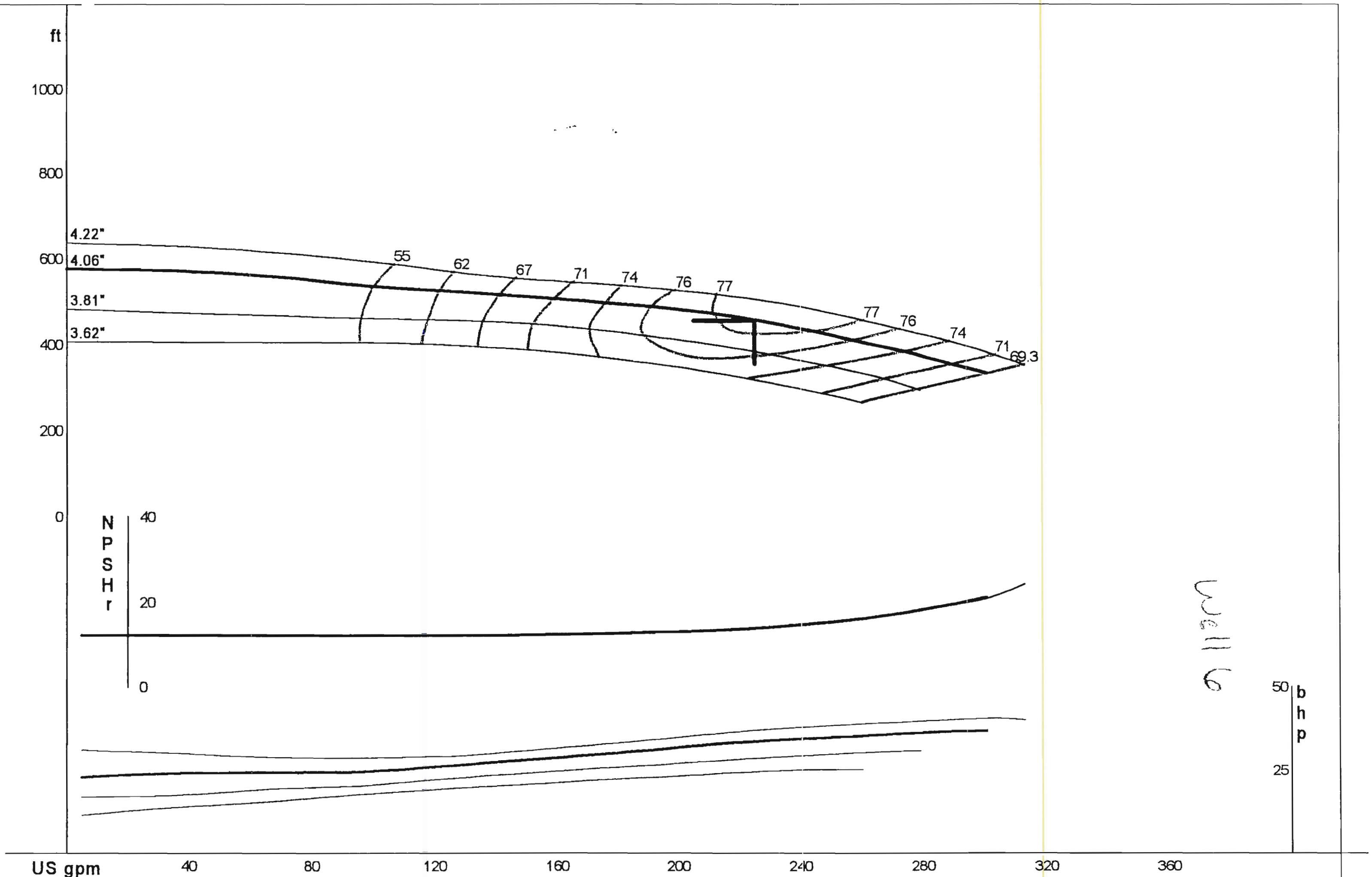
Well 5

Jacuzzi



19

Well 6



Arcadia Drilling	Turbine ~~60 Hz~~ 56.2 Hz	TURBINE - 3600
	Catalog: SUB60.MPC, vers 2.01	Size: 6CHC; - 7 Stg
08/06/04	Curve: 3016	Speed: 3450 rpm
Selection file: (untitled)	Design Point: 225 US gpm, 456 ft	Impeller: 4.06 in

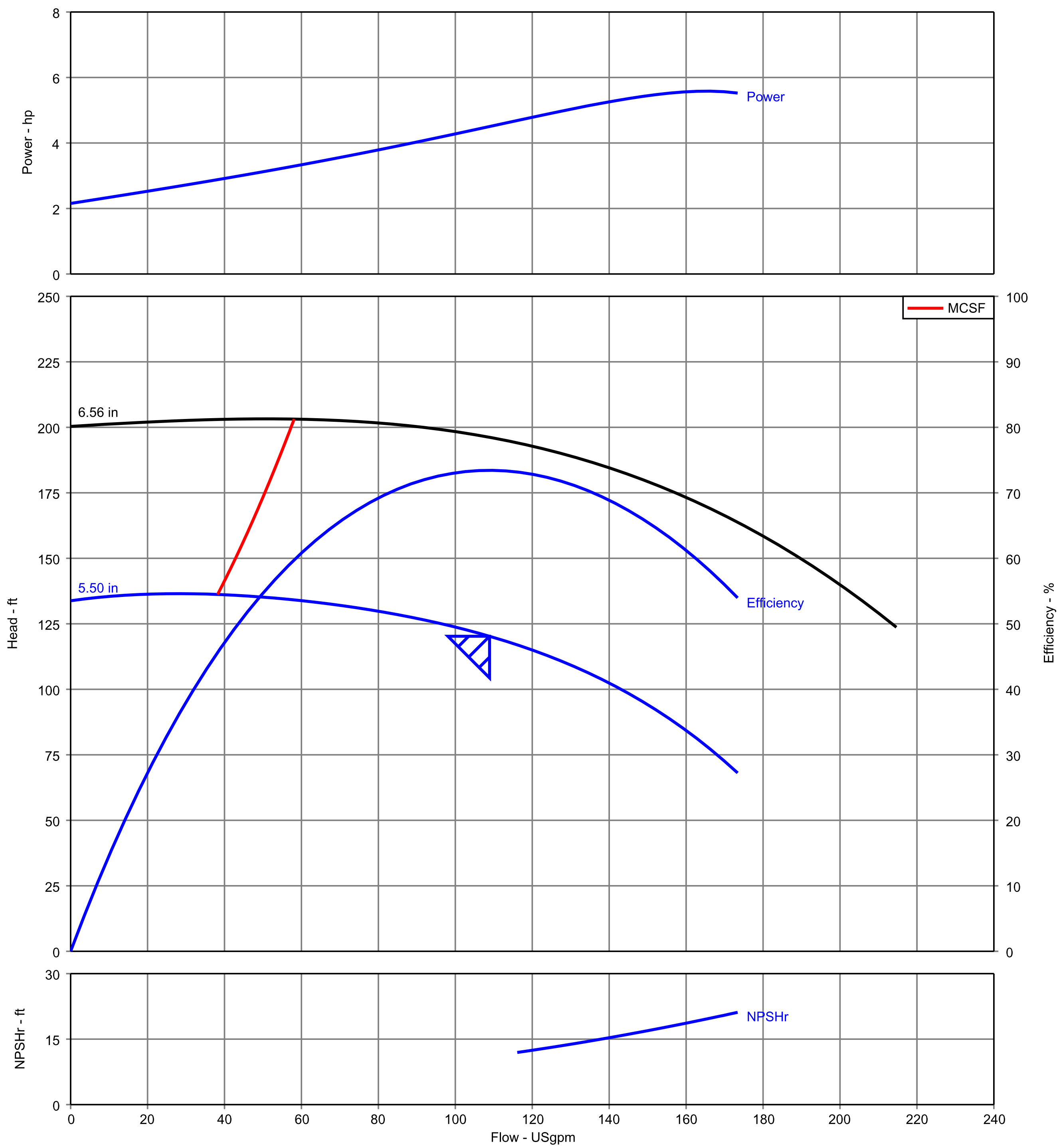
20

Appendix 10.4
Booster Pump Curves

Booster Pump #1

Pentair Electronic Catalog

Pump Performance Curve



Customer	:	Size	: 1-1/2 x 2 x 6 M (B1-1/2TPM)
Customer reference	:	Stages	: 1
Item number	: Default	Speed, rated	: 3,450 rpm
Service	:	Based on curve number	: 8888
Quantity	: 1	Efficiency	: 73.43 %
Quote number	:	Power, rated	: 4.50 hp
Date last saved	: 27 Mar 2013 12:33 PM	NPSH required	: - ft
Flow, rated	: 108.9 USgpm	Viscosity	: 1.00 cP
Differential head / pressure, rated	: 120.2 ft	Cq/Ch/Ce [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00
Fluid density, rated / max	: 1.000 / 1.000 SG		

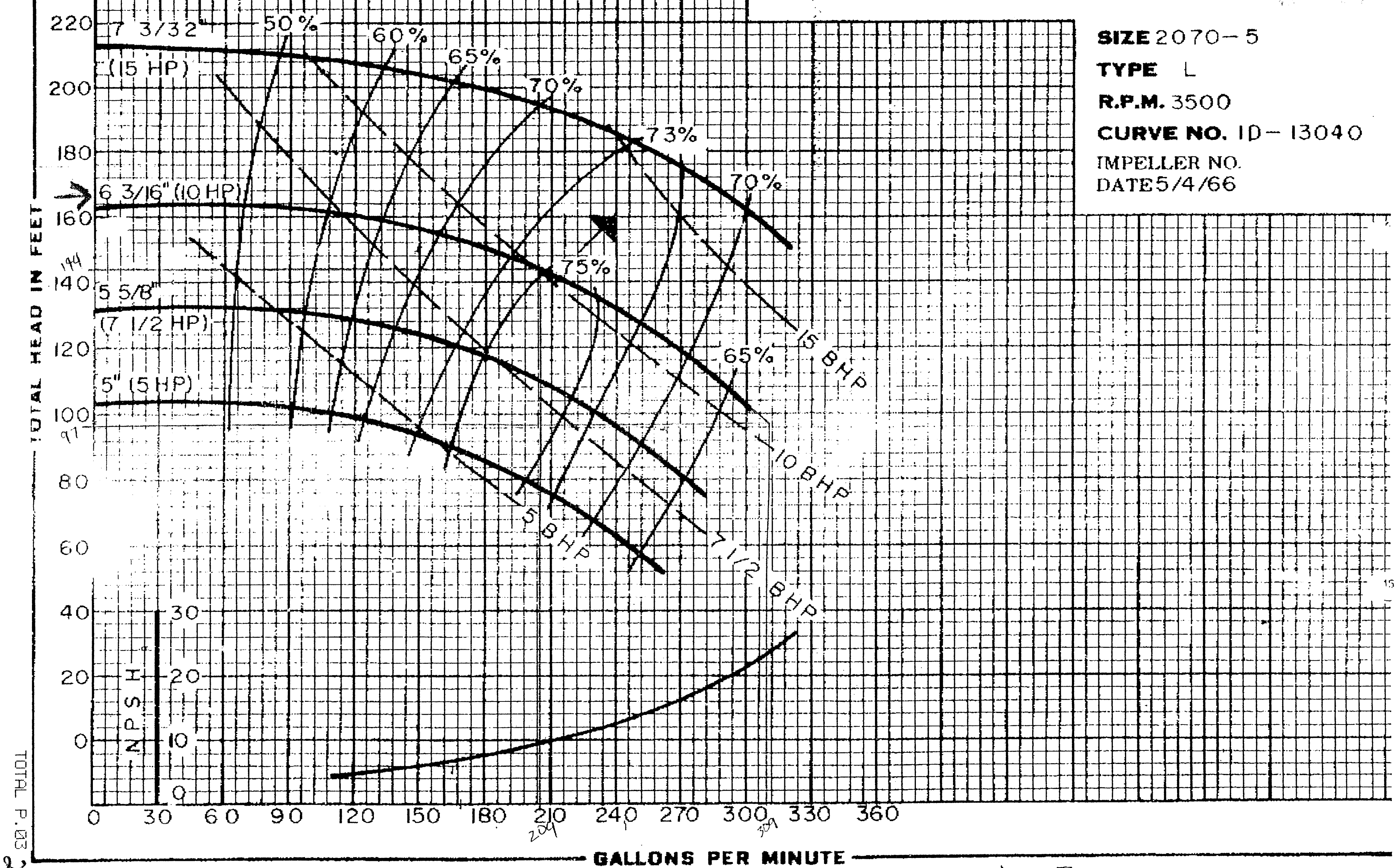
Booster Pumps 3A & 3B

CHARACTERISTIC CURVES

PACIFIC PUMPING COMPANY

Oakland, Calif., U. S. A.

SIZE 2070-5
TYPE L
R.P.M. 3500
CURVE NO. ID-13040
IMPELLER NO.
DATE 5/4/66



Form RB44B 2/54

240 @ 162'

MAIN PUMPS

2

Booster Pump 4

CHARACTERISTIC CURVES

PACIFIC PUMPING COMPANY

Oakland, Calif., U. S. A.

SIZE 1570 – 1

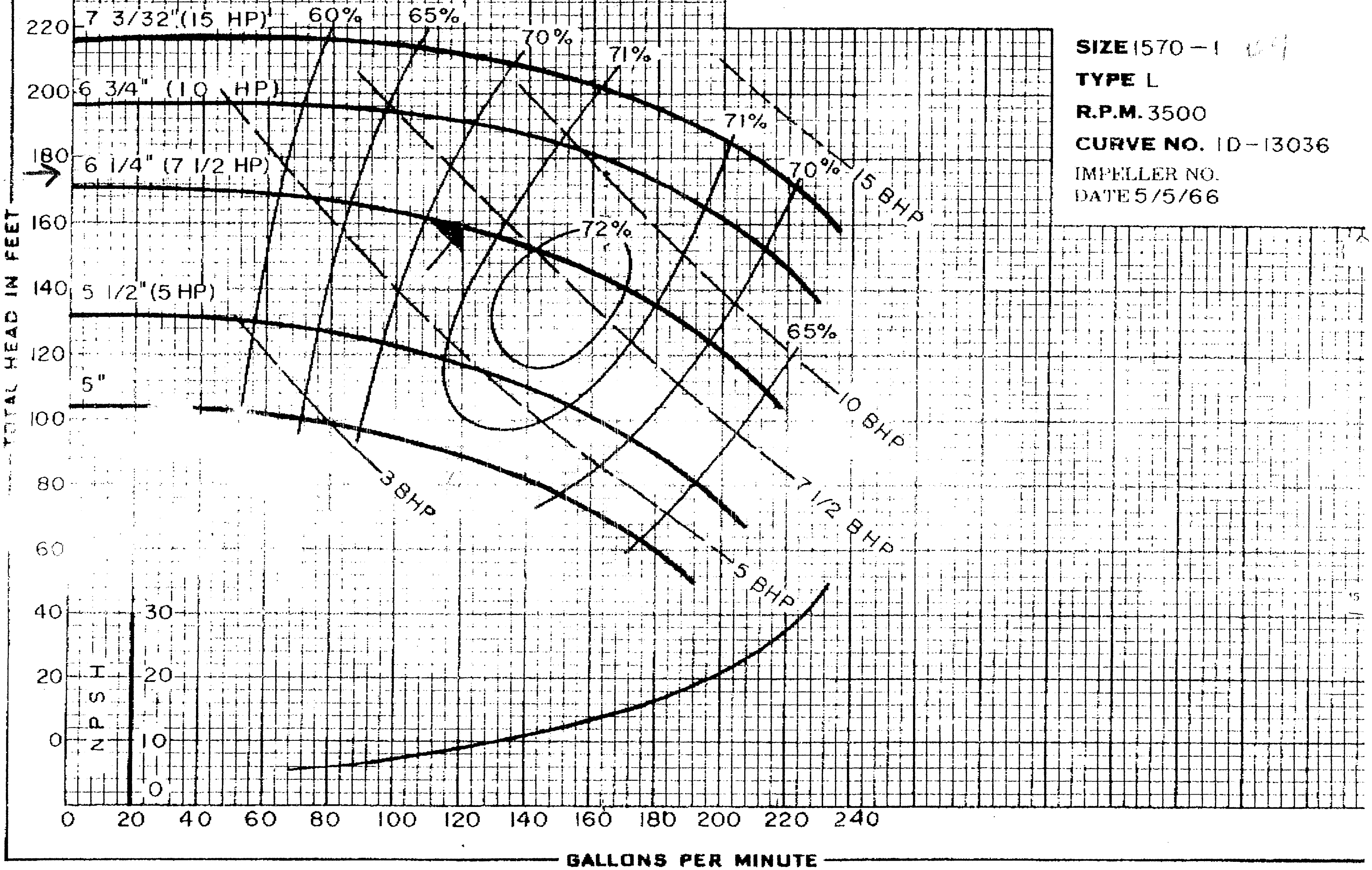
TYPE L

R.P.M. 3500

CURVE NO. ID – 13036

IMPELLER NO.

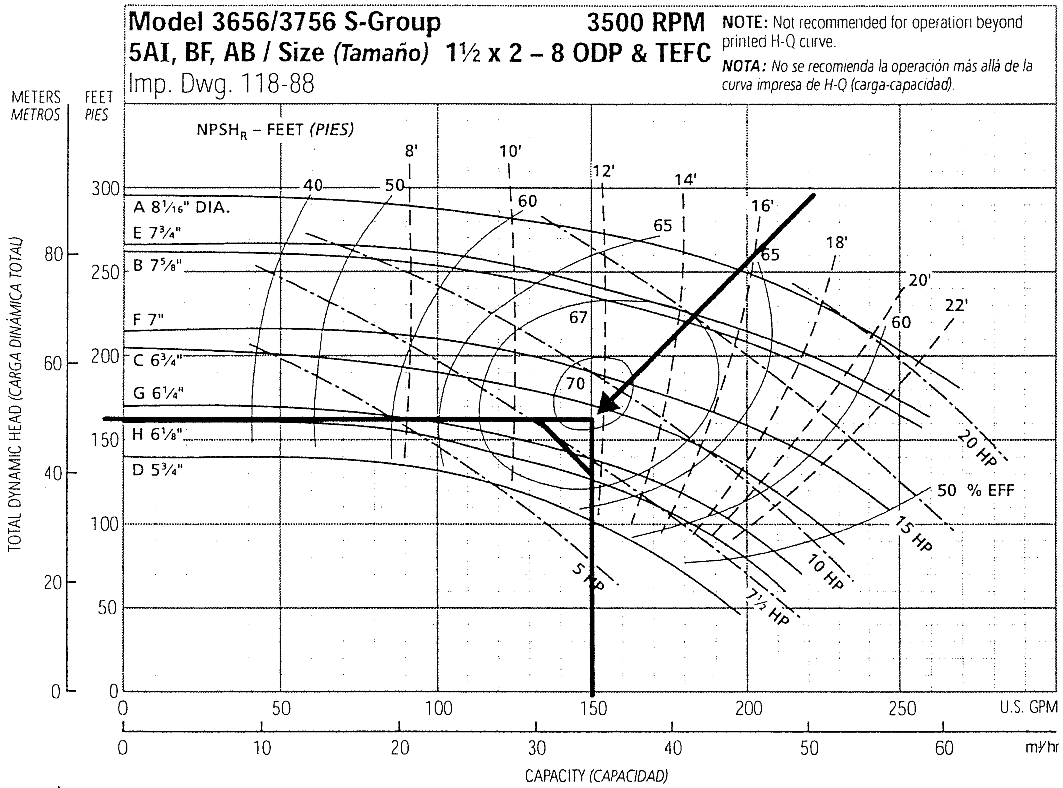
DATE 5/5/66



1200 162' LEAD Pump

Form R848B 2/59

Performance Curves – 60 Hz, 3500 RPM
Curvas de desempeño – 60 Hz, 3500 RPM



Optional Impeller *Impulsor optativo*	
Ordering Code *Código de pedido*	Dia. *Diá.*
A	8 1/16"
E	7¾"
B	7⅝
F	7
C	6¾
G	6¼
H	6⅛
D	5¾

NOTE: Pump will pass a sphere to 5/16" diameter.

Lake Limerick, P1,2, 150 GPM
@ 163' TDH, 70%, 10 hp
9/1/04 FJT

Appendix 10.5
System Inventory

Component	Year Installed	Service Life	Age	Assessed Life	Current Unit Price	Units	Current Replacement Cost	Cost at Next Replacement
Well 1, 10" x 116', and Source Approval	1967	80	53	27	$23,000	1	$23,000	$51,090
Well 2, 10" x 103', and Source Approval	1968	80	52	28	$22,000	1	$22,000	$50,334
Well 3A, 10" x 148', and Source Approval	1968	80	52	28	$25,000	1	$25,000	$57,198
Well 3B, 10" x 177', and Source Approval	1982	80	38	42	$27,000	1	$27,000	$93,439
Well 4, 10" x 110', and Source Approval	1969	80	51	29	$22,000	1	$22,000	$51,844
Well 5, 10" x 130', and Source Approval	1987	80	33	47	$24,000	1	$24,000	$96,285
Well 6, 10" x 434', and Source Approval	1989	80	31	49	$45,000	1	$45,000	$191,530
Well 1 Pump (3-HP), Controls, Drop Pipe	1998	30	22	8	$12,000	1	$12,000	$15,201
Well 2 Pump (10-HP), Controls, Drop Pipe	2002	30	18	12	$18,500	1	$18,500	$26,377
Well 3A Pump (7.5-HP), Controls, Drop Pipe	2010	30	10	20	$18,500	1	$18,500	$33,413
Well 3B Pump (7.5-HP), Controls, Drop Pipe	2003	30	17	13	$20,000	1	$20,000	$29,371
Well 4 Pump (10-HP), Controls, Drop Pipe	1998	30	22	8	$19,000	1	$19,000	$24,069
Well 5 Pump (10-HP), Controls, Drop Pipe	2004	30	16	14	$20,000	1	$20,000	$30,252
Well 6 Pump (40-HP), Controls, Drop Pipe	2013	30	7	23	$47,000	1	$47,000	$92,759
Booster S1-1 and controls, 4.5-HP	2004	30	16	14	$7,000	1	$7,000	$10,588
Booster S3-1 and controls, 10-HP	2002	30	18	12	$15,000	1	$15,000	$21,386
Booster S3-2 and controls, 10-HP	1991	30	29	1	$15,000	1	$15,000	$15,450
Booster S4-1 and controls, 7.5-HP	1999	30	21	9	$10,000	1	$10,000	$13,048
Booster S6-1 and controls, 10-HP	2004	30	16	14	$15,000	1	$15,000	$22,689
Booster S6-2 and controls, 10-HP	2004	30	16	14	$15,000	1	$15,000	$22,689
Site 1 Bldg, Appurtenances	1985	75	35	40	$12,500	1	$12,500	$40,775
Site 2 Bldg, Appurtenances	1967	75	53	22	$19,000	1	$19,000	$36,406
Site 3 Bldg, Appurtenances	1981	75	39	36	$19,000	1	$19,000	$55,067
Site 4 Bldg, Appurtenances	1968	75	52	23	$20,000	1	$20,000	$39,472
Site 5 Bldg, Appurtenances	1968	75	52	23	$12,500	1	$12,500	$24,670
Site 6 Bldg, Appurtenances	2004	75	16	59	$32,000	1	$32,000	$183,040
84,600 gallon Reservoir, Site 1	1986	100	34	66	$190,000	1	$190,000	$1,336,628
158,600 gallon Reservoir, Site 3	1992	100	28	72	$320,000	1	$320,000	$2,688,006
77,000 gallon Reservoir, Site 4	1983	100	37	63	$175,000	1	$175,000	$1,126,635
158,600 gallon Reservoir, Site 6	2004	100	16	84	$320,000	1	$320,000	$3,832,453
Site 3 Generator, natural gas	1998	50	22	28	$35,000	1	$35,000	$80,077
Site 4 Generator	2022	50	-	2	$40,000	1	$40,000	$42,436
Site 6 Generator, propane	2004	50	16	34	$35,000	1	$35,000	$95,617
Site 1 Fence	2000	50	20	30	$10,000	1	$10,000	$24,273
Site 3 Fence	1998	50	22	28	$10,000	1	$10,000	$22,879
Site 4 Fence	2004	50	16	34	$10,000	1	$10,000	$27,319
Site 5 Fence	2001	50	19	31	$5,000	1	$5,000	$12,500
Site 6 Fence	2001	50	19	31	$15,000	1	$15,000	$37,501
8" Waterline	1967	75	53	22	$80	15076	$1,206,080	$2,310,974
6" Waterline	1967	75	53	22	$70	58550	$4,098,500	$7,853,150
8" Distribution Valves	1967	50	53	15	$1,200	26	$31,200	$48,609
6" Distribution Valves	1967	50	53	15	$1,000	75	$75,000	$116,848
Fire Hydrants	1970	50	50	10	$5,000	54	$270,000	$362,857
Service Meters	2013	15	7	8	$350	1201	$420,350	$532,487
Meter Setters	2013	25	7	18	$300	1201	$360,300	$613,387
Service Laterals	1967	75	53	22	$1,200	1201	$1,441,200	$2,761,488
Air Vacuum Release Assy	1970	50	50	3	$2,000	7	$14,000	$15,298
Standpipe Blowoffs	1970	50	50	15	$2,000	54	$108,000	$168,260
SCADA System - routine upgrade/replace	2004	20	16	2	$40,000	1	$40,000	$42,436

Appendix 10.6
Meter Data

Production Summary
Consumption Summary
2019 Consumption Report

Production Report 2016-2019

	Well #1	Well #2	Well #3A	Well #3B	Well #4	Well #5	Well #6	Monthly Production
Jan-16	635,052	-	667,467	712,500	833,533	-	1,727,700	4,576,252
Feb-16	528,067	-	386,375	410,966	672,981	-	1,550,329	3,548,718
Mar-16	501,705	-	487,601	543,005	713,664	-	1,589,000	3,834,975
Apr-16	534,414	-	1,091,100	1,159,053	774,765	-	1,056,671	4,616,003
May-16	623,999	-	847,328	895,776	1,273,026	933,700	1,891,184	6,465,013
Jun-16	644,118	-	1,180,310	1,266,250	1,996,831	1,946,200	368,729	7,402,438
Jul-16	606,002	-	1,893,069	2,098,934	1,331,473	1,358,000	890,129	8,177,607
Aug-16	707,186	-	2,002,650	2,215,216	1,818,627	1,834,200	892,858	9,470,738
Sep-16	569,901	-	534,800	568,400	953,500	1,814,700	969,100	5,410,401
Oct-16	658,988	-	800,700	851,100	809,900	21,700	1,897,200	5,039,588
Nov-16	521,954	-	1,157,600	1,220,900	855,700	-	587,200	4,343,354
Dec-16	442,592	-	1,454,143	1,108,814	860,843	-	961,386	4,827,777
Jan-17	483,283	-	722,257	978,486	1,773,957	-	535,114	4,493,097
Feb-17	615,903	-	559,800	750,800	1,067,700	-	817,100	3,811,303
Mar-17	655,846	-	670,200	893,600	1,091,000	8,900	920,600	4,240,146
Apr-17	610,405	-	1,185,283	1,589,683	484,950	407,417	829,900	5,107,639
May-17	632,097	-	969,217	1,298,583	1,131,917	1,161,017	378,933	5,571,764
Jun-17	604,646	-	718,625	963,633	1,353,108	1,818,492	1,472,417	6,930,921
Jul-17	818,873	-	905,375	845,900	2,194,925	2,068,575	2,799,150	9,632,798
Aug-17	805,446	-	1,017,500	1,389,100	1,675,100	2,016,000	2,639,100	9,542,246
Sep-17	739,597	-	517,500	307,600	1,373,700	1,930,900	1,891,500	6,760,797
Oct-17	776,299	-	906,100	1,242,100	667,500	279,800	838,500	4,710,299
Nov-17	654,724	-	628,475	850,150	1,339,500	-	719,475	4,192,324
Dec-17	747,476	-	990,825	1,311,250	712,050	-	684,825	4,446,426
Jan-18	797,667	-	673,600	905,267	1,342,017	-	536,300	4,254,851
Feb-18	689,645	-	648,100	873,348	879,162	-	736,271	3,826,526
Mar-18	763,804	-	603,607	844,171	901,086	-	939,793	4,052,461
Apr-18	703,836	-	638,921	862,800	1,112,671	-	836,579	4,154,807
May-18	848,295	-	675,294	915,392	2,014,659	65,567	1,663,379	6,182,585
Jun-18	767,294	-	1,335,203	1,831,222	1,678,181	20,383	1,694,403	7,326,686
Jul-18	857,171	-	1,875,775	2,611,400	1,946,975	832,650	2,203,475	10,327,446
Aug-18	1,072,527	-	2,051,360	2,897,400	1,384,240	519,360	2,250,920	10,175,807
Sep-18	937,039	-	1,243,554	1,523,100	834,531	536,411	1,097,509	6,172,145
Oct-18	846,036	-	1,012,036	679,700	650,579	71,929	1,616,471	4,876,750
Nov-18	1,558,676	-	439,217	612,433	250,250	-	2,240,400	4,489,169
Dec-18	712,200	-	630,233	966,367	369,100	-	1,949,400	4,627,300
Jan-19	1,107,700	-	562,600	1,399,000	998,300	159,100	1,333,600	5,560,300
Feb-19	1,018,600	-	-	1,625,500	1,121,500	1,697,700	1,133,700	6,597,000
Mar-19	517,800	7,000	127,800	2,846,233	738,033	1,489,633	269,200	5,988,700
Apr-19	607,800	1,100	-	820,367	546,667	2,087,667	345,300	4,407,800
May-19	709,700	100	-	1,011,900	1,746,900	2,655,100	377,000	6,500,600
Jun-19	1,344,380	3,600	500	2,099,780	1,438,240	2,356,360	1,001,440	8,240,700
Jul-19	1,225,720	-	100	2,461,020	944,160	2,357,940	1,180,760	8,169,700
Aug-19	752,060	1,900	800	4,615,960	922,920	1,067,580	1,312,460	8,671,780
Sep-19	385,618	-	-	2,766,366	869,550	1,219,477	1,599,892	6,840,903
Oct-19	479,322	-	-	3,092,874	921,030	601,043	1,067,348	6,161,617
Nov-19	936,988	-	137,538	2,255,975	1,047,788	331,288	1,637,338	6,346,913
Dec-19	523,813	-	1,081,163	1,070,825	467,713	715,913	985,963	4,845,388

Consumption Summary 2013-2019

Year	Period	Days in Period	System-Wide Consumption (gal)	Average Monthly Use (gal)	Average Daily Use (gal)
2013	Jan-Mar	90	7,365,805	2,455,268	81,842
2013	Apr-Jun	91	11,802,620	3,934,207	129,699
2013	Jul-Sep	92	21,911,994	7,303,998	238,174
2013	Oct-Dec	92	11,976,322	3,992,107	130,177
2014	Jan-Mar	90	10,482,376	3,494,125	116,471
2014	Apr-Jun	91	7,938,675	2,646,225	87,238
2014	Jul-Sep	92	24,274,167	8,091,389	263,850
2014	Oct-Dec	92	13,573,977	4,524,659	147,543
2015	Jan-Mar	90	10,335,971	3,445,324	114,844
2015	Apr-Jun	91	11,964,336	3,988,112	131,476
2015	Jul-Sep	92	27,941,687	9,313,896	303,714
2015	Oct-Dec	92	12,067,536	4,022,512	131,169
2016	Jan-Mar	91	10,613,236	3,537,745	116,629
2016	Apr-Jun	91	13,738,268	4,579,423	150,970
2016	Jul-Sep	92	24,252,229	8,084,076	263,611
2016	Oct-Dec	92	13,080,952	4,360,317	142,184
2017	Jan-Mar	90	11,454,391	3,818,130	127,271
2017	Apr-Jun	91	12,865,061	4,288,354	141,374
2017	Jul-Sep	92	24,742,897	8,247,632	268,945
2017	Oct-Dec	92	10,447,030	3,482,343	113,555
2018	Jan-Mar	90	11,058,839	3,686,280	122,876
2018	Apr-Jun	91	13,805,094	4,601,698	151,704
2018	Jul-Sep	92	26,294,827	8,764,942	285,813
2018	Oct-Dec	92	16,323,240	5,441,080	177,427
2019	Jan-Mar	90	14,917,753	4,972,584	165,753
2019	Apr-Jun	91	20,943,298	6,981,099	230,146
2019	Jul-Sep	92	22,468,066	7,489,355	244,218
2019	Oct-Dec	92	12,427,323	4,142,441	135,080

WATER CONSUMPTION REPORT - 2019

WATER VOLUME ENTERING DISTRIBUTION SYSTEM

1 A. Total Volume Produced	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Totals
Total Volume Produced Well #1	1,162,400	1,018,600	517,800	607,800	709,700	1,256,700	1,313,400	727,000	452,500	437,500	989,200	469,000	9,661,600
Total Volume Produced Well #2	0	0	7,000	1,100	100	3,600	0	1,900	0	0	0	0	13,700
Total Volume Produced Well #3a	740,800	0	127,800	0	500	0	100	800	0	0	160,000	1,058,700	2,088,700
Total Volume Produced Well #3b	1,647,700	1,625,500	2,712,100	945,500	1,011,900	1,971,900	2,588,900	4,573,600	2,279,800	3,621,800	2,310,500	1,016,200	26,305,400
Total Volume Produced Well #4	1,144,800	1,121,500	703,100	581,600	1,746,900	1,377,200	1,005,200	868,900	1,023,400	821,200	1,136,900	378,600	11,909,300
Total Volume Produced Well #5	159,100	1,697,700	1,375,100	2,202,200	2,655,100	2,260,600	2,453,700	1,018,400	1,294,100	575,600	364,200	683,000	16,738,800
Total Volume Produced Well #6	1,518,600	1,133,700	269,200	345,300	377,000	815,800	1,339,400	1,200,800	2,024,800	754,100	1,794,200	829,100	12,402,000
1 B. Total Volume Purchased	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1. Total Water Produced All Sources:	6,373,400	6,597,000	5,712,100	4,683,500	6,501,200	7,685,800	8,700,700	8,391,400	7,074,600	6,210,200	6,755,000	4,434,600	79,119,500

TOTAL VOLUME CONSUMED

	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Totals
2 A. Water Volume Metered (Billed and Unbilled)	4,277,642	3,747,514	3,542,586	3,959,676	6,095,907	7,173,077	8,291,601	7,040,478	4,899,504	3,835,585	3,744,333	3,370,531	59,978,434
2 C. Estimated Authorized Uses (may be billed or Unbilled)													0
Utility Flushing and Tank Cleaning	2,900		7,000	1,100	1,100	4,000		1,900			21,733		39,733
Firefighting and Training													0
Storm or Sewer Cleening / Street Sweep													
Other:_____________________													
Distribution storage - Allowed										353,002.6	440,093	378,446	
2. Total Authorized Consumption	4,280,542	3,747,514	3,549,586	3,960,776	6,097,007	7,177,077	8,291,601	7,042,378	4,899,504	4,188,588	4,206,159	3,748,977	61,189,708
Total Volume DSL	**2,092,858**	**2,849,486**	**2,162,514**	**722,724**	**404,193**	**508,723**	**409,099**	**1,349,022**	**2,175,096**	**2,021,612**	**2,548,842**	**685,623**	17,929,792
Percent DSL	**32.8%**	**43.2%**	**37.9%**	**15.4%**	**6.2%**	**6.6%**	**4.7%**	**16.1%**	**30.7%**	**32.6%**	**37.7%**	**15.5%**	

Year to Date Total DSL:	**22.7%**

Compliance with leakage standard is based on a 3-year average from last three submitted years	**5.3%**
Next years 3 year average based on current data	**10.6%**

Water Rights Data	Right (acrft/yr) AFY (Qa)	% of total	Total	Acre-feet used	%Water right used	WR allocated (AFY)	WR allocated (%)	MIFR (Qi) GPM
5566-A (G2-08049) AHA-974 S05 Well #1	117	16.7%	9,661,600	29.7	25.3%	29.7	4.2%	100
5587-A AHA-978 S02 Well #2	166	23.7%	13,700	0.0	0.0%	89.5	12.8%	200
5888-A (G2-08834) AHA-976 S03 Well #3A	84	12.0%	2,088,700	6.4	7.6%	6.4	0.9%	100
APP G2-29483 AHA-975 S06 Well #3B	254	36.3%	26,305,400	80.7	31.8%		0.0%	210
7012-A (G2-09889) AHA-973 S04 Well #4	79	11.3%	11,909,300	36.5	46.3%	36.5	5.2%	100
G2-27215 AHA-977 S07 Well #5*	152	15.0%	16,738,800	51.4	33.8%		0.0%	190
G2-27443 S08 Well #6*	160	15.8%	12,402,000	38.1	23.8%		0.0%	200
Total AFY without supplementals	**700**	**130.8%**	**79,119,500**	**242.8**	**34.7%**	162.1	23.2%	**710**
Total*	**1,012**							**1100**

Electrical Usage in KwH

	Jan-18	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Total
Well #1	3,375	3,040	1,728	1,567	1,450	2,435	2,571	1,492	958	1,334	2,287	1,639	23,876
Well #2	552	1069	800	174	112	113	99	95	143	782	1150	914	6,003
Well #3	7,326	2,254	3,485	3,134	3,932	4,834	4,516	10,257	7,082	9,051	6,474	5,543	67,888
Well #4	3,044	3,168	2,131	1,489	4,264	3,313	2,422	2,140	2,531	2,081	2,900	1,077	30,560
Well #5	933	4,142	3,291	4,429	5,307	4,428	4,765	3,462	4,422	2,335	1,693	2,984	42,191
Well #6	6,892	5,178	2,131	2,449	2,398	3,740	5,604	5,216	8,106	3,934	7,813	4,240	57,701
total:	22,122	18,851	13,566	13,242	17,463	18,863	19,977	22,662	23,242	19,517	22,317	16,397	228,219

Gallons Per KwH

													Gal/KwH YTD
Well #1	344	335	300	388	489	516	511	487	472	328	433	286	407
Well #2	0	0	9	6	1	32	0	20	0	0	0	0	6
Well #3	326	721	815	302	257	408	573	446	322	400	382	374	444
Well #4	376	354	330	391	410	416	415	406	404	395	392	352	387
Well #5	171	410	418	497	500	511	515	294	293	247	215	229	358
Well #6	220	219	126	141	157	218	239	230	250	192	230	196	201
										AVG Gal/KwH combined =			**347**
total:	288	350	421	354	372	407	436	370	304	318	303	270	

Historical Data

	Pumped	Sold	Loss
2010	69,790,309	66,840,300	4.2%
2011	60,958,882	56,483,665	7.3%
2012	57,963,886	54,775,298	5.5%
2013	56,859,553	54,275,297	4.5%
2014	62,649,611	60,973,228	2.7%
2015	66,109,416	61,749,171	6.6%
2016	66,784,811	62,157,037	6.9%
2017	64,963,044	62,010,322	4.5%
2018	67,149,235	64,162,480	4.4%
2019	79,119,500	61,189,708	22.7%

Updated March 7, 2019 per Water Use Efficiency Guide Book Third Edition (Jan. 2017) per WSDOH Division of Environmental Health Office of Drinking Water Pub. DOH 331-375

Distribution System Leakage Notes: January and February estimated authorized consumption from an un-reported issue with a customer water pressure issue. Found a 1" poly had become seperated at the outlet of the backflow assembly. Customer stated he had low pressure since the end of December 2018. Several attemps were made to locate the cause of an incredible leak. March: found a 2 inch crack 1/4" wide on a service connection @ Stirling court & Saint Andrews. April: repaired a 1-inch split @ 2671 E. Saint Andrews Drive, leak repaired on shetland road from service connection in ditchline. Mainline break occurd by excavator on 11-12-2019 4" AC main 40-45 minutes before closing. Leak detected on December 9th 2019 on Errigal, this was the missing water in distribution from August to December 2019.

Appendix 10.7
Water Facilities Inventory

WATER FACILITIES INVENTORY (WFI) FORM

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

ONE FORM PER SYSTEM

Quarter: 1
Updated: 07/02/2020
Printed: 7/10/2020
WFI Printed For: On-Demand
Submission Reason: Contact Update

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
44150 T	LAKE LIMERICK WATER	MASON	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS
WILLIAM D. CASOTHERS ,	LAKE LIMERICK COUNTRY CLUB INC GENERAL MANAGER ROGER MILLMAN 790 EAST ST. ANDREWS DRIVE SHELTON, WA 98584
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM ABOVE**
ATTN	ATTN
ADDRESS	ADDRESS
CITY STATE ZIP	CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone:		Owner Daytime Phone: (360) 426-3581	
Primary Contact Mobile/Cell Phone:		Owner Mobile/Cell Phone:	
Primary Contact Evening Phone:		Owner Evening Phone:	
Fax:	E-mail: xxxxxxxxxxxxxxxxxxxx	Fax:	E-mail: xxxxxxxxxxxxxxxxxxxx

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed
- [ ] Managed Only
- [ ] Owned Only

SMA NAME: ____________________ SMA Number:

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

- [ ] Agricultural
- [ ] Commercial / Business
- [ ] Day Care
- [x] Food Service/Food Permit
- [x] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [ ] Industrial
- [ ] Licensed Residential Facility
- [ ] Lodging
- [x] Recreational / RV Park
- [x] Residential
- [ ] School
- [ ] Temporary Farm Worker
- [x] Other (church, fire station, etc.): ____________________

13. WATER SYSTEM OWNERSHIP (mark only one)

- [ ] Association
- [ ] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [x] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons)

~~320,000~~ 478,800

- SEE NEXT PAGE FOR A COMPLETE LIST OF SOURCES -

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
44150 T	LAKE LIMERICK WATER	MASON	A	Comm

15	16 SOURCE NAME	17 INTERTIE	18 SOURCE CATEGORY										19 USE			20	21 TREATMENT						22 DEPTH	23	24 SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S02	WELL # 2 AHA978		X											X		Y	X						103	200	NE NW	27	21N	03W
S03	WELL # 3A AHA976		X										X			Y	X						110	144	NW SW	27	21N	03W
S04	WELL # 4 AHA973		X										X			Y	X						92	74	SE SW	22	21N	03W
S05	WELL #1 AHA974		X										X			Y	X						89	49	NE NE	27	21N	03W
S06	WELL #3B AHA975		X										X			Y	X						167	194	SW SW	27	21N	03W
S07	WELL #5 AHA977		X										X			Y	X						110	35	NW SW	27	21N	03W
S08	WELL #6		X										X			Y	X						429	248	SE SW	27	21N	03W

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
44150 T	LAKE LIMERICK WATER	MASON	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)		842	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or more per year)	~~771~~ 793		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	~~71~~ 66		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	~~354~~ 333	354	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	~~3~~ 9	3	
28. TOTAL SERVICE CONNECTIONS		1199	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? ~~1915~~ 1,967

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?				48	96	142	142	142	47	47		
B. How many days per month are they present?				30	30	30	30	30	30	30		

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?	1200	1200	1200	1200	1600	1600	1600	1600	1200	1200	1200	1200
B. How many days per month is water accessible to the public?	30	30	30	30	30	30	30	30	30	30	30	30

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?	22 ~~21~~	22 ~~28~~	22 ~~29~~	22 ~~30~~	23 ~~34~~	23 ~~33~~	23 ~~34~~	23 ~~29~~	23 ~~29~~	22 ~~26~~	22 ~~27~~	22
B. How many days per month are they present?	30	30	30	30	30	30	30	30	30	30	30	30

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	2	2	2	2	2	2	2	2	2	2	2	2

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)			

35. Reason for Submitting WFI:

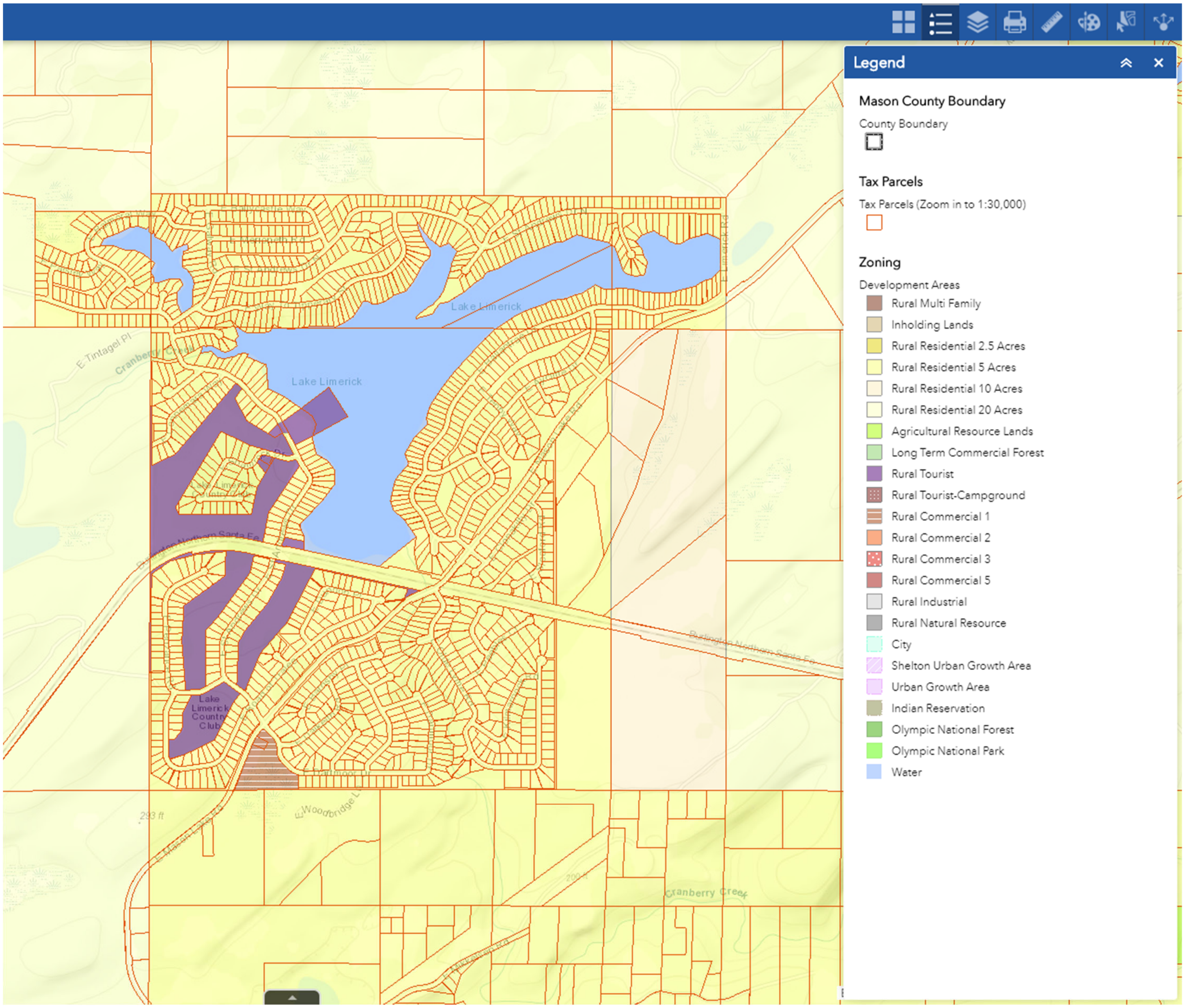
☒ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other ____________

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: ____________________ DATE: ____________________

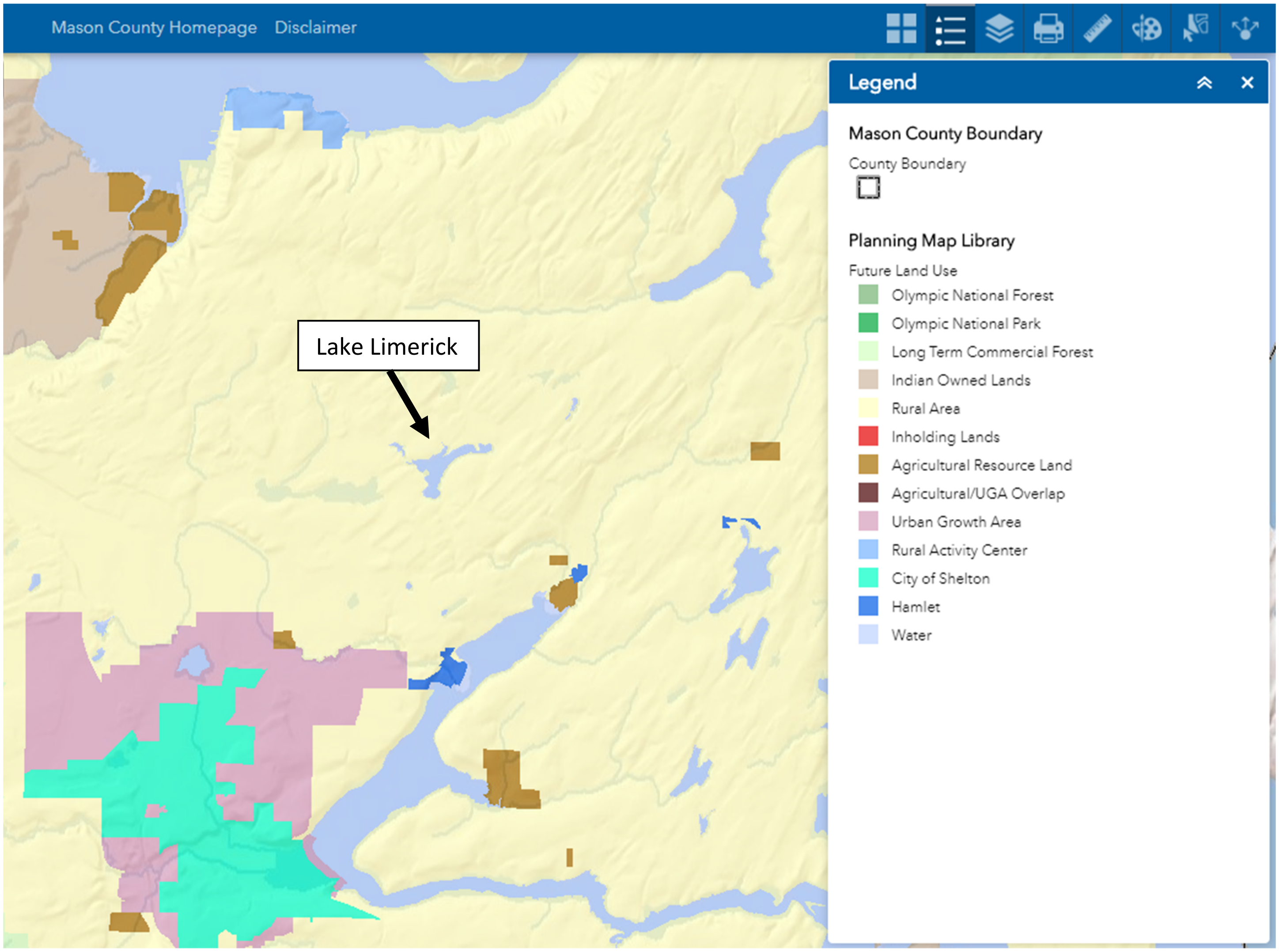
PRINT NAME: ____________________ TITLE: ____________________

Appendix 10.8
Zoning Maps



Zoning within the Lake Limerick Country Club as shown on the Mason County Development Areas Map, June 11, 2020

Zoning within the Lake Limerick Country Club includes rural residential, rural tourist (golf course), and rural commercial development areas.



Mason County Future Land Use Map, *Mason County Comprehensive Plan Update 2016-2036*

Appendix 10.9
Water Rights

Lake Limerick Country Club Water Rights Self Assessment – Existing Status

Permit, certificate or claim number	Name on document	Priority Date (List oldest first)	Source Name and Number	Any portion supplemental? (If yes, explain in footnote)	Existing Water rights		Existing consumption		Current water right status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 5566-A (G2-08049)	Lake Limerick Corp. & Osberg Construction Co.	04/19/1966	S05 – Well 1 AHA974	No	100 gpm	117 ac-ft	49 gpm	32.4	51 gpm (excess)	84.6 ac-ft/yr (excess)
2. 5587-A	Lake Limerick Country Club, Inc.	06/30/1967	S02 – Well 2 AHA978	No	200 gpm	166 ac-ft	200 gpm	0	0 gpm	166.0 ac-ft/yr (excess)
3. 5888-A (G2-08834)	Lake Limerick Country Club, Inc.	06/30/1967	S03–Well 3A AHA976	No	100 gpm	84 ac-ft	144 gpm + 194 gpm[3]	118.4	-238 gpm (deficiency)	-34.4 ac-ft/yr (deficiency)
4. 7012-A (G2-09889)	Lake Limerick Country Club, Inc.	11/19/1968	S04 – Well 4 AHA973	No	100 gpm	79 ac-ft	74 gpm	45.6	26 gpm (excess)	33.4 ac-ft/yr (excess)
5. G2-27215-C	Lake Limerick Community	11/17/1987	S07 – Well 5 AHA977	Yes[1]	190 gpm	152 ac-ft[1]	35 gpm	51.4	155 gpm (excess)	100.6 ac-ft/yr (excess)
6. G2-27443-C	Lake Limerick Country Club	10/26/1988	S08 – Well 6	Yes[1]	200 gpm	160 ac-ft[1]	248 gpm	54.5	-48 gpm (deficiency)	105.5 ac-ft/yr (excess)
TOTAL					**890 gpm**	**446 ac-ft**	**944 gpm[2]**	**302.3**	**-54 gpm[2] (deficiency)**	**143.7 ac-ft/yr (excess)**

Intertie name or Identifier	Name of purveyor Providing water	Existing limits on intertie use		Existing consumption through intertie		Current intertie supply status (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL							

Pending water right application (New/Change)	Name on application	Date submitted	Any portion supplemental? (If yes, explain in footnote)	Pending water rights	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. G2-29483	Lake Limerick Country Club	04/24/1997	Yes	210 gpm	254 ac-ft
2.					

[1] The annual water rights for Well 5 and Well 6 are supplemental to previous water rights and therefore not included in the total annual water rights.
[2] Wells are not operated simultaneously, no combination of sources operated at any time exceed 890 gpm.
[3] Well 3B is appropriated under certificate 5888-A, showing of compliance regarding this use has been submitted to the Department of Ecology

Lake Limerick Country Club Water Rights Self Assessment – 20 Year Forecast

Permit, certificate or claim number	Name on document	Priority Date (List oldest first)	Source Name or Number	Any portion supplemental? (If yes, explain in footnote)	Existing Water rights		Forecasted water use from sources (20-year Demand)		Forecasted water right status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. 5566-A (G2-08049)	Lake Limerick Corp. & Osberg Construction Co.	04/19/1966	S05 – Well 1 AHA974	No	100 gpm	117 ac-ft	49 gpm	33	51 gpm (excess)	84 ac-ft/yr (excess)
2. 5587-A	Lake Limerick Country Club, Inc.	06/30/1967	S02 – Well 2 AHA978	No	200 gpm	166 ac-ft	200 gpm	0	0 gpm	166.0 ac-ft/yr (excess)
3. 5888-A (G2-08834)	Lake Limerick Country Club, Inc.	06/30/1967	S03–Well 3A AHA976	No	100 gpm	84 ac-ft	144 gpm	39.1	-44 gpm (deficiency)	44.9 ac-ft/yr (excess)
3. App G2-29483	Lake Limerick Country Club, Inc.	06/30/1967	S03–Well 3B AHA976	No	210 gpm	254 ac-ft	194 gpm	81.6	16 gpm (excess)	172.4 ac-ft/yr (excess)
4. 7012-A (G2-09889)	Lake Limerick Country Club, Inc.	11/19/1968	S04 – Well 4 AHA973	No	100 gpm	79 ac-ft	74 gpm	46.5	26 gpm (excess)	32.5 ac-ft/yr (excess)
5. G2-27215	Lake Limerick Community	11/17/1987	S07 – Well 5 AHA977	Yes[1]	190 gpm	152 ac-ft[1]	190 gpm	52.4	0 gpm	99.6 ac-ft/yr (excess)[1]
6. G2-27443	Lake Limerick Country Club	10/26/1988	S08 – Well 6	Yes[1]	200 gpm	160 ac-ft[1]	248 gpm	55.6	-48 gpm (deficiency)	104.4 ac-ft/yr (excess)[1]
TOTAL					**1,100 gpm**	**700 ac-ft**	**1,099 gpm[2]**	**308.3-ac-ft/yr**	**1 gpm Excess**	**391.8 ac-ft/yr Excess**

Intertie name/ Identifier	Name of purveyor Providing water	Existing limits on intertie use		Forecasted consumption through intertie		Forecasted intertie supply status (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
TOTAL							

Pending water right application (New/Change)	Name on application	Date submitted	Any portion supplemental? (If yes, explain in footnote)	Pending water rights	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. G2-29483	Lake Limerick Country Club	04/24/1997	Yes	210 gpm	254 ac-ft
2.					

[1] The annual water rights for Well 5 and Well 6 are supplemental to previous water rights and therefore not included in the total annual water rights.

[2] SCADA controls prevent more than 890 gpm from being pumped from the sources at any given time except in the event of emergency fire-fighting operations, for which water rights are not required. Combined capacity exceeding 890 gpm allows community to maintain full service in the event of a source being offline at one or more sites.

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Appendix 10.10
Wellhead Contamination Susceptibility Assessment

Travel Time Radius Map
Susceptibility Assessments
Wellhead Protection Area Notification Letters

6-MO, 1-YR, 5-YR AND 10-YR GROUNDWATER TRAVEL TIME RADII BASED ON AVG. SOURCE PRODUCTION 2016-2019

100' RADIUS

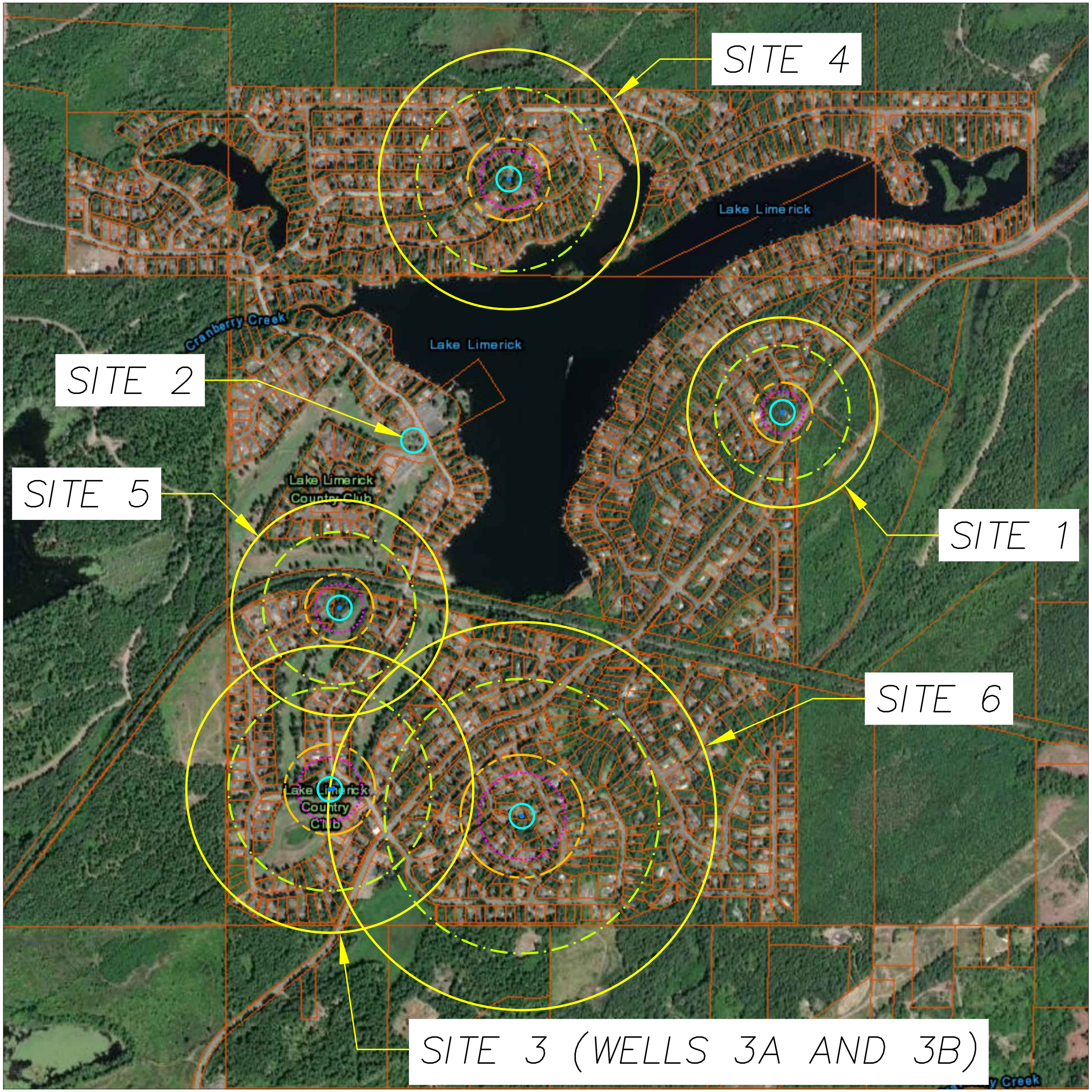
6-MO TRAVEL TIME RADIUS

1-YR TRAVEL TIME RADIUS

5-YR TRAVEL TIME RADIUS

10-YR TRAVEL TIME RADIUS

TRAVEL RADII (FEET)				
WELL	6-MO	1-YR	5-YR	10-YR
1	173	245	548	775
2	NOT USED			
3A	262	370	828	1171
3B	262	370	828	1171
4	237	335	750	1061
5	197	278	622	880
6	354	501	1120	1583



Well 1

Groundwater Contamination Susceptibility Assessment Form

With Updated Annual Volume Pumped and Travel Time Radii

NOTE: This form is for an approved source and is being included to show the updated groundwater time of travel (TOT) radii based on the average source production data from the most recent 4 years (2016-2019).

Only the highlighted cells showing Annual Volume Pumped and Groundwater Travel Time Radii have been updated.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**NENE S27, 21N, 3W**
Source Name:	**Well 1**	WA well ID tag number:	**AHA 974**
Source Number:	**S05**	Well Depth:	**116 ft**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **47.284N** Longitude: **123.039W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **3/25/1966** last reconstructed: **n/a**

2) Well Driller: Tyee Well Drilling Co. Inc
P.O. Box 30
Allyn, Wa 98524

3) Type of Well:

- [X] Drilled: **cable** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no

If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **49** gpm

Source of information: **Metered**

If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)

If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no

Residual level (at point closest to source): **N/A** ppm

Part III: **Hydrogeologic Information**

1) Depth to top of open interval: **89** ft

2) Depth to groundwater (static water level):

51 ft

[ ] flowing artesian well/spring

How was the water level determined: Sonic Sounder

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

[ ] yes/no

5) Wellhead elevation (height above mean sea level): **283** ft

how was elevation determined?

[X] topographic map
[ ] drilling/well log
[ ] altimeter
[ ] other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[**Yes**] (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

[**No**] (yes/no)

7) Sanitary setback: **120** ft (If less than 100 feet, describe the site conditions):

8) Wellhead Construction:

[X] in wellhouse
[ ] in doghouse
[ ] outside
[ ] controlled access:
[ ] other uses for wellhouse:

9) Surface seal:

[ ] 18 ft
[ ] >18 ft
[ ] <18 ft (no DOE approval)
[ ] <18 ft (with DOE approval, include documentation)
[X] no surface seal
[ ] unknown

10) Annual rainfall:

[ ] <10 in/yr
[ ] 10-25 in/yr
[X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **1,179,220** Cubic Feet

How was this determined?

X	Metered		
	Estimated	pumping rate:	**49** gpm
		pumping capacity:	**49** gpm
	Other:	aquifer/screen	**25** ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**173** ft	
groundwater travel time;	1 yr.	**245** ft	
groundwater travel time;	5 yr.	**548** ft	
groundwater travel time;	10 yr.	**775** ft	
length of screened/open interval:		**25** ft	

$r = [(Q*t)/(\pi*\eta H)]^{0.5}$

where: r = radius (ft)

Q = flow (ft^3/yr)

t = time (yr)

η = porosity (0.25 assumed)

H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application			**No**	
stormwater injection wells				**X**
other injection wells				**X**
abandoned ground water well				**X**
landfills, dumps, disposal areas			**No**	
known hazardous materials clean-up site			**No**	
water systems with water quality problems			**No**	
population density >1 house/acre			**Yes**	
residences commonly having septic tanks			**Yes**	
wastewater treatment lagoons			**No**	
sites used for land application of waste			**No**	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	level >MCL?
A. Nitrate:	10 mg/l	**0.8**
B. VOCs:	5 ug/l	**No Detect**
C. EDB:	0.05 ug/l	**No Detect**
D. DBCP:	0.2 ug/l	**No Detect**
E. Other SOC	(detectable)	**No Detect**

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

n/a

F. Bacterial Contamination:

Are any bacteriological test samples available	**Yes**	yes/no
Any bacterial detection from the source within past 3 years:	**No**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**No**	yes/no

Part VI: Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?
(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?
(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

505
Well #1

WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Application No. ______
Permit No. ______

(1) OWNER:
Name Lake Limerick Associates
Address 1132 No. 128th St
Seattle, Wn. 98133

(2) LOCATION OF WELL:
County Mason   Owner's number, if any — 2
NE ¼ NE ¼ Section 27 T 22N, R 3 W. W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ✓
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒
10 " Diam. from 0 ft. to 116 ft. Gage .2.279
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☐ No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☒ Yes ☐ No
Manufacturer's Name Edward E. Johnson Inc.
Type Stainless Steel   Model No.
Diam. 10" Slot size .050 Set from 89' ft. to 99' ft.
Diam. 10" Slot size .020 Set from 99 ft. to 114 ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes ☐ No Size of gravel
Gravel placed from ft. to ft.
Was a surface seal provided? ☐ Yes ☒ No To what depth? ft.
Material used in seal — Drill cuttings
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 51 ft. below land surface Date 3/25/66
Artesian pressure lbs. per square inch Date
Water is controlled by (Cap, valve, etc.)

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller
Yield: 95 gal./min. with 41 ft. drawdown after 6 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level
3:10	92	3:30	72' 4"
3:15	79	3:35	71
3:20	75	3:40	70' 4"
3:25	73' 6"	3:45	69' 6"

Date of test 3/25/66
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water   Was a chemical analysis made? ☒ Yes ☐ No

(12) WELL LOG:
Diameter of well 10 inches.
Depth drilled 116 ft. Depth of completed well 114 ft.
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Sand, clay & gravel	0	6
Hardpan	6	27
Gravel - dry	1	28
Hardpan	20	48
Gravel	3	51
Hardpan	6	60
Gravel - some water	10	78
Sand & gravel	10	88
" " " - water bearing	13	101
Sand	5	106
" & gravel	2	108
Sand	8	116
Muddy sand & gravel		116

Work started 19 Completed 19

(13) PUMP:
Manufacturer's Name
Type H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Tyee Well Drilling Co. (Person, firm, or corporation) (Type or print)
Division Tacoma Pump & Drilling Co. Inc
Address P.O. Box 3, Allyn Wn

[Signed] H H Hellman (Well Driller)

License No. Date 3/28/66, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

CK/WB

Well 2

Groundwater Contamination Susceptibility Assessment Form

NOTE: No updates have been made to the following form.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**NENW S27, 21N, 3W**
Source Name:	**Well 2**	WA well ID tag number:	**AHA 978**
Source Number:	**S02**	Well Depth:	**121**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **47.283N** Longitude: **123.051W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **5/8/1967** last reconstructed: **n/a**

2) Well Driller: Russell Well Drilling
PO Box 433
Shelton, WA 98584

3) Type of Well:
- [X] Drilled: **Cable** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no
If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **200** gpm
Source of information: **Metered**
If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)
If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no
Residual level (at point closest to source): **N/A** ppm

Part III: Hydrogeologic Information

1) Depth to top of open interval: **103** ft

2) Depth to groundwater (static water level):

11 ft

[ ] flowing artesian well/spring

How was the water level determined: Sonic Sounder

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

[ ] yes/no

5) Wellhead elevation (height above mean sea level): **240** ft

how was elevation determined?

[X] topographic map
[ ] drilling/well log
[ ] altimeter
[ ] other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[**Yes**] (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

[**Yes**] (yes/no)

7) Sanitary setback: **60** ft (If less than 100 feet, describe the site conditions):

Well located within a well-house at the corner of Shamrock and East Andrews drive. Small parking area located adjacent to wellhead (down hill from the well), and the tee box for one of the courses fairways is located 80' North west.

8) Wellhead Construction:

[X] in wellhouse
[ ] in doghouse
[ ] outside
[ ] controlled access:
[ ] other uses for wellhouse:

9) Surface seal:

[ ] 18 ft
[ ] >18 ft
[ ] <18 ft (no DOE approval)
[ ] <18 ft (with DOE approval, include documentation)
[X] no surface seal
[ ] unknown

10) Annual rainfall:

[ ] <10 in/yr
[ ] 10-25 in/yr
[X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **0** Cubic Feet

How was this determined?

X	Metered			
	Estimated	pumping rate:	**200**	gpm
		pumping capacity:	**200**	gpm
	Other:	aquifer/screen	**18**	ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**0** ft	$r = [(Q*t)/(\pi*\eta H)]^{0.5}$
groundwater travel time;	1 yr.	**0** ft	where: r = radius (ft)
groundwater travel time;	5 yr.	**0** ft	Q = flow (ft^3/yr)
groundwater travel time;	10 yr.	**0** ft	t = time (yr)
			η = porosity (0.25 assumed)
length of screened/open interval:		**18** ft	H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application			**No**	
stormwater injection wells			**No**	
other injection wells			**No**	
abandoned ground water well			**No**	
landfills, dumps, disposal areas			**No**	
known hazardous materials clean-up site			**No**	
water systems with water quality problems			**No**	
population density >1 house/acre			**No**	
residences commonly having septic tanks			**No**	
wastewater treatment lagoons			**No**	
sites used for land application of waste			**No**	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	level >MCL?
A. Nitrate:	10 mg/l	**No Detect**
B. VOCs:	5 ug/l	**No Detect**
C. EDB:	0.05 ug/l	**No Detect**
D. DBCP:	0.2 ug/l	**No Detect**
E. Other SOC	(detectable)	**No Detect**

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

n/a

F. Bacterial Contamination:

Are any bacteriological test samples available	**No**	yes/no
Any bacterial detection from the source within past 3 years:	**N/A**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**N/A**	yes/no

Part VI: **Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution**

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?
(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?
(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

S02

Well 2

WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Application No. 8833

Permit No.

(1) OWNER:
Name LAKE LIMERICK COUNTRY CLUB, INCORPORATED
Address 5125 25th N.E.
SEATTLE, WN.

(2) LOCATION OF WELL:
County MASON Owner's number, if any— 2
SE ¼ NW ¼ Section 27 T. 21N R 3W W.M.
Bearing and distance from section or subdivision corner
~~N~~ SOUTH & ~~W~~ EAST OF NW COR. SECTION 27
1405 1555

(3) TYPE OF WORK (check):
New Well X Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable X Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐
10" Diam. from 1 ft. to 103 ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes X No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed X Yes ☐ No
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No.
Diam. 10" Slot size 35 Set from 103 ft. to 121 ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes X No Size of gravel:
Gravel placed from ft. to ft.
Was surface seal provided? ☐ Yes ☐ No To what depth? ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes X No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 11' ft. below land surface Date JUNE 17-67
Artesian pressure lbs. per square inch Date
Water is controlled by (Cap, valve, etc.)

OK/PE

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? X Yes ☐ No If yes, by whom? Russell Drilling
Yield: 200 gal./min. with 84 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level

Date of test 6/17/67
Bailer test 132 gal./min. with 24 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well 10" inches.
Depth drilled 121 ft. Depth of completed well 121 ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
TopSoil Gr.	0	2
Cem. Gr.	2	10
Cem. Gr.	10	40
Cem. Gr. & clay	40	50
Cem. Gr. & clay	50	75
Clay Blue & Gray	75	78
Brown Clay & Gr.	78	85
" " "	85	95
Blue clay & Sand	95	100
Blue clay & Sand Course	100	104
Sand & Gr. Small streaks of blue clay	104	121

Work started May 3 1967 Completed May 8 1967

(13) PUMP:
Manufacturer's Name
Type: H.P.

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Russell Well Drilling Co.
(Person, firm, or corporation) (Type or print)
Address P.O. Box 433 Shelton Wash
[Signed] William J. Russell
(Well Driller)
License No. 223-01-5124 Date June 19 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—Rev. 9-62—8-62—5M. 75108.

8

Well 3A

Groundwater Contamination Susceptibility Assessment Form

With Updated Annual Volume Pumped and Travel Time Radii

NOTE: This form is for an approved source and is being included to show the updated groundwater time of travel (TOT) radii based on the average source production data from the most recent 4 years (2016-2019).

Only the highlighted cells showing Annual Volume Pumped and Groundwater Travel Time Radii have been updated.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**NWSW S27, 21N, 3W**
Source Name:	**Well 3A**	WA well ID tag number:	**AHA 976**
Source Number:	**S03**	Well Depth:	**148 ft**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **47.276N** Longitude: **123.054W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **6/19/1967** last reconstructed: **n/a**

2) Well Driller: Russell Drilling Co.
PO Box 433
Shelton, WA 98584

3) Type of Well:
- [X] Drilled: **Unknown** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no
If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **144** gpm
Source of information: **Metered**
If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)
If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no
Residual level (at point closest to source): **N/A** ppm

Part III: Hydrogeologic Information

1) Depth to top of open interval: **131** ft

2) Depth to groundwater (static water level):

56 ft

[ ] flowing artesian well/spring

How was the water level determined: Well Log

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

[ ] yes/no

5) Wellhead elevation (height above mean sea level): **290** ft

how was elevation determined?

[X] topographic map
[ ] drilling/well log
[ ] altimeter
[ ] other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[**Yes**] (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

[**No**] (yes/no)

7) Sanitary setback: **70** ft (If less than 100 feet, describe the site conditions):

East Andrews and East Penzance roads pass nearby. No other significant sources of contamination exist within 100 feet.

8) Wellhead Construction:

[X] in wellhouse
[ ] in doghouse
[ ] outside
[ ] controlled access:
[ ] other uses for wellhouse:

9) Surface seal:

[ ] 18 ft
[ ] >18 ft
[ ] <18 ft (no DOE approval)
[ ] <18 ft (with DOE approval, include documentation)
[X] no surface seal
[ ] unknown

10) Annual rainfall:

[ ] <10 in/yr
[ ] 10-25 in/yr
[X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **3,445,585** Cubic Feet

How was this determined? Combined Well 3A and 3B

X	Metered		
	Estimated	pumping rate:	**144** gpm
		pumping capacity:	**144** gpm
	Other:	aquifer/screen	**32** ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**262**	ft
groundwater travel time;	1 yr.	**370**	ft
groundwater travel time;	5 yr.	**828**	ft
groundwater travel time;	10 yr.	**1171**	ft
length of screened/open interval:		**17**	ft

$r = [(Q*t)/(\pi*\eta H)]^{0.5}$

where: r = radius (ft)

Q = flow (ft^3/yr)

t = time (yr)

η = porosity (0.25 assumed)

H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application	**X**			
stormwater injection wells				**X**
other injection wells				**X**
abandoned ground water well				**X**
landfills, dumps, disposal areas			**No**	
known hazardous materials clean-up site			**No**	
water systems with water quality problems			**No**	
population density >1 house/acre	**X**			
residences commonly having septic tanks	**X**			
wastewater treatment lagoons			**No**	
sites used for land application of waste			**No**	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

A fairway is located to the south of the well is the source of the pesticide application, residences located in the vicinity have septic tanks and lots smaller than 1 acre.

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	Reported	Level > MCL?
A. Nitrate:	10 mg/l	**0.48**	No
B. VOCs:	5 ug/l	**None Detected**	No
C. EDB:	0.05 ug/l	**None Detected**	No
D. DBCP:	0.2 ug/l	**None Detected**	No
E. Other SOC	(detectable)	**None Detected**	No

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

N/A

F. Bacterial Contamination:

Are any bacteriological test samples available	**Yes**	yes/no
Any bacterial detection from the source within past 3 years:	**No**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**No**	yes/no

Part VI: Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?
(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?
(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

SO 3

Well 3A

WATER WELL REPORT
STATE OF WASHINGTON

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Application No. 8834

Permit No.

(1) OWNER:
Name LAKE LIMERICK COUNTRY CLUB, INCORPORATED
Address 5125 25th N.E.
Seattle, Wn.

(2) LOCATION OF WELL:
County MASON Owner's number, if any #3
SW ¼ SW ¼ Section 27 T 21N. R 3W. W.M.
Bearing and distance from section or subdivision corner
~~1200~~ North & ~~25~~ East of S.W. Cor. Sec. 27 520
1165
El. 240' ±

(3) TYPE OF WORK (check):
New Well X Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐
10" Diam. from 1 ft. to 148 ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes X No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☐ No
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No.
Diam. 10" Slot size 30 Set from 131 ft. to 148 ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes X No Size of gravel
Gravel placed from ft. to ft.
Was a surface seal provided? ☐ Yes ☐ No To what depth? ft.
Material used in seal—
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 56 ft. below land surface Date June 17-67
Artesian pressure lbs. per square inch Date
Water is controlled by (Cap, valve, etc.)

OK/PE

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? X Yes ☐ No If yes, by whom? Russell Drilling
Yield 90 gal./min. with 79 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level

Date of test June 17-1967
Bailer test 80 gal./min. with 60 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well 10 inches.
Depth drilled 148 ft. Depth of completed well 148 ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Fill	0	3
Cem. Gr.	3	72
Gr. Sand (water)	72	77
Cem. Gr.	77	79½
San. Gr. (water)	79½	80½
Gr. Sand	80½	92
Cem. Gr.	92	110
Gr. & Sand	110	111
Cem. Gr.	111	112
Gr. Sand	112	113
Cem. Gr.	113	126
Cem. Gr.	126	128
Sand & Gr.	128	148

Work started June 19 . Completed 19

(13) PUMP:
Manufacturer's Name
Type: H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Russell Drilling Co. (Person, firm, or corporation) (Type or print)
Address P.O. Box 433 Shelton Wash
[Signed] William J. Russell (Well Driller)
License No. 223-01-5124 Date June 19, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—Rev. 9-62—8-62—5M 75160

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Well 3B

Groundwater Contamination Susceptibility Assessment Form

With Updated Annual Volume Pumped and Travel Time Radii

NOTE: This form is for an approved source and is being included to show the updated groundwater time of travel (TOT) radii based on the average source production data from the most recent 4 years (2016-2019).

Only the highlighted cells showing Annual Volume Pumped and Groundwater Travel Time Radii have been updated.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**NWSW S27, 21N, 3W**
Source Name:	**Well 3B**	WA well ID tag number:	**AHA 975**
Source Number:	**S06**	Well Depth:	**177 ft**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **47.276N** Longitude: **123.054W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **5/4/1981** last reconstructed: **n/a**

2) Well Driller: Bedell Pump and Drilling Co
1583 E. Dickinson St.
Shelton, WA 98584

3) Type of Well:
- [X] Drilled: **Rotary** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no
If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **194** gpm
Source of information: **Metered**
If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)
If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no
Residual level (at point closest to source): **N/A** ppm

Part III: Hydrogeologic Information

1) Depth to top of open interval: **167** ft

2) Depth to groundwater (static water level):

61 ft

[ ] flowing artesian well/spring

How was the water level determined: Well Log

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

[ ] yes/no

5) Wellhead elevation (height above mean sea level): **290** ft

how was elevation determined?

[X] topographic map
[ ] drilling/well log
[ ] altimeter
[ ] other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[**Yes**] (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

[**No**] (yes/no)

7) Sanitary setback: **70** ft (If less than 100 feet, describe the site conditions):

East Andrews and East Penzance roads pass nearby. No other significant sources of contamination exist within 100 feet.

8) Wellhead Construction:

[X] in wellhouse
[ ] in doghouse
[ ] outside
[ ] controlled access:
[ ] other uses for wellhouse:

9) Surface seal:

[X] 18 ft
[ ] >18 ft
[ ] <18 ft (no DOE approval)
[ ] <18 ft (with DOE approval, include documentation)
[ ] no surface seal
[ ] unknown

10) Annual rainfall:

[ ] <10 in/yr
[ ] 10-25 in/yr
[X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **3,445,585** Cubic Feet

How was this determined? Combined Well 3A and 3B

X	Metered		
	Estimated	pumping rate:	**194** gpm
		pumping capacity:	**194** gpm
	Other:	aquifer/screen	**32** ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**262** ft
groundwater travel time;	1 yr.	**370** ft
groundwater travel time;	5 yr.	**828** ft
groundwater travel time;	10 yr.	**1171** ft
length of screened/open interval:		**10** ft

$r = [(Q*t)/(\pi*\eta H)]^{0.5}$

where: r = radius (ft)
Q = flow (ft^3/yr)
t = time (yr)
η = porosity (0.25 assumed)
H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application	X			
stormwater injection wells				X
other injection wells				X
abandoned ground water well				X
landfills, dumps, disposal areas			No	
known hazardous materials clean-up site			No	
water systems with water quality problems			No	
population density >1 house/acre	X			
residences commonly having septic tanks	X			
wastewater treatment lagoons			No	
sites used for land application of waste			No	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

A fairway is located to the south of the well is the source of the pesticide application, residences located in the vicinity have septic tanks and lots smaller than 1 acre.

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	Leve >MCL?	Level > MCL?
A. Nitrate:	10 mg/l	**No Detect**	No
B. VOCs:	5 ug/l	**No Detect**	No
C. EDB:	0.05 ug/l	**No Detect**	No
D. DBCP:	0.2 ug/l	**No Detect**	No
E. Other SOC	(detectable)	**No Detect**	No

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

N/A

F. Bacterial Contamination:

Are any bacteriological test samples available	**Yes**	yes/no
Any bacterial detection from the source within past 3 years:	**No**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**No**	yes/no

Part VI: Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?

(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?

(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

306, Well 35

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No.

Permit No.

(1) OWNER: Name Lake Limmerick Address 90 St. Andrews Dr. Shelton, Wash.

(2) LOCATION OF WELL: County Mason #36 SW ¼ SW ¼ Sec 27 T 21 N., R 3W W.M.

g and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☑ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) X (OLD #3)

New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☑ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 177 ft. Depth of completed well 177 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8 " Diam. from 0 ft. to 177 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☑ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☑
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☑ No ☐
Manufacturer's Name Johnson SS 10'
Type #100 slot Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☑ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☑ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 240 ft.
Static level 61 ft. below top of well Date 5/4/81
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☑ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 210 gal./min. with 18 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☑

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Shot clay	0	3'
Hard pan	3	72'
Gravel & sand	72	77'
hard pan	77	81'
Gravel & sand	81	95'
Hard pan	95	112'
Gravel & sand	112	120'
Cemented gravel	120	134'
Sand, gravel & water	134	150'
Hard pan	150	161'
Gravel & water	161	177'

Work started 4/28, 19 Completed 5/4/81, 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Bedell Pump & Drilling Co. (Person, firm, or corporation) (Type or print)

Address 1583 E. Dickinson St. Shelton, Wash.

[Signed] Vern L Bedell (Well Driller)

License No. 0032 Date 5/26/81, 19

10

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

Well 4

Groundwater Contamination Susceptibility Assessment Form

With Updated Annual Volume Pumped and Travel Time Radii

NOTE: This form is for an approved source and is being included to show the updated groundwater time of travel (TOT) radii based on the average source production data from the most recent 4 years (2016-2019).

Only the highlighted cells showing Annual Volume Pumped and Groundwater Travel Time Radii have been updated.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**SESW S27, 21N, 3W**
Source Name:	**Well 4**	WA well ID tag number:	**AHA 973**
Source Number:	**S04**	Well Depth:	**111 ft**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **47.289N** Longitude: **123.049W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **5/4/1981** last reconstructed: **n/a**

2) Well Driller: Russel Drilling
PO Box 433
Shelton, WA 98584

3) Type of Well:
- [X] Drilled: **Rotary** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no

If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **74** gpm

Source of information: **Metered**

If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)

If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no

Residual level (at point closest to source): **N/A** ppm

Part III: **Hydrogeologic Information**

1) Depth to top of open interval: **91** ft

2) Depth to groundwater (static water level):

54 ft

[ ] flowing artesian well/spring

How was the water level determined: Well Log

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

[ ] yes/no

5) Wellhead elevation (height above mean sea level): **290** ft

how was elevation determined?

[X] topographic map
[ ] drilling/well log
[ ] altimeter
[ ] other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[Yes] (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

[No] (yes/no)

7) Sanitary setback: **110** ft (If less than 100 feet, describe the site conditions):

8) Wellhead Construction:

[X] in wellhouse
[ ] in doghouse
[ ] outside
[ ] controlled access:
[ ] other uses for wellhouse:

9) Surface seal:

[ ] 18 ft
[ ] >18 ft
[ ] <18 ft (no DOE approval)
[ ] <18 ft (with DOE approval, include documentation)
[X] no surface seal
[ ] unknown

10) Annual rainfall:

[ ] <10 in/yr
[ ] 10-25 in/yr
[X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **1,767,597** Cubic Feet

How was this determined?

X	Metered		
	Estimated	pumping rate:	**74** gpm
		pumping capacity:	**74** gpm
	Other:	aquifer/screen	**20** ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**237** ft
groundwater travel time;	1 yr.	**335** ft
groundwater travel time;	5 yr.	**750** ft
groundwater travel time;	10 yr.	**1061** ft
length of screened/open interval:		**20** ft

$r = [(Q*t)/(\pi*\eta H)]^{0.5}$

where: r = radius (ft)

Q = flow (ft^3/yr)

t = time (yr)

η = porosity (0.25 assumed)

H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application				**X**
stormwater injection wells				**X**
other injection wells				**X**
abandoned ground water well				**X**
landfills, dumps, disposal areas			**No**	
known hazardous materials clean-up site			**No**	
water systems with water quality problems			**No**	
population density >1 house/acre	**X**			
residences commonly having septic tanks	**X**			
wastewater treatment lagoons			**No**	
sites used for land application of waste			**No**	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

Homes are located within 200 feet of the wellhead

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	Leve >MCL?	Level > MCL?
A. Nitrate:	10 mg/l	**No Detect**	No
B. VOCs:	5 ug/l	**No Detect**	No
C. EDB:	0.05 ug/l	**No Detect**	No
D. DBCP:	0.2 ug/l	**No Detect**	No
E. Other SOC	(detectable)	**No Detect**	No

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

N/A

F. Bacterial Contamination:

Are any bacteriological test samples available	**Yes**	yes/no
Any bacterial detection from the source within past 3 years:	**No**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**No**	yes/no

Part VI: **Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution**

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?

(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?

(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

S0 4, Well 4

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 9889
Permit No. 9218

(1) OWNER: Name Lake Limerick   Address

(2) LOCATION OF WELL: County Mason   E½ - SE ¼ SW ¼ Sec. 22 T. 21 N., R. 3W W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☐ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 111 ft. Depth of completed well 111 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 10" Diam. from 1 ft. to 111 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☐
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type S.S. Steel Model No.
Diam. 10" Slot size from 91 ft. to 111 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level
Static level 54 ft. below top of well Date 8-1-68
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 93 gal./min. with 8 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil	1	2
Cem Gravel	2	10
" "	10	35
" "	35	49
Cem Gr (Blue)	49	50
" " "	50	58
Grt Sand	58	60
brown Clay Gr	60	70
" " "	70	78
blue Clay & Sand	78	88
brown Clay	88	92
Grt Sand	92	95
" "	95	106
" "	106	111

Work started 19 Completed 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Russell Drilling Co (Person, firm, or corporation) (Type or print)

Address P.O. Box 433 Shelton, Wash

[Signed] William J. Russell (Well Driller)

License No. 225-5144 Date 11-12 1969

OK/WPB

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 1356—Rev. (2-60)—2-66—5M. 4516.

Well 5

Groundwater Contamination Susceptibility Assessment Form

With Updated Annual Volume Pumped and Travel Time Radii

NOTE: This form is for an approved source and is being included to show the updated groundwater time of travel (TOT) radii based on the average source production data from the most recent 4 years (2016-2019).

Only the highlighted cells showing Annual Volume Pumped and Groundwater Travel Time Radii have been updated.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**NWSW S27, 21N, 3W**
Source Name:	**Well 5**	WA well ID tag number:	**AHA 977**
Source Number:	**S07**	Well Depth:	**130 ft**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **42.280 N** Longitude: **123.054W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **10/30/1986** last reconstructed: **n/a**

2) Well Driller: Arcadia Drilling
170 SE Walker Pk Dr.
Shelton, WA 98584

3) Type of Well:
- [X] Drilled: **Rotary** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no
If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **35** gpm
Source of information: **Metered**
If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)
If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no
Residual level (at point closest to source): **N/A** ppm

Part III: Hydrogeologic Information

1) Depth to top of open interval: **110** ft

2) Depth to groundwater (static water level):

42 ft

☐ flowing artesian well/spring

How was the water level determined: Well Log

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

☐ yes/no

5) Wellhead elevation (height above mean sea level): **270** ft

how was elevation determined?

- [X] topographic map
- ☐ drilling/well log
- ☐ altimeter
- ☐ other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

Yes (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

Yes (yes/no)

7) Sanitary setback: **80** ft (If less than 100 feet, describe the site conditions):

Rail line passes within 80-ft of the wellhead, no other structures or sources of contamination exist within 100-ft

8) Wellhead Construction:

- [X] in wellhouse
- ☐ in doghouse
- ☐ outside
- ☐ controlled access:
- ☐ other uses for wellhouse:

9) Surface seal:

- ☐ 18 ft
- [X] >18 ft
- ☐ <18 ft (no DOE approval)
- ☐ <18 ft (with DOE approval, include documentation)
- ☐ no surface seal
- ☐ unknown

10) Annual rainfall:

- ☐ <10 in/yr
- ☐ 10-25 in/yr
- [X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **1,216,066** Cubic Feet

How was this determined?

X	Metered		
	Estimated	pumping rate:	**35** gpm
		pumping capacity:	**35** gpm
	Other:	aquifer/screen	**20** ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**197**	ft
groundwater travel time;	1 yr.	**278**	ft
groundwater travel time;	5 yr.	**622**	ft
groundwater travel time;	10 yr.	**880**	ft
length of screened/open interval:		**20**	ft

$r = [(Q*t)/(\pi*\eta H)]^{0.5}$

where: r = radius (ft)

Q = flow (ft^3/yr)

t = time (yr)

η = porosity (0.25 assumed)

H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application	**X**			
stormwater injection wells				**X**
other injection wells				**X**
abandoned ground water well				**X**
landfills, dumps, disposal areas			**No**	
known hazardous materials clean-up site			**No**	
water systems with water quality problems			**No**	
population density >1 house/acre	**X**			
residences commonly having septic tanks	**X**			
wastewater treatment lagoons			**No**	
sites used for land application of waste			**No**	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

Homes and two fairways of the golfcourse are located within the 6-month travel boundary of the wellhead

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	Leve >MCL?	Level > MCL?
A. Nitrate:	10 mg/l	**No Detect**	No
B. VOCs:	5 ug/l	**No Detect**	No
C. EDB:	0.05 ug/l	**No Detect**	No
D. DBCP:	0.2 ug/l	**No Detect**	No
E. Other SOC	(detectable)	**No Detect**	No

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

N/A

F. Bacterial Contamination:

Are any bacteriological test samples available	**Yes**	yes/no
Any bacterial detection from the source within past 3 years:	**No**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**No**	yes/no

<u>Part VI:</u> **<u>Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution</u>**

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?
(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?
(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

507
Well 5

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ______
Permit No. 62-2715

(1) OWNER: Name Lake Limerick Address E. 790 St. Andrews Drive

(2) LOCATION OF WELL: County Mason — NW SW ¼ Sec. 27 T. 21 N., R. 3 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 5
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 130 ft. Depth of completed well 130 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10" Diam. from 0 ft. to 130 ft.
Threaded ☐ ___" Diam. from ___ ft. to ___ ft.
Welded ☒ ___" Diam. from ___ ft. to ___ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type S.S. Model No. ___
Diam. 8" Slot size 30 from 110 ft. to 130 ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name ___
Type: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 200 ft.
Static level 48 ft. below top of well Date 10-30-86
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ___
Yield: ___ gal./min. with ___ ft. drawdown after ___ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ___
Bailer test 120 gal./min. with 3 ft. drawdown after 4 hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water ___ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Brown Clay & Gravel	0	27
Sand	27	59
Brown Clay + Sand	59	74
Brown Clay & Gravel	74	109
gravel + water	109	130

RECEIVED
88 AUG 10 A10:51

Work started 10-23 19 86. Completed 10-30 19 86.

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Arcadia Drilling (Person, firm, or corporation) (Type or print)

Address 170 SE Walker Pk. Dr.

[Signed] William M. Neal III (Well Driller)

License No. 1455 Date 11-3 1986

(USE ADDITIONAL SHEETS IF NECESSARY)

12

Well 6

Groundwater Contamination Susceptibility Assessment Form

With Updated Annual Volume Pumped and Travel Time Radii

NOTE: This form is for an approved source and is being included to show the updated groundwater time of travel (TOT) radii based on the average source production data from the most recent 4 years (2016-2019).

Only the highlighted cells showing Annual Volume Pumped and Groundwater Travel Time Radii have been updated.

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

Important! Please complete one form for each ground water source (well, well field, spring) used in your system. Photocopy as necessary.

Part I: System Information

Well Owner:	**Lake Limerick Country Club**	Well Manager:	**Northwest Water Systems**
Water System Name:	**Lake Limerick**	Water System Number:	**44150-T**
County:	**Mason**	1/4, 1/4, Sec, T, R:	**NWSW S27, 21N, 3W**
Source Name:	**Well 6**	WA well ID tag number:	**None**
Source Number:	**S08**	Well Depth:	**434 ft**
Number of Connections:	**1199**	Population Served:	**1594**

Latitude: **42.275 N** Longitude: **123.048W**

How was lat/long determined?

- [ ] GPS device
- [ ] survey
- [X] topographic map
- [ ] other

*Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

Part II: Well Construction and Source Information

1) Date well originally constructed: **10/30/1986** last reconstructed: **n/a**

2) Well Driller: Arcadia Drilling
170 SE Walker Pk Dr.
Shelton, WA 98584

3) Type of Well:
- [X] Drilled: **Rotary** (rotary, bored, cable, dug)
- [ ] Other: (spring, lateral collection, driven, jetted, other)

Comments:

4) Well Report Available? **Yes** yes/no

If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets. Engineering reports, well reconstruction logs.

5) Average pumping rate: **248** gpm

Source of information: **Metered**

If not documented, how was the pumping rate determined?

6) Is this source treated? **No** yes/no (disinfection, filtration, carbon filter, airstripper, other)

If so, what type of treatment:

purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained? **N/A** yes/no

Residual level (at point closest to source): **N/A** ppm

Part III: **Hydrogeologic Information**

1) Depth to top of open interval: **429** ft

2) Depth to groundwater (static water level):

189 ft

☐ flowing artesian well/spring

How was the water level determined: Well Log

3) If the source is a flowing well or spring, what is the confining pressure?

N/A psi **N/A** ft

4) If the source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source:

☐ yes/no

5) Wellhead elevation (height above mean sea level): **280** ft

how was elevation determined?

[X] topographic map
☐ drilling/well log
☐ altimeter
☐ other

6) Confining layers: (This can be completed only for those sources with a drilling log, well log, or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[Yes] (yes/no) Is there evidence of a confining layer in the well log?

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

[Yes] (yes/no)

7) Sanitary setback: **100** ft (If less than 100 feet, describe the site conditions):

8) Wellhead Construction:

[X] in wellhouse
☐ in doghouse
☐ outside

☐ controlled access:
☐ other uses for wellhouse:

9) Surface seal:

☐ 18 ft
[X] >18 ft **284 feet**
☐ <18 ft (no DOE approval)
☐ <18 ft (with DOE approval, include documentation)

☐ no surface seal
☐ unknown

10) Annual rainfall:

☐ <10 in/yr
☐ 10-25 in/yr

[X] >25 in/yr

Part IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: **1,969,151** Cubic Feet

How was this determined?

X Metered			
☐ Estimated	pumping rate:	**248**	gpm
	pumping capacity:	**248**	gpm
☐ Other:	aquifer/screen	**10**	ft

2) "Calculated Fixed Radius" estimate of groundwater movement: (see Instruction Packet)

groundwater travel time;	6 mo.	**354**	ft
groundwater travel time;	1 yr.	**501**	ft
groundwater travel time;	5 yr.	**1120**	ft
groundwater travel time;	10 yr.	**1583**	ft
length of screened/open interval:		**10**	ft

$r = [(Q*t)/(\pi*\eta H)]^{0.5}$

where: r = radius (ft)

Q = flow (ft^3/yr)

t = time (yr)

η = porosity (0.25 assumed)

H = screen/aquifer height (ft)

3) Is there a river, lake, pond, stream, or other surface water body within the six month travel boundary?

No yes/no (if yes, identify on a map and describe below)

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the six month time of travel boundary? (if yes, identify on a map and describe below)

No

Part V: Assessment of Water Quality

1) Regional sources of risk to groundwater:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 mo.	1 yr	5 yr	unknown
likely pesticide application	**X**			
stormwater injection wells				**X**
other injection wells				**X**
abandoned ground water well				**X**
landfills, dumps, disposal areas			**No**	
known hazardous materials clean-up site			**No**	
water systems with water quality problems			**No**	
population density >1 house/acre	**X**			
residences commonly having septic tanks	**X**			
wastewater treatment lagoons			**No**	
sites used for land application of waste			**No**	

Identify on a map all of the risks listed above which are located within the six month time of travel boundary. (Please include a map of the wellhead and time of travel areas within this form. Please indicate any of the following.) If other potential sources of groundwater contamination exist within the ten year time of travel circular zone around your supply, please describe:

Homes with on site septics are located within the 6-month travel boundary of the wellhead

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions:
(Unless listed on the assessment, MCLs are listed in assistance package.)

	MCL/detection	Leve >MCL?	Level > MCL?
A. Nitrate:	10 mg/l	**No Detect**	No
B. VOCs:	5 ug/l	**No Detect**	No
C. EDB:	0.05 ug/l	**No Detect**	No
D. DBCP:	0.2 ug/l	**No Detect**	No
E. Other SOC	(detectable)	**No Detect**	No

If any SOC's in addition to EDB/DBPC were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list methods here:

N/A

F. Bacterial Contamination:

Are any bacteriological test samples available	**Yes**	yes/no
Any bacterial detection from the source within past 3 years:	**No**	yes/no
Any bacterial detection in the distribution system and attributed to the source within the past 3 years:	**No**	yes/no

Part VI: Geographic or Hydrologic Factors contributing to a non-Circular Zone of Contribution

The following questions will help identify those groundwater systems which may not be accurately represented by the calculated field radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the ten year time of travel zone of the CFR?
(does the largest circle extend over a stream, river, lake, or up a steep hillside, mountain or ridge?)

No yes/no if yes, describe with references to the map produced in Part IV:

2) Aquifer Material

A) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

No yes/no

B) Does the drilling, well, or other geologic/engineering report identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

No yes/no

3) Is the source located in an aquifer with a high horizontal flow rate?
(These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

No yes/no

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gpm within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within:

	6 mo. travel time
	1 yr. travel time
	5 yr. travel time
No	10 year travel time

5) Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the contribution zone for this source. Reference them to locations on the map in Part IV.

None

Well 6
508
pg 1 of 2

Page 1

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 019887

Water Right Permit No. ______

(1) OWNER: Name Lake Limerick Country Cb. Address ______

(2) LOCATION OF WELL: County Mason SE ¼ SW ¼ Sec 27 T 21 N., R 3W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) ______

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) #6
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 534 feet. Depth of completed well 534 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 12" Diam. from 0' ft. to 284' ft.
Welded ☒ 8" Diam. from +1' ft. to 539 ft.
Liner installed ☐ ______ " Diam. from ______ ft. to ______ ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type ______ Model No. ______
Diam. 7" Slot size 80 from 529 ft. to 534 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☒ No ☐ To what depth? 284 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☒ No ☐
Type of water? HEAVY IRON SH2S Depth of strata 175'
Method of sealing strata off CASED OFF

(7) PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 189 ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? ARCADIA D.
Yield: 110 gal./min. with 57 ft. drawdown after 4 hrs.
" " "
" " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
8' Am	199	8:05	73?	9'31	189
925Am	134	10:38	137	11:00	232
12:50	??2	1:05	137		

Date of test 10/ ? / 88

Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Fill	0'	1'
~~Brown Sand~~	~~1'~~	~~5'~~
ROCKY SAND	1'	5'
BROWN HARDPAN	5'	16'
BROWN SANDY CLAY	16'	22'
BROWN ROCKY CLAY	22'	27'
BROWN HARDPAN	27'	45'
BROWN ROCKY CLAY	45'	50'
BROWN HARDPAN W/LARGE ROCK	50'	58'
BROWN ROCKY CLAY	58'	64'
BROWN SANDY CLAY	64'	71'
SANDY GRAVEL - H2O	71'	72'
BROWN HARDPAN	72'	82'
BROWN ROCKY CLAY	82'	89'
BROWN HARDPAN	89'	108'
BROWN ROCKY CLAY	108'	120'
BROWN SANDY CLAY	120'	138'
GRAVELLY SAND H2O	138'	140'
BROWN HARDPAN	140'	145'
BROWN ROCKY CLAY	145'	151'
BLUE CLAY	151'	161'
BLUE HARDPAN W/ORGANICS	161'	165'
GRAY CEMENTED GRAVEL H2O	165'	166'
SANDY GRAVEL	166'	175'
BLUE SHALE	175'	178'
GRAY GRAVELLY CLAY	178'	183'
GRAY GUMMY CLAY	183'	190'
BLACK SILTY CLAY	190'	198'
BLACK ROCKY CLAY	198'	205'
BLACK HARDPAN	205'	219'
BLUE CLAY	219'	225'
BLACK SILTY CLAY	225'	232'
GRAY GRAVELLY CLAY	232'	239'
GRAY HARDPAN	239'	263'

Work started 10/01/88, 19 Completed 10/03/88, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME ARCADIA Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address SE 178 Walker PK Shelton
(Signed) Jack Watkins (WELL DRILLER) License No. 1465
Contractor's Registration No. ARCADD*147K1 Date 10-5-88, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

Well 6
308
pg 2 of 2

Start Card

WATER WELL REPORT

STATE OF WASHINGTON

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

Start Card No. 18887

Water Right Permit No. ____

(1) OWNER: Name Yaka Limerick Country Club Address ____

(2) LOCATION OF WELL: County Mason SE ¼ SW ¼ Sec 27 T 21 N., R 3 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) ____

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ____
Abandoned ☐ New well ☐ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well ____ inches.
Drilled ____ feet. Depth of completed well ____ ft.

(6) CONSTRUCTION DETAILS:
Casing installed: ____ " Diam. from ____ ft. to ____ ft.
Welded ☐ ____ " Diam. from ____ ft. to ____ ft.
Liner installed ☐
Threaded ☐ ____ " Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☐
Type of perforator used ____
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☐
Manufacturer's Name ____
Type ____ Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☐ Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☐ No ☐ To what depth? ____ ft.
Material used in seal ____
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name ____
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level ____ ft. below top of well Date ____
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom? ____
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ____
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
SANDY CLAY W/SOME GRAVEL - H2O	263'	287'
BROWN CLAY	287'	298'
GRAY SANDY CLAY	298'	306'
BROWN HARDPAN	306'	309'
GRAVELLY SANDY CLAY	309'	312'
BROWN HARDPAN	312'	316'
BROWN SANDY CLAY	316'	320'
BROWN HARDPAN	320'	324'
BROWN GRAVELLY CLAY	324	340'
BROWN SANDY CLAY	340'	412'
BROWN HARDPAN	412'	420'
SANDY GRAVEL - H2O	420'	434'
BROWN CLAY	434	

Work started 10/01/88, 19 Completed 10/03/88, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Arcadia Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address SE 170 Walker Park, Shelton

(Signed) [signature] (WELL DRILLER) License No. 1465

Contractor's Registration No. ARCADDI177K Date 10/5/88, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

Planning ● Management ● Engineering
P.O. Box 123 ● Port Orchard, WA 98366 ● 1-888-881-0958

June 18, 2020

Subject: Notification of Wellhead Protection Area

Dear Lake Limerick Country Club resident:

The Lake Limerick Water Department has taken steps to protect our valuable drinking water supply by establishing a local wellhead protection plan. A wellhead protection plan is developed by delineating the geographic area where the water supplies originate and protecting that area from pollutant sources. The purpose of this letter is to tell you that your parcel may be within a portion of the 10-year groundwater travel radius wellhead protection area around one of the community's wells which contribute groundwater to our drinking water supply. The area enclosed by the radius of each well is shown in the enclosed map. This letter is not an agreement but serves as a notification, which is required by the Department of Health. One element of our local wellhead protection plan involves creating more awareness of the need to take precautions to prevent groundwater contamination in this area. We are asking for your commitment to join us in this effort.

We realize that you are already careful to protect the environment. We hope that informing you of your location in our wellhead protection area will result in an increase in precautions to ensure that your activities on your property will not impact our drinking water.

Potentially polluting and harmful activities that should be avoided include the improper disposal of paint, paint thinners, cleaning solvents, and used motor oil. Any unwanted or unused household hazardous materials can be disposed at your local solid waste landfill or hazardous waste disposal facility.

Thank you for your cooperation and assistance in helping us ensure safe, clean drinking water. Please let us know if you have any questions or comments.

Sincerely,

Andrew Nelson
On behalf of Lake Limerick Country Club

Planning ● Management ● Engineering
P.O. Box 123 ● Port Orchard, WA 98366 ● 1-888-881-0958

June 18, 2020

Subject: Notification of Wellhead Protection Area

Dear property owner:

The Lake Limerick Water Department has taken steps to protect our valuable drinking water supply by establishing a local wellhead protection plan. A wellhead protection plan is developed by delineating the geographic area where the water supplies originate and protecting that area from pollutant sources. The purpose of this letter is to tell you that your parcel may be within a portion of the 10-year groundwater travel radius wellhead protection area around one of the community's wells which contribute groundwater to our drinking water supply. The area enclosed by the radius of each well is shown in the enclosed map. This letter is not an agreement but serves as a notification, which is required by the Department of Health. One element of our local wellhead protection plan involves creating more awareness of the need to take precautions to prevent groundwater contamination in this area. We are asking for your commitment to join us in this effort.

We realize that you are already careful to protect the environment. We hope that informing you of your location in our wellhead protection area will result in an increase in precautions to ensure that your activities on your property will not impact our drinking water.

Potentially polluting and harmful activities that should be avoided include the improper disposal of paint, paint thinners, cleaning solvents, and used motor oil. Any unwanted or unused household hazardous materials can be disposed at your local solid waste landfill or hazardous waste disposal facility.

Thank you for your cooperation and assistance in helping us ensure safe, clean drinking water. Please let us know if you have any questions or comments.

Sincerely,

Andrew Nelson
On behalf of Lake Limerick Country Club

Planning ● Management ● Engineering
P.O. Box 123 ● Port Orchard, WA 98366 ● 1-888-881-0958

June 18, 2020

Mason County Department of Emergency Management
100 W Public Works DR
Shelton WA, 98584

Subject: Lake Limerick Water System Notification of Wellhead Protection Area

Dear Mason County:

As part of our wellhead protection program and in accordance with state regulations (WAC 246-290-135), the Lake Limerick Country Club hereby informs you of the findings of our wellhead protection area delineation.

The enclosed map shows the 6-month, 1-year, 5-year, and 10-year travel boundaries for our wellhead protection areas located in Sections 22, 26, 27, 28, and 34, Township 21N, Range 3W. Please review the map and correlate it with your land-use planning. Any groundwater contamination that occurs within this wellhead protection area has a potential to reach our wells. It is of importance to us that all reasonable steps are taken to ensure that land use activities within this area do not contaminate our drinking water supply. Please return notification if you are aware of an unidentified potential source of contamination located within the wellhead protection area.

In addition, please note the location of the wellhead in the event of an emergency. Thank you for your cooperation and assistance in helping us ensure safe, clean drinking water. If you have any questions, contact Northwest Water Systems.

Sincerely,

____

Andrew Nelson
Northwest Water Systems
On behalf of Lake Limerick Country Club

Planning ● Management ● Engineering
P.O. Box 123 ● Port Orchard, WA 98366 ● 1-888-881-0958

June 18, 2020

Department of Ecology – SW Regional Office
300 Desmond Drive SE
Lacey, WA 98503

Subject: Lake Limerick Water System Notification of Wellhead Protection Area

Dear Department of Ecology:

As part of our wellhead protection program and in accordance with state regulations (WAC 246-290-135), the Lake Limerick Country Club hereby informs you of the findings of our wellhead protection area delineation.

The enclosed map shows the 6-month, 1-year, 5-year, and 10-year travel boundaries for our wellhead protection areas located in Sections 22, 26, 27, 28, and 34, Township 21N, Range 3W. Please review the map and correlate it with your land-use planning. Any groundwater contamination that occurs within this wellhead protection area has a potential to reach our wells. It is of importance to us that all reasonable steps are taken to ensure that land use activities within this area do not contaminate our drinking water supply. Please return notification if you are aware of an unidentified potential source of contamination located within the wellhead protection area.

In addition, please note the location of the wellhead in the event of an emergency. Thank you for your cooperation and assistance in helping us ensure safe, clean drinking water. If you have any questions, contact Northwest Water Systems.

Sincerely,

____

Andrew Nelson
Northwest Water Systems
On behalf of Lake Limerick Country Club

Planning ● Management ● Engineering
P.O. Box 123 ● Port Orchard, WA 98366 ● 1-888-881-0958

June 18, 2020

Mason County Public Health Department
415 N 6th St
Shelton WA, 98584

Subject: Lake Limerick Water System Notification of Wellhead Protection Area

Dear Mason County:

As part of our wellhead protection program and in accordance with state regulations (WAC 246-290-135), the Lake Limerick Country Club hereby informs you of the findings of our wellhead protection area delineation.

The enclosed map shows the 6-month, 1-year, 5-year, and 10-year travel boundaries for our wellhead protection areas located in Sections 22, 26, 27, 28, and 34, Township 21N, Range 3W. Please review the map and correlate it with your land-use planning. Any groundwater contamination that occurs within this wellhead protection area has a potential to reach our wells. It is of importance to us that all reasonable steps are taken to ensure that land use activities within this area do not contaminate our drinking water supply. Please return notification if you are aware of an unidentified potential source of contamination located within the wellhead protection area.

In addition, please note the location of the wellhead in the event of an emergency. Thank you for your cooperation and assistance in helping us ensure safe, clean drinking water. If you have any questions, contact Northwest Water Systems.

Sincerely,

____

Andrew Nelson
Northwest Water Systems
On behalf of Lake Limerick Country Club

Planning ● Management ● Engineering
P.O. Box 123 ● Port Orchard, WA 98366 ● 1-888-881-0958

June 18, 2020

Mason County Community Development
615 W Alder St
Shelton WA, 98584

Subject: Lake Limerick Water System Notification of Wellhead Protection Area

Dear Mason County:

As part of our wellhead protection program and in accordance with state regulations (WAC 246-290-135), the Lake Limerick Country Club hereby informs you of the findings of our wellhead protection area delineation.

The enclosed map shows the 6-month, 1-year, 5-year, and 10-year travel boundaries for our wellhead protection areas located in Sections 22, 26, 27, 28, and 34, Township 21N, Range 3W. Please review the map and correlate it with your land-use planning. Any groundwater contamination that occurs within this wellhead protection area has a potential to reach our wells. It is of importance to us that all reasonable steps are taken to ensure that land use activities within this area do not contaminate our drinking water supply. Please return notification if you are aware of an unidentified potential source of contamination located within the wellhead protection area.

In addition, please note the location of the wellhead in the event of an emergency. Thank you for your cooperation and assistance in helping us ensure safe, clean drinking water. If you have any questions, contact Northwest Water Systems.

Sincerely,

____

Andrew Nelson
Northwest Water Systems
On behalf of Lake Limerick Country Club

Appendix 10.11
Water Quality Monitoring Programs

Water Quality Monitoring Schedule
Lead and Copper Monitoring Plan
Coliform Monitoring Plan
System Map / Sample Locations

Washington State Department of Health
Environmental Public Health
Office of Drinking Water

Water Quality Monitoring Schedule

System: LAKE LIMERICK WATER **PWS ID: 44150 T** **Region: SOUTHWEST**
Contact: Kevin R Odegard **Group: A - Comm** **County: MASON**
SMA ID: 119 **SMA Name: Northwest Water Systems, Inc.**

NOTE: To receive credit for compliance samples, you must fill out laboratory and sample paperwork completely, send your samples to a laboratory accredited by Washington State to conduct the analyses, AND ensure the results are submitted to DOH Office of Drinking Water. There is often a lag time between when you collect your sample, when we credit your system with meeting the monitoring requirement, and when we generate the new monitoring requirement.

Coliform Monitoring Requirements

	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021
Coliform Monitoring Population	2143	2139	2134	2031	2026	1982	1977	1976	1983	1984	2033	2095
Number of Routine Samples Required	2	2	2	2	2	2	2	2	2	2	2	2

- Collect samples from representative points throughout the distribution system.
- Collect required repeat samples following an unsatisfactory sample. In addition, collect a sample from each operating groundwater source.
- For systems that chlorinate, record chlorine residual (measured when the coliform sample is collected) on the coliform lab slip.

Chemical Monitoring Requirements

Distribution Monitoring

Test Panel/Analyte	*# Samples Required*	*Compliance Period*	*Frequency*	*Last Sample Date*	*Next Sample Due*	
Lead and Copper	10	Jan 2018 - Dec 2020	standard - 3 year	08/15/2017	***Aug 2020***	
Asbestos	1	Jan 2020 - Dec 2028	standard - 9 year	11/13/2018	Sep 2027	

Notes on Distribution System Chemical Monitoring

For *Lead and Copper*:
- Collect samples from the COLD WATER side of a KITCHEN or BATHROOM faucet that is used daily.
- Before sampling, make sure the water has sat unused in the pipes for at least 6 hours, but no more than 12 hours (e.g. overnight).
- If you are sampling from a faucet that has hot water, make sure cold water is the last water to run through the faucet before it sits overnight.
- If your sampling frequency is annual or every 3 years, collect samples between June 1 and September 30.

For *Asbestos:* Collect the sample from one of your routine coliform sampling sites in an area of your distribution system that has asbestos concrete pipe.

Water Quality Monitoring Schedule

Source Monitoring

- Collect 'source' chemical monitoring samples from a tap after all treatment (if any), but before entering the distribution system.
- Washington State grants monitoring waivers for various test panels /analytes. Please note that we may require some monitoring as a condition of some waivers. We have granted complete waivers for dioxin, endothal, glyphosate, diquat, and insecticides.
- Nitrate, arsenic, iron, and other individual inorganics are included as part of a Complete Inorganic (IOC) analysis when it is collected.

Source S02 — WELL # 2 AHA978 — Well — Use - Seasonal — Susceptility - Moderate

Test Panel/Analyte	# Samples Required	Compliance Period	Frequency	Last Sample Date	Next Sample Due
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Jul 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	11/13/2018	Jul 2028
Iron	1	Jan 2020 - Dec 2022	standard - 3 year	11/13/2018	Jul 2022
Manganese	1	Jan 2020 - Dec 2022	standard - 3 year	11/13/2018	Jul 2022
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	03/28/2017	Jul 2025
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	05/23/2012	May 2021
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	12/07/2006	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	08/02/2016	Aug 2022
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	08/02/2016	Aug 2022

Source S03 — WELL # 3A AHA976 — Well — Use - Permanent — Susceptility - Moderate

Test Panel/Analyte	# Samples Required	Compliance Period	Frequency	Last Sample Date	Next Sample Due
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Aug 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	08/21/2018	Aug 2027
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	03/21/2017	Mar 2023
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	04/17/2012	Apr 2021
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	02/16/2000	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	03/28/2017	Mar 2023
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	03/28/2017	Mar 2023

Water Quality Monitoring Schedule

Source Monitoring

- Collect 'source' chemical monitoring samples from a tap after all treatment (if any), but before entering the distribution system.
- Washington State grants monitoring waivers for various test panels /analytes. Please note that we may require some monitoring as a condition of some waivers. We have granted complete waivers for dioxin, endothal, glyphosate, diquat, and insecticides.
- Nitrate, arsenic, iron, and other individual inorganics are included as part of a Complete Inorganic (IOC) analysis when it is collected.

Source S04 — WELL # 4 AHA973 — Well — Use - Permanent — Susceptility - Moderate

Test Panel/Analyte	# Samples Required	Compliance Period	Frequency	Last Sample Date	Next Sample Due
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Aug 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	08/21/2018	Aug 2027
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	03/21/2017	Mar 2023
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	05/23/2012	May 2021
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	08/01/2006	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	07/26/2016	Jul 2022
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	07/26/2016	Jul 2022

Source S05 — WELL #1 AHA974 — Well — Use - Permanent — Susceptility - High

Test Panel/Analyte	# Samples Required	Compliance Period	Frequency	Last Sample Date	Next Sample Due
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Aug 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	08/21/2018	Aug 2027
Manganese	1	Jan 2020 - Dec 2022	standard - 3 year	08/21/2018	Aug 2022
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	07/07/2015	Jul 2021
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	05/23/2012	May 2021
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	09/14/2006	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	07/26/2016	Jul 2022
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	07/26/2016	Jul 2022

Water Quality Monitoring Schedule

Source Monitoring

- Collect ‘source’ chemical monitoring samples from a tap after all treatment (if any), but before entering the distribution system.
- Washington State grants monitoring waivers for various test panels /analytes. Please note that we may require some monitoring as a condition of some waivers. We have granted complete waivers for dioxin, endothal, glyphosate, diquat, and insecticides.
- Nitrate, arsenic, iron, and other individual inorganics are included as part of a Complete Inorganic (IOC) analysis when it is collected.

Source S06 WELL #3B AHA975 Well Use - Permanent Susceptility - Low

Test Panel/Analyte	# Samples Required	Compliance Period	Frequency	Last Sample Date	Next Sample Due
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Aug 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	08/21/2018	Aug 2027
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	03/21/2017	Mar 2023
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	07/24/2012	Jul 2021
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	02/16/2000	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	06/09/2015	Jun 2021
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	06/09/2015	Jun 2021

Source S07 WELL #5 AHA977 Well Use - Permanent Susceptility - Low

Test Panel/Analyte	# Samples Required	Compliance Period	Frequency	Last Sample Date	Next Sample Due
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Aug 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	08/21/2018	Aug 2027
Manganese	1	Jan 2020 - Dec 2022	standard - 3 year	08/21/2018	Aug 2022
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	03/28/2017	Mar 2023
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	04/17/2012	Apr 2021
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	02/16/2000	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	06/09/2015	Jun 2021
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	06/09/2015	Jun 2021

Water Quality Monitoring Schedule

Source Monitoring

- Collect 'source' chemical monitoring samples from a tap after all treatment (if any), but before entering the distribution system.
- Washington State grants monitoring waivers for various test panels /analytes. Please note that we may require some monitoring as a condition of some waivers. We have granted complete waivers for dioxin, endothal, glyphosate, diquat, and insecticides.
- Nitrate, arsenic, iron, and other individual inorganics are included as part of a Complete Inorganic (IOC) analysis when it is collected.

Source S08   WELL #6   Well   Use - Permanent   Susceptility - Low

Test Panel/Analyte	*# Samples Required*	*Compliance Period*	*Frequency*	*Last Sample Date*	*Next Sample Due*
Nitrate	1	Jan 2020 - Dec 2020	standard - 1 year	08/06/2019	***Aug 2020***
Complete Inorganic (IOC)	1	Jan 2020 - Dec 2028	waiver - 9 year	08/21/2018	Aug 2027
Volatile Organics (VOC)	1	Jan 2020 - Dec 2025	waiver - 6 year	11/28/2018	Sep 2024
Herbicides	1	Jan 2014 - Dec 2022	waiver - 9 year	08/11/2015	
Pesticides	0	Jan 2020 - Dec 2022	waiver - 3 year	12/07/2006	
Soil Fumigants	0	Jan 2020 - Dec 2022	waiver - 3 year		
Gross Alpha	1	Jan 2020 - Dec 2025	standard - 6 year	06/09/2015	Jun 2021
Radium 228	1	Jan 2020 - Dec 2025	standard - 6 year	06/09/2015	Jun 2021

Water Quality Monitoring Schedule

Other Information

Other Reporting Schedules	*Due Date*
Submit Consumer Confidence Report (CCR) to customers and ODW (Community systems only):	07/01/2020
Submit CCR certification form to ODW (Community systems only):	10/01/2020
Submit Water Use Efficiency report online to ODW and to customers (Community and other municipal water systems only):	07/01/2020
Send notices of lead and copper sample results to the customers sampled:	30 days after you receive the laboratory results
Submit Certification of customer notification of lead and copper results to ODW:	90 days after you notify customers

Special Notes

None

Southwest Regional Water Quality Monitoring Contacts

For questions regarding chemical monitoring:	Sophia Petro: (360) 236-3046 or sophia.petro@doh.wa.gov
For questions regarding DBPs:	Regina Grimm, p.e.: (360) 236-3035 or regina.grimm@doh.wa.gov
For questions regarding coliform bacteria and microbial issues:	Southwest Office: (360) 236-3030 or SWRO.Coli@doh.wa.gov

Additional Notes

The information on this monitoring schedule is valid as of the date in the upper left corner on the first page. However, the information may change with subsequent updates in our water quality monitoring database as we receive new data or revise monitoring schedules. There is often a lag time between when you collect your sample and when we credit your system with meeting the monitoring requirement.

We have not designed this monitoring schedule to display all compliance requirements. The purpose of this schedule is to assist water systems with planning for most water quality monitoring, and to allow systems to compare their records with DOH ODW records. Please be aware that this monitoring schedule does not include constituents that require a special monitoring frequency, such as monitoring affiliated with treatment.

Any inaccuracies on this schedule will not relieve the water system owner and operator of the requirement to comply with applicable regulations.

If you have any questions about your monitoring requirements, please contact the regional office staff listed above.

Lead and Copper Monitoring Plan

Last Date Modified: 2020

As a public water system, LLWS is required to monitor lead and copper in the cold water as specified by the Lead and Copper Rule (LCR). It is required for the water system to take 10 samples each of lead and copper from the distribution every 6 monthts for standard monitoring. However, LLWS has qualified for reduced monitoring in which 10 samples are required only every 3 years between June and September. The samples must be taken at a kitchen or sink faucet from ten (10) separate homes that are single family residences. The home should be selected based on the risk of lead and copper exceedances caused by indoor plumbing material.

Sample Sites:
1: 180 E. Penzance
2: 1280 E. St. Andrews
3: 211 E. Aycliffe Dr.
4: 521 E. Way to Tipperary
5: 20 E. Aycliffe Dr.
6: 550 E. Way to Tipperary
7: 710 E. St. Andrews
8: 141 E. Way to Tipperary
9: 281 E. St. Andrews
10: 521 E. St. Andrews

Contact information and area of responsibility

Owner contact or POC:	Don Bird	**Phone:**	360-426-4563
		Email:	don.bird47@gmail.com
Management company:	Northwest Water Systems	**Phone:**	360-876-0958
Department of Health Chemical Water Quality Monitoring Program	Southwest Regional Office PO Box 47823 Olympia, Wa 98504	**Phone:** **Email:**	360-236-3046 sophia.petro@doh.wa.gov
Laboratory:	Spectra Labs	**Phone:**	(360) 779-5141

Should any questions or concerns arise, contact DOH. Safe drinking water is highest priority for any water system. Maintaining an open line of communication with DOH may be the difference in best determining the correct approach to a water quality event and the best resolution. Rules and regulations change, and DOH can provide guidance that can make the requirements easy to comply with.

This document was prepared by Northwest Water Systems

Signature: Andrew D. Nelson Date: 6/18/2020

Print Verification: Andrew Nelson

Coliform Monitoring Plan for: Lake Limerick Water System

A. System Information

Plan Date: June 2020

Water System Name	**County**	**System I.D. Number**
Lake Limerick Water System	Mason	44150T
Name of Plan Preparer Andrew Nelson	**Position** Design Engineer	**Daytime Phone** **360-876-0958**

Sources: DOH Source Number, Source Name, Well Depth, Pumping Capacity

DOH #	Name	Depth	Capacity (gpm)
S05	1	116	49
S02	2	121	200
S03	3A	148	144
S04	3B	177	194
S04	4	111	74
S07	5	130	35
S08	6	434	248

Storage: List and Describe

4 Concrete Reservoirs

Name	Capacity (gal)
Tank 1	84,600
Tank 3	158,600
Tank 4	77,000
Tank 6	158,600

Treatment: Source Number & Process	None
Pressure Zones: Number and name	1
Population by Pressure Zone	1,967
Number of Routine Samples Required Monthly by Regulation:	2
Number of Sample Sites Needed to Represent the Distribution System:	12
***Request DOH Approval of Triggered Source Monitoring Plan?**	Yes ☐ No ☒

*If approval is requested a fee will be charged for the review.

B. Laboratory Information

Laboratory Name	**Office Phone 253-531-3121**
Water Management Laboratory	**After Hours Phone** - -
Address 1515 80th St. E, Tacoma WA, 98404	**Cell Phone** - - **Email** ______

Hours of Operation Monday-Friday 8AM-5PM, Saturday 9AM -12PM	
Contact Name ______	
Emergency Laboratory Name Centric Analytical Labs	**Office Phone 360-443-7845** **After Hours Phone - -**
Address 1786 Mile Hill Dr, Port Orchard WA, 98366	**Cell Phone - -** **Email ______**
Hours of Operation Monday-Friday 8AM-5PM	
Contact Name ______	

C. Wholesaling of Groundwater

	Yes	No
We are a consecutive system and purchase groundwater from another water system.	☐	☒
If yes, Water System Name: Contact Name: Telephone Numbers Office - - After Hours - -		
We sell groundwater to other public water systems.	☐	☒
If yes, Water System Name: Contact Name: Telephone Numbers Office - - After Hours - -		

D. Routine, Repeat, and Triggered Source Sample Locations*

Site Group	Location/Address for **Routine and Repeat 1 Sample Sites**	Location/Address for **Repeat 2 Sample Site**	Location/Address for **Repeat 3 Sample Site**	Groundwater Sources for **Triggered Sample Sites****
A-1	980 E. St. Andrews	930 E. St. Andrews	30 E. Connemara	1 from each active source
A-2	571 Old Lyme	641 Old Lyme	520 Old Lyme	1 from each active source
B-1	160 E. Shamrock	201 E. Shamrock	Facilities Bldg.	1 from each active source
B-2	420 Way to Tipperary	370 Way to Tipperary	480 Way to Tipperary	1 from each active source
C-1	121 Shannon	60 Shannon	1280 E. St. Andrews	1 from each active source
C-2	151 E. Tenby	180 E. Tenby	540 E. Aycliffe	1 from each active source
D-1	2191 E. St. Andrews	2281 E. St. Andrews	2150 E. St. Andrews	1 from each active source
D-2	261 Rd of Tralee	91 Rd of Tralee	421 Rd of Tralee	1 from each active source
E-1	571 E. Ballantrae	481 E. Ballantrae	631 E. Ballantrae	1 from each active source
E-2	90 Dalkeith	10 Dalkeith	180 Dalkeith	1 from each active source
F-1	120 E. Balmoral	72 E. Balmoral	21 E. Balmoral	1 from each active source
F-2	91 Dunoon	120 Dunoon	51 Dunoon	1 from each active source

*NOTE: If you need more than three routine samples to cover the distribution system, attach additional sheets as needed.

**** When you collect the repeats, you must sample every groundwater source that was in use when the original routine sample was collected.**

Important Notes for Sample Collector:

E. Reduced Triggered Source Monitoring Justification (add sheets as needed):

F. Routine Sample Rotation Schedule

Month	Routine Site(s)	Month	Routine Site(s)
January	A1, A2	July	A1, A2
February	B1, B2	August	B1, B2
March	C1, C2	September	C1, C2
April	D1, D2	October	D1, D2
May	E1, E2	November	E1, E2
June	F1, F2	December	F1, F2

G. Level 1 and Level 2 Assessment Contact Information

Name Doug Carothers, WDM-2	Office Phone 360-507-6258 After Hours Phone - -
Address	Email water@lakelimerick.com
Name Kevin Odegard, WDM-3	Office Phone 360-876-0958 After Hours Phone - -
Address	Email kevin@nwwatersystems.com

H. *E. coli*-Present Sample Response

Distribution System *E. coli* Response Checklist				
Background Information	**Yes**	**No**	**N/A**	**To Do List**
We inform staff members about activities within the distribution system that could affect water quality.	☒	☐	☐	☐
We document all water main breaks, construction & repair activities, and low pressure and outage incidents.	☒	☐	☐	☐
We can easily access and review documentation on water main breaks, construction & repair activities, and low pressure and outage incidents.	☒	☐	☐	☐
Our Cross-Connection Control Program is up-to-date.	☒	☐	☐	☐
We test all cross-connection control devices annually as required, with easy access to the proper documentation.	☒	☐	☐	☐
We routinely inspect all treatment facilities for proper operation.	☐	☐	☒	☐
We identified one or more qualified individuals who are able to conduct a Level 2 assessment of our water system.	☒	☐	☐	☐
We have procedures in place for disinfecting and flushing the water system if it becomes necessary.	☒	☐	☐	☐
We can activate an emergency intertie with an adjacent water system in an emergency.	☐	☒	☐	☐
We have a map of our service area boundaries.	☒	☐	☐	☐
We have consumers who may not have access to bottled or boiled water.	☐	☒	☐	☐
There is a sufficient supply of bottled water immediately available to our customers who are unable to boil their water.	☒	☐	☐	☐
We have identified the contact person at each day care, school, medical facility, food service, and other customers who may have difficulty responding to a Health Advisory.	☒	☐	☐	☐
We have messages prepared and translated into different languages to ensure our consumers will understand them.	☒	☐	☐	☐
We have the capacity to print and distribute the required number of notices in a short time period.	☒	☐	☐	☐
Policy Direction	**Yes**	**No**	**N/A**	**To Do List**
We have discussed the issue of *E. coli*-present sample results with our policy makers.	☒	☐	☐	☐
If we find *E. coli* in a routine distribution sample, the policy makers want to wait until repeat test results are available before issuing advice to water system customers.	☒	☐	☐	☐
(Cont.)				

Distribution System *E. coli* Response Checklist				
Potential Public Notice Delivery Methods	**Yes**	**No**	**N/A**	**To Do List**
It is feasible to deliver a notice going door-to-door.	☒	☐	☐	☐
We have a list of all of our customers' addresses.	☒	☐	☐	☐
We have a list of customer telephone numbers or access to a Reverse 9-1-1 system.	☒	☐	☐	☐
We have a list of customer email addresses.	☐	☒	☐	☐
We encourage our customers to remain in contact with us using social media.	☒	☐	☐	☐
We have an active website we can quickly update to include important messages.	☒	☐	☐	☐
Our customers drive by a single location where we could post an advisory and expect everyone to see it.	☐	☒	☐	☐
We need a news release to supplement our public notification process.	☐	☒	☐	☐

Distribution System *E. coli* Response Plan

If we have *E. coli* in our distribution system we will immediately:

1. Call DOH.
2. Collect repeat and triggered source samples per Part D. Collect additional investigative samples as necessary.
3. Inspect our water system facilities, including treatment plants for proper operation.
4. Interview staff to determine whether anything unusual was happening in the water system service area, especially since the previous month's sample(s).
5. Review new construction activities, water main breaks, and pressure outages that may have occurred during the previous month.
6. Review Cross-Connection Control Program status.
7. Discuss with DOH whether to issue a Health Advisory based on the findings of steps 3-6.

E. coli-Present Triggered Source Sample Response Checklist – All Sources				
Background Information	**Yes**	**No**	**N/A**	**To Do List**
We review our sanitary survey results and respond to any recommendations affecting the microbial quality of our water supply.	☒	☐	☐	☐
We address any significant deficiencies identified during a sanitary survey.	☒	☐	☐	☐
There are contaminant sources within our Wellhead Protection Area that could affect the microbial quality of our source water, and	☐	☒	☐	☐
If yes, we can eliminate them.	☐	☐	☐	☐
We routinely inspect our well site(s).	☒	☐	☐	☐
We have a good raw water sample tap installed at each source.	☒	☐	☐	☐
After we complete work on a source, we disinfect the source, flush, and collect an investigative sample.	☒	☐	☐	☐
Public Notice	**Yes**	**No**	**N/A**	**To Do List**
We discussed the requirement for immediate public notice of an *E. coli*-present source sample result with our water system's governing body (board of directors or commissioners) and received direction from them on our response plan.	☒	☐	☐	☐
We discussed the requirement for immediate public notice of an *E. coli*-present source sample result with our wholesale customers and encouraged them to develop a response plan.	☒	☐	☐	☐
We have prepared templates and a communications plan that will help us quickly distribute our messages.	☒	☐	☐	☐

E. coli-Present Triggered Source Sample Response Checklist – Source S__*

Alternate Sources	**Yes**	**No**	**N/A**	**To Do List**
We can stop using this source and still provide reliable water service to our customers.	☒	☐	☐	☐
We have an emergency intertie with a neighboring water system that we can use until corrective action is complete (perhaps for several months).	☐	☒	☐	☐
We can provide bottled water to all or part of the distribution system for an indefinite period.	☒	☐	☐	☐
We can quickly replace our existing source of supply with a more protected new source.	☐	☒	☐	☐
Temporary Treatment	**Yes**	**No**	**N/A**	**To Do List**
This source is continuously chlorinated, and our existing facilities can provide 4-log virus treatment (CT = 6) before the first customer. If yes, at what concentration? _____ mg/L	☐	☒	☐	☐
We can quickly introduce chlorine into the water system and take advantage of the existing contact time to provide 4-log virus treatment to a large portion of the distribution system.	☒	☐	☐	☐
We can reduce the production capacity of our pumps or alter the configuration of our storage quantities (operational storage) to increase the amount of time the water stays in the system before the first customer to achieve CT = 6.	☒	☐	☐	☐
We can alter the demand for drinking water (maximum day or peak hour) through conservation messages to increase the time the water is in the system prior to the first customer in order to achieve 4-log virus treatment with chlorine.	☐	☒	☐	☐

*NOTE: If your system has multiple sources, you may want to complete a separate checklist for each source.

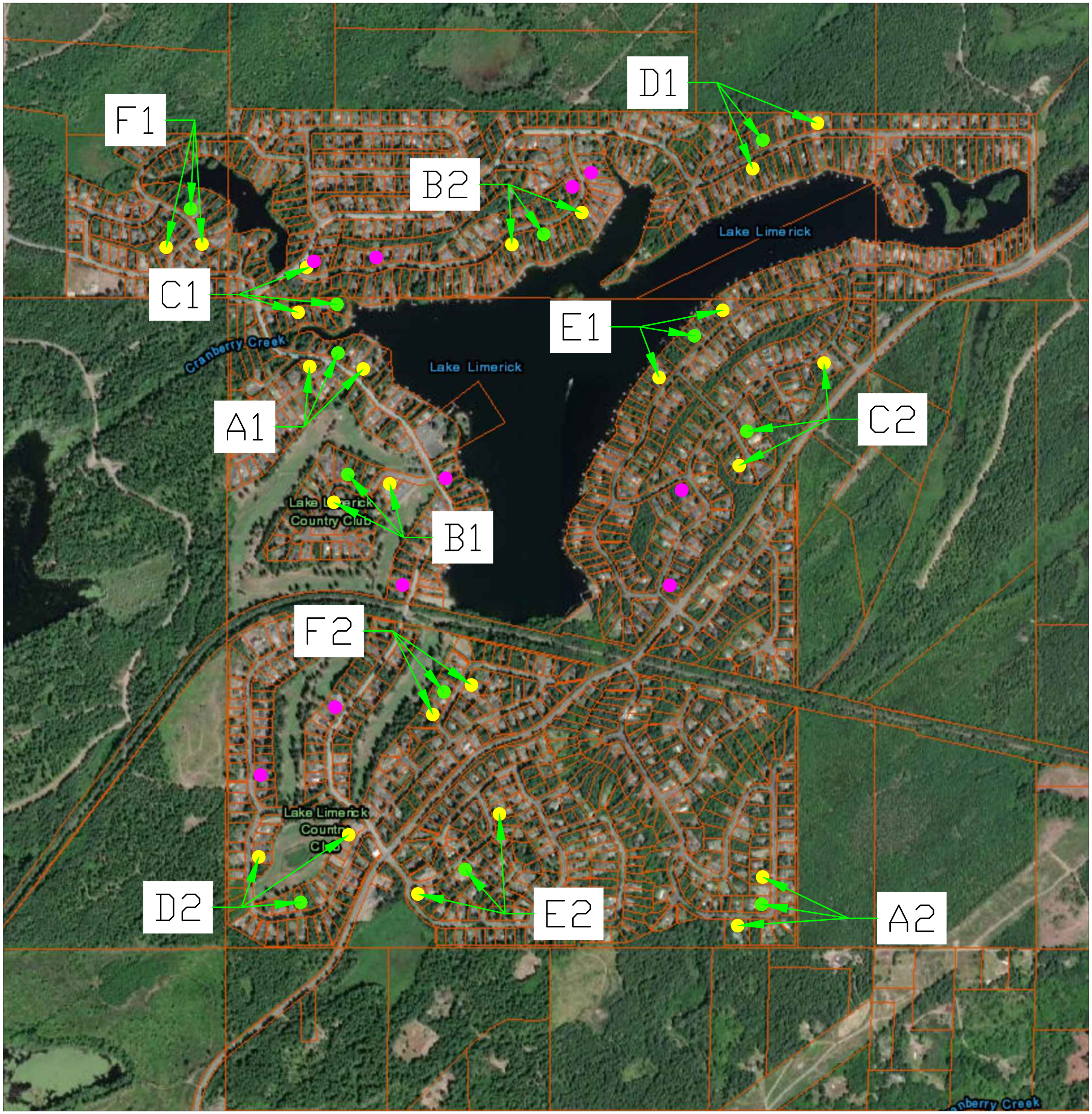
E. coli-Present Triggered Source Sample Response Plan – Source ___

If we have *E. coli* in Source ___ water we will immediately:

1. Call DOH.
2. Distribute Required Notice
3. Interview Staff
4. In concert with DOH, begin work on corrective action plan. Corrective action options: discontinue use of the contaminated source; provide 4-log virus treatment of the source.

I. System Map

SAMPLE LOCATIONS FOR COLIFORM AND LEAD & COPPER SAMPLES



COLIFORM – ROUTINE AND REPEAT 1

COLIFORM – REPEAT 2 AND 3

LEAD AND COPPER

Appendix 10.12
Cross Connection Control Program

Cross-Connection Control Policy
Cross-Connection Control Program
Backflow Incidence Response Plan
List of Backflow Devices and Test Dates

LAKE LIMERICK WATER
CROSS-CONNECTION CONTROL POLICY

Finding of Fact

Whereas it is the responsibility of a water purveyor to provide water to the customer at the meter that meets Washington state water quality standards;

Whereas it is the water purveyor's responsibility to prevent the contamination of the public water system from the source of supply (i.e., to the customer's connection to the service pipe or meter);

Whereas it is a requirement of the Washington State Department of Health (DOH) for the Purveyor to establish a cross-connection control program satisfactory to DOH;

Whereas cross-connections within the customer's plumbing system may pose a potential source for the contamination of the public water supply system;

Now be it resolved that Lake Limerick Country Club, Inc., hereinafter referred to as the Purveyor, establishes the following cross-connection control policy to protect this purveyor-owned water system from the risk of contamination. For public health and safety, this policy shall apply equally to all new and existing customers.

Definitions

Unless otherwise defined, all terms used in this policy pertaining to cross-connection control have the same definitions as those contained in WAC 246-290-010 (Definitions, abbreviations, and acronyms) of the Group A Drinking Water Regulations.

Implementation of the Cross-Connection Control Policy

The Purveyor will implement a cross-connection control program that relies on premises isolation and in-premises protection as defined in WAC 246-290-010.

The Purveyor will employ or engage the services of a DOH-certified Cross-connection Control Specialist (CCS) to develop, implement, and be in responsible charge of **Lake Limerick Water's** cross-connection control program.

The Purveyor will ensure the written cross-connection control program is consistent with this policy and complies with the requirements contained in WAC 246-290-490 (Cross-connection control) of the Group A Drinking Water Regulations.

The Purveyor will ensure the most recent editions of the following publications are used as references and technical aids for cross-connection control program development and implementation:

1. *Cross-Connection Control Manual, Accepted Procedures and Practice*, published by the Pacific Northwest Section, American Water Works Association, or latest edition thereof.
2. *Manual of Cross-Connection Control*, published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, or latest edition thereof.
3. *Cross-Connection Control Guidance Manual for Small Water Systems*, published by the DOH Office of Drinking Water.

The Purveyor will ensure coordination with the authority having jurisdiction (*f.k.a., Local Administrative Authority*) in all matters concerning cross-connection control. Documentation and description of the coordination, including delineation of responsibilities, shall be provided in the written cross-connection control program.

The Purveyor will incorporate the written cross-connection control program into the Water System Plan required under WAC 246-290-100 or the Small Water System Management Program required under WAC 246-290-105.

The Purveyor retains the authority to make reasonable decisions related to cross-connections in cases and situations not provided for in this policy or the written program.

Technical Provisions - Prevention of Contamination

The Purveyor will ensure that periodic hazard surveys (administered through a customer completed CCC Hazard Survey form and/or performed on-site through a CCC Hazard Field Survey) of the customer's plumbing system(s) and water usage are conducted and evaluated by the CCS as follows:

> **Single Family/Duplex Residential & Non-residential Recreational Connections (*private campsites/RV sites*):** Surveys shall be conducted on a triennial basis (every three years). Normal method of survey shall be through a customer completed/self-reporting CCC Hazard Survey form. An on-site Field Survey may be required under special or unusual circumstances. If an on-site Field Survey is required, the customer must sign the completed Field Survey Report and a copy is provided to them.
>
> **All Other Non-residential (commercial, business, schools, daycares, churches, institutional, agricultural, medical, industrial, food service/processing, etc.)** surveys shall be conducted on a biennial basis (every other year). Normal method of survey shall be through a customer completed pre-survey form <u>and</u> an on-site Field Survey. The owner or authorized representative must sign the Field Survey Report and a copy is provided to them.

With an accumulation of data and an aggressive customer education program the time interval for re-surveys may be lengthened or shortened as deemed necessary and acceptable to the Purveyor, CCS, and DOH.

Survey of a customer's plumbing system(s) and water usage is for the sole purpose of establishing the minimum requirements for the protection of the public water supply system.

Technical Provisions – Backflow Prevention Assemblies

The Purveyor will utilize a 'multiple-barrier' approach to protect the public water system from contamination via cross-connections commonly experienced by *Group A - Community* systems with predominantly residential connections. This approach consists of **Primary** and **Secondary protection measures** as follows:

Primary protection measures: The Purveyor, in conjunction with the CCS's assessment, will ensure that cross-connections between a customer's water system(s) and/or water usage and the public water system are eliminated or controlled by the appropriate method of backflow protection as follows:

1. The Purveyor will ensure compliance with the premises isolation requirements specified in WAC 246-290-490 § (4)(b); and
2. May reduce premises isolation requirements and rely on in-premises protection for premises other than the type addressed in WAC 246-290-490 § (4)(b), only when the following conditions are met:
   (a) The in-premises backflow preventer provides a level of protection commensurate with the assessed degree of hazard;

(b) Backflow preventers which provide the in-premises backflow protection meet the definition of 'approved backflow preventers' as described in WAC 246-290-010;

(c) The approved backflow preventers are installed, inspected, tested (at least annually), maintained, and repaired in accordance with WAC 246-290-490 § (6) & (7);

(d) Records of the backflow preventers are maintained in accordance with WAC 246-290-490 § (3)(j) & (8); and

(e) The Purveyor and designated CCS have reasonable access to the customer's premises to conduct periodic hazard (re)evaluations to determine whether the in-premises protection is adequate to protect the Purveyor's distribution system.

Secondary protection measures: The system distribution design consists of 'Y' connection points off of the main distribution line which feeds two residential service lines (one on each arm of the 'Y'). The Purveyor has installed DOH-approved Double Check Valve Assemblies (DCVAs) on the tail of the 'Y' connection points (e.g., downstream of the main distribution line connection and upstream of the split to the individual residential service lines.) The purpose of these DCVAs is to provide a secondary layer of protection to the distribution system. The Purveyor owns these assemblies and ensures:

(a) The approved backflow preventers are installed, inspected, maintained and repaired or replaced in accordance with WAC 246-290-490; and

(b) Records of the backflow preventers are maintained in accordance with WAC 246-290-490 § (3)(j) & (8); and

(c) The approved backflow preventers shall be tested in accordance with all testing requirements established in WAC 246-290-490 with the exception of frequency as follows:

  (i) Assemblies relied upon as Secondary protection measures shall be inspected periodically throughout the year and tested on a triennial (every 3 years) basis; and

  (ii) If an assembly fails a periodic inspection it shall be tested within 10 working days; and

  (iii) If an assembly fails a regularly scheduled triennial test it shall be repaired or replaced and retested within 10 working days and placed on an annual testing schedule until it has passed (without any failures) for two consecutive years. The requirement for annual testing may be extended as deemed necessary by the Purveyor and CCS.

Technical Provisions – Backflow Incidence

A Backflow Incidence Response Plan (BIRPlan) is created as part of the CCC Program. The CCS will act as the system coordinator in the event of an incident. The CCS will generate a Backflow Incident Report form and file it with the Department of Health (DOH) and/or Authority Having Jurisdiction (AHJ) in accordance with WAC 246-290-490 regulations.

Administrative Provisions

The Purveyor will take the appropriate corrective action(s) when:

1. A cross-connection exists that is not controlled commensurate to the degree of hazard assessed;
2. A customer fails to comply with WAC 246-290-490 requirements regarding the survey of a customer's water system(s) and/or water usage; or

3. A customer fails to comply with WAC 246-290-490 requirements regarding the installation, inspection, testing, maintenance or repair of a required backflow preventer.

The Purveyor's corrective action(s) may include, but are not limited to:

1. Denying or discontinuing water service to a customer's premises until the customer returns a completed CCC Hazard Survey form and/or a CCC Hazard Field Survey is conducted and appropriately completed report is submitted;
2. Denying or discontinuing water service to a customer's premises until the identified cross-connection hazard is eliminated or controlled to the satisfaction of the Purveyor;
3. Requiring the customer to install an approved backflow preventer for premises isolation commensurate with the assessed degree of hazard; or.
4. The Purveyor installing an approved backflow preventer for premises isolation commensurate with the assessed degree of hazard.

Except in the event of an emergency, the Purveyor or CCS shall notify the Authority Having Jurisdiction prior to denying or discontinuing water service to a customer's premises.

The Purveyor, in conjunction with the CCS, shall provide pertinent and up-to-date educational materials and/or programs each non-survey year.

The Purveyor or CCS shall complete all annual and/or periodic reports required under WAC 246-290-490. If the Purveyor completes the reports the CCS shall review them prior to submission to the Department of Health or Authority Having Jurisdiction.

The Purveyor shall maintain all records and data pertinent to the Cross-Connection Control Program (CCCP) and will provide electronic or paper copies of such CCCP related records or information as requested by the Washington State Department of Health and/or Authority Having Jurisdiction.

The Purveyor prohibits the intentional return of used water to the Purveyor's distribution system. Used water includes, but is not limited to, water used for heating, cooling, or other purposes within the customer's water system.

The Purveyor's requirements contained within this cross-connection control policy and the written program do not constitute an approval of the customer's plumbing system, compliance of the customer's plumbing system with the Uniform Plumbing Code or an absolute assurance of the absence of cross-connections within the customer's plumbing system or through their water usage.

If any provision in this policy or in the written cross-connection control program is found to be less stringent than or inconsistent with the Group A Drinking Water Regulations (Chapter 246-290 WAC), or other Washington state statuettes or rules, the more stringent state statue, rule or regulation shall apply.

Policy Adopted: ______________________________

Effective Date: ______________________________

Signatures: ______________________________

____

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LAKE LIMERICK WATER
CROSS-CONNECTION CONTROL PROGRAM

A. Requirement for Program

Lake Limerick Water (44150 T), hereinafter referred to as "the Purveyor", has the responsibility to protect the public water system from contamination due to cross connections. A cross connection may be defined as *"any actual or potential physical connection between a potable water line and any pipe, vessel, or machine that contains or has a probability of containing a non-potable gas or liquid, such that it is possible for a non-potable gas or liquid to enter the potable water system by backflow."*

All public water systems are required to develop and implement cross-connection control (CCC) programs. The CCC requirements are contained in Washington Administrative Code (WAC) 246-290-490 of the Group A Drinking Water Regulations. The minimum required elements of a CCC program are:

1. Establishment of legal authority and program policies;
2. Evaluation of premises for cross-connection hazards;
3. Elimination and/or control of cross connections;
4. Provision of qualified personnel;
5. Inspection and testing of backflow prevention assemblies;
6. Quality control of testing process;
7. Response to backflow incidents;
8. Public education for consumers;
9. Record keeping for CCC program; and
10. Special requirements for reclaimed water use.

Other CCC program requirements include:

1. Coordination with the Authority Having Jurisdiction (AHJ) (*fka: Local Administrative Authority*), i.e., the local building or plumbing official regarding CCC activities;
2. Prohibition of the return of used water into the public water system (PWS) distribution system; and
3. Inclusion of a written CCC Program in a Water System Plan (WSP) or Small Water System Management Program (SWSMP).

B. Program Objectives

The objectives of the CCC program are to:

1. Reasonably reduce the risk of contamination of the public water distribution system; and
2. Reasonably reduce the Purveyor's exposure to legal liability arising from the backflow of any contaminant originating from the customer's plumbing system and then supplied to other customers.

C. Summary of Program Decisions

The following table summarizes the major policy and program decisions adopted for the **Lake Limerick Water System**. The items in the table represent CCC Program areas that have more than one acceptable approach or option.

CCC Program Decision Summary Table for the Lake Limerick Water

Decision Item	Decision
1. Type of Program [General, WAC 246-290-490(2)(e)]	
a. Premises isolation only	
b. Premises isolation and in-premises protection (combination program)	X
2. Extent of Coordination with the AHJ [WAC 246-290-490(2)(d)]	
a. Information exchange	X
b. Interaction	
c. Joint program	
3. Relationship with Customer [Element 1]	
a. Signed service agreement or contract	
b. Ordinance/resolution; implied service agreement	X
4. Enforcement of Corrective Action [Element 1]	
a. Rely upon shut-off of water service	X
b. Rely upon purveyor-installed premises isolation	X
5. Assessment and Re-assessment of Hazard [Element 2]	
a. By purveyor's staff or equivalent	X
b. By cross-connection control specialist (CCS) contracted by purveyor; report reviewed by purveyor's CCS	X
6. Location/ Ownership of Premises Isolation Backflow Prevention Assembly [Element 3]	
a. On purveyor's service line	X
b. On customer's service line	X
7. CCS Option – Purveyor's Program Management [Element 4]	
a. Purveyor's staff member certified	X
b. Inter-agency agreement or use other agency's CCS	
c. Contract with consultant CCS	X
8. Testing of Backflow Prevention Assemblies [Element 5]	
a. By purveyor's staff or purveyor-contracted backflow assembly tester (BAT)	X
b. By customer-employed (contractor) BAT	X
9. Cost Recovery [WAC 246-290-100(4)(h) and –105(4)(p)]	
a. Borne by all customers (general water rates)	X
b. Assessed to specific class (commercial meters)	
c. Each customer directly bears cost	X

D. Required Elements of Program

The **Washington State Department of Health (DOH)** drinking water regulations for Group A public water systems, WAC 246-290, require CCC programs to include certain minimum elements. The elements are listed in WAC 246-290-490(3). This section describes how the water system intends to comply with each of the required program elements. Elements are numbered the same as they appear in the WAC.

Element 1: *Adoption of a written legal instrument authorizing the establishment and implementation of a CCC program.*

Lake Limerick Country Club, Inc. has adopted a cross-connection control policy, which authorizes the Purveyor to implement a CCC program. The policy also authorizes the system to take corrective action when customers do not comply with the CCC program requirements. The primary method for protection of the distribution system will be the installation of a backflow prevention assembly by the Purveyor.

Legal Instrument Status	***Schedule***
Preparation of proposed legal instrument	*03/05/2012*
Adoption of legal instrument	*03/21/2012*
Legal instrument becomes effective	*03/21/2012*

Element 2: *Development and implementation of procedures and schedules for evaluating new and existing service connections to assess the degree of hazard.*

Initial Cross-Connection Hazard Surveys

The procedures for evaluating the backflow prevention requirements for new and existing customers are as follows:

1. For all ***new services***, the Purveyor will require that the customer either submit an on-site CCC Hazard Field Survey report completed by a customer employed, DOH-certified CCS; or allow access of the Purveyor employed/contracted DOH-certified CCS to complete an on-site CCC Hazard Field Survey of the possible hazard(s) posed by the proposed plumbing system(s). Cost of the survey to be borne by the customer.
2. For all ***existing services***, the Purveyor will require the customer to submit to the Purveyor, within 30 days of notification, a completed and signed CCC Hazard Survey form.
3. For all existing services, should the customer fail to supply a correctly completed and signed CCC Hazard Survey form, the Purveyor may require an on-site CCC Hazard Field Survey conducted by a DOH-certified CCS acceptable to the Purveyor, require the installation of an RPBA for premises isolation, or take other such actions consistent with the previously stated policy and bill the customer for the associated costs.

Cross-Connection Hazard Survey Schedule for Initial Hazard Assessments

The schedule for initial hazard assessment is outlined in the following table. The schedule starts from the date the CCC program is established.

Initial Assessment Task	Schedule
Assessment of all new connections	Within 30 days of issue
Identification and assessment of high-hazard premises which are listed on Table 9 of Washington Administrative Code (WAC) 246-290-490	Within 6 months
Identification and assessment of hazardous premises supplemental to Table 9 of WAC 246-290-490	Within 9 months
Identification of residential connections with special plumbing facilities and/or water use on the premises	Within 12 months

Cross-Connection Hazard Survey Schedule for Subsequent Hazard Re-Assessments

For subsequent cross-connection hazard surveys, procedures for evaluating the backflow prevention requirements are:

1. For **Single Family/Duplex Residential & Non-residential Recreational** ***(private campsites/RV sites)*** **Connections,** the Purveyor will require the customer to submit to the Purveyor, within 30 days of purveyor notification, a completed "CCC Hazard Survey form". The procedure used for evaluating the hazard re-assessment and the potential change in the required backflow prevention will be the same as used for the initial hazard assessment. The frequency of hazard re-assessments will be every 3 years.
2. For all **Other Non-residential Connections** ***(commercial, business, schools, daycares, churches, institutional, agricultural, medical, industrial, food service/processing, etc.)***, the Purveyor will require the customer to submit to the Purveyor, within 30 days of purveyor notification, a customer completed pre-survey form and an on-site CCC Hazard Field Survey conducted by a DOH-certified CCS. The frequency of the hazard re-assessments will be every 2 years.

With an accumulation of data and an aggressive customer education program the time interval for re-surveys may be lengthened or shortened as deemed necessary and acceptable to the Purveyor, CCS, and DOH.

The Purveyor will inform the customer that the Purveyor's survey of a customer's premises (whether by a representative of the Purveyor or through the evaluation of a questionnaire completed by the customer) is for the sole purpose of establishing the Purveyor's minimum requirements for the protection of the public water supply system, and that the required backflow protection will be commensurate with the Purveyor's assessment of the degree of hazard.

The Purveyor will also inform the customer or any regulatory agencies that the Purveyor's survey, requirements for the installation of backflow prevention assemblies, lack of requirements for the installation of backflow prevention assemblies, or other actions by the purveyor's personnel or agent do not constitute an approval of the customer's plumbing system or an assurance to the customer or any regulatory agency of the absence of cross connections.

Element 3: *Development and implementation of procedures and schedules for elimination and/or control of cross-connections.*

Backflow Prevention Assembly Requirements

The following service policy shall apply to all new and existing customers:

1. The Purveyor will utilize a "multiple-barrier" approach to protect the public water system from contamination via cross-connections commonly experienced by Group A – Community systems with predominantly residential connections. The approach consists of **Primary** and **Secondary** protection measures as described herein.
2. As **Primary** protection measures the Purveyor will require all **Single Family/Duplex Residential & Non-residential Recreational** ***(private campsites/RV sites)*** **Connections** with facilities of the type described in Table 9 of WAC 246-290-490 to be isolated with an RPBA. All other residential customers with special plumbing or water use on the premises will be isolated with a DCVA. "Special plumbing" includes, but is not limited to, the following:
   a. A lawn irrigation system;
   b. A solar heating system;
   c. An auxiliary source of supply, e.g., a private well or creek;
   d. Piping for livestock watering, hobby farming, etc.;
   e. Residential fire sprinkler system (except for a Flow-through fire system or a Combination fire system); and
   f. Property containing a small boat moorage.
3. As **Primary** protection measures the Purveyor will require that water service to all **Other Non-residential Connections** with facilities of the type described in Table 9 of WAC 246-290-490 to be isolated with an RPBA. For facilities of the type identified as Severe Health Hazard (wastewater treatment plants, radioactive material processing plants, nuclear reactors) the Purveyor will require that either an approved air gap is installed for premises isolation or an approved RPBA is installed for premises isolation in conjunction with an in plan approved air gap. For customers within this classification and that do not have facilities or water use of the type described in Table 9, the Purveyor shall require protection commensurate with the assessed degree of hazard.
4. As **Secondary** protection measures the Purveyor has installed DOH-approved DCVAs at each bi-connection take off point (the system distribution/customer connection design consists of 'Y' connection points off of the main distribution line which feeds two residential service lines – one on each arm of the 'Y'). The backflow prevention assemblies have been installed on the leg of the 'Y', downstream of the connection take-off point and upstream of the split to the two individual residential service lines. The purpose of these backflow prevention assemblies is to provide a secondary layer of protection to the distribution system.
5. All backflow prevention assemblies relied upon by the Purveyor to protect the public water system shall meet the definition of "approved backflow prevention assembly" as contained in WAC 246-290-010. The Purveyor's CCS will obtain and maintain a current list of backflow prevention assemblies approved for installation in Washington State from the DOH Office of Drinking Water.

   All backflow prevention assemblies will be installed in:

   - The orientation for which they are approved;

- A manner and location that facilitates their proper operation, maintenance, and testing or inspection;
- A manner that will protect them from weather-related conditions such as flooding and freezing; and
- Compliance with applicable safety regulations.

Installation standards contained in the most recently published edition of the Pacific Northwest Section, American Water Works Association (PNWS-AWWA) *CCC Manual* or the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCCHR) *CCC Manual* shall be followed.

The Purveyor has no regulatory responsibility or authority over the installation and operation of the customer's plumbing system. The customer is solely responsible for compliance with all applicable regulations and for prevention of contamination of his/her plumbing system from sources within his/her premises. Any action taken by the Purveyor to survey plumbing, inspect or test backflow prevention assemblies, or to require premises isolation (installation of DCVA or RPBA on service) is solely for the purposes of reducing the risk of contamination of the Purveyor's distribution system.

Except for easements containing the Purveyor's distribution system, the Purveyor will not undertake work on the customer's premises unless the customer has provided written request and signed authorization.

6. The following table shows the schedule that the Purveyor will follow for installation of backflow prevention assemblies when they are required (based on a hazard evaluation).

Type of Service	Schedule
New connections with cross-connection hazards	Before service is initiated
Existing connections with Table 9-type hazards and other high cross-connection hazards	Within 30 days after notification
Existing connections with other than Table 9 of WAC 246-290-490 or high cross-connection hazards	Within 90 days after notification
Existing fire protection systems using chemicals or supplied by unapproved auxiliary water source	Within 30 days after notification
Existing fire protection systems (except Flow-through & Combination fire systems) not using chemicals and supplied by purveyor's water	Within 90 days after notification

Element 4: *Provision of qualified personnel, including at least one person certified as a CCS, to develop and implement the CCC program.*

1. **Program Administration:** The responsibility for administration of the CCC Program rests with the Purveyor. General policy direction and risk management decisions are established by **the Purveyor's DOH-certified CCS**.

2. The Purveyor will employ, or otherwise have on staff, at least one DOH-certified CCS to develop and implement the CCC program. As an alternative, or when no employees or other staff members are properly qualified, the Purveyor may retain a DOH-certified CCS on contract to provide the necessary expertise and services.

3. The following cross-connection related tasks will be performed by or under the direction of the Purveyor's DOH-certified CCS (on staff or under contract):

   - Preparation of and recommendations regarding changes to the CCC program;
   - Performance of and/or reviews of CCC hazard evaluations;

- Recommendations on the type of backflow prevention assembly to be installed;
- Inspections of backflow prevention assemblies for proper application and installation;
- Reviews of backflow prevention assembly inspection and test reports;
- Recommendations and/or the granting of exceptions to mandatory premises isolation;
- Participation in or cooperation with other water utility staff in the investigation of backflow incidents and other water quality problems;
- Completion of Backflow Incident Reports; and
- Completion of CCC Activity and Program Summary Reports.

The following table identifies the current CCS retained on contract by the Purveyor to manage the Purveyor's CCC Program and/or act as the CCC technical resource for the Purveyor:

Name of CCS	Linda Martin, Northwest Water Systems, Inc.
Address	P. O. Box 123
City, State, Zip	Port Orchard, WA 98366
Telephone Number	(360) 876-0958
CCS Certification Number	012810

Element 5: *Development and implementation of procedures to ensure that approved backflow prevention assemblies are inspected and/or tested (as applicable).*

1. Inspection and Testing of Backflow Prevention Assemblies

All backflow prevention assemblies that the Purveyor relies upon for protection of the water system will be subject to inspection and, if applicable, testing. Inspection and testing of backflow prevention assemblies will be as follows:

- The Purveyor's DOH-certified CCS will inspect backflow prevention assemblies for proper application (i.e., to ensure that backflow prevention assemblies installed are commensurate with the assessed degree of hazard).
- Either a DOH-certified CCS or backflow assembly tester (BAT) will perform inspections of backflow prevention assemblies for correct installation.
- A DOH-certified backflow assembly tester will test all backflow prevention assemblies the Purveyor relies upon to protect the public water system.

2. Frequency of Inspection and Testing

Inspection and/or testing of backflow prevention assemblies for **Primary** protection will be conducted:

- At the time of installation;
- Annually after installation;
- After a backflow incident; and
- After repair, reinstallation, relocation, or re-plumbing.

The Purveyor may require a backflow prevention assembly to be inspected and/or tested more frequently than once a year, when it protects against a high-health hazard or when it repeatedly fails tests or inspections.

Inspection and/or testing of backflow prevention assemblies for **Secondary** protection will be conducted in accordance with all testing requirements established in WAC 246-290-490 with the exception of frequency as follows:

- Backflow prevention assemblies relied upon as Secondary protection measures shall be inspected periodically throughout the year and tested on a triennial (every 3 year) basis; and
- If a backflow prevention assembly fails a periodic inspection it shall be tested within 10 working days; and
- If a backflow prevention assembly fails a regularly scheduled triennial test it shall be repaired or replaced and retested within 10 working days and placed on an annual testing schedule until it has passed (without any failures) for two consecutive years. The requirement for annual testing may be extended as deemed necessary by the Purveyor and CCS.

3. Responsibility for Inspection and Testing

The Purveyor will be responsible for inspection and testing of all purveyor-owned backflow prevention assemblies.

The Purveyor will provide inspection and testing of backflow prevention assemblies owned by the customer. The customer must provide written authorization for the Purveyor or Purveyor's employees, staff or contracted service providers to enter the premises for the purpose of conducting inspection and/or testing of backflow prevention assemblies. The customer may terminate their authorization in writing. When a customer declines Purveyor's offer of inspection and testing of backflow prevention assemblies, the customer shall be required to employ, at customer expense, a DOH-certified BAT to conduct the inspection and test within the time period specified in the testing notice sent by the Purveyor. The test report shall be completed and signed by the customer and BAT and returned to the Purveyor's CCS, before the due date specified by the Purveyor.

4. Approved Test Procedures

The Purveyor will require that all backflow prevention assemblies relied upon to protect the public water system be tested in accordance with DOH-approved test procedures as specified in WAC 246-290-490(7)(d). Any proposal to use alternate test procedures must be approved by the Purveyor's CCS.

5. Notification of Inspection and/or Testing

For customers who own backflow prevention assemblies that are relied upon to protect the public water system and have declined Purveyor's offer to provide inspection and testing, the Purveyor will notify the customer in writing to have their backflow prevention assembly(ies) inspected and/or tested. Notices will be sent out not less than 30 days before the due date of the inspection and/or test. The notice will also specify the date by which the properly completed inspection/test report must be received by the Purveyor.

6. Enforcement

When a customer fails to send in the inspection/test report within 45 days after the notification date, and the Purveyor has not approved an extension to the due date, the Purveyor will take the following enforcement action:

- The Purveyor will send a second notice giving the customer an additional 15 days to send in the report. The notice will also inform the customer that failure to satisfactorily respond to this notice will result in water service shut-off.
- The Purveyor will send copies of the second notice to the owner(s) and occupant(s) of the premises (if different from the customer).

- If the owner and/or occupant have not responded satisfactorily to the Purveyor within 15 days of the due date specified in the second notice, the Purveyor will implement water service shut-off procedures.

Element 6: *Development and implementation of a backflow prevention assembly testing quality assurance/quality control program.*

The Purveyor will maintain a list of local, DOH-certified BATs that are pre-approved by the Purveyor to perform the following activities:

- Backflow prevention assembly inspection for proper installation; and
- Backflow prevention assembly testing.

The list will be compiled of individual testers who have requested to work in the system's area, who have previously submitted properly completed test reports, or are listed on the DOH list of certified testers.

Quality Assurance

The Purveyor's CCS will review backflow prevention assembly inspection/test report forms within 30 days of receipt.

The Purveyor's CCS will provide follow-up on test reports that are deficient in any way. The Purveyor's CCS will report incidences of fraud or gross incompetence on the part of any BAT or CCS to DOH Operator Certification program staff.

Element 7: *Development and implementation (when appropriate) of procedures for responding to backflow incidents.*

1. **Backflow Incident Response Plan**

The Purveyor's CCS will participate in developing a backflow incident response plan that will be part of the water system's emergency response program as required by WAC 246-290-415(2). The incident response plan will include, but will not be limited to:

- Notification of affected population;
- Notification and coordination with other agencies, such as DOH, the AHJ, and the local health jurisdiction;
- Identification of the source of contamination;
- Isolation of the source of contamination and the affected area(s);
- Cleaning, flushing, and other measures to mitigate and correct the problem; and
- Apply corrective action to prevent future backflow occurrences.

2. **Technical Resources**

The Purveyor will use the most recently published edition of the manual, *Backflow Incident Investigation Procedures*, published by the PNWS-AWWA as a supplement to the Backflow Incident Response Plan for **Lake Limerick Water**.

Element 8: *Development and implementation of a cross-connection control public education program.*

1. **Customer Education**

   The Purveyor will distribute at regular intervals (every non-survey year), public education brochures to system customers. For residential customers, such brochures will describe the cross-connection hazards in homes and the recommended backflow prevention assemblies or devices that should be installed by the homeowner to reduce the hazard to the public water system. The education program will emphasize the responsibility of the customer in preventing the contamination of the public water supply. The Purveyor's staff will produce the public education brochures or the Purveyor will obtain brochures from national backflow associations, such as PNWS-AWWA, Spokane Regional Cross-Connection Control Committee (SRC4), Western Washington Cross-Connection Prevention Professionals Group (The Group), USC FCCCHR, the American Backflow Prevention Association (ABPA), and/or Other water utilities. The information distributed by the Purveyor will include, but not be limited to, the following subjects:

   - Cross-connection hazards in general;
   - Irrigation system hazards and corrective actions;
   - Fire sprinkler cross-connection hazards;
   - Importance of annual inspection and/or testing of backflow prevention assemblies; and
   - Thermal expansion in hot water systems when backflow prevention assemblies are installed for premises isolation.

Element 9: *Development and maintenance of cross-connection control records.*

1. Types of Records and Data to be Maintained

   The Purveyor will maintain records of the following types of information required by WAC 246-290-490:

   - Service connections/customer premises information including:
     - Assessed degree of hazard; and
     - Required backflow prevention assembly to protect the public water system.

   - Backflow prevention assembly inventory and information including:
     - Air gap (AG) location, installation and inspection dates, inspection results and person conducting inspection;
     - Backflow prevention assembly location, assembly description (type, manufacturer, make, model, size, and serial number), installation, inspection and test dates, test results and data, and person performing test; and
     - Information on atmospheric vacuum breakers (AVB) used for irrigation system applications, including manufacturer, make, model, size, dates of installation and inspections, and person performing inspections.

   The Purveyor will maintain records on all backflow prevention assemblies that protect the public water system from contamination. At a minimum, the Purveyor will maintain records on all premises isolation backflow prevention assemblies required to protect the public water system.

2. Reports to be Prepared and Submitted to DOH

The Purveyor will prepare the following reports required by WAC 246-290-490 including:

- Cross-connection control program activities report for the calendar year, to be sent to DOH when requested;
- Cross-connection control program summary information, when required, or when there are significant policy changes;
- Backflow incident reports to DOH (and voluntarily to the PNWS-AWWA CCC Committee); and
- Documentation when exceptions to mandatory premises isolation are granted.

At a minimum, the Purveyor's CCS will prepare and sign the exceptions reports.

Element 10: *Additional cross-connection control requirements for reclaimed water.*

At this time **Lake Limerick Water** does not receive or distribute reclaimed water. In the event that reclaimed water use is proposed within the PWS's service area, the Purveyor will make all cross-connection control requirements mandated by the Permitting Authority in accordance with Chapter 90.46 RCW part of the written CCC program plan and comply with such additional requirements.

E. Other Provisions

Coordination With the Authority Having Jurisdiction (AHJ): Both WAC 246-290-490 and the Uniform Plumbing Code (as amended for Washington) require coordination between Purveyors and the Authority Having Jurisdiction (*fka Local Administrative Authority*) in all matters concerning cross-connection control.

a. Identification of the Authority Having Jurisdiction (AHJ) - the AHJ that enforces the plumbing code for the premises served by the Purveyor is **Mason County, Department of Community Development, Building Department, Attn: Mark Core, 426 W Cedar Street (PO Box 186), Shelton, WA 98584, (360) 427-9670**.

b. Coordination with the Authority Having Jurisdiction (AHJ) - A letter indicating that this cross-connection control program has been implemented has been provided on 03/30/2012.

c. Description of Coordination with the AHJ - The Purveyor coordinates with the AHJ as follows: **Coordination consists of information sharing only**. However, the Purveyor requests the opportunity to review any plumbing plans for new or existing connections to the water system when permits are applied for.

d. Delineation of Responsibilities - The Purveyor and the AHJ are responsible for the following CCC activities within the **Lake Limerick Water System**. AHJ reviews new construction drawings; the Purveyor is responsible for all other Cross-Connection Control evaluations, tests, inspections, and record keeping.

e. Notification of the Authority Having Jurisdiction - The Purveyor will inform the AHJ when there is a:

  - Reported change in plumbing that requires a plumbing permit;
  - Reported change in the use of any part of the premises that alters the cross-connection hazard level;
  - Backflow incident; or
  - Service connection shut-off scheduled due to customer non-compliance with CCC regulations.

F. Relationship to Other Planning and Operations Program Requirements

The Purveyor will consider the requirements and consequences of the CCC program on the utility's planning and operations requirements. Such considerations include, but are not limited to ensuring:

- And promoting adequate communication between CCC program personnel and other water utility staff;
- That adequate training is provided to all staff to recognize potential cross-connection control problems;
- That cross-connection issues be considered in water quality investigations;
- That the design of the water distribution system makes adequate provisions for expected head losses incurred through the installation of backflow prevention assemblies;
- That CCC program personnel be consulted in the design of water and wastewater treatment facilities and when proposals are made to receive or distribute reclaimed water;
- That operations under normal and abnormal conditions do not result in excessive pressure losses; and
- That adequate financial and administrative resources are available to carry out the CCC program.

Planning • Management • Engineering
P.O. Box 123 • Port Orchard, WA 98366 • 888-881-0958 • 360-876-0958

Backflow Incidence Response Plan
for Lake Limerick Water

A. General

This Backflow Incident Response Plan should be considered a supplement to the water system's Emergency Plan.

Purveyors should immediately begin a backflow incident investigation whenever the initial evaluation of a water quality complaint indicates that:

1. A backflow incident has occurred (i.e., drinking water supply has been contaminated) or may have occurred; or
2. The complaint can't be explained as a "normal" aesthetic problem.

Also, whenever a water main break (or power outage for pumped systems) causes a widespread loss of water pressure in the system (creating backsiphonage conditions), purveyors should initiate a check of distribution system water quality as a precursor to the need for a backflow incident investigation.

WAC 246-290-490 requires purveyors to notify DOH, the Local Administrative Authority and local health jurisdiction as soon as possible, but no later than the end of the next business day when a backflow incident contaminates the potable water supply (in the distribution system and/or in the customer's plumbing system). Purveyors should include a list of emergency contact telephone numbers at the beginning of the water system's O & M Manual, so that the information is readily available when an incident occurs.

Purveyors can get more detailed guidance on how to respond to a backflow incident from the manual, *Backflow Incident Investigation Procedures*, published by the Pacific Northwest Section, American Water Works Association (PNWS-AWWA).

B. Short List of Tasks

Small water system purveyors can use the following short list of tasks as initial guidance for dealing with backflow incidents. Purveyors should consult the most recently published edition of the PNWS-AWWA *Backflow Incident Investigation Procedures Manual* referenced above for greater detail as soon as possible after learning of a possible or confirmed backflow incident. Note: the water system is referred to as the Purveyor in the short task list.

1. Customer Notification

a. As soon as possible, the Purveyor will notify customers not to consume or use water.
b. The Purveyor will start the notification with the customers nearest in location to the assumed source of contamination (usually the customer(s) making the water quality complaint).
c. The Purveyor will inform the customer about the reason for the backflow incident investigation and the Purveyor's efforts to restore water quality as soon as possible. The Purveyor will let the

customer know that customers will be informed when they may use water, the need to boil water used for consumption until a satisfactory bacteriological test result is obtained from the lab, etc.

d. Where a customer cannot be contacted immediately, the Purveyor will place a written notice on the front door handle, and a follow-up visit will be made to confirm that the customer received notice about the possible contamination of the water supply.

e. When dealing with a backflow incident, the Purveyor will let customers know that it could take several days to identify the source and type of contaminant(s) and to clean and disinfect the distribution system.

2. Identification of Source of Contamination

a. The Purveyor will give consideration to the distribution system as a potential source of the contaminant (e.g., air valve inlet below ground).

b. The Purveyor will not start flushing the distribution system until the source of contamination is identified (flushing may aggravate the backflow situation, and will likely remove the contaminant before a water sample can be collected to fully identify the contaminant).

c. The Purveyor will conduct a house-to-house survey to search for the source of contamination and the extent that the contaminant has spread through the distribution system. Note: a check of water meters may show a return of water (meter running backward) to the distribution system.

d. When the cross connection responsible for the system contamination is located, the Purveyor should discontinue water service to that customer, until the customer completes the corrective action ordered by the Purveyor.

3. Isolation of Contaminated Portion of System

a. The Purveyor will isolate the portions of the system that are suspected of being contaminated by closing isolating valves; leave one valve open to ensure that positive water pressure is maintained throughout the isolated system.

b. The Purveyor will be sure to notify all affected customers in the isolated area first and then notify other customers served by the system.

4. Public Health Impacts

a. The Purveyor will seek immediate input from and work with state and local health agencies to accurately communicate and properly mitigate potential health effects.

b. If appropriate, the Purveyor will refer customers that may have consumed the contaminant or had their household (or commercial) plumbing systems contaminated to public health personnel and Local Administrative Authorities (plumbing inspectors).

5. Cleaning/Disinfecting the Distribution System

a. The Purveyor will develop and implement a program for cleaning the contaminated distribution system consistent with the contaminant(s) identified.

b. Where both chemical and bacteriological contamination has occurred, the Purveyor will disinfect the system after the removal of the chemical contaminant.

c. Where any bacteriological contamination is suspected, the Purveyor will provide field disinfection.

C. Additional Information on Cleaning/Disinfecting the Distribution System

Most chemical or physical contaminants can be flushed from the water distribution system or customer's plumbing system with adequate flushing velocity. However, this may not be the case in systems where scale and corrosion deposits (e.g., tuberculation on old cast iron mains) provide a restriction to obtaining adequate flushing velocity, or where chemical deposits or bacteriological slimes (biofilm) are present (on which the chemical contaminant may adhere).

To remove a chemical or physical contaminant from the distribution system, purveyors may need to:

1. Physically clean the affected area using foam swabs (pigs); and/or
2. Alter the form of the chemical contaminant (e.g., through oxidation using chlorination or addition of detergents).

When adding any chemical (including chlorine) to remove a contaminant from the distribution system, it is essential that the Purveyor fully understand the chemistry of the contaminant. **Adding the wrong chemical could make the contaminant more toxic to customers and/or more difficult to remove from the distribution system.**

Purveyors should contact the appropriate DOH regional office to discuss proposed approaches to contaminant removal and disinfection prior to taking corrective action.

Lake Limerick Backflow Prevention Assemblies

The Lake Limerick water system contains approximately 800 one and two-premise isolation assemblies which are tested every 3 years and were last tested in 2018.

There are also 89 in-premise assemblies which are tested annually and are listed below.

Address		Device(s)
201	Connemara Way	Febco 850 DC, Wilkins 350 DCVA
91	E Aycliffe Dr	Wilkins 350 DCVA
271	E Aycliffe Dr	Wilkins 950XLT DC
511	E Aycliffe Dr	Febco 805Y DC
120	E Ballbriggan	Watts 007M1QT DC
131	E Ballentrae Dr	Febco 850 DC, Wilkins 350 DCVA
201	E Ballentrae Dr	Wilkins 950XLT DC
211	E Ballentrae Dr	Wilkins 950XLT DC
331	E Ballentrae Dr	Febco 850 DC
361	E Ballentrae Dr	Wilkins 350 DCVA
371	E Ballentrae Dr	Wilkins 350 DCVA
401	E Ballentrae Dr	Wilkins 950XLT DC
481	E Ballentrae Dr	Wilkins 350 DCVA
501	E Ballentrae Dr	Wilkins 350 DCVA
511	E Ballentrae Dr	Wilkins 350 DCVA
571	E Ballentrae Dr	Wilkins 350 DCVA
651	E Ballentrae Dr	Febco 850 DC, Wilkins 350 DCVA
661	E Ballentrae Dr	Wilkins 350 DCVA
680	E Ballentrae Dr	Febco 850 DC
791	E Ballentrae Dr	Wilkins 950XLT DC
871	E Ballentrae Dr	Febco 850 DC
881	E Ballentrae Dr	Febco 850 DC
901	E Ballentrae Dr	Wilkins 350 DCVA
1001	E Ballentrae Dr	Wilkins 350 DCVA
1051	E Ballentrae Dr	Wilkins 350 DCVA
80	E Balmoral Way	Wilkins 350 DCVA
470	E Balmoral Way	Wilkins 350 DCVA
261	E Dunoon Pl	Wilkins 350 DCVA
291	E Dunoon Pl	Wilkins 350 DCVA
111	E Dunvegan Rd	Wilkins 350 DCVA
251	E Merioneth Rd	Wilkins 350 DCVA
150	E Penzance Rd	Wilkins 350 DCVA
200	E Penzance Rd	Wilkins 350 DCVA (2x)
230	E Penzance Rd	Wilkins 350 DCVA (2x)
251	E Penzance Rd	Wilkins 350 DCVA (2x)
320	E Penzance Rd	Wilkins 350 DCVA (2x), Febco 850 DC
360	E Penzance Rd	Wilkins 350 DCVA
380	E Penzance Rd	Wilkins 350 DCVA
401	E Penzance Rd	Wilkins 350 DCVA
20	E Road to Tralee	Wilkins 350 DCVA
51	E Road to Tralee	Wilkins 350 DCVA
71	E Road to Tralee	Wilkins 350 DCVA
360	E Road to Tralee	Wilkins 350 DCVA

521 E Road to Tralee	Wilkins 350 DCVA
630 E Road to Tralee	Wilkins 350 DCVA
641 E Road to Tralee	Wilkins 350 DCVA
161 E Shamrock Dr	Wilkins 350 DCVA
180 E Shamrock Dr	Wilkins 350 DCVA
264 E Shamrock Dr	Wilkins 350 DCVA
340 E Shamrock Dr	Wilkins 350 DCVA
360 E Shamrock Dr	Wilkins 350 DCVA
350 E St Andrews Dr	Wilkins 350 DCVA
380 E St Andrews Dr	Wilkins 950XLT DC
391 E St Andrews Dr	Wilkins 950XLT DC
670 E St Andrews Dr	Wilkins 950XLT DC (2x), Wilkins 350 DCVA
680 E St Andrews Dr	Wilkins 950XLT DC
860 E St Andrews Dr	Wilkins 350 DCVA
881 E St Andrews Dr	Wilkins 350 DCVA
1060 E St Andrews Dr	Wilkins 350 DCVA
1720 E St Andrews Dr	Wilkins 350 DCVA
1721 E St Andrews Dr	Wilkins 350 DCVA
2150 E St Andrews Dr	Wilkins 350 DCVA
2171 E St Andrews Dr	Wilkins 350 DCVA
2420 E St Andrews Dr	Wilkins 350 DCVA
2450 E St Andrews Dr	Wilkins 350 DCVA
41 E Stirling Ct	Wilkins 350 DCVA
121 E Tenby Way	Wilkins 350 DCVA
200 E Tenby Way	Wilkins 950XLT DC
130 E Way to Tipperary	Wilkins 350 DCVA
140 E Way to Tipperary	Wilkins 350 DCVA
181 E Way to Tipperary	Febco 850 DC
311 E Way to Tipperary	Watts 007M1QT DC
350 E Way to Tipperary	Wilkins 350 DCVA
380 E Way to Tipperary	Wilkins 950XLT DC
390 E Way to Tipperary	Wilkins 950XLT DC
520 E Way to Tipperary	Wilkins 350 DCVA
50 E Weymouth Pl	Wilkins 350 DCVA
90 E Weymouth Pl	Wilkins 350 DCVA
111 E Weymouth Pl	Febco 805Y DC

Appendix 10.13
Articles and Bylaws

Articles of Incorporation for LLCC
Bylaws of LLCC
Water Department Bylaws

The Articles of Incorporation are filed with the State of Washington and provide the basic legal framework for the Club, as a corporation.

STATE OF WASHINGTON | DEPARTMENT OF STATE

1, BRUCE K. CHAPMAN, Secretary of State of the State of Washington and custodian of its seal,

Hereby certify that according to the records on file in my office LAKE LIMERICK COUNTRY CLUB, INC.

A Washington non−profit, Non−stock Corporation, was incorporated March 8, 1966; and I further certify that the Above−named Corporation is in good standing on the records of this office, having complied with the filing provisions of the non-profit statute.

In witness whereof I have signed and have Affixed the seal of the State of Washington to This certificate at Olympia, the State Capitol

September 12, 1975

BRUCE K. CHAPMAN

SECRETARY OF STATE

ARTICLES OF INCORPORATION

of

LAKE LIMERICK COUNTRY CLUB, INC.

KNOW ALL MEN BY THESE PRESENTS: That we, Mark J.Antoncich, Kenneth W. Engel, John W. Osberg and W. J. Pierce, and Allan F. Osberg,/residing in the State of Washington, and being citizens of the United States, each being over the age of twenty-one years, and being desirous of forming a corporation under Title 24, Revieed Code of Washington relating to non-profit corporations, do hereby associate ourselves together for the purpose of forming a non-profit corporation, and make, subscribe, execute and adopt, in triplicate, the following Articles of Incorporation, and certify as follows:

ARTICLE I

The name of the corporation shall be Lake Limerick Country Club, Inc.

The purposes for which this corporation is formed are:

1. To purchase or otherwise acquire, construct, improve, develop, repair, maintain, operate, care for and/or dispose of streets, roadways, easements, parkways, playgrounds, open spaces and recreational areas, tennis courts, beaches, boat landings, mooring basins, floats, piers, clubhouses, swimming pools and/or swimming areas, bathhouses, places of amusement, community buildings, community clubhouses and in general community facilities appropriate for the use and benefit of its members, and/or for the improvement and development of the property hereinafter referred to.

2. To build, improve and maintain roadways, culverts, bridges and drainage area. and to provide for the improving, cleaning and sprinkling of streets, and for collection and disposal of the street sweepings, garbage, ashes, rubbish and the like; to prevent and suppress fires, to provide police protection, and to make and collect charges to cover the costs and expenses therefore.

3. To improve, light and/or maintain streets, roads, alleys, courts, walks, gateways, fences and ornamental features now existing or

hereafter to be created or erected, and shelters, comfort stations and/or buildings and improvements ordinarily appurtenant to any of the foregoing; to improve, plant and maintain grass plots and other areas, trees and plantings within the lines of the street immediately adjoining or within the property hereinafter described or referred to.

4. So far as it can legally do so, to grant franchises rights of way and easements for public utilities or other purposes upon, over, and/or under any of said property.

5. To acquire by gift, purchase, lease or otherwise, and to own, hold, enjoy, operate, *maintain* and to convey, sell, lease, transfer, mortgage and otherwise encumber, dedicate for public use and/or otherwise dispose of, real and/or personal property and interest therein wherever situate.

6. To enforce assessments, liens, charges, restrictions, conditions and covenants existing upon and/or created for the benefit of parcels of real property in the plat or added to the plat of Lake Limerick Country Club, Inc., Section 27, T21N, R3W, W.M. and the S1/2 S1/2 Section 22, T21N, R3W, W.M. and SE1/4 SE1/4 Section 21 T21N, R3W. W.M. and SW1/4 SW1/4 of Section 23, T21N, R3W.W.M. (all of the foregoing in Mason County, Washington) to which said parcels may be subject, and to pay all expenses incidental thereto.

7. To pay the taxes and assessments which may be levied by any public authority upon any of the said property now or hereafter used or set apart for roadway, easements, parks, parkways, play-grounds, open areas, tennis courts, beaches, boat landings, mooring basins, community clubhouses, community club buildings, places of amusement and/or recreation areas, or upon such other recreation spaces wherever situate as may be *maintained* for the general benefit and use of the owners of lots in said property: to pay taxes and assessments levied by any public authority upon any property which may be held in trust for said corporation.

8. To exercise such powers of control, interpretation, construction, consent, decision, determination, modification, amendment, cancellation, annulment and/or enforcement of covenants, reservations, restrictions, liens and charges imposed upon said property, and as may be vested in, delegated to, or assigned to said corporation and such duties with respect thereto as may be assigned to and assumed by said corporation.

9. To appropriate, purchase, divert, acquire, and store water from streams, water courses, wells or any other source, and to distribute the water so appropriated and acquired to its members for use upon the lands of said members and for domestic purposes: to acquire, own, construct, hold, possess, use and maintain such pumping plants, tanks, pipe lines, reservoirs, ditches, buildings, roads, trails and appliances, and such other property, including water rights and shares of stock in other corporations as said corporation may from time to time desire to acquire or purchase for furnishing and supplying water to its members; provided that this corporation shall not use or dispose of such water as a public utility, but solely for the use and benefit of its members and for the irrigation of lands and domestic and other useful and beneficial purposes.

10. To fix, establish, levy and collect annually such charges and/or assessment. as may be necessary in the judgment of the board of trustees, to carry out any or all of the purposes for which this corporation is formed, but not in excess of the maximum from time to time fixed by the By-Laws.

11. To expend the moneys collected by said corporation from assessments and charges and other sums received for the payment and discharge of costs, expenses and obligations incurred by said corporation in carrying out any or all of the purposes for which said corporation is formed.

12. Generally, to do any and all lawful things which may be advisable, proper, authorized and/or permitted to be done by said corporation under or by virtue of any restrictions, conditions, *and/or* covenants or laws affecting said property, or any portions thereof (including areas now or hereafter dedicated to public use); and to do and perform any and all acts which may be either necessary for, or incidental to, the exercise of any of the foregoing powers or for the peace, health, comfort, safety, and/or general welfare of owners of said property, or portions thereof, or residents thereon.

13. To borrow money and mortgage, pledge or hypothecate any or all of the real or personal property of said corporation as security for money borrowed or debts incurred; and to do any *and* all things that a corporation organized under esad laws of the State of Washington may lawfully do when operating for the benefit of its members or the property of its members, and without profit to said corporation.

14. Generally, to do and perform any and all acts which may be either necessary or proper for or incidental to the exercise of any of the foregoing powers and such powers granted by the provisions of Title 24,

Revised Code of Washington, and other laws of the State of *Washington* relating to non-profit corporations.

15. Nothing contained in these Articles of Incorporation shall be construed as authorizing or permitting said corporation to own, manage or operate any real or personal property for profit. It is the *intention* and purpose that the business of said corporation shall not be carried on for profit either to itself or for the benefit of its members, and wherever it is authorized to collect charges or assessments it shall have no power or authority to use said charges or assessments except as necessary to cover the actual cost or expense of the act, duty, power, or transaction performed.

16. All of the foregoing purposes and powers are to be exercised and carried into effect for the purpose of doing, serving and applying the things above set forth for the benefit of all property situated in the plat or added to the plat of Lake Limerick Country Club, Inc., Section 27, T21N, R3W, W.M. and the S1/2 S1/2 Section 22, T21N, R3W, W.M. and SE1/4 SE1/4 Section 21 T21N, R3W, W.M. and SW1/4 SW1/4 of Section 23, T21N, R3W.W.M. (all of the foregoing in Mason County, Washington).

ARTICLE II.

The corporation shall at all times hereafter be a joint and mutual association of the above named incorporators, and such other persons as may hereafter be admitted to membership in accordance with the By-Laws of the corporation. Membership and certificates evidencing the same shall be inseparably appurtenant to tracts or division of tracts owned by the members, and upon transfer of ownership or contract for sale of any such tract, membership and certificate of membership shall ipso facto be deemed to be transferred to the grantee or contract purchaser. No membership or certificate of membership may be transferred, assigned, or conveyed in any manner other than in the manner herein set forth. In the event of the death of a member the membership or certificate of membership of such deceased member shall be and become the property of the personal representative of such deceased member upon appointment and qualification as such in a judicial proceeding and such personal representative shall have all of the rights, privileges and liabilities of such member until title shall be transferred or contracted to be transferred. The property in possession of this corporation shall be managed by the board of trustees hereinafter mentioned and only alienated and disposed of in accordance with the By-Laws of the corporation. The interest of each incorporator or member shall be equal to that of any other and no incorporator or member can acquire any interest *which* will entitle him to any greater voice, vote, authority or interest in the corporation than any other member.

ARTICLE III.

The number of trustees of this corporation shall not be less than three (3) nor more than ten (10). The names of trustees who shall manage the affairs of the corporation for not

4.

more than six (6) months until the trustees are elected by the members are:

NAME	ADDRESS
Mark J. Antoncich	7001 - 31st N. E., Seattle, Wash.
Kenneth W. Engel	8010 - 208th N. E., Redmond, Wash
John W. Osberg	1132 North 128th, Seattle, Wash.
Allan F. Osberg	1132 North 128th, Seattle, Wash.
W. J. Pierce	1132 North 128th, Seattle, Wash.

ARTICLE IV.

The time of the existence of this corporation shall be perpetual.

ARTICLE V.

The registered office and post office address of this corporation shall be 5125 – 25th Ave NE, Seattle, WA 98105

ARTICLE VI.

The qualifications of the members of said corporation, the property, voting and other rights and privileges, and the liabilities to charges and assessments of the members, shall be set forth in the By-Laws of the corporation.

IN WITNESS WHEREOF, we, the undersigned, the incorporators of this corporation have this 28th day of February, 1966, hereunto set our hands and seals in triplicate, and state that our first meeting was this day.

John W. Osberg
. W J Pierce
Allan F. Osberg

Mark J. Antoncich
Kenneth W Engel

STATE OF WASHINGTON) SS

COUNTY−OF K I N G)

THIS IS TO CERTIFY THAT on the 28 day of February 1966, before me, the undersigned, a Notary Public in *and* for the State of Washington, duly commissioned and sworn, personally appeared

W.J. Pierce and John W. Osberg, Mark J. Antoncich, Kenneth W. Engel, and Allan F. Osberg, /to me known to be the individuals described in and who executed the within and foregoing instrument and acknowledged to me that they signed and sealed the same as their free and voluntary act and deed, for the uses and purposes therein mentioned.

WITNESS BY HAND AND OFFICIAL SEAL, the day and year in this certificate first above written.

Notary Public in and for the State of Washington, residing at Seattle.

Recording date December 15, 2005
Mason Co. Auditor Recording No. 1856085

BYLAWS OF LAKE LIMERICK COUNTRY CLUB

TABLE OF CONTENTS

ARTICLE I

GENERAL PROVISIONS

A. Name. The name of the Association is Lake Limerick Country Club.

B. Jurisdiction. This Association has jurisdiction over all land within the Lake Limerick development ("Lake Limerick Country Club"), legally described as:

> Lots one (1) to two hundred seven (207), both inclusive, Lake Limerick Division No. One, Volume 6 of Plats, pages 34 to 37, both inclusive, records of Mason County, Washington; Parcel Nos. 32127-50-00001 to 32127-50-00207;
>
> Lots one (1) to three hundred four (304), both inclusive, Lake Limerick Division No. Two, Volume 6 of Plats, pages 73 to 79, both inclusive, records of Mason County, Washington; Parcel Nos. 32127-51-00001 to 32127-51-00906;
>
> Lots one (1) to five hundred fifteen (515), both inclusive, Lake Limerick Division No. Three, Volume 6 of Plats, pages 118 to 128, both inclusive, records of Mason County, Washington; Parcel Nos. 32122-50-00001 to 32122-50-00900;
>
> Lots one (1) to two hundred forty (240), both inclusive, Lake Limerick Division No. Four, Volume 6 of Plats, pages 190 to 195, both inclusive, records of Mason County, Washington; Parcel Nos. 32127-53-00001 to 32127-53-90015;
>
> Lots one (1) to one hundred thirty-nine (139), both inclusive, Lake Limerick Division No. Five, Volume 7 of Plats, pages 16 to 22, both inclusive, records of Mason County, Washington; Parcel Nos. 32127-54-00001 to 32127-54-00139; and
>
> Lots one (1) to thirty-seven (37), both inclusive, Replat of Lot 2, Lake Limerick Division No. 2, Volume 9 of Plats, pages 199, 200 and 201, records of Mason County, Washington; Parcel Nos. 32127-52-00001 to 32127-52-00900;

as well as all activities therein related to the purposes of the Association.

C. Purposes. The purposes for which this Association is founded are to promote the community welfare of the members and their families, to make Lake Limerick Country Club a better place in which to live and enjoy life, for the benefit of members and their families; and to exercise any or all powers of non-profit associations and homeowners' associations pursuant to the laws of the State of Washington, including RCW chs. 24.03 and 64.38, or as amended.

D. Common Areas. The ownership of the common areas in Lake Limerick is vested in the Association. Such common areas are for the exclusive use and enjoyment of members in good standing, their families and their guests; and those invited by the Association to use said common areas, including holders of easements, licenses, associate memberships, and other rights granted by the Association, if any. Unless invited as specified by the Association, through its Board of Directors, tenants are not authorized to use any of said common areas. The Association, through its Board of Directors, may create reasonable rules and regulations for the use of its common areas, and for the conduct of members, their family members and guests, and others with respect thereto, as well as with respect to the entire Lake Limerick development. The Association is responsible for paying taxes and assessments on the common areas, and to operate and maintain the same, and pay the costs associated therewith. The Association may also own any other property, real or personal.

E. Authorities. This Association is subject to the applicable recorded Protective Covenants of Lake Limerick Country Club, as well as any other applicable recorded documents; its Articles of Incorporation; these Bylaws; other Association governing documents; other rules and regulations of the Association; RCW ch. 24.03, the Nonprofit Corporation Act, or its successor; RCW ch. 64.38, the Homeowners' Association Act, or its successor; and the laws of the State of Washington and of the United States.

F. Definitions. As used in these Bylaws, the following have the specified meanings:

1. Common Areas. These include property owned by the Association, such as beaches, the lake, parks, boat launches, the pro shop, the golf course, the Inn, green belts, water systems and facilities, and any other property currently owned by the

Association, as well as any property later acquired by the Association.

2. Family Members. For the purposes of these Bylaws, these include the spouses of members, and their dependents who live with them.

3. Guests. Guests are those whom a member invites to use the member's property. Tenants are not guests. Family members other than those defined above may be guests, depending on the circumstances.

4. Member. A member is the owner or contract purchaser of a Lake Limerick lot.

5. Members in Good Standing. These are members with no current substantial Protective Covenant or other rule violations; and those who are no more than 90 days delinquent in the payment of any amount due to the Association, unless a repayment agreement has been reached and is complied with.

6. Tenants. Tenants (renters) are those who compensate a member in some way for the right to live on or use a Lake Limerick lot.

ARTICLE II
MEMBERSHIP

A. General. Although the Board of Directors acts in most instances on behalf of the Association, the primary authority of Lake Limerick Country Club rests with its members. Members are the legal owners or contract purchasers of residential lots within the jurisdiction of Lake Limerick Country Club. Members elect directors to the Board of Directors, approve or disapprove the annual budget and further financial proposals, and vote on initiatives or referenda. Members are responsible for complying with all Association requirements, including paying in a timely manner all assessments due to the Association, and respecting the covenants and other applicable rules. Membership is appurtenant to ownership of each lot in Lake Limerick Country Club. No member may withdraw membership except by transfer of ownership. Each member in good standing has the right to use Association property and facilities, and to permit guests and family members to do so as well; all pursuant to Lake Limerick Country Club's reasonable rules and regulations. Each member in good standing also has the right to apply for approval of permits for building and other plans and/or activities, to participate in Association activities, and serve on the Association Board of Directors and its committees.

Failure to comply with Lake Limerick Country Club's covenants and other rules, including the obligation to pay assessments, may result in loss of status as a member in good standing, as set forth in Article II(C) below, and therefore loss of the rights to use such property and facilities, including the Lake Limerick Country Club water system; to make such applications; and to participate in such activities and serve on such Board of Directors and committees. This loss of status will apply to the members personally as well as their rights with respect to each of their lots.

Each member is personally responsible for the actions of himself or herself, and all guests, family members and tenants, as they relate to the facilities and operations of the Association, its governing documents, and other Association rules and regulations and other requirements. Each member also has all of the rights and responsibilities conferred by Lake Limerick Country Club covenants and governing documents and other Association rules and regulations, as well as state law.

B. Voting Rights. Only members in good standing are eligible voters. A member in good standing who is an owner or purchaser of a lot may cast one vote. Multiple owners of any lot shall designate who shall cast the vote for said lot. One vote may be cast for each lot. Any one member may only cast one vote, regardless of the number of lots owned. For example, a husband and wife who own three lots may cast one vote each, or a total of two votes.

C. Members in Good Standing. Members shall not lose their status as members in good standing unless the Board of Directors acts to change their status, after notice and an opportunity to be heard at a Board of Directors meeting; or they are more than 90 days delinquent in their payments, unless a repayment agreement has been reached, and is complied with.

D. Meetings.

1. Annual Membership Meeting. There shall be a general annual membership meeting of the Association in April of each year. There shall also be an annual membership meeting in October of each year, to address the Association's budget.

2. Special Membership Meetings. Special meetings of the membership may be called by the President of the Board of Directors, a majority of the Board of Directors, or by members having ten percent of the total votes of the Association.

3. Notice. Notice of all membership meetings shall be delivered, or sent by prepaid, first class United States mail, to each member. Notice shall be given not less than 14 days, and not more than 50 days prior to the meeting. The notice shall state the time, place and agenda of the meeting.

4. Place. Membership meetings shall be held at the Lake Limerick Inn, or, if the Inn is not available, at such other place as may be designated by the Board.

5. Agenda. The notice of any membership meeting shall include the agenda for the meeting, as set by the Board of Directors. The agenda for membership meetings may include elections and approval of a budget and/or other financial proposals. The agenda may also include referenda, which are issues submitted to the general membership by the Board of Directors, either for binding vote, or guidance; and initiatives, which are issues submitted by the signatures of members in good standing representing ten percent of the total votes of the Association. It may also include provision for discussion of particular issues.

At the annual membership meeting, the Officers and committee chairpersons shall provide summary reports of operations of the preceding year, and plans for the upcoming year, as well as long-range plans, which shall also be included in the agenda.

In order to be fair to members unable to attend, neither the agenda nor any items on it may be amended during the course of the meeting, and all items to be voted on shall be considered as presented without amendment or modification.

6. **Quorum.** A quorum for the transaction of business at any general membership meeting shall be ten percent of the total number of votes of eligible voters, voting either in person, or by proxy.

7. **Ballots.** A member may cast his or her vote in person or by proxy, according to procedures established by the Board of Directors. Votes cast by proxy shall be specific as to each particular issue. The Notice of any general membership meeting shall include a proxy ballot, which shall be identical in all significant respects to the ballot provided to members voting in person.

8. **Majority.** Actions of the membership shall be taken by a majority vote of the members in good standing, voting at a meeting with a quorum, except as otherwise provided by law or Lake Limerick governing documents. An example of such an exception is set out at Article V(H) below, having to do with Washington State law about how budgets are adopted.

9. **Procedures.** The Board of Directors shall establish procedures for initiatives, referenda, and membership meetings that are reasonable and fair, including additional procedures to ensure the accuracy of voting as deemed appropriate.

ARTICLE III
ASSOCIATE MEMBERSHIPS

The Board of Directors may provide for one or more categories of associate memberships in its discretion, including provision for rights and responsibilities of the same. Associate members are not Lake Limerick Country Club members, and are not entitled to vote as such.

ARTICLE IV
BOARD OF DIRECTORS
POWERS AND DUTIES

A. General. The Board of Directors is responsible for acting in all instances on behalf of the Association, except where otherwise expressly provided. It conducts, manages, and controls the affairs and business of the Association, and exercises ownership authority and control over all of the common properties of the Association.

Members of the Board of Directors develop skills and insight into the work of the Association through their service to the Association, including as Directors. Their responsibilities are to follow state laws and Lake Limerick Country Club governing documents and rules and regulations in ways that, in their individual and collective judgments, best serve the purposes of the Association, and are fair and reasonable.

B. Membership Participation. The Board of Directors shall keep the membership informed of significant current and prospective issues. The Board of Directors shall define such issues, take steps to educate and inform the membership about them, and listen to the members' responses, including use of informational "town meetings" as appropriate. In evaluating the opinions of the members, the Board of Directors shall take care to consider its duties to the purposes of the Association, and to avoid allowing any one member to exercise a disproportionate role in the process.

C. Rules and Regulations. The Board of Directors shall, when necessary and appropriate, develop rules and regulations to support the purposes of the Association, and to provide procedures for its operation.

ARTICLE V
BOARD OF DIRECTORS
GENERAL

A. Number. There shall be nine members of the Board of Directors.

B. Qualification. Any member in good standing is qualified to serve as a Director.

C. Terms of Office. Each Director shall serve a term of three years.

D. Removal. A Director may be removed with or without cause by a majority vote of the members in good standing voting at a meeting with a quorum, upon proper submission of a member initiative or Board of Directors referendum. A Director may also be removed by resignation or disqualification. A Director shall become disqualified if he or she is no longer a member, or a member in good standing; or misses three consecutive meetings without reasonable cause, as determined by the Board of Directors.

E. Vacancies. If a Director is removed, becomes disqualified, or resigns, the Board of Directors shall appoint a successor within a reasonable period of time. The successor shall fill the remainder of the unexpired term of the former Director.

F. Meetings.

1. Where and When. The Board of Directors shall meet at the office of the Association, unless otherwise necessary, at least monthly.

2. Notice. Notice of regular Director meetings shall be given by general reference in mailings to the membership, by electronic communication, and/or by posting at the office and/or clubhouse. Notice of special Board of Directors meetings shall be given, when reasonably possible, to the Directors at least 24 hours prior to the meeting, by personal communication, or reasonable alternate means best calculated to be received. Notice of special Board of Directors meetings shall also be given to the general members at least 24 hours prior to the meeting, when reasonably possible, by posting notice at the office and/or clubhouse.

3. Quorum. A quorum of the Board of Directors for the transaction of business shall be a majority of the then sitting Directors.

4. Majority. A majority vote of the Directors at a meeting at which a quorum is present is sufficient to transact the business of the Board of Directors.

5. Procedures. The Board of Directors shall develop procedures for its operation that are fair and reasonable under all the circumstances.

6. Distance Meeting. Any meeting of the Board of Directors may be conducted by telephone conference call, or similar communications medium, whereby all directors participating are in voice or electronic contact with each other throughout the meeting, subject to all other meeting requirements as set forth herein.

G. Delegation of Powers. The Board of Directors may delegate such powers with respect to management of the Association as it deems appropriate, subject to state law and the governing documents and rules and regulations of the Association.

H. General or Special Budget for income, expenses and reserves. The Board of Directors shall adopt an annual budget for assessment and other income, expenses and reserves, as well as special or amended budgets for the same, when needed. Any such budget shall be submitted to the membership as provided by Washington State law. Consideration by the membership may take place at the Association's annual general or budget meeting, or at any special membership meeting. If at any time state law no longer specifies the procedure for adoption of budgets, any general, special or amended budget adopted by the Board of Directors for assessment and other income, as well as expenses and/or reserves, shall be submitted to the membership for its approval or rejection pursuant to the most recent applicable state law, until these Bylaws are or may be amended to provide otherwise.

I. Budget Reports. The Board of Directors will make available to the members budget reports, specifying performance in light of the budget.

ARTICLE VI
OFFICERS

A. Election. At the first meeting of the Board of Directors after each annual meeting of the members, the Board of Directors shall elect its President, Vice-President, Secretary, and Treasurer from among the Directors. Officers of the Association so elected shall hold office until their successors are qualified.

B. Removal. Any Officer may be removed as such by a majority vote of all of the Directors. Upon removal of an Officer, the Board of Directors shall elect a replacement within a reasonable time.

C. President and Vice-President. The President shall preside at all meetings of the Directors and members, shall sign as President on all agreements, contracts and instruments authorized by the Board of Directors, and shall be its chief executive officer. The Vice President shall perform the duties of the President when the President is unavailable.

D. Secretary. The Secretary shall be generally responsible for all meeting notices and the minutes of all meetings of the membership and of the Board of Directors, and shall have charge of all of the Association books, records, and papers.

E. Treasurer. The Treasurer shall be generally responsible for keeping safely all money, financial accounts of the Association, and for preparing and keeping a complete accounting of the financial records of the Association, for presentation to the members at the annual membership meeting, and at all other times as required.

F. Execution of Documents. The President, or in the absence of the President, the Vice-President, shall sign and execute all contracts, conveyances, notes and security agreements on behalf of the corporation. The same shall also be signed and executed by either the Treasurer or the Secretary. When necessary due to particular circumstances, the Board of Directors may specifically authorize signing and execution otherwise. Checks, drafts, and other negotiable instruments, and other documents except amendments to Association documents, may be signed and/or executed as provided by the Board of Directors. The President or Vice President, in the absence of the President; and Secretary or Treasurer, in the absence of the Secretary; shall together be responsible for preparing, executing, certifying and recording Association governing documents, Association rules and regulations, and amendments thereto.

G. Employees and Agents. The Board of Directors may appoint, engage and/or employ, pursuant to its direction, employees, contractors, agents and volunteers.

ARTICLE VII
COMMITTEES

A. General. The Board of Directors may form committees at any time for such purposes as it may deem necessary. The Board of Directors shall adopt a Resolution establishing each such committee, addressing its makeup, authority and operating procedures. The Board of Directors may delegate, pursuant to law, its authority to take action to any committee that is composed entirely of Directors. The actions of any committee shall be subject to the ratification or disapproval of the Board of Directors.

B. Executive Committee. The Executive Committee shall be composed of the President, Vice-President, Secretary and Treasurer of the Board of Directors, and a non-voting representative from the Water Committee. The Executive Committee shall act pursuant to procedures established by the Board of Directors by Resolution.

C. Nominating Committee. The President of the Board of Directors shall appoint, with the consent of the Board of Directors, a chairperson and other members to a Nominating Committee. The Nominating Committee shall solicit and present candidates to serve on the Board of Directors, and for other positions, pursuant to procedures established by the Board of Directors by Resolution. Any Association member may also nominate any such candidate.

D. Hearing Committee. The President of the Board of Directors shall appoint, with the consent of the Board of Directors, at least three Hearing Committee members. The Hearing Committee is responsible for adjudicating claims that a member has violated any provisions of Lake Limerick governing documents or other rules.

The Hearing Committee will perform its duties pursuant to procedures as developed by the Board of Directors by Resolution, which procedures shall include provisions for appeal to the Board of Directors of any determination made by the Hearing Committee.

E. Water Committee. The Water Committee shall be elected by the general membership. It shall be responsible for ensuring the provision of water to lots within Lake Limerick, including the maintenance, repair and replacement of facilities, compliance with controlling federal, state and local laws, rules and regulations, and the administration of the same. It may adopt for its purposes its own Bylaws, and other rules of procedure, as well as other regulations regarding the provision of water.

ARTICLE VIII
CODE OF ETHICS

A. Standard of Care. All Directors, Officers, committee members, agents, contractors, employees, volunteers and others performing services for or on behalf of the Association, shall do so in a manner they believe to be in the best interest of the Association, and with such care, including reasonable inquiry, as an ordinarily prudent person in a like position would use in similar circumstances.

B. Open Meetings. All meetings of the Board of Directors and its committees shall be open for observation by all members and their authorized agents, except as otherwise specified by law.

C. Open Records. Except as otherwise specified by law, the minutes of any membership, Board, or committee meetings, and all other records of the Association, shall be available for examination by all members and the holders of any mortgages on any lots and their authorized agents, on reasonable notice, and upon payment of reasonable costs incurred to provide the same.

D. Compensation. No Director, Officer, committee member or volunteer shall be compensated for work performed as such without approval by the Board of Directors. Reasonable expense reimbursement is not considered compensation. Compensation may be paid for services performed as an employee, agent or contractor, subject to conflict of interest limitations set forth below.

E. Conflict of Interest. No member of the Board of Directors, or of any Board of Directors committee, shall participate in any vote on any subject in which he or she has a specific personal, professional, financial, or other conflict of interest. He or she may, however, participate in discussions regarding the same.

F. Loyalty. All members, including Directors, are encouraged to share their views and opinions. Constructive dissent can be a very valuable resource to a Board of Directors. Directors may vote in the minority on issues, and they are not required to personally endorse any Board of Directors decision or action. They may discuss their opinions freely and openly with anyone. But by accepting a Board of Directors position, each Director agrees to work within the Association processes and systems to advance his or her views or positions, and not to either individually, or in collaboration with others, intentionally sabotage or subvert the work of the Board of Directors.

G. Confidentiality. All members, including Board members, as well as volunteers, employees, agents, and contractors, shall maintain confidentiality with respect to any information they become aware of having to do with any matters involving personnel, consultation or communications with legal counsel, likely or pending litigation, possible violations of the governing documents, or involving the possible liability of a member to the Association, insofar as such matters may be discussed in any closed session meeting of the Board of Directors.

H. Loans. The Association shall make no loans to its Directors or Officers.

I. Audit. The Board of Directors may cause to be prepared an audit of any or all of the financial accounts or affairs of the Association at any time, and to what extent, it deems appropriate. In addition, at least annually, the Board of Directors shall cause to be prepared a financial statement of the Association. Such financial statements shall be audited where provided by law, or as directed by the Board of Directors.

J. Accounts. The funds of the Association shall be kept in accounts in its name, and shall not be commingled with the funds of any other Association, the President of the Association, or any other person responsible for custody of such funds.

ARTICLE IX
ASSESSMENTS

A. Each member, by accepting an ownership interest in any lot within the development, agrees to pay all assessments imposed by the Association.

B. Assessments as defined herein shall constitute a personal obligation of each member. In addition, they shall constitute a lien as specified herein, whether this lien is reduced to writing and recorded, or not. A “lot” for assessment purposes means any lot as shown on the original plats of Lake Limerick Country Club. The effective date of each such lien shall be the date of recordation of the applicable protective covenant.

C. Members have the obligation to pay assessments, but the Association recognizes that individual members often face financial difficulties. The Association shall diligently collect all accounts. When an account becomes delinquent, the Association shall make reasonable efforts to work with the member to bring the account current, including readily accepting reasonable payment plans, supported by a promissory note, where such plans provide for payment in full of all delinquencies, and specify that all future assessments will be paid on time.

D. When reasonable collection efforts are not successful, and if appropriate in the judgment of the Association, assessment liens may be foreclosed, in the general manner of foreclosure of real property mortgages, with adaptations where reasonable in the judgment of the Board of Directors; provided, that a revised deficiency judgment may be entered after confirmation of sale, crediting the sale proceeds, and any payments or other credits, and debiting any post-judgment assessments, costs and attorney fees; the member may stay the proceedings at any time, prior to sale, by payment to Lake Limerick of the full amount due, as defined below; and if a lot has been improved and abandoned, as defined by state law, upon request, a court may order no redemption period as well as a deficiency judgment.

E. The lien of Lake Limerick Country Club for payment of all assessments as defined herein is prior to any other lien, mortgage, deed of trust, or any other encumbrance, regardless of filing date of notice of the same. However, as to any lot, this lien shall be automatically subordinated to one mortgage, deed of trust, or other financing encumbrance in favor of an institutional lender, which is undertaken for the sole purpose of purchase of the lot, construction (or remodeling) of improvements to the lot, or refinancing of the same; provided that the Association account with respect to any such lot is not delinquent at the time of recordation of the encumbrance, and that a copy of such encumbrance is delivered personally, evidenced by a receipt for the same, or sent by certified or registered mail; and received at the office of Lake Limerick Country Club within sixty days of its execution. The burden of proving receipt is on the lender.

F. In addition, Lake Limerick Country Club may choose to subordinate its lien to any other encumbrance, when in the best interests of the Association, and consistent with the purposes of Lake Limerick Country Club as set forth herein.

G. Assessments. The following are included in the meaning of "assessments:"

1. General Annual Assessment and/or Dues. The Association shall impose a general annual assessment and/or dues on each lot or member within the development, which assessment or dues shall be imposed as specified in these Bylaws as specified in Article V(H) above.

2. Special Assessments. Special assessments for particular expenses may also be imposed as specified in these Bylaws.

3. Other Charges. In addition to these general and special assessments, the following charges may also be imposed, and are for the purposes of the Bylaws also considered assessments:

a. Service Fees. The Board of Directors may in its discretion impose direct fees for such goods and services as, for example, cart shed rental, trail fees, the use of recreational facilities, retail sales items, and lien filing;

b. Remediation expenses. The Board of Directors may charge to a member any lot condition remediation expenses incurred by the Association, as specified in the recorded Covenants, either before or after any Sheriff's sale;

c. Fines. Any fines, pursuant to a system for the imposition of fines for violation of Lake Limerick Country Club covenants and/or rules, as adopted by the Board of Directors;

d. Late Fees and Interest. The Association may add reasonable late fees, as well as interest of not more than 12% per annum, compounded annually, to any delinquent account and all assessments related thereto; and

e. **Expenses and Fees.** If the Board of Directors is required to expend any funds, with or without litigation, in pursuit of the collection of any assessments, as defined herein; the assertion of or defense to any claims regarding the authority, jurisdiction or exercise of any of the powers of the Association; the correction of any violation of Lake Limerick Country Club covenants and/or rules; or with regard to any other dispute concerning its actions and/or powers; all expenses, including but not limited to attorney, accountant, other expert, title report and surveyor fees; lot condition remediation costs; and all other costs of litigation, including court and discovery expenses; and any and all other amounts reasonably expended in the process of collection, dispute resolution or correction; shall be paid by the member responsible.

ARTICLE X
GOVERNANCE

A. Binding Rules. The rules of the Association, including the covenants, Articles of Incorporation, these Bylaws, and other Association rules and regulations, are binding on all members. The acceptance of an interest in title also constitutes an agreement that the member accepts Association governing documents and rules and regulations as they exist now and may be lawfully amended in the future, for himself or herself as well as for all family members, guests and tenants.

B. Construction. Where any terms of the covenants and/or other rules are unclear, the Association shall have the right, power and authority to interpret the same by providing a meaning that is reasonable and fair, and advances the purpose of the Association and the collective interests of the members.

C. Violations of Rules. In addition to collection of assessments, it may from time to time be necessary for legal action to be undertaken in order to correct violations of Lake Limerick covenants and/or rules, and/or to respond to claims against the Association. The Association itself may bring actions to correct such violations or, where the rule violated is a recorded restrictive covenant, any individual members may also do so. A corrective action, other claim, or response to a claim may be brought at law or in equity, and may request relief in the form of injunction, remediation, foreclosure, damages and/or collection of assessments as defined at Article IX above, or any other relief authorized by law or in equity.

D. Limitation on Actions Against the Board of Directors. No legal action may be brought against the Board of Directors, its Officers, employees, and agents, committee members and/or volunteers, for failure to enforce any provisions of the governing documents or rules and regulations under any circumstances; or for mistakes made reasonably and in good faith regarding the approval or failure to approve building or other lot improvement plans.

E. Indemnification. The Association may indemnify current or former directors or Officers, or any other person, to the maximum extent pursuant to law.

F. Severability. If any provision of these bylaws is deemed illegal or without effect, the remaining provisions shall not be effected.

G. Non-Waiver. Failure of the Association to enforce any Association covenant, Article of Incorporation, Bylaw, or any other rule or regulation against any member shall not operate (1) to waive the right of the Association to enforce at any time the same rule or any other rule against the same or any other member; (2) to acquiesce in the future non-enforcement of the same or any other rule; (3) as the abandonment of the right to enforce the same or any other rule; or (4) to constitute any other defense to enforcement in any particular case. No member may rely on any such failure to enforce for any purpose.

H. Application. The provisions of these Bylaws shall apply to all circumstances existing at the time of their adoption, except where to do so would seriously impair an existing vested right or interest, where the owner of that interest would be entitled to assert an equitable claim regarding the same.

I. Amendments. Amendments to these Bylaws may be submitted to the membership by the Board of Directors, or by a petition of members in good standing to the Board of Directors representing twenty percent of the total votes of the Association. These Bylaws may be amended by the majority vote of the members in good standing voting at a meeting with a quorum. The effective date of each amendment shall be as specified therein.

ARTICLE XI
CERTIFICATION OF AMENDMENT

A. Certification. We, the President and Secretary of Lake Limerick Country Club, certify that the above stated Bylaws were properly adopted according to all requirements as an amendment to the Bylaws of Lake Limerick Country Club.

B. Effective Date. The effective date of these Amended Bylaws shall be and is the _____ day of _____________________, 20___.

By our signatures hereto, we so certify.

___________________________	_________________________	_______________
Signature President, Board of Directors	Typed Name	Date
___________________________	_________________________	_______________
Signature Secretary, Board of Directors	Typed Name	Date

STATE OF WASHINGTON)
) ss.
COUNTY OF MASON)

On this ________ day of ____________________ , 20___, personally appeared before me __________________________________ , personally known to me or provided to me on the basis of satisfactory evidence to be the President of Lake Limerick Country Club, the corporation that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he/she is authorized to execute the said instrument.

WITNESS my hand and official seal affixed the day and year first above written.

Affiant Known ☐
Affiant produced ID ☐
Type of ID _____________________
____

____
PRINT NAME:_____________________________
NOTARY PUBLIC IN AND FOR THE STATE OF WASHINGTON, residing in ___________________
My commission expires:_______________________

STATE OF WASHINGTON)
) ss.
COUNTY OF MASON)

On this ________ day of ____________________ , 20___, personally appeared before me __________________________________ , personally known to me or provided to me on the basis of satisfactory evidence to be the Secretary of Lake Limerick Country Club, the corporation that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he/she is authorized to execute the said instrument.

WITNESS my hand and official seal affixed the day and year first above written.

Affiant Known ☐
Affiant produced ID ☐
Type of ID _____________________
____

____
PRINT NAME:_____________________________
NOTARY PUBLIC IN AND FOR THE STATE OF WASHINGTON, residing in ___________________
My commission expires: _______________________

Water Department Bylaws

WATER COMMITTEE OPERATING PROCEDURES

PURPOSE AND SCOPE

LAKE LIMERICK WATER SYSTEM

The Water System is charged with the responsibility of the operation and maintenance of the water system. To fulfill that responsibility, the Board of Trustees created a six member Water Committee in 1976. Two members are to be elected to three-year terms at each Annual Membership Meeting.

The actions of the Committee are accountable to the Board of Directors.

In order to retain the private water system classification with the Washington State Utilities and Transportation Commission it is required that the Lake Limerick Water System supply water only to Lake Limerick property and members in good standing.

Monies collected by the Water System are to be used solely for operation, maintenance, and improvement of the Lake Limerick Water System.

COMMITTEE STRUCTURE AND RESPONSIBILITIES

Officers of the Committee are to be Chairperson, Treasurer, and Secretary. Officers are to be elected following the Lake Limerick Country Club annual elections in April of each year.

The Chairperson will conduct the meetings and cause an agenda to be prepared for each meeting. All items of importance are to be approved by a vote of the Committee. The Chairperson will not vote unless there is a tie, in which event that vote will be the deciding vote.

In the absence of the Chairperson the Water Committee Secretary will assume the duties of the Chairperson. If the Secretary is also to be absent, then the Treasurer will assume the duties of the Chairperson.

The Treasurer will be responsible for the monies collected and for the distribution of such monies. All checks issued shall require signatures of two individuals, who have signed a bank authorization document. They may be the Chairperson, Secretary or Treasurer of the Water Committee. Office staff as designated by the Water Committee Treasurer may also sign checks.

The Water Committee Treasurer shall supervise the office staff individual(s) who are designated responsible for the Water System financial record keeping.

The Water Committee may request the Board of Directors to cause to be prepared an audit of any or all of the financial accounts or affairs of the Water System at any time, and to what extent, it deems appropriate. In addition, at least annually, the Board of Directors shall cause to be prepared a financial statement of the Association. Such financial statements shall be audited where provided by law, or as directed by the Board of Directors.

By a majority vote of the Water Committee a member may be recommended for removal with cause. This recommendation must be sent to the Board of Directors for action. The Board of Directors will then appoint or approve a new member recommended by the Water Committee to fill the un-expired term of the removed member.

MEETINGS

Regular meetings of the Water Committee shall be established after the annual election in April by vote of the committee. Special meetings may be called by the chairperson or a vote of the committee. All meetings shall be open to Lake Limerick members in good standing.

A quorum of four (4) members need to be present to conduct business.

AMENDMENTS

These procedures may be amended by a majority vote of the Water Committee followed by approval of the Board of Directors.

These Water Committee Procedures replace the Water Committee Bylaws.

These procedures adopted by the Water Committee the 11th day of October 2006.

These procedures adopted by the Board of Directors the 21st day of October 2006.

Appendix 10.14
10-Year Budget

Ten Year Budget
for the
Lake Limerick Water System

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Automobile Expenses	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	20,159
Bank Service Charges	1,236	1,273	1,311	1,351	1,391	1,433	1,476	1,520	1,566	1,613
Computer and Internet	515	530	546	563	580	597	615	633	652	672
Dues and Subscriptions	2,060	2,122	2,185	2,251	2,319	2,388	2,460	2,534	2,610	2,688
Employee Expenses	136,063	140,145	144,349	148,680	153,140	157,734	162,466	167,340	172,361	177,531
Equipment Rental	4,120	4,244	4,371	4,502	4,637	4,776	4,919	5,067	5,219	5,376
General Liability	21,115	21,748	22,401	23,073	23,765	24,478	25,212	25,969	26,748	27,550
Interest Expense	1,100	700	300	0	0	0	0	0	0	0
License and Permits	2,266	2,334	2,404	2,476	2,550	2,627	2,706	2,787	2,871	2,957
Meals and Entertain.	309	318	328	338	348	358	369	380	391	403
Merchant Acct Charges	2,472	2,546	2,623	2,701	2,782	2,866	2,952	3,040	3,131	3,225
NSF Check Fees	309	318	328	338	348	358	369	380	391	403
Office Supplies	824	849	874	900	927	955	984	1,013	1,044	1,075
Office Expense	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	2,016
Postage and Delivery	4,635	4,774	4,917	5,065	5,217	5,373	5,534	5,700	5,871	6,048
Professional Fees	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239
Repairs and Maint.	20,000	20,600	21,218	21,855	22,510	23,185	23,881	24,597	25,335	26,095
Service Contracts	3,296	3,395	3,497	3,602	3,710	3,821	3,936	4,054	4,175	4,301
Small Tools and Equip.	4,120	4,244	4,371	4,502	4,637	4,776	4,919	5,067	5,219	5,376
Supplies	12,360	12,731	13,113	13,506	13,911	14,329	14,758	15,201	15,657	16,127
Taxes - Property	100	103	106	109	113	116	119	123	127	130
Taxes - Public Utility	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	20,159
Telephone	1,957	2,016	2,076	2,138	2,203	2,269	2,337	2,407	2,479	2,553
Travel Expense	515	530	546	563	580	597	615	633	652	672
Uniforms	1,030	1,061	1,093	1,126	1,159	1,194	1,230	1,267	1,305	1,344
Utilities	21,630	22,279	22,947	23,636	24,345	25,075	25,827	26,602	27,400	28,222
Water Testing	5,150	5,305	5,464	5,628	5,796	5,970	6,149	6,334	6,524	6,720
General Expense Total	**329,627**	**339,083**	**348,834**	**358,990**	**369,760**	**380,853**	**392,278**	**404,047**	**416,168**	**428,653**
Operating Reserve										
Target Balance	60,000	61,800	63,654	65,564	67,531	69,556	71,643	73,792	76,006	78,286
Current Balance	58,252	60,000	61,800	63,654	65,564	67,531	69,556	71,643	73,792	76,006
Annual Installment	1,748	1,800	1,854	1,910	1,967	2,026	2,087	2,149	2,214	2,280
Running Balance	60,000	61,800	63,654	65,564	67,531	69,556	71,643	73,792	76,006	78,286
Emergency Reserve										
Target Balance	100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987	126,677	130,477
Current Balance	97,087	100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987	126,677
Annual Installment	2,913	3,000	3,090	3,183	3,278	3,377	3,478	3,582	3,690	3,800
Running Balance	100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987	126,677	130,477
Short-Term Asset Reserve										
Target Balance	225,000	231,750	238,703	245,864	253,239	260,837	268,662	276,722	285,023	293,574
Current Balance	244,660	294,660	346,160	399,205	453,842	510,117	568,081	627,783	156,790	220,129
Annual Installment	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239
Expenditures	0	0	0	0	0	0	0	532,487	0	0
Running Balance	294,660	346,160	399,205	453,842	510,117	568,081	627,783	156,790	220,129	285,367
Long-Term Asset Reserve										
Target Balance	665,789	928,001	1,278,058	1,662,824	2,067,793	2,493,789	2,941,663	3,372,049	3,851,984	3,997,634
Current Balance	350,000	665,789	928,001	1,278,058	1,662,824	2,067,793	2,493,789	2,941,663	3,372,049	3,851,984
Annual Installment	315,000	324,450	334,184	344,209	354,535	365,171	376,126	387,410	399,033	411,004
Expenditures	15,450	84,872	15,298	0	0	0	0	39,270	13,048	362,857
Accrued Interest	16,239	22,634	31,172	40,557	50,434	60,824	71,748	82,245	93,951	97,503
Running Balance	665,789	928,001	1,278,058	1,662,824	2,067,793	2,493,789	2,941,663	3,372,049	3,851,984	3,997,634
Reserve Payment Total	**369,660**	**380,750**	**392,173**	**403,938**	**416,056**	**428,537**	**441,394**	**454,635**	**468,274**	**482,323**
Monthly Cost Summary										
General Expenses	$ 27,469	$ 28,257	$ 29,070	$ 29,916	$ 30,813	$ 31,738	$ 32,690	$ 33,671	$ 34,681	$ 35,721
Reserve Payments	$ 30,805	$ 31,729	$ 32,681	$ 33,661	$ 34,671	$ 35,711	$ 36,783	$ 37,886	$ 39,023	$ 40,194
Total	**$ 58,274**	**$ 59,986**	**$ 61,751**	**$ 63,577**	**$ 65,485**	**$ 67,449**	**$ 69,473**	**$ 71,557**	**$ 73,704**	**$ 75,915**
Number of Paying Connections	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211
Monthly Cost Per Connection	$ 48.48	$ 49.86	$ 51.29	$ 52.76	$ 54.30	$ 55.88	$ 57.51	$ 59.19	$ 60.91	$ 62.69

A 3% rate of inflation is assumed for all regular expenses. The Operating, Emergency, and Short-Term Replacement Reserves should be kept in readily accessible liquid assets. A negligible rate of return is expected for these reserves. The Long-Term Replacement Reserve should be kept in moderately conservative investments with an assumed rate of return of 2.5%.

Appendix 10.15
Consumer Confidence Report

Contaminants in drinking water:

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. In order to ensure that tap water is safe to drink, EPA prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration (FDA) regulations establish limits for contaminants in bottled water which must provide the same protection for public health. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water hotline (1-800-426-4791).

Sources of drinking water (both tap water and bottled water) can include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animal or human activity.

Contaminants that may be present in source water include:

Microbial contaminants, *such as viruses, parasites, and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, or wildlife.*

Inorganic contaminants, *such as salts and metals, which can occur naturally or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, and farming.*

Pesticides and herbicides, *which may come from various sources such as agriculture, urban stormwater runoff, and residential uses.*

Organic chemical contaminants, *including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production. They can also come from gas stations, urban stormwater runoff, and septic systems. Radioactive contaminants, which can occur naturally or result from oil and gas production and mining activities.*

Source Protection Information: The Dept of Health Office of Drinking Water has compiled Source Water Assessment Program (SWAP) data for all community water systems in Washing. SWAP data for your system is available online at:

You can now download your reports on our website at nwwatersystems.com or by scanning the QR Code to the right. To opt out of mailing please email or call the office

Northwest Water Systems
PO Box 123
Port Orchard, WA 98366

Lake Limerick 2019 Water Quality Report State ID# 44150T

Northwest Water Systems is pleased to present you with the annual Water Quality Report on behalf of Lake Limerick as required by the Safe Drinking Water Act (SDWA). This report is a snapshot of last years' water quality and the purpose is to provide you with details about where your water comes from, what it contains, and how it compares to standards set by regulatory agencies.

Safe drinking water is essential and we are committed to informing you so that you are able to make personal health-based decisions regarding your drinking water consumption and become more involved in decisions which may affect your health. We hope you find this information helpful.

The Lake Limerick Water System receives its water from 7 wells in various locations throughout the community. The depth of the wells varies from 111-430 feet.

Water Use Efficiency Tips:

- Turn water off while brushing your teeth and rinsing your dishes.
- Cut the time per shower by a few minutes and save up to 150 gallons per month.
- Run full loads in your washing machine and dishwasher.
- Wash vegetables and fruits in a pan of water instead of running water. Then use the water for watering plants.
- Insulate hot water pipes to save water and energy.
- Mulch around plants to reduce watering

Water Quality Data

Lead in Drinking Water:

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Lake Limerick is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or online at: http://www.epa.gov/safewater/lead

Do I need to take special precautions?

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Water Drinking Hotline: (800-426-4791).

Your drinking water is regularly tested in accordance with all federal and state regulations for over 50 substances in both the water sources and throughout the distribution system. In 2019, Lake Limerick conducted over 100 tests for the parameter listed below. Only those substances that were detected are included in the water quality summary.

Table 1: Primary Contaminants Detected in Your Drinking Water

Inorganic Chemicals	Units	Year Tested	MCL	MCLG	Your Water	Violation?	Major Sources in Drinking Water
Nitrate	ppm	2019	10	10	0.2	No	Runoff from fertilizer use; leaching from septic tanks sewage; erosion of natural deposits
Arsenic	Ppb	2018	10	0	0.0010	No	Erosion of natural deposits; Runoff from orchards; Runoff from glass and electronics production wastes
Primary Contaminants	**Units**	**Year Tested**	**AL**	**90th Percentile**	**Samples <AL**	**Violation?**	**Major Sources in Drinking Water**
Copper	ppm	2018	1.3	0.0200	0 of 5	No	Corrosion of household plumbing systems; Erosion of natural deposits

Table 2: Secondary Contaminants:

Table 2: Secondary Contaminants	Units	Year Tested	SMCL	SRL	Your Water	Violation?	Major Sources in Drinking Water
Iron	ppm	2018	0.05	NA	0.6	No	Leaching from natural deposits; industrial wastes
Manganese	ppm	2018	0.3	0.1	0.0660	No	Leaching from natural deposits
Chloride	ppm	2018	250	NA	1.7	No	Runoff/leaching from natural deposits; seawater influence
Hardness	ppm	2018	NA	169	56.2	No	Erosion of natural deposits
Conductivity	Umhos/cm	2018	700	700	113.2	No	Substances that form natural deposits
Turbidity	NTU	2018	N/A	NA	4.76	No	Soil runoff
Color	Color Units	2018	15	NA	12	No	Naturally occurring organic materials

Your drinking water source meets all applicable EPA and Dept of Health Standards!

Terms and Abbreviations used:

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

AL: Action Level The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

MRDL (Maximum Residual Disinfectant Level): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

SRL (State Reporting Limit): If exceeds this amount it must be reported.

Secondary Maximum Contaminant Level (SMCL): These standards are developed as guidelines to protect the aesthetic qualities of drinking water and are not health based.

Ppm: Parts per million

Ppb: Parts per billion

N/A: Not applicable

Northwest Water Systems
PO Box 123
Port Orchard, WA 98366
Operations Supervisor: Kevin Odegard

Appendix 10.16
Sanitary Survey

RECEIVED NOV 05 2018

Emailed to Don
11.12.2018

STATE OF WASHINGTON

DEPARTMENT OF HEALTH

SOUTHWEST DRINKING WATER REGIONAL OPERATIONS
P.O. Box 47823 Olympia, Washington 98504-7823
TDD Relay 1-800-833-6388

October 30, 2018 Kevin Odegard, Operator Northwest Water Systems Post Office Box 123 Port Orchard, Washington 98366	Lake Limerick ID #44150	
	County:	Mason
	System Type:	Community
	Operating Permit Color:	Green
	Surveyor:	Regina Grimm
	Inspection Date:	October 3, 2018

Thank you for having your staff meet with me to conduct a survey of this water system. Sanitary surveys are the Office of Drinking Water's (ODW) way to inspect public water systems through a field visit. ODW is also able to offer technical assistance to help utilities improve their system operations and ensure that public health is protected.

This report documents the findings of this survey. Significant Deficiencies and Findings are assigned a due date. If you are not able to complete the work by the assigned date, you MUST submit a Corrective Action Plan describing how and when the work will be completed. Failure to respond by the date below will result in further compliance actions in accordance with WAC 246-290-050.

As you correct the items, send me documentation that demonstrates the items have been completed as directed. Include the system name, ID number, the item #, and the date the deficiencies were corrected. You can send them to me by e-mail at regina.grimm@doh.wa.gov or by mail at PO Box 47823, Olympia, Washington 98504-7823.

SIGNIFICANT DEFICIENCIES* - None were identified during the survey.

SIGNIFICANT FINDINGS - None were identified during the survey.**

OBSERVATIONS

1. The walls of the booster station at the Well #5 site appear to be mildewed, and there is insulation and dark specs on the floor. The pump house should be sealed to protect from rodents and the walls may need to be replaced.

SYSTEM INFORMATION

Lake Limerick Water is a community water system that is approved to serve an "unspecified" number of connections. The 2014 Water System Plan update demonstrates the system can serve up to 1,307 equivalent residential units. They are currently serving 1199 active connections composed of 771 full time residential, 71 part time residential, 354 recreational connections, and 3 institutional connections.

SCANNED

The system has quite a few reservoirs and wells, which give very good reliability to the system in case of power outages or if repairs require something to be taken out of service. The facilities include 7 groundwater wells, 4 storage tanks, 4 booster stations with pressure tanks, and the distribution piping. Fire flow is not provided.

The system is equipped with a SCADA system that makes it easier to control the system and troubleshoot problems. Each of the four reservoir sites include at least one well and a booster station. At these sites, the wells are called by the tank level, and they pump directly to the tank. Then the booster station provides pressurized water to the system. For reliability, two of the tank sites are equipped with generators. There are two sites with only a groundwater well and in these cases, the well pumps directly to distribution.

SECTION 1: SOURCE

The system has seven groundwater wells with a total physical pumping capacity of 944 gallons per minute (gpm). The wells are spread out throughout the system and most of them are organized into stations with a well, booster pumps, and a storage tank.

The system is sized to meet peak summer demands, and they have a large increase in demand compared to winter months because of a large number of recreational and part time connections. To help ensure all the wells are exercised, the operators rotate use of the wells using SCADA rather than relying solely on system pressure to control which wells are used.

Well #2 is no longer used as a potable supply. It is only being used for filling fire tanker trucks and has been physically disconnected from the water system. The WFI has been updated as part of this survey.

Well #5 was offline during the survey because the well house is being re-built and is under construction. It was not evaluated.

Source ID #	Name:	Description:	Ecology Tag #	Listed on WFI Yes	No
03	Well #3A	Groundwater Well - Permanent	AHA976	☒	☐
04	Well #4	Groundwater Well - Permanent	AHA973	☒	☐
05	Well #1	Groundwater Well - Permanent	AHA974	☒	☐
06	Well #3B	Groundwater Well - Seasonal	AHA975	☒	☐
07	Well #5	Groundwater Well – Permanent – Not inspected because under construction.	AHA977	☒	☐
08	Well #6	Groundwater Well – Permanent	None	☒	☐

WELLHEAD	Source ID #03		Source ID #04		Source ID #05		Source ID #06		Source ID #08	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
System has well log	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
*Wellcap sealed	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
*Openings sealed	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
*Vent screened	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Terminates 6" above grade	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
*Protected from flooding	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Source meter	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Pressure gauge	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
**Raw water sample tap	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Check valve	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
**Protected from unauthorized access	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Structure in good condition	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
*Sanitary control area has no unmitigated contaminants	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
**Protected from physical damage	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Frequency of routine site visit	Two times per week by onsite operator. Weekly by SMA.									
Frequency of source meter reading	Daily		Daily		Daily		Daily		Daily	

WELL PUMP EQUIPMENT	Source ID #03		Source ID #04		Source ID #05		Source ID #06		Source ID #08	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
*Functional and reliable pump and pump controls	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
*Pump control valve or vacuum relief valve with a protected air gap at discharge	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐

WELL PUMP EQUIPMENT	Source ID #03		Source ID #04		Source ID #05		Source ID #06		Source ID #08	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Generator available	☒	☐	☐	☐	☒	☐	☐	☐	☒	☐
Generator has automatic startup	☒	☐	N/A		☒	☐	N/A		☐	☒
Generator fuel source	Natural Gas		N/A		Propane		N/A		Natural Gas	

EMERGENCY SOURCES

Source ID #	Name:	Description:	Ecology Tag #	Listed on WFI Yes	No*	Disconnected Yes	No*	Inspected Yes	No*
02	Well #2	Groundwater Well – No longer used for water system. Used to fill fire trucks.	AHA978	☒	☐	☒	☐	☒	☐

SECTION 2: DISINFECTION

This system does not provide disinfection treatment.

SECTION 3: OTHER TREATMENTS

This system does not provide other treatment.

SECTION 4: DISTRIBUTION SYSTEM

The distribution piping is primarily AC pipe and consists of 2, 4, 6, and 8-inch pipe that were installed in the 1960s and 1970s. Eventually the water system intends to replace the distribution system and upgrade the sizing to 6 and 8-inch pipe. Rather than using AC pipe, they are using primarily C-900 PVC for main replacements. Most of the distribution system is looped, which helps keep water circulating and minimizes the need for distribution flushing.

The system has very good numbers for distribution leakage. Their three-year average is 6 percent; in 2017, the DSL was 4 percent. They have an active leak detection program and closely track water use. The new WUE guidelines instruct water systems to count water from main breaks as distribution leakage. Lake Limerick has been estimating water loss during a main break and counting it as accounted for water (this is what the old WUE guidance said to do). Their DSL percentage will likely increase by changing how they track the water used and lost through breaks.

The system has a fully implemented cross-connection control program. They have conducted customer surveys and all testable devices with hazards are tested annually. The have a large number of testable backflow devices at properties with no hazard. They were installed by previous management based on their views of the cross connection program. We discussed whether it makes sense to do regular testing of the devices that are not needed to protect the system from a cross connection hazard. In my opinion, the homes that do not have an identified cross connection hazard would typically have a check valve at the meter rather than a testable device. So, completing ongoing testing of these devices when there is no risk would be sufficient and a device is not necessary. I think it is sufficient to complete annual testing for the connections with hazards and then do customer assessments every five years for the homes with testable devices that do not have hazards. The assemblies at these connections can be treated as if they were simple check valves that are not tested.

FEATURES	Yes	No
Service area and facility map	☒	☐
Minimum pressure requirements met	☒	☐
Service meters (reading frequency is monthly)	☒	☐
Leak detection program	☒	☐
Water system leakage (%)	4 % (3-year average is 6 %)	
Adequate valving for flushing and pipe repair	☒	☐
Blow-offs on dead ends	☒	☐
Routine flushing (frequency is annually)	☒	☐
Routine valve exercise (frequency is annually)	☒	☐

CROSS CONNECTION CONTROL	Yes	No
System has enabling authority	☒	☐
Ongoing hazard inspections	☒	☐
High hazards identified	☒	☐
High hazards protected	☒	☐
Annual testing	☒	☐
System has installation standards	☒	☐
CCS on staff or under contract	☒	☐
Cross connections observed have been eliminated	☒	☐

SECTION 5: FINISHED WATER STORAGE

The water system has four tanks that are intended to provide equalizing and operational storage. The system has decided not to provide standby storage, because they have reliability during power outages by using the generators to run several of the wells and booster stations. This is more reliable because the system is not gravity fed. Even if there were the traditional amount of standby storage, it would not be usable without using generators.

RESERVOIR	RESERVOIR NAME	DESCRIPTION	TOTAL VOLUME (GAL)
1	Tank 1	Welded Steel Reservoir. Located at Well #1 Site.	125,000
2	Tank 3	Concrete Mt. Baker Silo. Located at Well #3A and #3B site.	150,000
3	Tank 4	Concrete Mt. Baker Silo. Located at Well #5 Site.	60,000
4	Tank 6	Concrete Mt. Baker Silo. Located at Well #6 Site.	160,000

TOP OF RESERVOIR	Res #1	Res #2	Res #3	Res #4
	Yes No	Yes No	Yes No	Yes No
**Hatch: Locked	☒ ☐	☒ ☐	☒ ☐	☒ ☐
*Hatch: Watertight seal or gasket	☒ ☐	☒ ☐	☒ ☐	☒ ☐
Hatch: Over-lapping cover	☒ ☐	☒ ☐	☒ ☐	☒ ☐
*Screened air vent	☒ ☐	☒ ☐	☒ ☐	☒ ☐
*Openings sealed/protected	☒ ☐	☒ ☐	☒ ☐	☒ ☐

FEATURES	Res #1		Res #2		Res #3		Res #4	
	Yes	No	Yes	No	Yes	No	Yes	No
Separate inlet/outlet	☒	☐	☒	☐	☒	☐	☒	☐
Protected drain outlet	☒	☐	☒	☐	☒	☐	☒	☐
*Protected overflow outlet	☒	☐	☒	☐	☒	☐	☒	☐
*Overflow line discharges into a sanitary sewer with an air gap	N/A		N/A		N/A		N/A	
Operational water level gauge	☒	☐	☒	☐	☒	☐	☐	☐
Bypass piping or isolation possibility	☐	☒	☒	☐	☒	☐	☒	☐
**Protected from unauthorized entry	☒	☐	☒	☐	☒	☐	☒	☐
Low level alarms	☒	☐	☒	☐	☒	☐	☐	☐
Sample tap at outlet	☒	☐	☒	☐	☒	☐	☒	☐

MAINTENANCE	Res #1		Res #2		Res #3		Res #4	
	Yes	No	Yes	No	Yes	No	Yes	No
Frequency of structural and coating inspection	Inspection and cleaning by diving company very 5 years. Last cleaning in 2015 for all tanks.							
Frequency of cleaning	5 years							
Frequency of appurtenance inspection	Annually							
Frequency of routine site visit	Two times per week minimum							
**Structure in good condition	☒	☐	☒	☐	☒	☐	☒	☐
Clear of excessive vegetation	☒	☐	☒	☐	☒	☐	☒	☐

SECTION 6: PRESSURE TANKS

This system has pressure tanks at each of their well sites and booster stations. Several of the sites with hydropneumatic tanks have been replaced with VFD controlled pump systems and smaller bladder tanks. No deficiencies were noted.

Site	Location	# of Hydropneumatic Tanks	# of Bladder Tanks
1	Well #1	1	
2	Well #3A and #3B	(tank removed)	1
3	Well #4	(tank removed)	1
4	Well #5	1	
5	Well #6		1

HYDROPNEUMATIC	Site: 1		Site: 5	
	Yes	No	Yes	No
Pressure relief valve	☒	☐	☒	☐
Pressure gauge	☒	☐	☒	☐
Water level sight glass	☒	☐	☒	☐
Can be isolated	☒	☐	☒	☐
**Oilless Air compressor	☒	☐	☒	☐
In good condition	☒	☐	☒	☐

BLADDER	Site: 3		Site: 4		Site: 6	
	Yes	No	Yes	No	Yes	No
Isolation valve	☒	☐	☒	☐	☒	☐

BLADDER	Site: 3		Site: 4		Site: 6	
	Yes	No	Yes	No	Yes	No
Pressure relief valve	☒	☐	☒	☐	☒	☐
Pressure gauge	☒	☐	☒	☐	☒	☐
In good condition	☒	☐	☒	☐	☒	☐

BUILDINGS/ENCLOSURE	Site: 1		Site: 2		Site: 3		Site: 4		Site: 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
**Facility secure	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Structure in good condition	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐

SECTION 7: BOOSTER PUMPS AND FACILITIES

The water system is pressurized by four booster stations located throughout the system. Each booster station site includes a storage tank, and the booster pumps are controlled based on water levels in the tanks. They are also controlled through the SCADA system.

The booster station at the Well #5 site was not physically inspected. I requested the operator take photos of the inside of the booster station. From the photos, it appears there are pieces of insulation and black specks on the floor of the pump house, which may indicate rodent activity. Also the walls of the pump house seem to have signs of mold. Ensure that there are no openings in the side of the walls and evaluate the condition of the pump house building. It may need to be replaced if the building is starting to deteriorate.

Facilit	Name	Description	Total Capacity (gpm)
1	Well #1 Booster Station	Located at the Well #1 Site	130
2	Well #3A and #3B Booster Station	Located at the Well #3A and 3B Site	420
3	Well #5 Booster Station	Located at the Well #5 Site – Not Inspected	150
4	Well #6 Booster Station	Located at the Well #6 Site	400

BOOSTER PUMPS	Facility 1		Facility 2		Facility 4	
	Yes	No	Yes	No	Yes	No
Frequency of routine site visit	Two times per week minimum					

BOOSTER PUMPS	Facility 1		Facility 2		Facility 4	
	Yes	No	Yes	No	Yes	No
Isolation valves	☒	☐	☒	☐	☒	☐
Pressure gauge(s)	☒	☐	☒	☐	☒	☐
Pressure relief valve	☒	☐	☒	☐	☒	☐
Pump failure alarm	☒	☐	☒	☐	☒	☐
*Functional pump and pump controls	☒	☐	☒	☐	☒	☐
Protected from flooding	☒	☐	☒	☐	☒	☐
Redundant pumps	☒	☐	☒	☐	☒	☐
Equipment in good condition	☒	☐	☒	☐	☒	☐
Generator available	☐	☒	☒	☐	☒	☐
Generator has automatic startup	N/A		☒	☐	☒	☐
Generator fuel source	N/A		Natural Gas		Natural Gas	

BUILDINGS/ENCLOSURE	Facility 1		Facility 2		Facility 4	
	Yes	No	Yes	No	Yes	No
**Facility secure	☒	☐	☒	☐	☒	☐
Structure in good condition	☒	☐	☒	☐	☒	☐

SECTION 8: WATER QUALITY MONITORING AND REPORTING

No water quality issues are known. Well #5 has had high manganese results in the past, and the system has some iron and manganese, but there have not been a large number of complaints. No issues with contamination have occurred in the active sources.

The Coliform Monitoring Plan has been recently updated to include information about the Groundwater Rule and Revised Total Coliform Rule. The sites are adequately distributed throughout the system and they are sampled on a rotating schedule.

Refer to the Water Quality Monitoring Schedule for your monitoring requirements and status. If you have any questions on source monitoring, please contact Sophia Petro at (360) 236-3046.

CHEMICAL	
Sample Point	Description
1	Well #1 Raw Water Sample Tap

CHEMICAL	
Sample Point	**Description**
2	Well #3A & 3B Raw Water Sample Taps
3	Well #4 Raw Water Sample Tap
4	Well #5 Raw Water Sample Tap
5	Well #6 Raw Water Sample Tap

CHEMICAL	Sample Point 1		Sample Point 2		Sample Point 3		Sample Point 4		Sample Point 5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Monitoring adequate	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
ODW WQ data reviewed	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐
Sample collection sites correct	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐

System has prior:
- ☐ Nitrate results above 5 mg/L
- ☐ Nitrite results above 0.5 mg/L
- ☐ Primary MCL
- ☒ Secondary MCL exceedance(s)
- ☐ Organic detections
- ☐ Other _____

COLIFORM	Yes	No
Monitoring adequate	☒	☐
Monitoring plan adequate	☒	☐
Monitoring plan followed	☒	☐
# of violations since last survey	One total coliform MCL violation in September 2013	

LEAD & COPPER	Yes	No
Monitoring adequate	☒	☐
Results below action level	☒	☐

SECTION 9: SYSTEM MANAGEMENT AND OPERATIONS

The water system is managed by onsite maintenance staff. They also use the services of Northwest Water Systems. This is a very large homeowners association that is governed by a board of directors and consists of 9 community members. There is also a water committee of 6 members that focus on making decisions for the management of the water system. Their water system plan is up to date and the water system is proactive with addressing issues.

PROJECT/PLANNING	Yes	No
System approved	☒	☐
Current WSP/SWSMP	☒	☐
Year WSP/SWSMP approved	2014	
Emergency response plan	☒	☐

REPORTING	Yes	No	N/A
WFI reviewed and updated with purveyor	☒	☐	---
Consumer confidence report (Community only)	☒	☐	☐
Water use efficiency report (Municipal Water Suppliers)	☒	☐	☐
Cross connection control annual report (> 1000 conn)	☒	☐	☐

OPERATOR CERTIFICATION

This system is required to have a certified operator with a minimum certification level of Water Distribution Manager 2. They have met this requirement. If you have any questions or this information is inaccurate, please contact Operator Certification at (800) 525-2536.

Name of Operator	Certification Number	Certifications	Mandatory Operator
Kevin Odegard	006962	WDM3, WTPO1, CCS	☒
Joseph Castelluccio	014159	WDM2, CCS	☐
Steve Wheaton	012764	WDM2, CCS	☐

WDS-Water Distribution Specialist; WDM-Water Distribution Manager; WTPO-Water Treatment Plant Operator, BTO-Basic Treatment Operator; CCS-Cross Connection Specialist; BAT-Backflow Assembly Tester

OPERATIONS	Yes	No
Operational records maintained	☒	☐
Complaints followed up	☒	☐
Complaints documented	☒	☐
# of complaints recorded at ODW (since last survey)	None	
Operation and maintenance program	☒	☐
Previous survey deficiencies/findings corrected, if no list below.	☒	☐

CLOSING

Your system qualifies for the reduced frequency of sanitary surveys under WAC 246-290-416. Your next survey is due in 5 years.

Regulations establishing a schedule of fees, including fees for sanitary surveys, were adopted March 18, 2012 (WAC 246-290-990). The amount due is $918. An itemized worksheet is enclosed with the invoice.

If you have any questions, please contact me at (360) 236-3035 or by e-mail at regina.grimm@doh.wa.gov.

Sincerely,

Regina Nicol Grimm

Regina N. Grimm, P.E.
Office of Drinking Water, Regional Engineer

Enclosures

cc: Jeff Wilmoth, Mason County Public Health

Well #4 Facilities Site

Well Head

Well House Piping

Source Meter

Pressure Tank

Booster Pumps

Well #2 – Physically Disconnected

Booster Pumps

Well Head

Source Meter Vault

Booster Station

Booster Station Skid

Well Head

Well Enclosure

Well Head

Booster Station Pump House

Storage Tank

Overflow with Air Gap

Storage Tank

Well Head

Booster Pumps

Booster Pumps

Storage Tank

Overflow Air Gap

Booster Pump House

Storage Tank

Tank Overflow

Discharge Line from Booster Station

Pressure Tank

Control Panel

Appendix 10.17
Consistency Statements

Planning • Management • Engineering
P.O. Box 123 • Port Orchard, WA 98366 • 888-881-0958 • 360-876-0958

August 5, 2020

Mason County Community Development
c/o David Windom, Director
Mason County Building 8
615 W Alder St.
Shelton, WA 98584

Re: Lake Limerick Country Club – Water System Plan
Local Government Consistency Review Checklist

Dear Mr. Windom:

The Lake Limerick Country Club (DOH System ID 44150-T) has completed an update to the Water System Plan. Northwest Water Systems prepared the planning document on behalf of Lake Limerick and seeks your review and concurrence in regard to the required Local Government Consistency Review Checklist.

Please find enclosed relevant portions of the Water System Plan for your review. A copy of the DOH's Local Government Consistency Review Checklist is also enclosed. If you have any questions or need any other information, please call me at 360-876-0958, extension 109, or email andrew@nwwatersystems.com.

Sincerely,

Andrew Nelson
NORTHWEST WATER SYSTEMS, INC.

enclosure

Local Government Consistency Determination Form

Water System Name: Lake Limerick Country Club PWS ID: 44150 T

Planning/Engineering Document Title: Water System Plan Plan Date: August 2020

Local Government with Jurisdiction Conducting Review: Mason County

Before the Department of Health (DOH) approves a planning or engineering submittal under Section 100 or Section 110, the local government must review the documentation the municipal water supplier provides to prove the submittal is consistent with **local comprehensive plans, land use plans and development regulations** (WAC 246-290-108). Submittals under Section 105 require a local consistency determination if the municipal water supplier requests a water right place-of-use expansion. The review must address the elements identified below as they relate to water service.

By signing this form, the local government reviewer confirms the document under review is consistent with applicable local plans and regulations. If the local government reviewer identifies an inconsistency, he or she should include the citation from the applicable comprehensive plan or development regulation and explain how to resolve the inconsistency, or confirm that the inconsistency is not applicable by marking N/A. See more instructions on reverse.

Local Government Consistency Statement	For use by water system: Identify the page(s) in submittal	For use by local government: Yes or Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the service area.	Section 1.4, 10.8	
b) The growth projection used to forecast water demand is consistent with the adopted city or county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	Section 2.6	
c) For cities and towns that provide water service: All water service area policies of the city or town described in the plan conform to all relevant utility service extension ordinances.	N/A	
d) Service area policies for new service connections conform to the adopted local plans and adopted development regulations of all cities and counties with jurisdiction over the service area.	Sections 1.5, 1.6	
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable. This may include Coordinated Water System Plans, Regional Wastewater Plans, Reclaimed Water Plans, Groundwater Management Area Plans, and the Capital Facilities Element of local comprehensive plans.	Section 1.3	

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature ______________________ Date ________

Printed Name, Title, & Jurisdiction ______________________

Appendix 10.18
SEPA

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

1. Name of proposed project, if applicable:

   Lake Limerick Water System Plan

2. Name of applicant:

Lake Limerick Country Club

3. Address and phone number of applicant and contact person:

Lake Limerick Country Club c/o Don Bird, Water System Board President
Address: 790 East St. Andrews Drive, Shelton, WA 98584
Phone: 360-426-9931

4. Date checklist prepared:

6/15/20

5. Agency requesting checklist:

Washington Department of Health

6. Proposed timing or schedule (including phasing, if applicable):

The Water System Plan Update evaluates the existing water system and projects future needs for the next 20 years. The Plan will be submitted to the Washington Department of Health for review and approval in 2020. Updates to the Water System Plan are required every 10 years.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

The Water System Plan Update identifies improvements for the Lake Limerick Water System (see Chapter 8). Improvement to the SCADA system (addition of real-time monitoring of source meter and aquifer levels) will be performed in the next couple of years. Improvement projects planned for implementation after 2030 will be part of the next Water System Plan Update.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Environmental checklists will be prepared for specific projects recommended in the plan for any actions that do not qualify as categorically exempt under SEPA.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

None known.

10. List any government approvals or permits that will be needed for your proposal, if known.

The Water System Plan Update needs to be approved by the Washington Department of Health, Office of Drinking Water. The Department of Ecology will review and may comment on the Water System Plan Update. Mason County will also review the Water System Plan for consistency with county comprehensive planning.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The Water System Plan Update is a document covering all aspects of the Lake Limerick water system including projection of water demands for the next 20 years. The Water System Plan also identifies capital improvement projects needed over the next 20 years. The Plan covers physical facilities (wells, reservoirs, waterlines), operational plans, source water protection, financial status of the water system, and projected costs of the improvements. No new facilities are planned, and only repair or like-for-like replacement of existing facilities is proposed.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The Lake Limerick Country Club is located near its namesake lake in Township 21 North, Range 3 West, W.M. and occupies Section 27 as well as the southeast quarter of Section 21, the southern half of Section 22, and the southwest quarter of Section 23. A vicinity map and service area maps are provided in Chapter 1 of the Water System Plan Update.

B. Environmental Elements [HELP]

1. *Earth* [help]

a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____________

b. What is the steepest slope on the site (approximate percent slope)?

Less than 5 percent.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The soils around Lake Limerick are mostly gravelly sandy loams.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

The proposed capital improvement project within the current planning period (improvement to SCADA system) does not require filling or grading.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Erosion is not anticipated for any of the capital improvement projects described in the Water System Plan.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

The projects identified in the Water System Plan are not expected to result in any increase of impervious surface area associated with the water system facilities.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

If required, erosion control at new construction sites would be based on applicable local and regional ordinances and/or guidance.

2. Air [help]

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Dust and emissions from heavy equipment are possible during any construction activities, but these impacts will be short-lived and transient.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Not applicable.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Not applicable.

3. Water [help]

a. Surface Water: [help]

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Lake Limerick was formed in 1966 by impoundment of Cranberry Creek. Lake Limerick is fed mainly by Cranberry Creek as well as three other minor inlets.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No work is anticipated within 200 feet of Lake Limerick in association with proposed projects. Potential impacts to surface waters associated with distribution system replacement or other construction in the future will be addressed under subsequent environmental review.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No dredge or fill proposed.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Tributaries and outlets for Lake Limerick lie within a 100-year floodplain.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Ground Water: [help]

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

Lake Limerick relies on groundwater as its source of supply. The system withdraws approximately 201.1 ac-ft/yr on average, with the highest annual withdrawal in the past 10 years being 242.8 ac-ft/yr. The system is permitted to withdraw 446 ac-ft/yr. at a maximum rate of 890 gpm.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Not applicable.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

No increase in the amount of impervious surfaces or run-off are anticipated as a result of the improvements identified in the Water System Plan.

2) Could waste materials enter ground or surface waters? If so, generally describe.

No waste materials would be discharged into ground or surface waters as a result of the proposed project.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Not applicable.

4. *Plants* [help]

a. Check the types of vegetation found on the site:

__X__deciduous tree: alder, maple, aspen, other
__X__evergreen tree: fir, cedar, pine, other
__X__shrubs
__X__grass
_____pasture
_____crop or grain
_____orchards, vineyards or other permanent crops.
__X__wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
_____water plants: water lily, eelgrass, milfoil, other
__X__other types of vegetation - No detailed survey was completed. A wide range of vegetation exists in the area, especially in landscaped areas.

b. What kind and amount of vegetation will be removed or altered?

No vegetation removal is anticipated for the improvement projects proposed during the next 10 years. Minor amounts of vegetation (primarily grass and shrubs) may be removed, altered, or disturbed as a result of future capital improvement projects identified in the Water System Plan Update.

c. List threatened and endangered species known to be on or near the site.

Not known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Not applicable.

e. List all noxious weeds and invasive species known to be on or near the site.

Not known.

5. *Animals* [help]

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

Examples include:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other _yellow perch________

b. List any threatened and endangered species known to be on or near the site.

Washington Department of Fish and Wildlife lists the following species on their Priority Habitat and Species (PHS) database as being within the Lake Limerick service area. These represent species that are priorities for management and conservation. Only the Steelhead is marked as "threatened" and none are marked as "endangered".

Steelhead, Resident Coastal Cutthroat, Coho, Rainbow Trout, Chum, Big Brown Bat.

c. Is the site part of a migration route? If so, explain.

The Pacific flyway is a major north-south migration route extending from Alaska to South America that is used by waterfowl and other bird species. Cranberry Creek and Lake Limerick are identified for migration and spawning habitat use for salmonid species.

d. Proposed measures to preserve or enhance wildlife, if any:

None.

e. List any invasive animal species known to be on or near the site.

Not known.

6. Energy and Natural Resources [help]

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

The proposed improvements in the Water System Plan Update are not expected to create additional energy demands after construction. Water production relies on electrically powered pumps. Proposed improvements do not increase energy usage.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The Water System Plan Update includes a conservation plan to reduce water usage by Lake Limerick customers. A reduction in water use would result in a reduction in electrical demand to pump water. Additionally, replacement of well pump 5 with a more efficient pump would reduce electrical usage at that site by an estimated 50%.

7. *Environmental Health* [help]

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

None known.

1) Describe any known or possible contamination at the site from present or past uses.

None known.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

None known.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

None.

4) Describe special emergency services that might be required.

Approval of the Plan is not expected to result in the need for additional emergency services beyond the operation procedure established for equipment failure, contamination of source, etc.

5) Proposed measures to reduce or control environmental health hazards, if any:

Not applicable.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Not applicable.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

No construction noise is anticipated for the recommended projects.

3) Proposed measures to reduce or control noise impacts, if any:

Construction will occur during daytime hours.

8. Land and Shoreline Use [help]

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

Lake Limerick is a residential community with a 9-hold golf course and several small community parks.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No known agricultural use.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No.

c. Describe any structures on the site.

Single family residences are the primary structures in the community.

d. Will any structures be demolished? If so, what?

No.

e. What is the current zoning classification of the site?

Rural Residential, Rural Commercial (restaurant, pro shop), and Rural Tourist (golf course)

f. What is the current comprehensive plan designation of the site?

Rural Residnetial

g. If applicable, what is the current shoreline master program designation of the site?

Lake Limerick and Cranberry Creek are designated as residential freshwater shoreline areas.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

Lake Limerick and Cranberry Creek are Shorelines of the state, regulated by Mason County's Shoreline Master Program and Resource Ordinance. Other streams, geologically hazardous areas, and associated wetlands to Lake Limerick are protected critical areas regulated by the County's Resource Ordinance.

i. Approximately how many people would reside or work in the completed project?

The Lake Limerick Water System serves a population of approximately 1,915 people.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The Water System Plan is consistent with planned land uses identified in Mason County's Comprehensive Land Use Plan and zoning ordinances.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

Not applicable.

9. Housing [help]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable

10. Aesthetics [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

No new structures are proposed in the Water System Plan Update. The water system has several existing concrete reservoirs, the tallest of which are 30 feet.

b. What views in the immediate vicinity would be altered or obstructed?

None.

b. Proposed measures to reduce or control aesthetic impacts, if any:

None.

11. Light and Glare [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Not applicable.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light and glare impacts, if any:

Not applicable.

12. Recreation [help]

a. What designated and informal recreational opportunities are in the immediate vicinity?

A golf course and private community beach owned by Lake Limerick Country Club is located near the southwestern shore. A Washington Dept of Fish and Wildlife boat launch is near Mason Lake Road on the south side of the lake.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Not applicable.

13. Historic and cultural preservation [help]

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers ? If so, specifically describe.

No historic properties identified on the Washington Information system for Architectural and Archaeological Records Data (WISAARD) system.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

None known.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Search on the Washington Information system for Architectural and Archaeological Records Data (WISAARD) system.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

If objects of potential historic or cultural importance are identified during excavation, the SHPO will be contacted for further direction.

14. Transportation [help]

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

The Lake Limerick community includes a network of streets owned and maintained by the community.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

There is no public transit service within the Lake Limerick service area. The nearest transit stop is over 2.2 miles away at the intersection of Mason Lake Road and Highway 3.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

Not applicable.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

No.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

Not applicable.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No.

h. Proposed measures to reduce or control transportation impacts, if any:

Not applicable.

15. Public Services [help]

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

No.

b. Proposed measures to reduce or control direct impacts on public services, if any.

None.

16. Utilities [help]

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other ___________

c. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Not applicable.

C. Signature [HELP]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Andrew D. Nelson

Name of signee _Andrew Nelson

Position and Agency/Organization _Design Engineer, Northwest Water Systems

Date Submitted: _7/29/2020

D. Supplemental sheet for nonproject actions [HELP]

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

The proposed improvements in the Water System Plan Update are not expected to cause an increase in these areas

Proposed measures to avoid or reduce such increases are:

Not applicable.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

The proposed improvements in the Water System Plan Update are not likely to affect plants, animals, fish, or marine life.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

Not applicable.

3. How would the proposal be likely to deplete energy or natural resources?

The proposed improvements in the Water System Plan Update will not adversely affect the use of energy or natural resources.

Proposed measures to protect or conserve energy and natural resources are:

Water/energy conservation measures discussed in Section 6-c above.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   The proposed improvements in the Water System Plan Update will not impact environmentally sensitive areas.

   Proposed measures to protect such resources or to avoid or reduce impacts are:

   Not applicable.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   The proposed improvements in the Water System Plan Update will not affect land or shoreline uses.

   Proposed measures to avoid or reduce shoreline and land use impacts are:

   Not applicable.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   The proposed improvements in the Water System Plan Update will not increase demands on transportation or public services and utilities.

   Proposed measures to reduce or respond to such demand(s) are:

   Not applicable.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

   No conflicts with local, state, or federal laws are anticipated.

Appendix 10.19
SMA Contract

CONTRACT FOR MANAGEMENT AND OPERATION OF A SATELLITE WATER SYSTEM COMMUNITY WATER SYSTEM CONTRACT # 12011702

This agreement was created by and between Northwest Water Systems, Inc., (hereinafter known as "**NWS**"), a Washington Corporation and Lake Limerick Country Club, Inc. (hereinafter known as the "**Owner**") on the 19th day of January, 2012

Whereas the **Owner** owns and operates a public water system known as Lake Limerick Water (hereinafter known as "**System**"), and such water system is identified by the Washington State Department of Health under identification number 44150 T as a Group A Community water system; and

Whereas **NWS** is a State Department of Health approved Satellite Management Agency authorized to provide Management and Operations Services, and is in the business of managing and operating public water systems; and

Whereas the **Owner** desires to contract with **NWS** to obtain Management Services for the **System**, and **NWS** wants to contract with the **Owner** to provide Management Services for the **System**;

Now, therefore, the parties, **NWS** and the **Owner** hereby agree as follows:

SECTION 1: EFFECTIVE DATE

This contract agreement is effective as of 2/1/12

This **Effective Date** requires payment of **Setup Services** fees and first month's **Included Services** fee.

SECTION 2: PARTIES INFORMATION

SUBSECTION A: NWS

Mailing Address:
P.O. Box 123
Port Orchard, WA 98366
Principal Contact:
Jon Willey
NWS Operator in Responsible Charge:
Kelly Alsin

Telephone Number:
1-888-881-0958
Satellite Management Agency Number:
119
Website:
www.nwwatersystems.com

SUBSECTION B: OWNER

Billing Address:
E 790 St Andrews DR
Shelton, WA 98584
Principal Contact Name:
Sheila Hedlund

Primary Telephone Number:
360.426.3581
Secondary Telephone Number:
360.507.6202
Principal Contact Email Address:
llccbk@hctc.com

SECTION 3: SYSTEM LOCATION

Street: E 790 St Andrews DR
City: Shelton
State: WA
Zip: 98584
County: Mason

Notes: Steve Wheaton, WMD 1, 360.427.4563

NWS: JPW

OWNER: Pa SAK

SECTION 4: SERVICE REPAIR PROVIDER

Service Repair Providers include but are not limited to Well Drillers, Pump Installers, Plumbers, Electricians, Excavation Services/Main Installation, etc.

The purpose of the *Service Repair Provider* **Section** is to state the **Owner's** preferred service provider in the case of emergencies. Identifying one service repair provider is required.

Selected Service Repair Provider:

1. Hometown Electric, Arcadia Drilling, Brown & Caldwell, Zephyr Construction (hereinafter known as **"Primary Service Providers"**)

SECTION 5: SERVICES

OPERATIONAL & MANAGEMENT SERVICES

Coordinate with **Owner's** WDM staff in providing daily scheduled operation and maintenance of the **System** in accordance with accepted public health practices. Routine operation and maintenance includes, but is not limited to the following items:

- Act as the point of contact in emergency situations by providing a 24-hour emergency response telephone number. This includes, but is not limited to assisting in the development of a remedial action-plan in the case of an emergency.
- Update the **System's** WFI and submit to DOH.
- Recommend ongoing maintenance strategies to the **Owner.**
- Adjust **System** components according to operational needs.
- Perform maintenance on equipment and provide consultation regarding routine and scheduled upgrades or repairs, this excludes project management.
- Perform water quality monitoring, interpret results, maintain adequate records, and manage follow-up action to comply with State and/or Federal drinking water regulations.
- Develop and implement a coliform monitoring plan.
- Analyze and review recording-instrument readings and laboratory tests and maintain a record of this information. Maintain **System** files, documents, onsite visit records and correspondence with the **Owner.**
- Facilitate the ordering of materials and parts for the operation and maintenance of the **System.**
- Make the current **System** information available to **System** customers and **Owner** upon request.
- Represent the **System** during media interaction
- Prepare the annual Consumer Confidence Report.
- Implement an existing Cross-Connection Control Program.
- NWS is to represent the **System** during a Department of Health Sanitary Survey.
- The issuance of official Letter of Water Availability to customers of the **System.**
- Meet public notification requirements according to WAC 246-290; Part 7. Reporting; Subpart A – Public Notification and Consumer Information.
- Implement remedial actions in emergencies. This includes following Department of Health directives to address the situation. In emergency situations actions will be taken to protect public health and safety of the **System**.
- Arrange for the inspection and testing of backflow prevention devices (excludes performance of backflow testing).
- Arrange for or provide Locater Services as requested.
- Arrange for Leak Detection Services as requested.

NWS: UPW

OWNER: Pa

Implement the **System's** Capital Improvement Program.

Maintain/update as-built **System** drawings by hand (excludes drafting/Autocad work).

Verify locations and causes of malfunctions.

Perform and/or arrange for emergency and/or urgent repairs after **NWS** has been notified that repairs are needed. Travel associated with emergency response is billable hourly.

SECTION 6: CHARGES FOR SERVICE

Services are billed in advance as a monthly fee of **$1000.00** plus **$50.00 per hour** for services provided between 8:00 AM and 5:00 PM. Services provided from 5:00 PM to 8:00 AM are outside of normal business hours and are provided at a rate of **$100.00 per hour.**

SECTION 7: TERMS & CONDITIONS

This contract is valid for **30 days** from the date of creation found at the top of the first page of this contract.

The Washington State Department of Health requires that **NWS** take immediate action to correct emergencies that may impact public health, safety and/or property damage. This includes but is not limited to water quality problems, defined as water sample test results exceeding primary water quality standards.

The **Owner** is responsible to update primary contact information.

This Contract includes all of the terms and conditions of **NWS'** Satellite Management Agency Plan as it currently exists, and as amended in the future. Without limiting the foregoing, it is agreed as follows:

- **NWS** does not own the water system.
- **NWS'** responsibility is limited to the services included in this contract.
- **NWS** has no responsibility in the event that the **System's** source is interrupted, the volume thereof is reduced, or the water is contaminated, other than to assist in correcting these issues.
- **NWS** is not responsible for failure to perform in situations beyond human control. This includes natural disasters and/or Acts of God.
- The **Owner** hereby grants **NWS** license to enter the pump houses and all utility easements in the performance of **NWS'** responsibilities under this contract.

Work requiring engineering services are explicitly excluded from this contract, and require independent proposals.

All Invoices to the System are due 15 days from the date of the invoice. There will be a 30 day grace period from the date the invoice is due. Any invoice that extends past the grace period will be subject to a 1.5% per month late charge calculated and applied the day directly following the grace period. Subsequent late charges are calculated based on the invoice amount plus any previous late charges.

The monthly fee for ***Services*** increases February 1st 2013, and every year thereafter by the inflation rate from January 1st to December 31st of the preceding year. This inflation rate is identified by the national Consumer Price Index posted by the Federal Government. **Owner** is to be notified of this rate annually.

Reimbursable Expenses include but are not limited to such items as laboratory fees, copying and reproduction expenses, postage and other similar incidental expenses incurred by **NWS** on behalf of the **Owner**.

The **Owner** authorizes **NWS** to perform or arrange for necessary maintenance repairs that cost less than **$500.00**. Repairs in excess of this specified amount shall be preapproved by an authorized representative of the **Owner.**

Routine and scheduled upgrades or repairs will be performed through an operating agreement with the **Primary Service Provider** unless **System** principal contact or **Owner** specifies otherwise.

Emergency and/or urgent repairs will be performed through an operating agreement with the **Primary Service Provider**. If the **Primary Service Provider** is unwilling or unable to perform the work needed to repair the **System** or do so on an

NWS: JPW

OWNER: Pa

acceptable time schedule **NWS** will contact a qualified and certified service repair provider to perform the work. Unless the **System** principal contact or **Owner** is unavailable, verbal and/or written approval from the **System** principal contact or **Owner** will be sought prior to performance of repairs. If **NWS** cannot reach the **Owner**, **NWS** has authorization to take the necessary actions to protect public health and safety and/or to prevent/minimize property damage. The **Owner** is responsible for all expenses associated with resolving emergencies. **NWS** will work with the **System** to arrange timing of repairs for work related to public health issues, with the limitation of adhering to the Department of Health's requirements. Charges from repair providers or other contractors will be billed directly to the **Owner**. **Owner** may elect to resolve public health issues in-house, contingent on the involvement of personnel certified to perform the required work. In the case of an imminent health threat, steps to resolve the issue must be taken within the framework of a time schedule determined by **NWS**. If the time schedule is not met, **NWS** will resolve the water quality issue at **Owner's** expense.

SECTION 8: DURATION

This contract shall remain in effect for a period of one year from the **Effective Date**. After the initial one year period, the contract continues in a month-to-month status.

The contract may be terminated by **NWS** and/or the **Owner** due to any violation of this contract. The contract may be terminated by **NWS** due to non-payment of agreed upon fees and charges by **Owner**. **Owner** may terminate the contract due to non-performance by **NWS**. The contract may also be terminated upon mutual agreement by all parties. The contract may be terminated by either party by providing 30 days' notice at the end of any contract period. **NWS** may also terminate the contract if the **System** is unable or unwilling, to comply with applicable government regulations. Termination notice must be in writing (E-mail or Mail.)

NWS shall provide the Local Health Jurisdiction and the State Department of Health written notification within 30 days should the contract be terminated.

SECTION 9: INTEGRATION

This Contract constitutes the entire agreement between the parties. There are no other verbal or written agreements or representations which modify or affect this contract.

Amendments to this contract shall be in writing and shall be signed by **NWS** and the **Owner**.

SECTION 10: INDEMNIFICATION

The **Owner** shall indemnify and hold **NWS** harmless from loss, damage, or defense costs including attorneys' and defense fees arising from actual or alleged negligent acts or omissions of the **Owner**, its officers, employees, subcontractors or other agents, limited to the performance of the **Owners** services set forth in this agreement.

SECTION 11: AUTHORITY

By signing this contract, I, ______________________________, certify that I am the **Owner**, or am an authorized agent of the **Owner**, and have the legal right to enter the **System** into a binding agreement with **NWS**.

SECTION 12: PARTIES SIGNATURES

NWS: JPW

OWNER: Pa

CONTRACT FOR MANAGEMENT AND
OPERATION OF A SATELLITE WATER SYSTEM
COMMUNITY WATER SYSTEM
CONTRACT # 12011702

SUBSECTION A: NWS

Signature

Jon Wiley
Print Name

President/CEO
Title

01/31/2012
Date

SUBSECTION B: LAKE LIMERICK WATER

Phyllis M. Antonsen
Signature

PHYLLIS ANTONSEN
Print Name (Primary Contact)

WATER COMMITTEE CHAIR
Title

01-31-12
Date

Sheila M. Hedlund

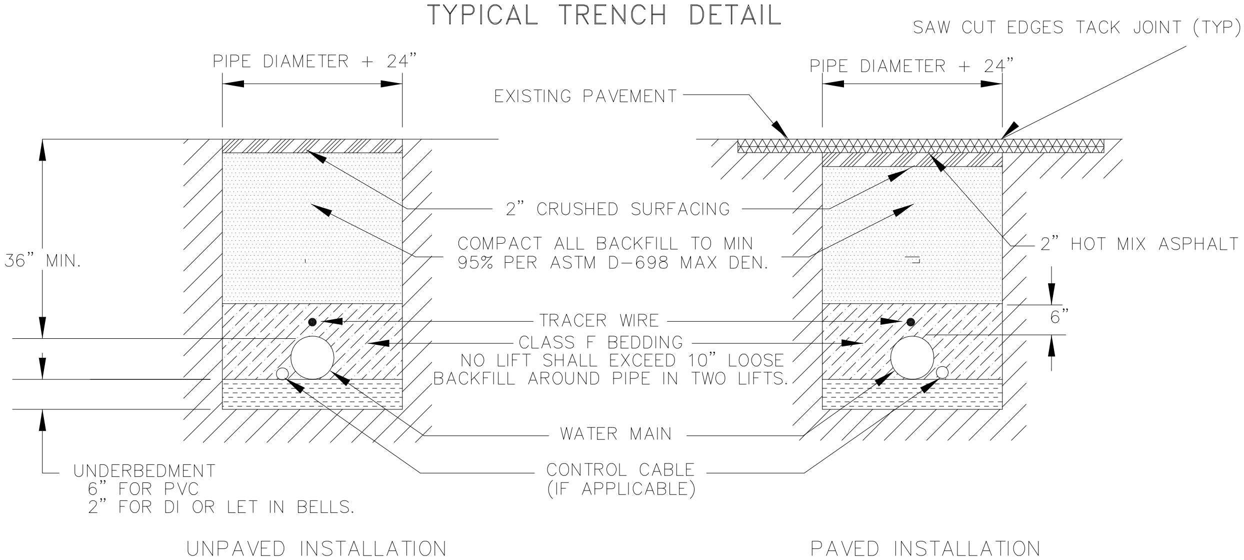
Sheila M. Hedlund

General Manager

1-31-12

Appendix 10.20
Construction Standards

TYPICAL TRENCH DETAIL



WATER MAINS SHALL BE NSF61 CERTIFIED. WATER MAINS LESS THAN 4-IN NOMINAL DIAMETER SHALL BE SCHED. 40 PVC OR BETTER;
WATER MAINS 4-IN NOMINAL DIAMETER AND GREATER SHALL BE DR18 C900 PVC OR BETTER.
IT IS REQUIRED FOR THE CONTRACTOR TO CALL FOR UTILITY LOCATES BEFORE DIGGING, PER RCW. TRACER WIRE SHALL BE TAPED TO WATER MAIN.
DISTRIBUTION SYSTEM SHALL BE DISINFECTED PRIOR TO PLACING IN SERVICE
DISTRIBUTION SYSTEM SHALL BE PRESSURE TESTED IAW DESIGNER'S SPECIFICATIONS PRIOR TO BACKFILLING
ANY TRENCH OVER 4' IN DEPTH SHALL HAVE CAVE IN PROTECTION AS REQUIRED IN CHAPTER 49.17 RCW

WATER MAIN DISINFECTION

STERILIZATION OF THE WATER MAINS SHALL BE ACCOMPLISHED BY THE SYSTEM INSTALLER IN ACCORDANCE WITH THE REQUIREMENTS OF THE HEALTH DISTRICT AND THE WASHINGTON STATE DEPARTMENT OF HEALTH.

DURING CONSTRUCTION, CALCIUM HYPOCHLORITE GRANULES SHALL BE PLACED AT THE UPSTREAM END OF EACH LENGTH OF PIPE LAID SUCH THAT, UPON FILLING THE MAIN , THE INITIAL CONCENTRATION OF CHLORINE WILL BE 50 MG/L. THIS EQUATES TO 1/4 TEASPOON OF 65% HIGH TEST CALCIUM HYPOCHLORITE PER 20 FT OF 2" PIPE, 1 TEASPOON/20FT OF 4" PIPE, 2 TEASPOONS/20FT OF 6" PIPE, AND 4 TEASPOONS/20FT OF 8" PIPE.

WHEN INSTALLATION IS COMPLETE, THE MAINS SHALL BE FILLED SLOWLY WITH WATER SUCH THAT THE MAXIMUM VELOCITY OF FLOW SHALL BE LESS THAN 1 FPS. ALL AIR POCKETS SHALL BE BLED FROM THE SYSTEM DURING THE FILLING PROCESS, AND ALL VALVES SHALL BE OPERATED. FOLLOWING A 24-HOUR SOAKING PERIOD, THE SYSTEM SHALL BE FLUSHED UNTIL NO TRACE OF CHLORINE REMAINS.

ALTERNATIVELY, PROVISIONS MAY BE MADE IN THE CONSTRUCTION OF THE SYSTEM TO ALLOW FOR EFFICIENT INTRODUCTION OF CHLORINE INTO THE MAINS FOLLOWING CONSTRUCTION TO A CONCENTRATION OF 50 MG/L.

A REPRESENTATIVE OF NORTHWEST WATER SYSTEMS, INC. MUST BE ON-SITE DURING THE INITIAL FLUSHING OF THE SYSTEM AND DURING THE FLUSHING OF THE MAINS AFTER THE SOAKING PERIOD. FOLLOWING THE FLUSHING, A BACTERIOLOGICAL SAMPLE WILL BE TAKEN AND SUBMITTED FOR TESTING. THE SYSTEM MUST PASS BACTERIOLOGICAL TESTING BEFORE IT CAN BE PLACED INTO SERVICE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT NORTHWEST WATER SYSTEMS, INC. 24 HOURS PRIOR TO INITIAL FILLING OF THE SYSTEM.

HYDROSTATIC TESTING

ALL WATER MAIN INSTALLATIONS SHALL BE INSPECTED AND APPROVED BY NORTHWEST WATER SYSTEMS, INC. NO NEW PIPE OR PIPE EXTENSIONS SHALL BE PUT INTO SERVICE OR CONNECTED TO AN EXISTING WATER SYSTEM WITHOUT A STATE DEPARTMENT OF HEALTH APPROVED BACKFLOW PREVENTER INSTALLED IN THE CONNECTING LINE.

ALL WATER MAIN AND EQUIPMENT INSTALLATIONS SHALL BE HYDROSTATIC AND LEAK TESTED. SUCH TESTING SHALL BE WITNESSED BY NORTHWEST WATER SYSTEMS, INC. ALL WATER MAIN JOINTS MUST BE EXPOSED TO VIEW AND BACKFILL MATERIAL MUST BE ON-SITE AT THE TIME OF THE TEST. ALL THRUST BLOCKING, IF REQUIRED, SHALL BE POURED-IN-PLACE OF TYPE 1 PORTLAND CEMENT. BLOCKING SHALL CURE AT LEAST SEVEN DAYS BEFORE TESTING. THE PRESSURE GAUGE USED IN THE PERFORMANCE OF SUCH TESTS SHALL HAVE MINIMUM DIVISIONS OF 5 PSI.

THE MAINS SHALL BE FILLED SLOWLY (NOT MORE THAN 2 FPS WATER VELOCITY IF USING 50PPM CHLORINATED WATER, 1FPS IF POWDERED CHLORINE WAS ADDED TO EACH PIPE) AND TRAPPED AIR COMPLETELY VENTED THROUGH AIR VENTS OR SERVICES.

AFTER COMPLETELY FILLING THE PIPE WITH WATER IT SHALL BE SUBJECTED TO A HYDROSTATIC TEST PROCEDURE AS FOLLOWS:

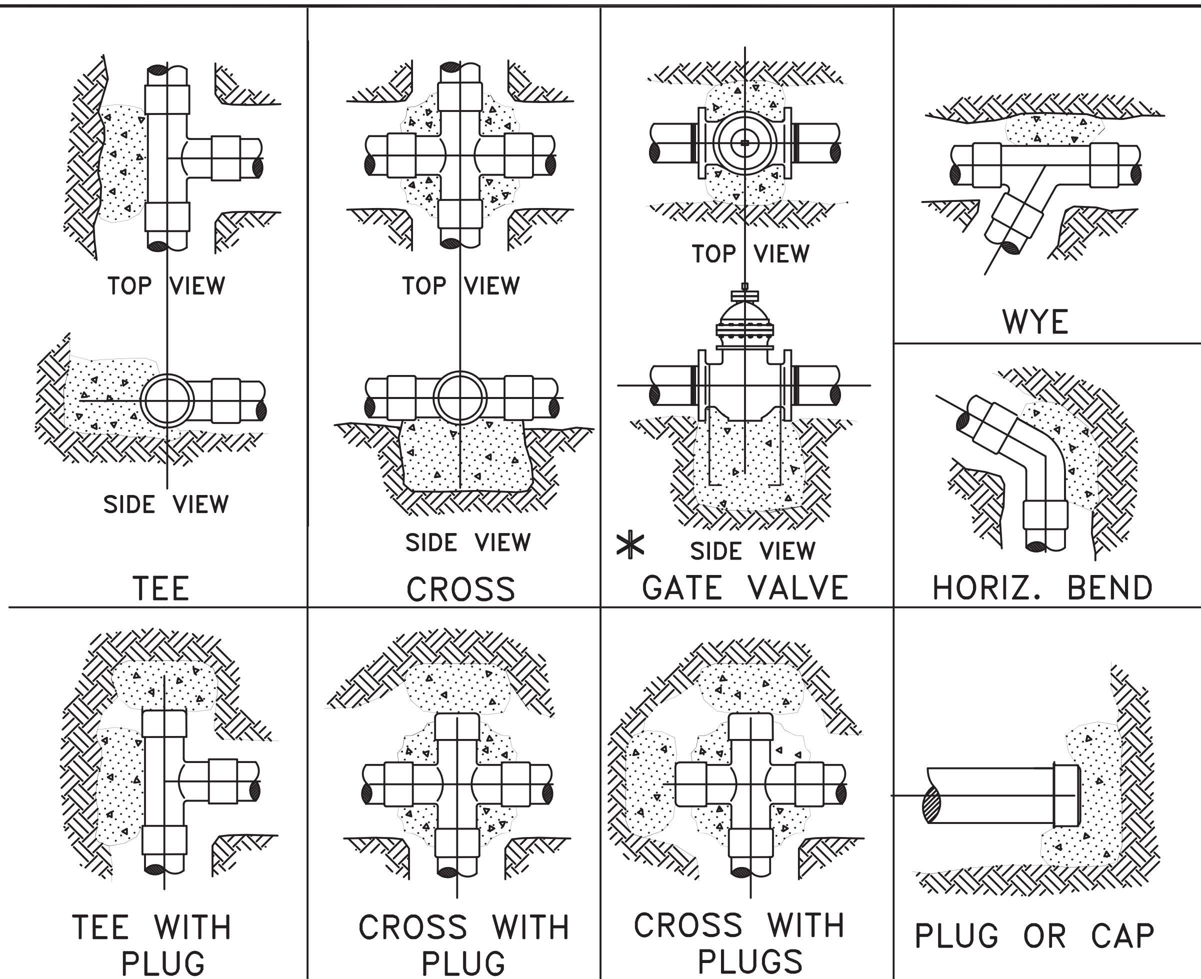
FOR PVC AND DUCTILE IRON PIPE TEST PRESSURE SHALL BE 200 PSI, UNLESS THE ENGINEER DETERMINES BASED ON SITE CONDITIONS THAT A LOWER PRESSURE IS APPROPRIATE. PRESSURE SHALL NOT IN ANY CASE BE LESS THAN 150% OF THE WORKING PRESSURE AT THE LOWEST ELEVATION POINT OF THE SEGMENT TESTED. COMPONENTS NOT COMPATIBLE WITH THE TEST OVERPRESSURE (PRESSURE RELIEF VALVES, HYDROPNEUMATIC TANKS, ETC.) MAY BE ISOLATED FROM THE SECTION UNDER TEST. THE TEST PRESSURE SHALL BE APPLIED BY PUMPING AND THE PRESSURE MAINTAINED FOR TWO HOURS. PRESSURE LOSS MAY NOT EXCEED 5 PSI ONCE THE PIPE HAS BEEN FILLED WITH WATER AND AIR EXPELLED; ADDITIONAL PUMPING MAY BE PERFORMED AS REQUIRED TO MAINTAIN THE TEST PRESSURE. LEAKAGE IS DEFINED BY THE VOLUME OF WATER REQUIRED TO MAINTAIN PRESSURE. ALLOWABLE LEAKAGE CAN BE CALCULATED PER AWWA C600-93 AS:

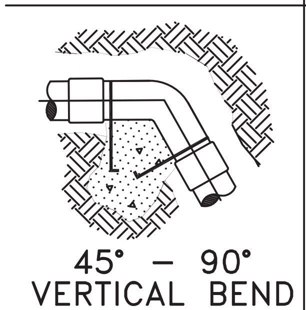
L=S*D*[SQRT(P)] / 133,200

WHERE L IS THE ALLOWABLE LEAKAGE IN GALLONS PER HOUR, S IS THE LENGTH OF PIPE IN FEET, D IS THE NOMINAL DIAMETER OF THE PIPE IN INCHES, AND P IS THE AVERAGE TEST PRESSURE (PSI).

FOR HDPE PIPING, THE MODIFIED PRESSURE REBOUND METHOD SHALL BE USED PER ASTM F2164. HDPE SHALL BE TESTED AT THE LESSER OF 150% OF DESIGN WORKING PRESSURE, OR THE PRESSURE RATING OF THE LOWEST PRESSURE RATED COMPONENT EXPOSED TO TEST PRESSURE. THE TEST SECTION SHALL BE PRESSURIZED FOR 2 HOURS TO ALLOW FOR EXPANSION; PRESSURE SHALL THEN BE REDUCED BY 10 PSI AND OBSERVED FOR 1 HOUR; SUCCESSFUL TESTING REQUIRES LESS THAN 5% VARIATION IN PRESSURE. HDPE SHALL NOT BE SUBJECT TO PRESSURES ABOVE DESIGN PRESSURE FOR MORE THAN 8 CONTINUOUS HOURS; AFTER DEPRESSURIZING, A MINIMUM 8 HOURS SHALL BE ALLOWED FOR RELAXATION PRIOR TO RETESTING.

DURING THE TEST, THE SECTION BEING TESTED SHALL BE INSPECTED FOR LEAKAGE. NO WATER SYSTEM FACILITY SHALL BE PLACED IN SERVICE WITHOUT A PROPER CERTIFICATE OF COMPLETION EXECUTED BY THE DESIGNER.





NOTES:

1. *CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.*
2. *PLASTIC BARRIER SHALL BE PLACED BE– TWEEN ALL THRUST BLOCKS & FITTINGS.*
3. *ANCHOR REBAR SHALL BE #5 ON 12" DIA. AND LESS WITH 30" IMBEDMENT, #5 ON 16"–24" DIAMETER WITH 36" IMBEDMENT.*
4. *PLUGS TO BE MINIMUM OF 5' FROM TEE, WYE, CROSS ON VALVE.*

* *IF IN THE OPINION OF THE ENGINEER THE VALVE IS ON A SLOPE AND/OR THE COVER ON THE PIPE WOULD APPLY UPWARD THRUST, THEN THRUST BLOCKING WILL BE REQUIRED.*

RESTRAINT BLOCKING		
FILE NO. DETAILS	FILE NAME THRUST	SHEET NO.
DATE 12/30/99	SCALE NO SCALE	

NORTHWEST WATER SYSTEMS
DESIGN–CONSULTING–MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958

THRUST LOADS

THRUST AT FITTINGS IN POUNDS AT 200 POUNDS PER SQUARE INCH OF WATER PRESSURE

PIPE DIAMETER	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND	DEAD END OR TEE
4"	3,600	2,000	1,000	500	2,600
6"	8,000	4,400	2,300	1,200	5,700
8"	14,300	7,700	4,000	2,000	10,100
10"	22,300	12,100	6,200	3,100	15,800
12"	32,000	17,400	8,900	4,500	22,700
14"	43,600	23,600	12,100	6,100	30,800
16"	57,000	30,800	15,700	7,900	40,300

NOTES:

1. BLOCKING SHALL BE CEMENT CONCRETE CLASS "B" POURED IN PLACE AGAINST UNDISTURBED EARTH. FITTING SHALL BE ISOLATED FROM CONCRETE THRUST BLOCK WITH PLASTIC OR SIMILAR MATERIAL.
2. TO DETERMINE THE BEARING AREA OF THE THRUST BLOCK IN SQUARE FEET (S.F.):

   EXAMPLE: 12" – 90° BEND IN SAND AND GRAVEL
   32,000 LBS ÷ 3000 LB/S.F. = 10.7 S.F. OF AREA
3. AREAS MUST BE ADJUSTED FOR OTHER PIPE SIZE, PRESSURES AND SOIL CONDITIONS.
4. BLOCKING SHALL BE ADEQUATE TO WITHSTAND FULL TEST PRESSURE AS WELL AS TO CONTINUOUSLY WITHSTAND OPERATING PRESSURE UNDER ALL CONDITIONS OF SERVICE.

SAFE SOIL BEARING LOADS

FOR HORIZONTAL THRUSTS WHEN THE DEPTH OF COVER OVER THE PIPE EXCEEDS 2 FEET

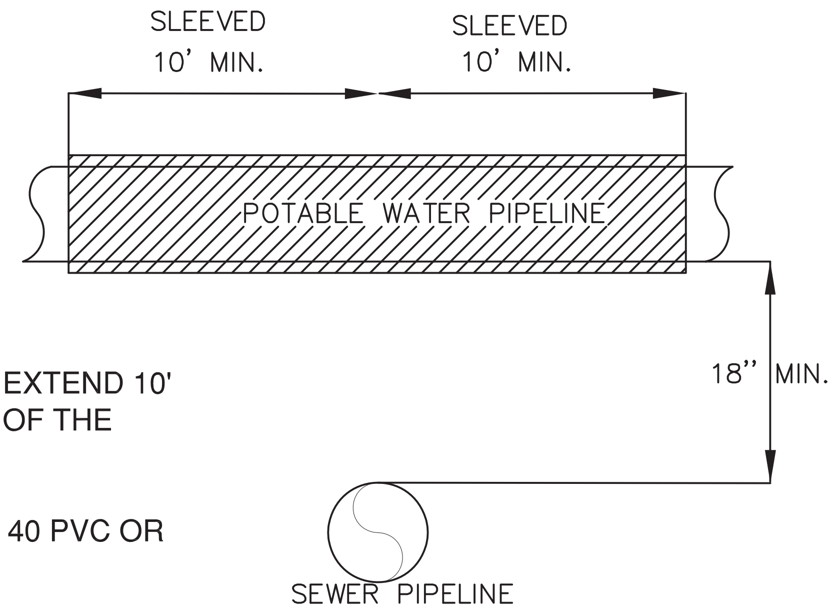
SOIL	POUNDS PER SQUARE FOOT
MUCK, PEAT	0
SOFT CLAY	1,000
SAND	2,000
SAND & GRAVEL	3,000
SAND & GRAVEL CEMENTED WITH CLAY	4,000
HARD SHALE	10,000

RESTRAINT BLOCKING		
FILE NO. DETAILS	FILE NAME THRUST	SHEET NO.
DATE 12/30/99	SCALE NO SCALE	

NORTHWEST WATER SYSTEMS
DESIGN–CONSULTING–MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876-0958

SEWER CROSSING DETAIL

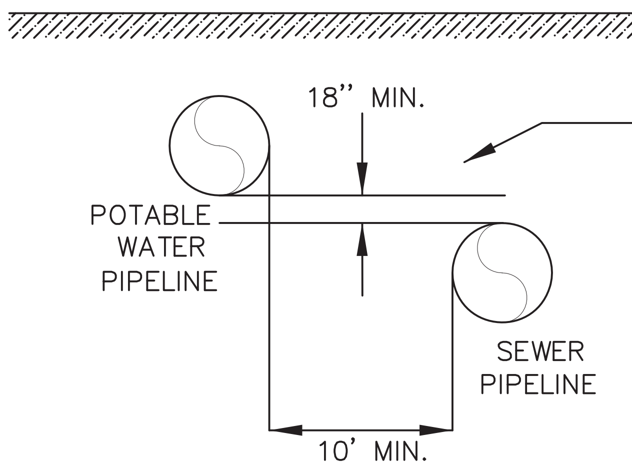
PERPENDICULAR SEPARATION



PIPE SLEEVE SHALL EXTEND 10' BEYOND EACH SIDE OF THE CROSSING.

PIPE SLEEVE IS SCH 40 PVC OR BETTER.

PARALLEL SEPARATION



IF HORIZONTAL SEPARATION IS GREATER THAN 10', MINIMUM VERTICAL SEPARATION OF 18" IS NOT REQUIRED.

PERPENDICULAR SEPARATION SHOULD BE AS CLOSE TO 90 DEGREES AS POSSIBLE.

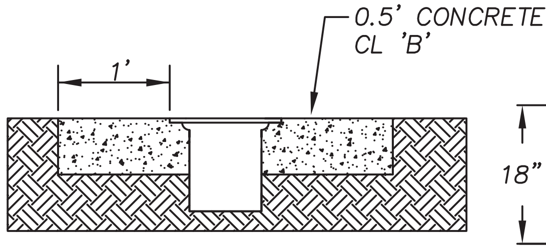
IF THE VERTICAL SEPARATION IS LESS THAN 18", OR THE SEWER LINE MUST CROSS UNDER THE POTABLE WATER LINE, THE POTABLE LINE MUST BE CASED AS ABOVE.

IF HORIZONTAL DISTANCE IS LESS THAN 10', SEWER MAY BE LAID IN SEPARATE TRENCH. CHECK WITH LOCAL GOVERNMENT STANDARDS FOR CONSISTENCY.

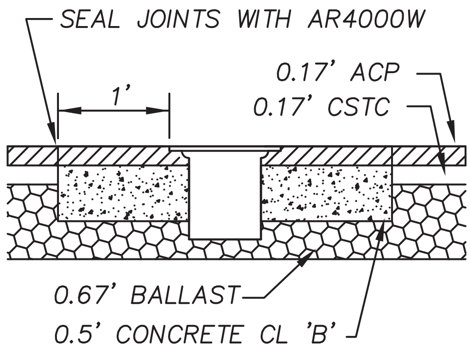
IF OUTSIDE CONFIGURATION AS SHOWN, CONTACT ENGINEER FOR APPROVAL.

TITLE			
SEWER CROSSING DETAIL			
FILE NO. DETAILS	FILE NAME SEWER		SHEET NO. OF
DATE 2016		SCALE NO SCALE	

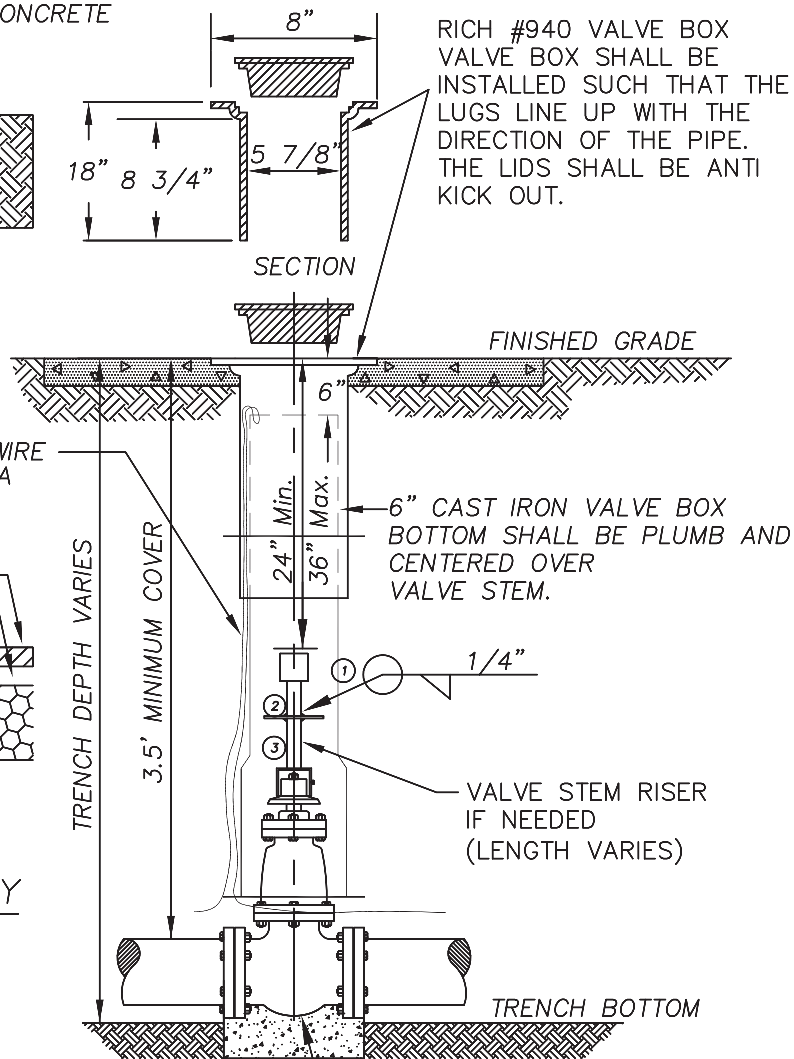
NORTHWEST WATER SYSTEMS
DESIGN–CONSULTING–MANAGEMENT
P.O. BOX 123
PORT ORCHARD, WA 98366
(360) 876–0958



OUTSIDE PAVED AREA



INSIDE PAVED ROADWAY



NOTE:

ALL VALVES SHALL HAVE 14 GAUGE COATED COPPER TRACER WIRE TIED OFF AT VALVE BODY, EXTENDING TO THREE FEET ABOVE TOP OF VALVE BOX BOTTOM BETWEEN VALVE BOX BOTTOM AND VALVE BOX LID.

EQUIVALENT MATERIALS AND EQUIPMENT MAY BE SUBSTITUTED WITH ENGINEER'S APPROVAL

VALVE STEM EXTENSION LEGEND

1. VALVE OPERATING NUT OR 1 7/8" X 1 7/8" X 2" HIGH GRADE STEEL WELDED TO GUIDE PLATE.
2. 3/16" THICK X 5 1/5" DIA STEEL GUIDE PLATE WELDED TO RISER SHAFT.
3. 2"X2"X 3/16" SQUARE STRUCTURAL STEEL TUBING TO FIT OPERATING NUT. LENGTH AS REQUIRED.

NOTE:

WELD ALL AROUND, AS SPECIFIED ABOVE

WATER SYSTEM		
FILE NO. DETAILS	FILE NAME GVALVE	SHEET NO. 1 OF 1
DATE SEPTEMBER 22, 2014	SCALE NO SCALE	

NORTHWEST WATER SYSTEMS
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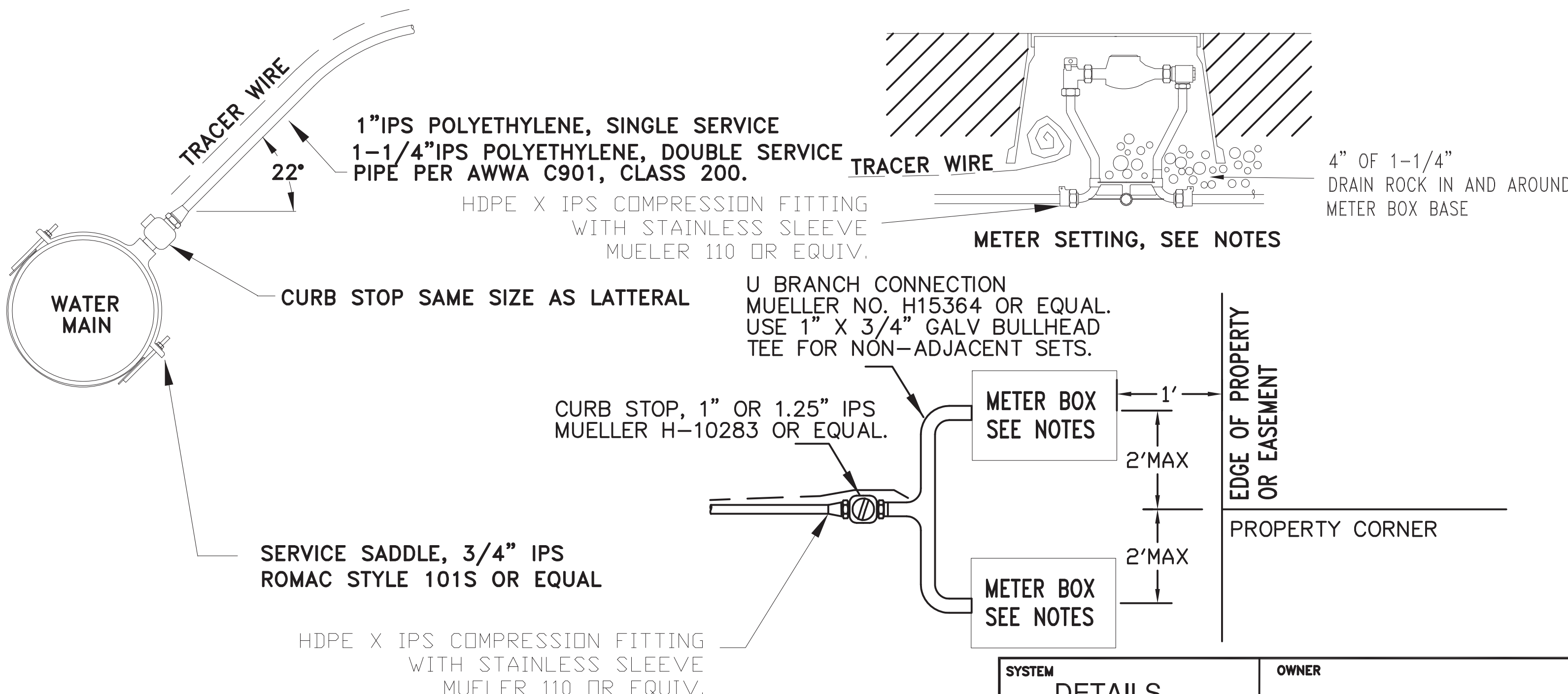
1. METER CONFORMING TO AWWA C700, FROST PROOF MODEL WITH MAGNETICALLY DRIVEN REGISTER & STRAIGHT READING REGISTERS MEASURING IN CU. FT. BADGER M25, OR EQUAL.
2. METER SETTING – 12" COPPER METER SETTER INCLUDING METER VALVE WITH LOCKWING AND OUTLET CHECK VALVE. MUELLER OR EQUAL.
3. METER BOX – PARKING STRIP INSTALLATION
   PRECAST CONCRETE AND STEEL LID, FOG TITE METER SEAL CO 1D OR EQUAL.
4. METER BOX – OFF ROAD INSTALLATION
   PLASTIC BOX WITH READER LID COVER, CARSON 1419–15 OR EQUAL.
5. INSTALL METER IN EASEMENT RIGHT OF WAY ADJACENT TO PROPERTY LINE.
6. SET METER HORIZONTALLY IN BOTH AXES WITH METER PORTS 5–7" BELOW GRADE.
7. SET METER BOX WITH LID AT GRADE (IN TRAFFIC) OR 2" ABOVE GRADE (NON–TRAFFIC) LEVEL AND READER PORT CENTERED OVER METER DIAL.
8. INSTALL COPPER TRACER WIRE IN TRENCH BESIDE POLYETHYLENE PIPE. PROVIDE 36" EXCESS LENGTH ON METER BOX. ELECTRICALLY BOND THE END OF TRACER WIRE TO MAIN LINE TRACER WIRE USING SPLIT NUT CONNECTION.
9. INSTALL PRESSURE REGULATOR WHERE PRESSURE EXCEEDS 80 PSI (recommended) AND 100 PSI (REQUIRED). 3/4" WILKENS 70SC OR EQUAL.
10. SCH 80 PVC TEE MAY BE SUBSTITUTED FOR SADDLE ON 2" WATER MAIN



SERVICE CONNECTION DETAIL

SYSTEM DETAILS	OWNER	
FILE NO. DETAILS	FILE NAME SVC METER	SHEET NO.
DATE SEPTEMBER 2013	SCALE NTS	

NORTHWEST WATER SYSTEMS
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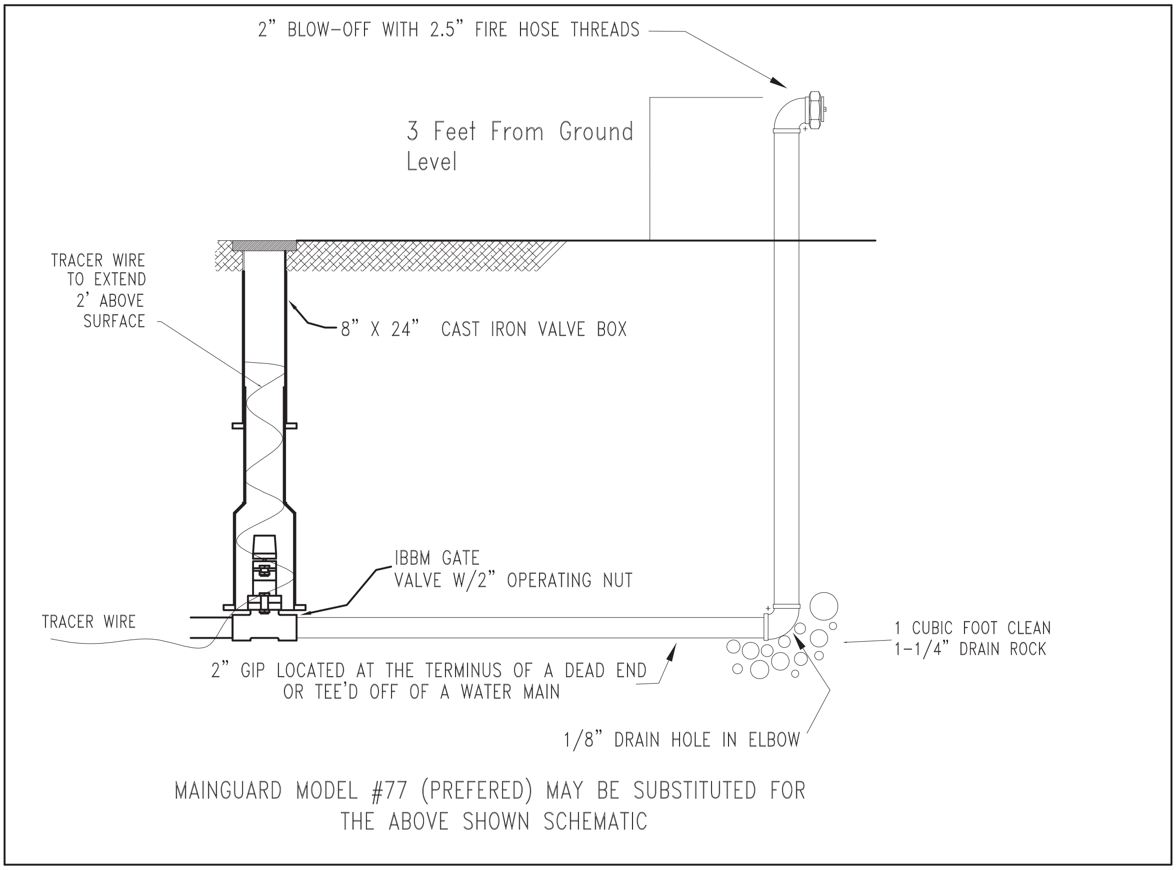
2" BLOWOFF STANDARD DETAIL



NORTHWEST WATER SYSTEMS, INC.

DESIGN - CONSULTING - MANAGEMENT

P.O. BOX 123

PORT ORCHARD, WA 98366

(360) 876-0958

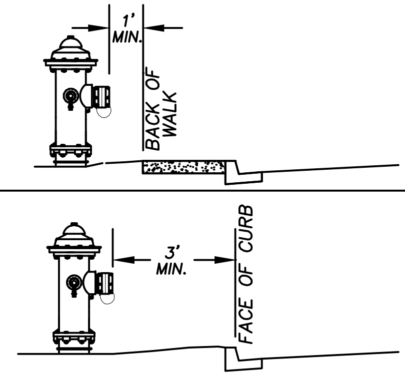
NWWATERSYSTEMS.COM

NOTES

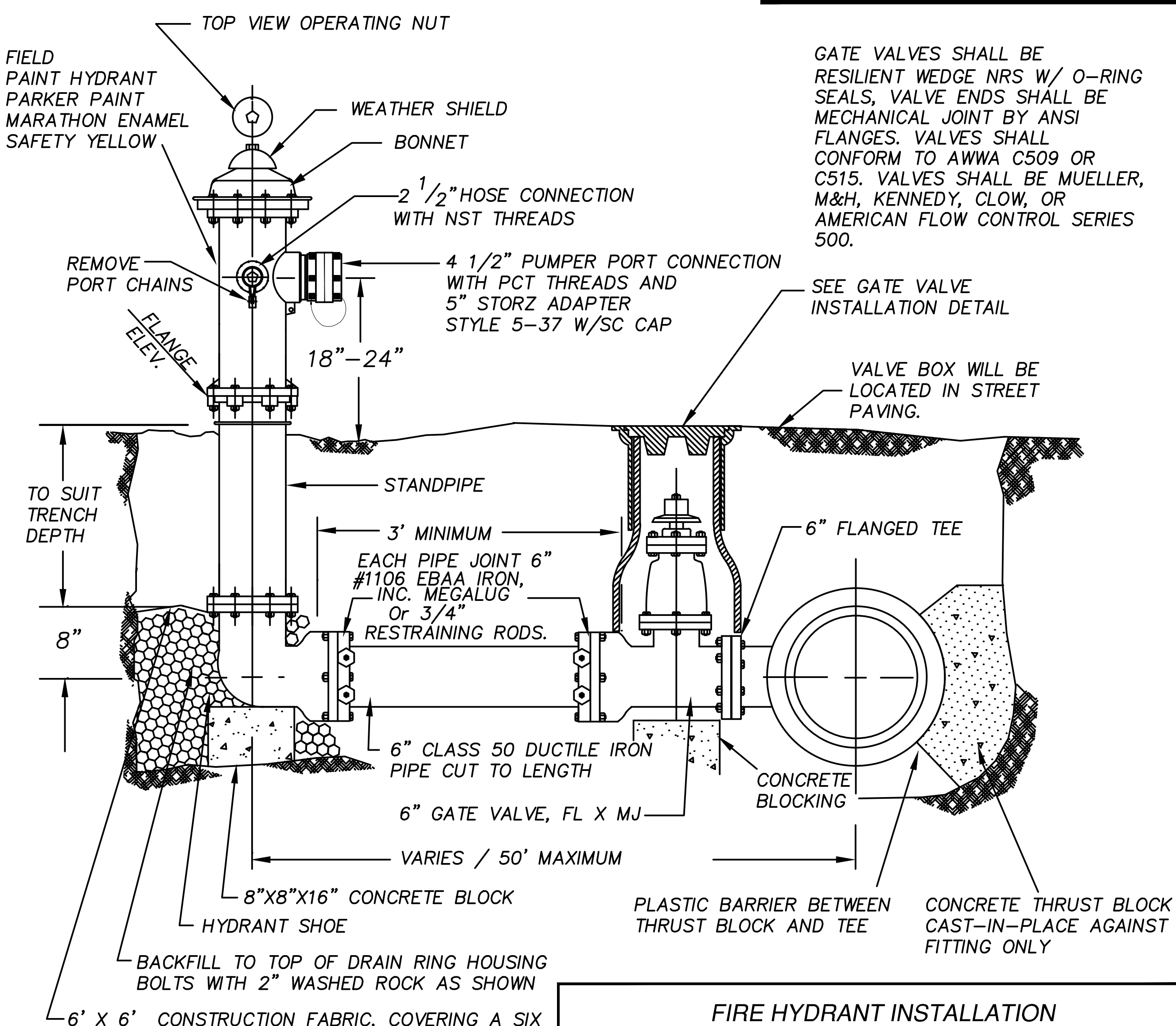
1. HYDRANTS SHALL BE LOCATED WITH A MINIMUM THREE FOOT RADIUS UNOBSTRUCTED WORKING AREA PROVIDED AROUND ALL HYDRANTS, AND IN NO CASE SHALL BE LOCATED IN SIDEWALK.

2. WHEN R/W IS NOT ADEQUATE, A MINIMUM 5' EASEMENT IS REQUIRED ON ALL SIDES OF THE HYDRANT.

3. HYDRANT SHALL BE DRESSER M & H RELIANT STYLE 929, MUELLER CENTURION, OR CLOW MEDALLION.



HYDRANT OFFSET



FIRE HYDRANT INSTALLATION

FILE NO.	FILE NAME	SHEET NO.
DETAILS	HYDRANT	

DATE	SCALE
OCTOBER 15, 2013	NTS

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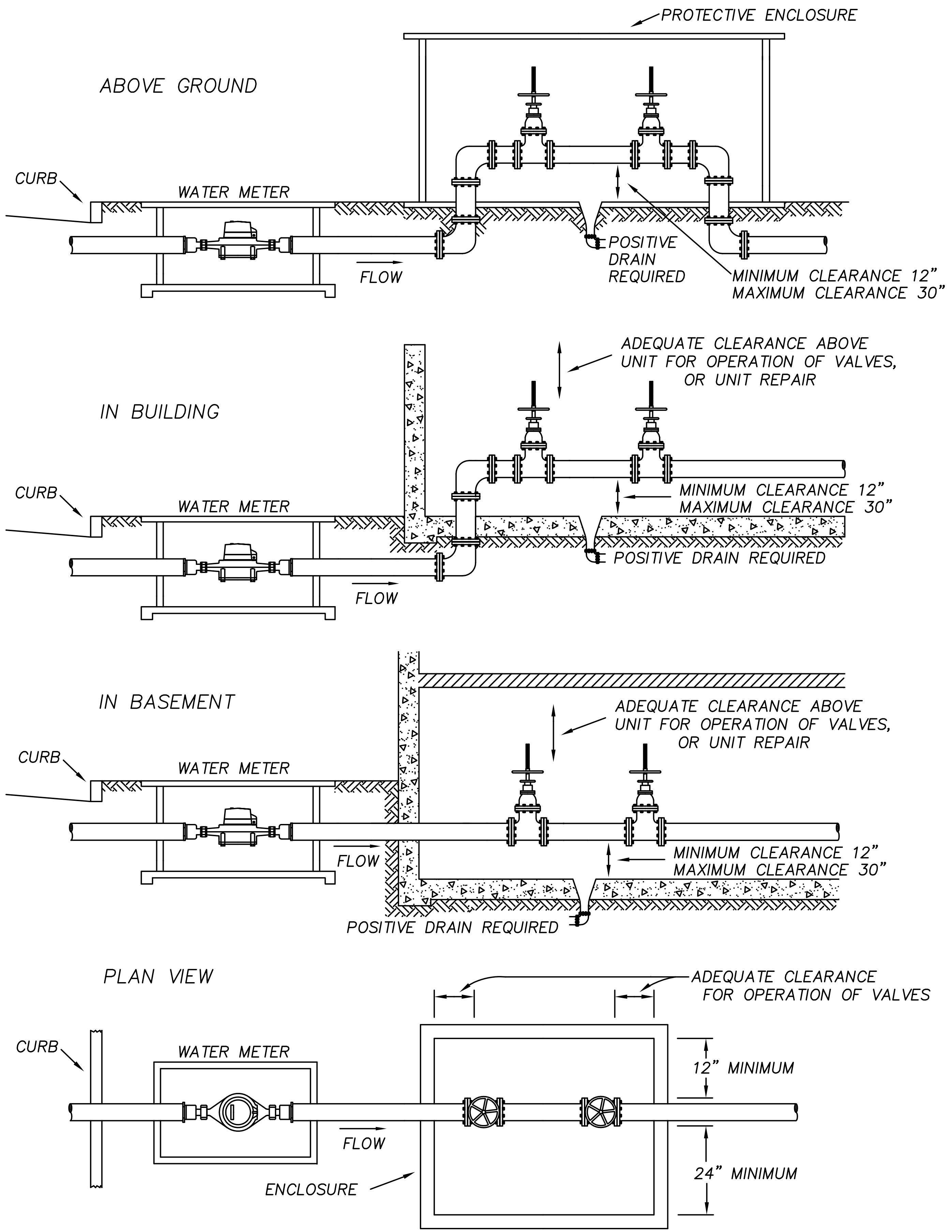
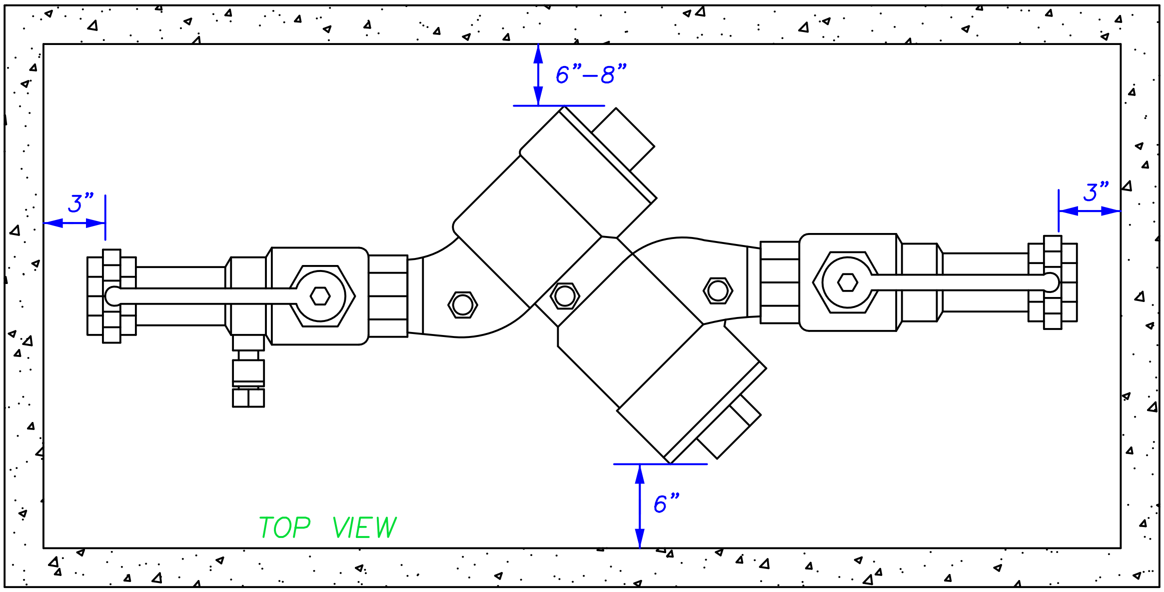
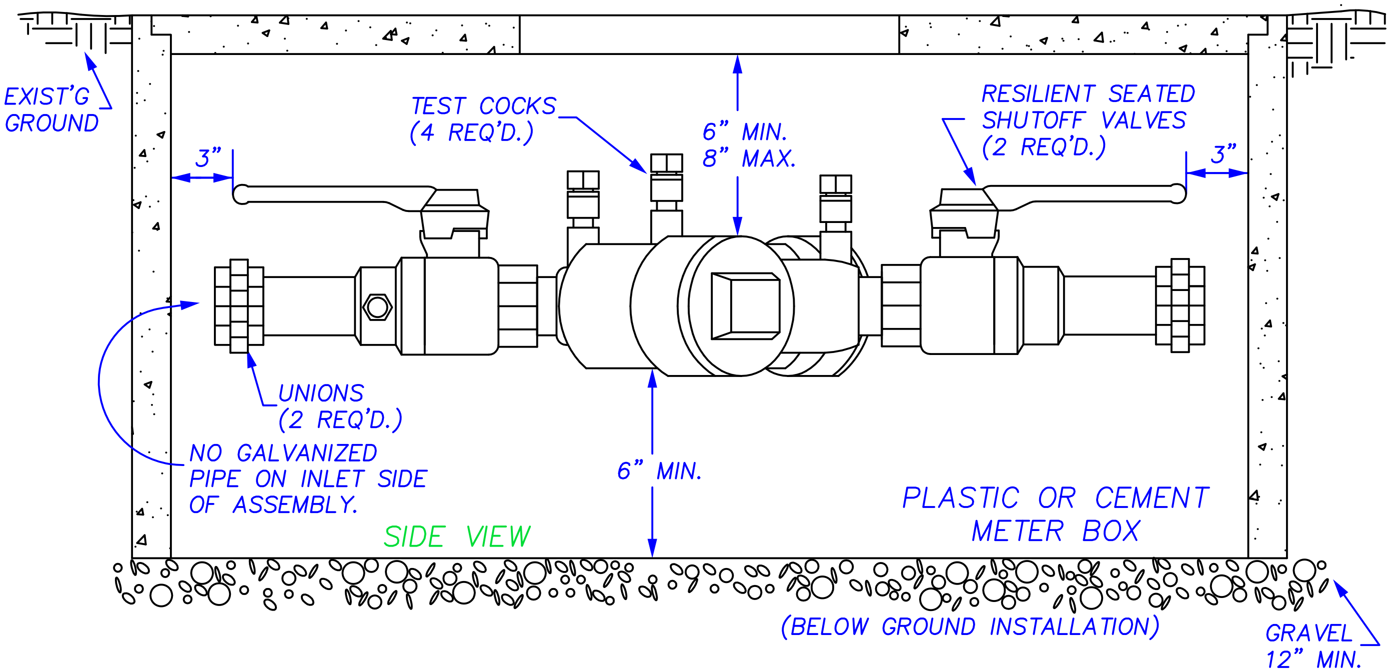


ALL INITIALIZATIONS SHALL HAVE 4" DRAIN TO DAYLIGHT. MIN. SLOPE 2%, SCREEN BOTH ENDS (24-MESH SS).

REVISED DATE	NORTHWEST WATER SYSTEMS	JOB NUMBER
1/15/18	TYPICAL INSTALLATIONS WITH MINIMUM CLEARANCES BACKFLOW PREVENTION DEVICE ASSEMBLIES	DETAIL

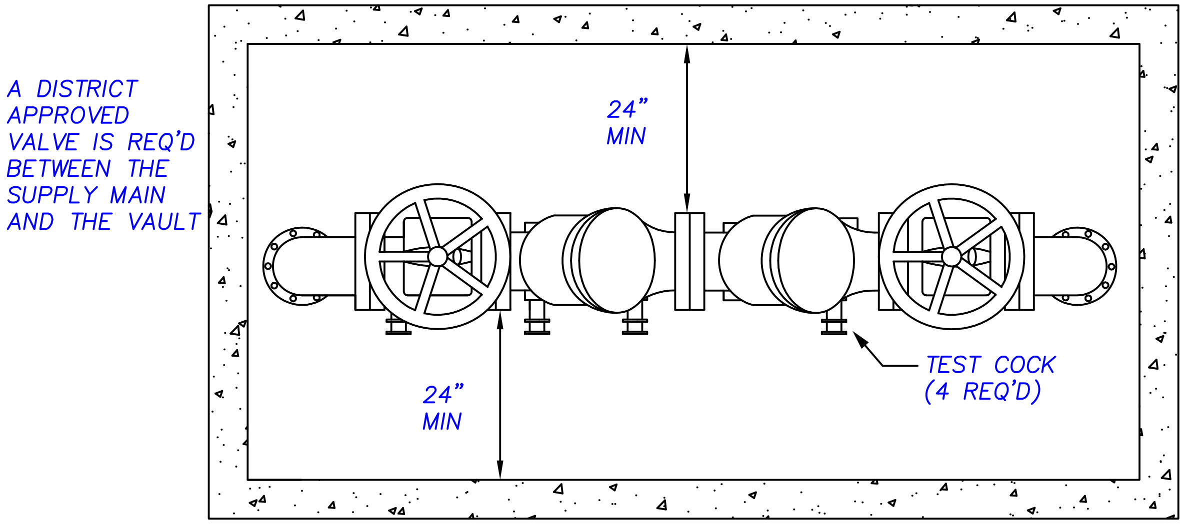




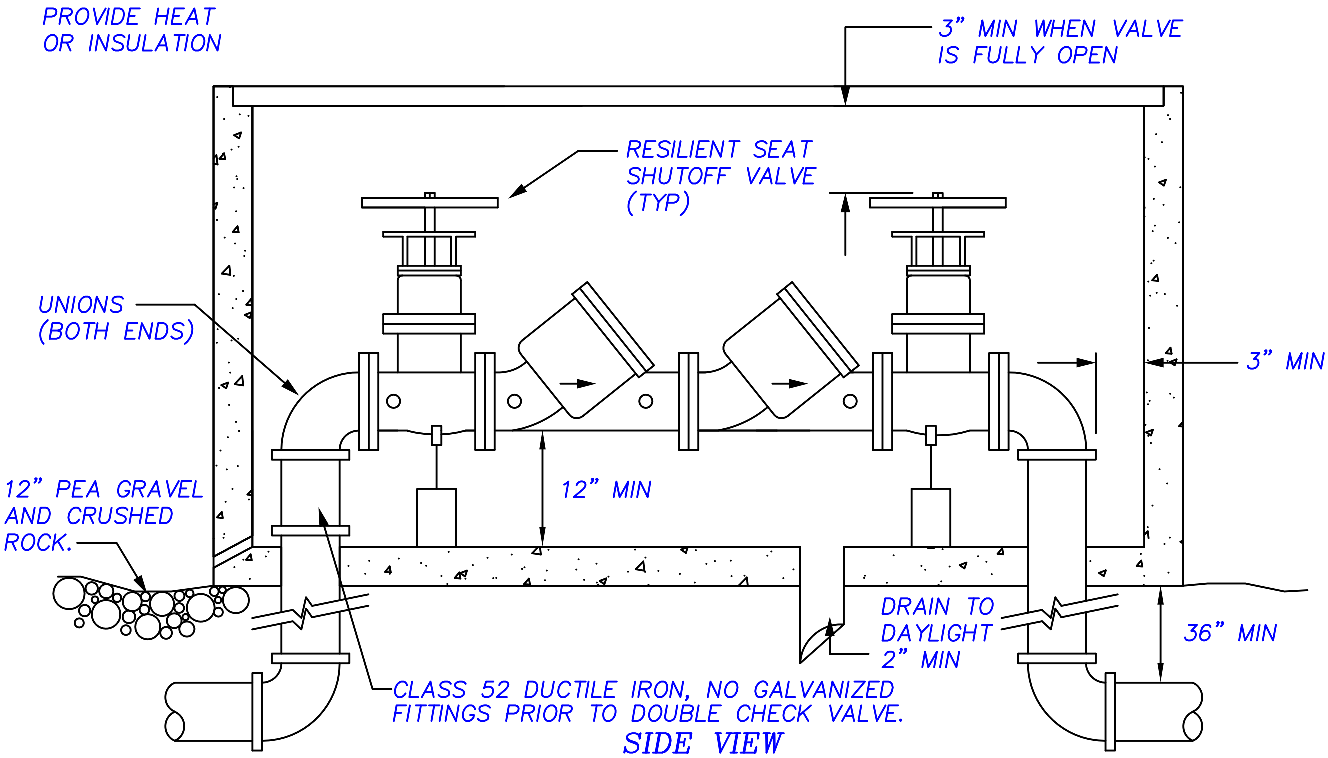
NOTE: ALL ITEMS SHALL COMPLY WITH THE FOLLOWING.

- APPROVED DOUBLE CHECK VALVE ASSEMBLY SHALL LAY HORIZONTAL WITH GROUND.
- DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE.
- THOROUGHLY FLUSH LINES PRIOR TO INSTALLATION OF BACK FLOW PREVENTER
- NO GALVANIZED PIPE BEFORE ASSEMBLY
- THE DCVA MAY BE INSTALLED ABOVE OR BELOW THE GROUND PROVIDED ALL CLEARANCES ARE MET.
- DO NOT INSTALL IN AN AREA SUBJECT TO FLOODING.
- VALVE SHALL BE PROTECTED FROM FREEZING CONDITIONS.
- THE BACK FLOW ASSEMBLY SHALL BE A CURRENT WASHINGTON STATE DEPARTMENT HEALTH APPROVED MODEL.
- A PLUMBING PERMIT IS REQUIRED.

REVISED DATE	NORTHWEST WATER SYSTEMS	JOB NUMBER
1/15/18	DOUBLE CHECK VALVE ASSEMBLY 2" & SMALLER	DETAIL



TOP VIEW



SIDE VIEW

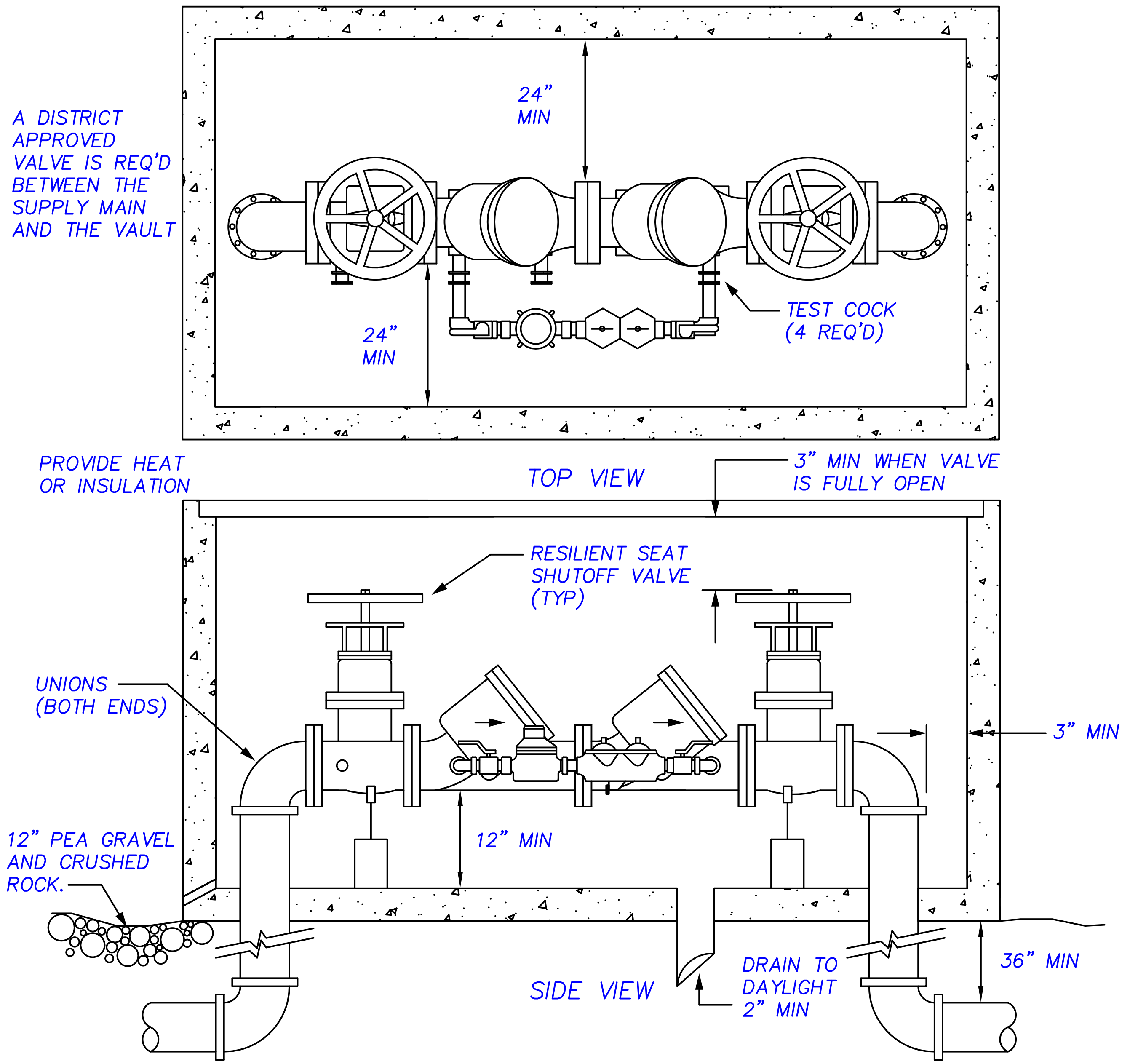
NOTE: ALL ITEMS SHALL COMPLY WITH THE FOLLOWING

- DOUBLE CHECK VALVE ASSEMBLY SHALL BE A WASHINGTON STATE DEPT. OF HEALTH APPROVED MODEL.
- BACK FLOW ASSEMBLY SHALL BE AN APPROVED MODEL W/4 TEST COCKS AND A RESILIENT SEATED SHUT OFF VALVE MOUNTED AT EACH END.
- THE WATER LINE SHALL BE DISINFECTED, FLUSHED, AND PRESSURE TESTED PRIOR TO INSTALLING THE BACK FLOW ASSEMBLY. THE BACK FLOW ASSEMBLY SHALL BE PROTECTED FROM FREEZING AND FLOODING.
- THE BACK FLOW ASSEMBLY SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE AND ALSO YEARLY THEREAFTER BY A CERTIFIED BACK FLOW ASSEMBLY TESTER OR CITY OF DISTRICT CROSS CONNECTION SPECIALIST. TEST RESULTS SHALL BE SENT TO THE DISTRICT AND MAINTAINED IN RECORDS.
- ALL PIPE VALVE AND FITTING JOINTS, FROM THE SUPPLY MAIN, SHALL BE FLANGED AND RESTRAINED.
- FIRE DEPT. CONNECTION SHALL NOT EXIT THROUGH THE TOP OF THE VAULT.
- GROUT PIPE ENTRANCE AND EXIT, IN VAULT, WITH WATERTIGHT GROUT.
- ALL VAULTS SHALL BE PRE APPROVED PRIOR TO INSTALLATION.
- VAULTS SHALL BE INSTALLED AT PROPERTY LINE OR EASEMENT LINE AND ON OWNERS PROPERTY.
- VAULTS SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
- FIRE SERVICES REQUIRE DETECTOR TYPE BACK FLOW PROTECTION ASSEMBLIES. (ABOVE GROUND INSTALLATION)

NOTE: IF WYE PATTERN– MUST LAY CHECKS HORIZONTAL W/GROUND AND TEST CHECKS FACING UP. 2" AND SMALLER.

VAULTS MUST BE WITHIN 3' OF METER.

REVISED DATE	NORTHWEST WATER SYSTEMS	JOB NUMBER
1/15/18	2" AND LARGER DOUBLE CHECK VALVE ASSEMBLY	DETAIL



NOTE: ALL ITEMS SHALL COMPLY WITH THE FOLLOWING

- DOUBLE CHECK DETECTOR CHECK VALVE ASSEMBLY SHALL BE A WASHINGTON STATE DEPT. OF HEALTH APPROVED MODEL.
- BACK FLOW ASSEMBLY SHALL BE AN APPROVED MODEL W/4 TEST COCKS AND A RESILIENT SEATED SHUT OFF VALVE MOUNTED AT EACH END.
- THE WATER LINE SHALL BE DISINFECTED, FLUSHED, AND PRESSURE TESTED PRIOR TO INSTALLING THE BACK FLOW ASSEMBLY. THE BACK FLOW ASSEMBLY SHALL BE PROTECTED FROM FREEZING AND FLOODING.
- THE BACK FLOW ASSEMBLY SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE AND ALSO YEARLY THEREAFTER BY A CERTIFIED BACK FLOW ASSEMBLY TESTER OR DISTRICT CROSS CONNECTION SPECIALIST. TEST RESULTS SHALL BE SENT TO THE DISTRICT AND MAINTAINED ON RECORD.
- ALL PIPE VALVE AND FITTING JOINTS, FROM THE SUPPLY MAIN, SHALL BE FLANGED AND RESTRAINED.
- FIRE DEPT. CONNECTION SHALL NOT EXIT THROUGH THE TOP OF THE VAULT.
- GROUT PIPE ENTRANCE AND EXIT, IN VAULT, WITH WATERTIGHT GROUT.
- ALL VAULTS SHALL BE PRE-APPROVED PRIOR TO INSTALLATION.
- VAULTS SHALL BE INSTALLED AT PROPERTY LINE OR EASEMENT LINE AND ON OWNERS PROPERTY.
- VAULTS SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
- REQUIRED FOR FIRE SUPPRESSION SYSTEMS.

NOTE: IF WYE PATTERN-MUST LAY CHECKS HORIZONTAL W/GROUND AND TEST CHECKS FACING UP. 2" AND SMALLER.

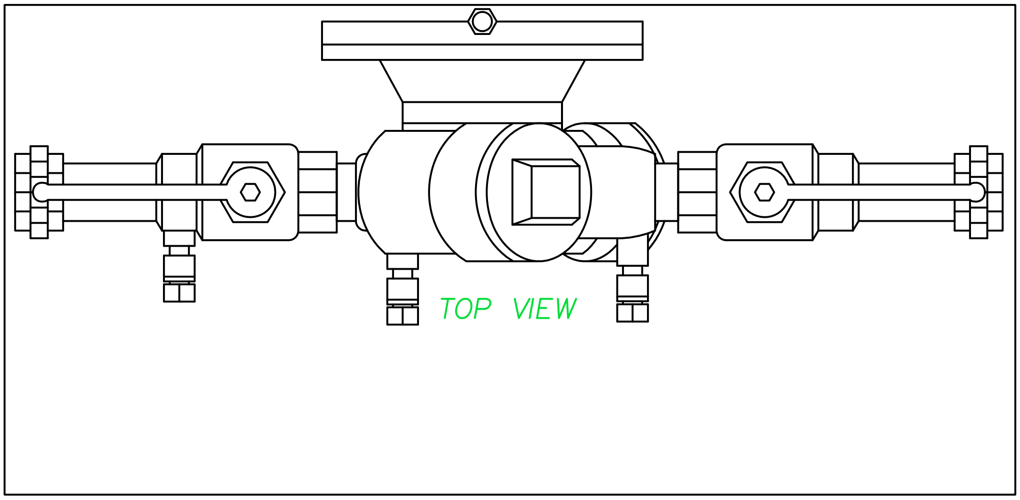
VAULTS MUST BE WITHIN 3' OF METER OR INSTALLED HORIZONTALLY WITHIN THE BUILDING

(ABOVE GROUND INSTALLATION)

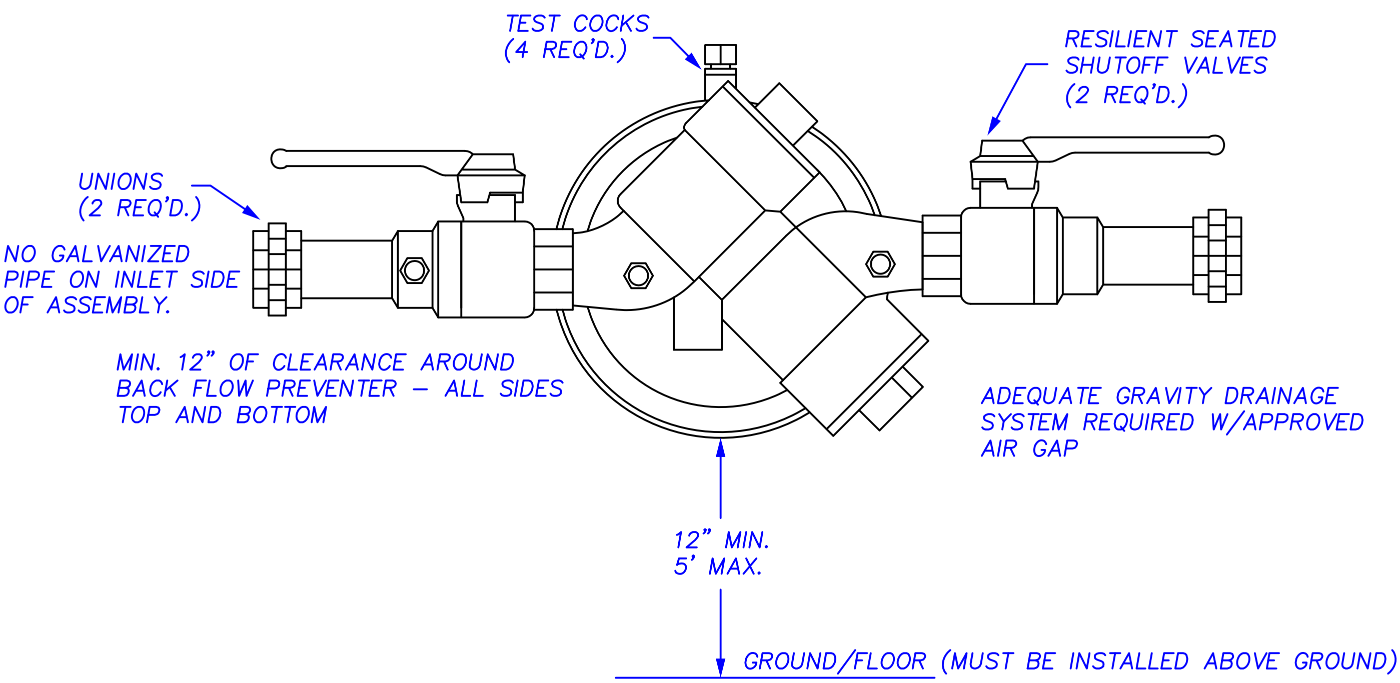
REVISED DATE	NORTHWEST WATER SYSTEMS	JOB NUMBER
1/15/18	DOUBLE CHECK DETECTOR CHECK VALVE ASSEMBLY	DETAIL

A DISTRICT APPROVED VALVE IS REQ'D. BETWEEN THE SUPPLY MAIN AND THE VAULT

PROVIDE HEAT OR REMOVABLE INSULATED ENCLOSURE ON OUTSIDE APPLICATIONS: PRO-BOX, HOT BOX OR EQUAL INSULATED ENCLOSURES.



TOP VIEW



SIDE VIEW

NOTE: ALL ITEMS SHALL COMPLY WITH THE FOLLOWING.

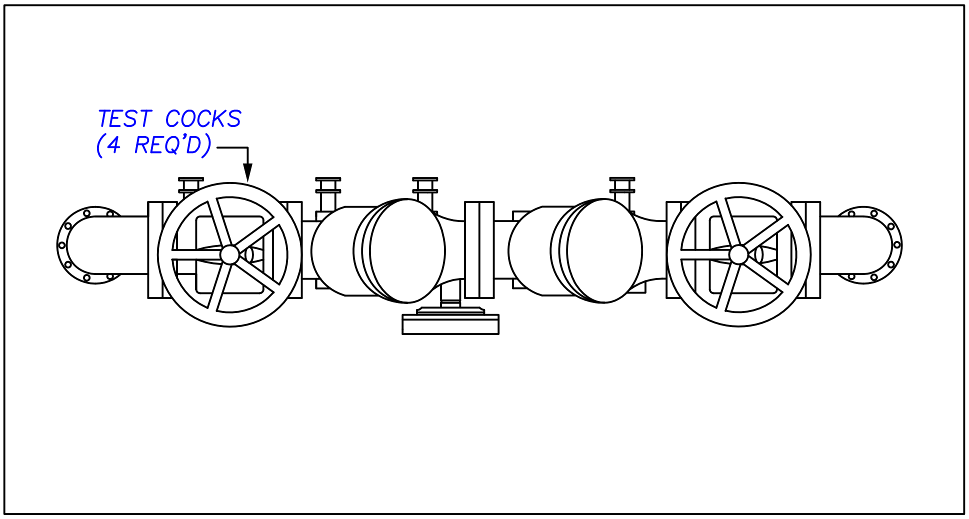
- APPROVED REDUCED PRESSURE BACK FLOW ASSEMBLY SHALL LAY HORIZONTAL ONLY.
- DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE.
- THOROUGHLY FLUSH LINES PRIOR TO INSTALLATION OF BACK FLOW PREVENTER.
- DO NOT INSTALL IN AN AREA SUBJECT TO FLOODING.
- NO GALVANIZED PIPE BEFORE ASSEMBLY
- VALVE SHALL BE PROTECTED FROM FREEZING CONDITIONS.
- THE BACK FLOW ASSEMBLY SHALL BE A CURRENT WASHINGTON STATE DEPARTMENT OF HEALTH APPROVED MODEL.
- A PLUMBING PERMIT IS REQUIRED.

(ABOVE GROUND INSTALLATION)

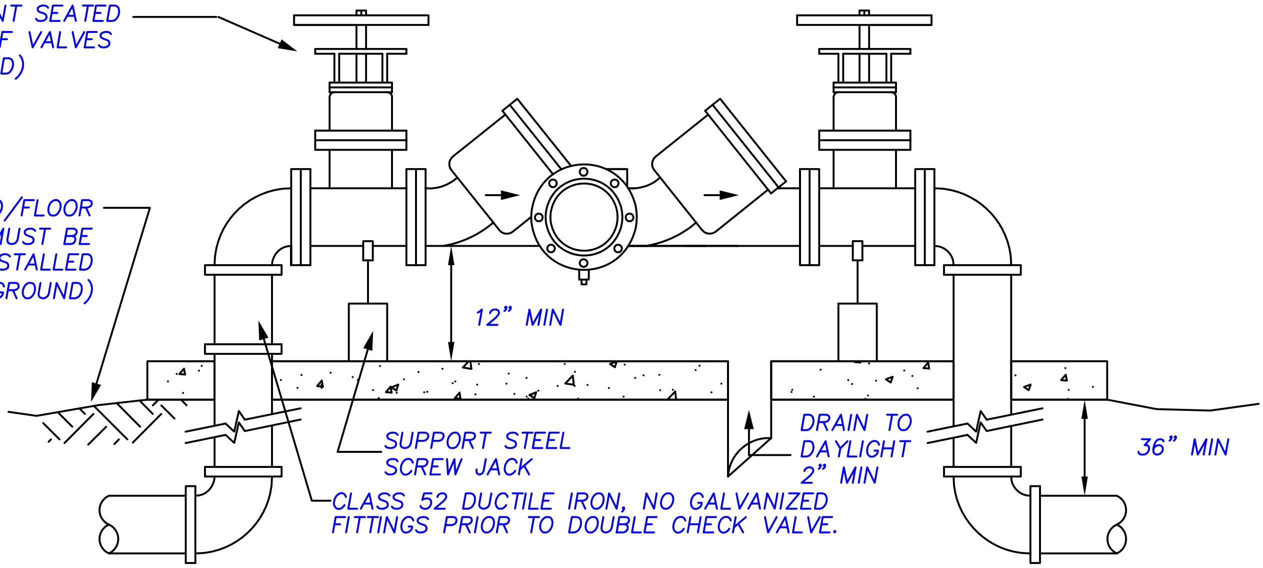
REVISED DATE	NORTHWEST WATER SYSTEMS	JOB NUMBER
1/15/18	REDUCED PRESSURE BACK FLOW ASSEMBLY– 2" & SMALLER	DETAIL

A DISTRICT APPROVED VALVE IS REQ'D. BETWEEN THE SUPPLY MAIN AND THE VAULT

PROVIDE HEAT OR REMOVABLE INSULATED ENCLOSURE ON OUTSIDE APPLICATIONS: PRO-BOX, HOT BOX OR EQUAL INSULATED ENCLOSURES.



TOP VIEW



SIDE VIEW

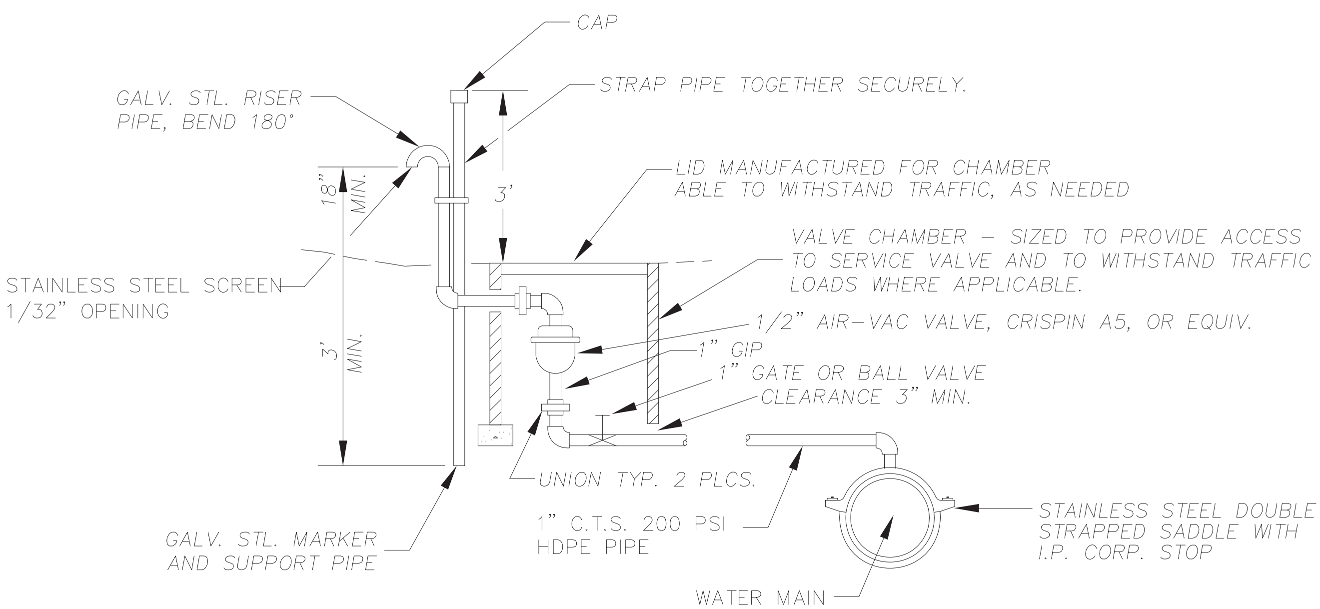
NOTE: ALL ITEMS SHALL COMPLY WITH THE FOLLOWING

- APPROVED BY THE WASHINGTON STATE DEPARTMENT OF HEALTH.
- APPROVED REDUCED PRESSURE BACK FLOW ASSEMBLY TO LAY HORIZONTAL ONLY.
- DESIGNED FOR BACK SIPHONAGE AND BACK PRESSURE.
- THE WATER LINE SHALL BE DISINFECTED, FLUSHED, AND PRESSURE TESTED PRIOR TO INSTALLING THE BACK FLOW ASSEMBLY. THE BACK FLOW ASSEMBLY SHALL BE PROTECTED FROM FREEZING AND FLOODING.
- ALL PIPE, VALVES, AND FITTING JOINTS, FROM SUPPLY MAIN, SHALL BE FLANGED AND RESTRAINED.
- FIRE DEPT. CONNECTION SHALL NOT EXIT THROUGH THE TOP OF THE VAULT.
- ALL ENCLOSURES AND AIR-GAP DRAINS SHALL BE PRE APPROVED PRIOR TO INSTALLATION.
- ALL LOCATIONS SHALL BE PRE APPROVED PRIOR TO INSTALLATION.
- ENCLOSURES SHALL HAVE A MINIMUM OF 3' CLEARANCE FROM ALL STRUCTURES.
- THE BACK FLOW ASSEMBLY SHALL BE TESTED AFTER INSTALLATION AND PRIOR TO ACCEPTANCE AND ALSO YEARLY THEREAFTER BY A CERTIFIED BACK FLOW ASSEMBLY TESTER OR THE DISTRICT'S CROSS CONNECTION SPECIALIST. TEST RESULTS SHALL BE SENT THE DISTRICT AND MAINTAINED IN RECORDS.
- FIRE SERVICES REQUIRE DETECTOR TYPE BACK FLOW PROTECTION ASSEMBLIES.

(ABOVE GROUND INSTALLATION)

REVISED DATE	NORTHWEST WATER SYSTEMS	JOB NUMBER
1/15/18	REDUCED PRESSURE BACK FLOW ASSEMBLY 2 1/2" & LARGER	DETAIL

AIR/VAC INSTALLATION



ACTUAL PIPE SIZES ARE DEPENDENT ON VALVE SIZE.

BOTTOM OF VAULT SHALL BE FILLED WITH MIN. 4" OF 1.25" DRAIN ROCK

VAULT SHALL BE DRAINED TO DAYLIGHT IF VAULT FLOODING IS A CONCERN.
DRAINS SHALL BE DAYLIGHTED AND SCEENED.

TITLE		
AIR/VAC INSTALLATION		
FILE NO. DETAILS	FILE NAME AIR/VAC	SHEET NO. 1 OF 1
DATE MAY 28, 2007	SCALE NO SCALE	

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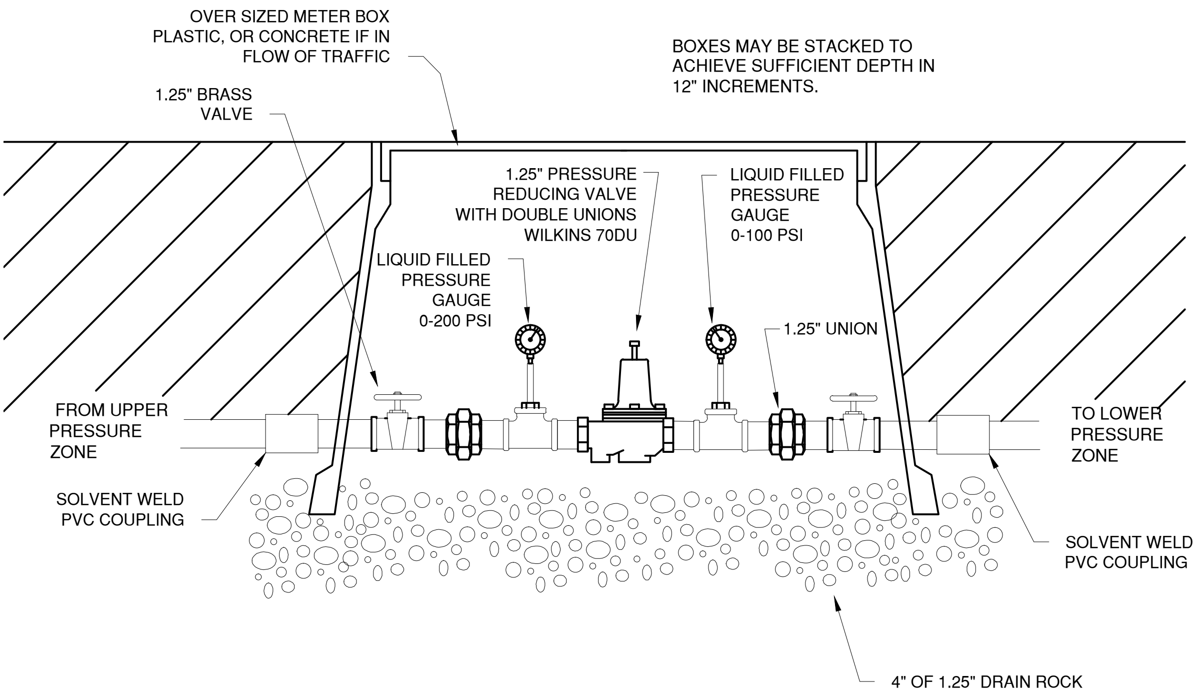

DRAIN VAULT TO DAYLIGHT
(SCREENED) IF STANDING
WATER IS OF CONCERN

MINIMUM ISTALLATION DEPTH:
36 INCHES IF SUSCEPTIBLE TO TRAFFIC
18 INCHES IF NOT SUSCEPTIBLE TO TRAFFIC

ALL CONNECTIONS SHALL BE SOLVENT WELD PVC, THREADED, OR FLANGED.

ADDITIONAL UNIONS NOT REQUIRED IF PRV MODEL CHOSEN INCLUDES UNIONS.

TITLE 1.25-IN PRV DETAIL		
FILE NO. DETAIL	FILE NAME PRV	SHEET NO. 1 OF 1
DATE OCTOBER 3, 2019	SCALE NO SCALE	

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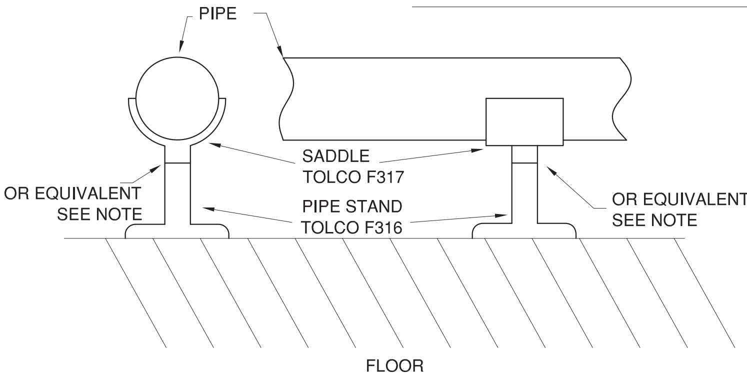
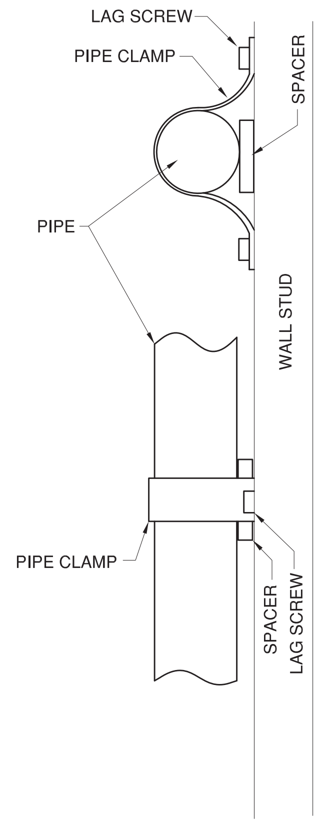
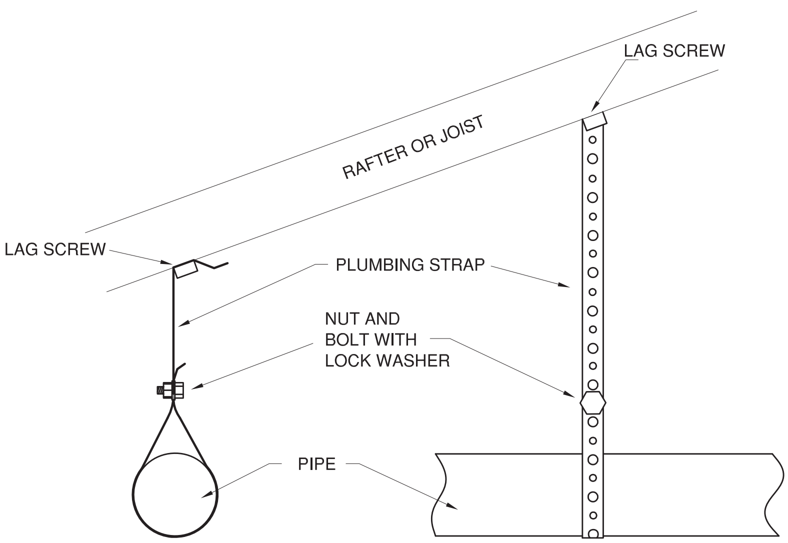
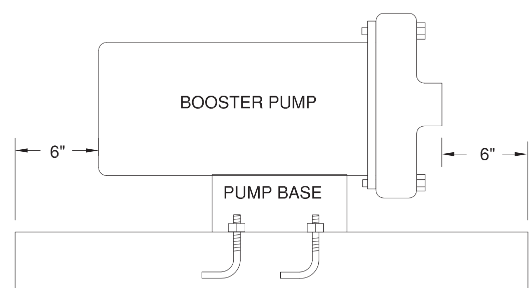
ANCHORING DETAILS









POURED CONCRETE BASE WITH 1/2"-ANCHOR BOLTS (4 MINIMUM). BASE HEIGHT 3.5" EXTENDING A MINIMUM OF 6" PAST LENGTH AND WIDTH OF PUMP

DRILLED HOLES AND CONCRETE ANCHOR LAGS INSTALLED INTO PUMPHOUSE FLOOR MAY BE SUBSTITUTED FOR CONCRETE BASE

NOTES:

PIPE SUPPORTS SHALL BE SPACED AT A MINIMUM OF EVERY FOUR FEET

BOOSTER PUMPS AND CHEMICAL FEED PUMPS SHALL BE SECURED USING MASONARY OR WOOD LAGS AS APPROPRIATE AND PUMP BRACKETS SUPPLIED BY THE MANUFACTURER

ALL PIPE SUPPORTS SHALL SUPPORT THE WEIGHT OF THE PIPE AND WATER. SUPPORTS SHALL BE CONFIGURED IN SUCH A WAY AS TO PROTECT THE PIPES FROM PHYSICAL DAMAGE.

ALL SUPPORTS SHALL BE CONSTRUCTED OF MATERIAL THAT RESISTS CORROSION.

EQUIVALENT SUPPORTS (MASONARY BLOCKS, PIPE RACKS, COMPRESSION CLAMPS, U-CHANNEL, ETC.) MAY BE USED AS SUPPORTS AND ANCHORS AS LONG AS THEY FOLLOW GENERALLY ACCEPTED INDUSTRY STANDARDS AND WSDOH GUIDELINES.

DRAWING ANCHORING DETAILS		
FILE NO. DETAILS	FILE NAME ANCHORING	SHEET NO.
DATE APRIL 30, 2007	SCALE NTS	

NORTHWEST WATER SYSTEMS
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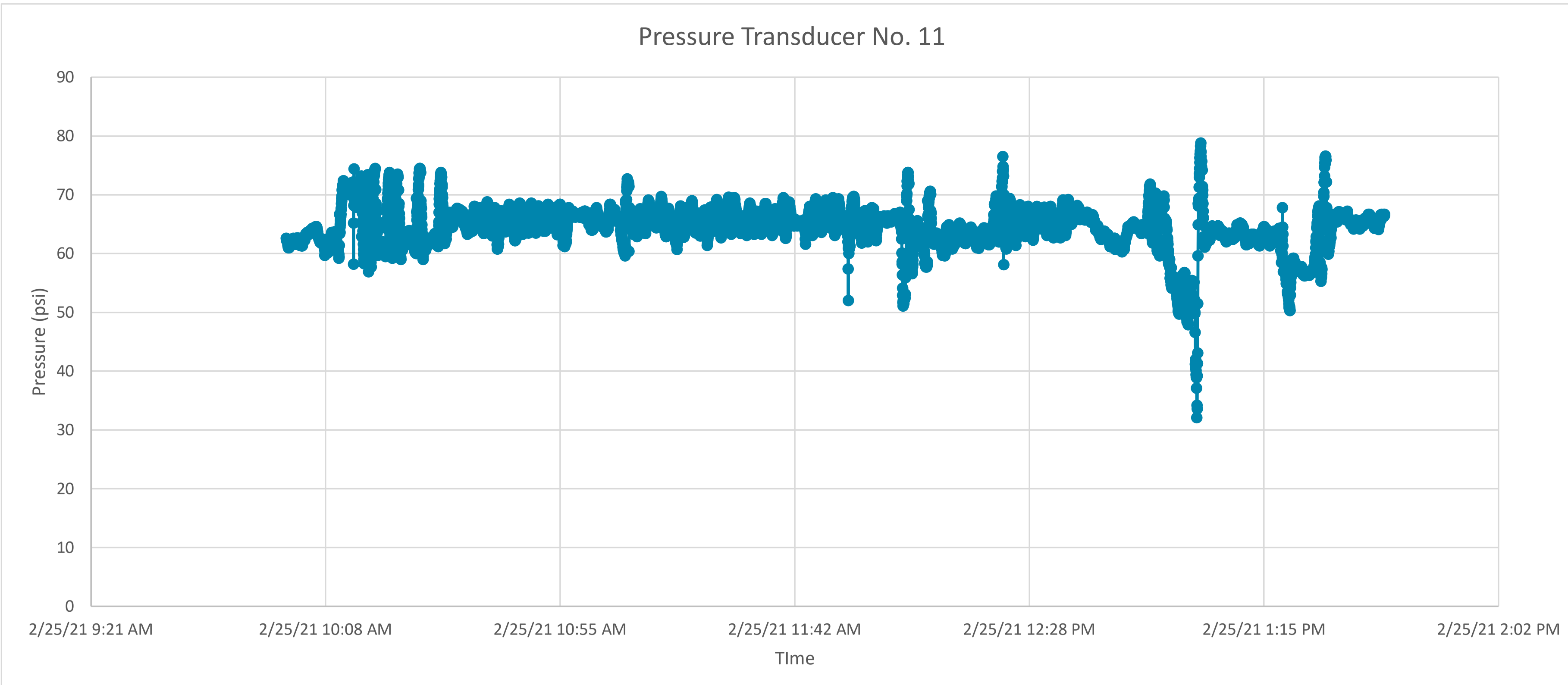
Appendix 10.21

WSP Adoption and General Correspondence

Appendix E



Pressure Transducer No. 11
Pressure (psi)
90
80
70
60
50
40
30
20
10
0
2/25/21 9:21 AM
2/25/21 10:08 AM
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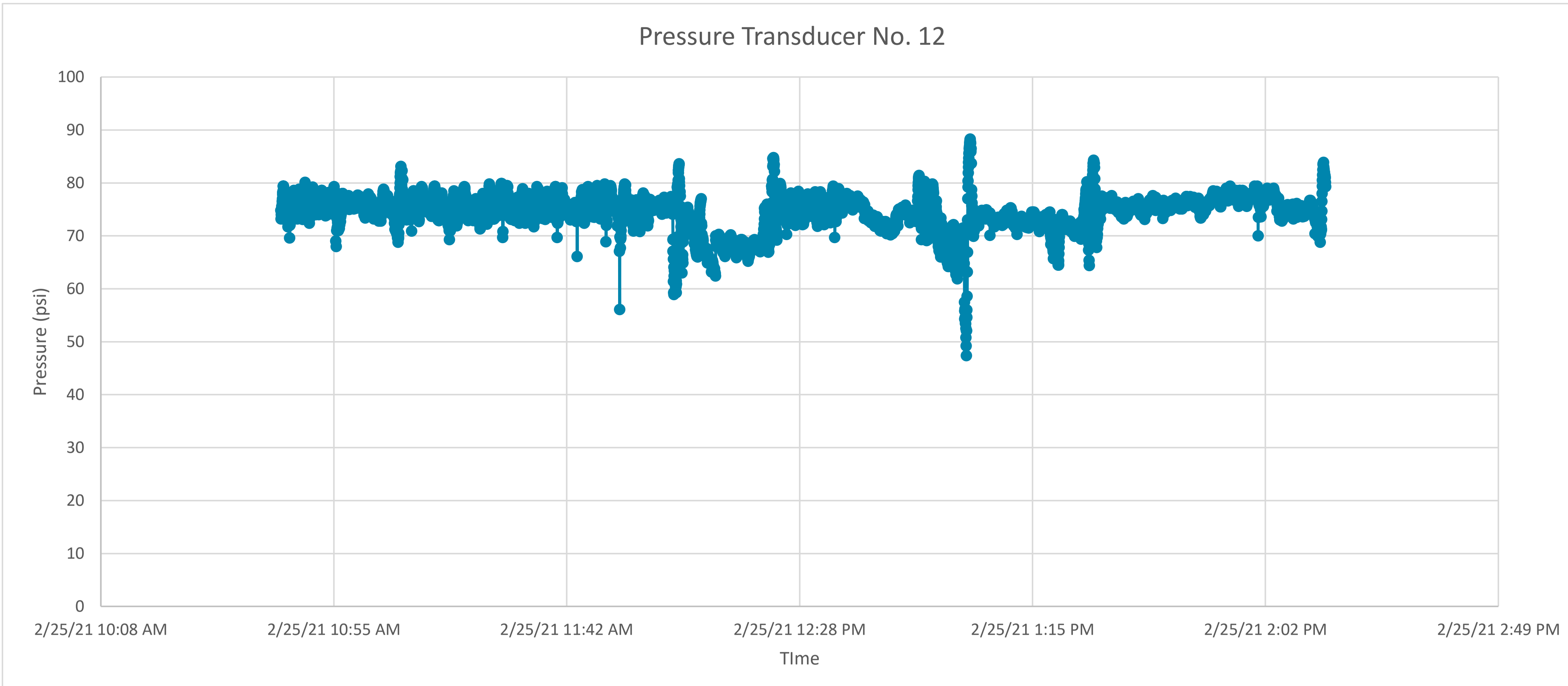
2/25/21 12:28 PM
2/25/21 1:15 PM
2/25/21 2:02 PM
TIme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Pressure (psi)
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70
60
50
40
30
20
10
0
2/25/21 10:08 AM
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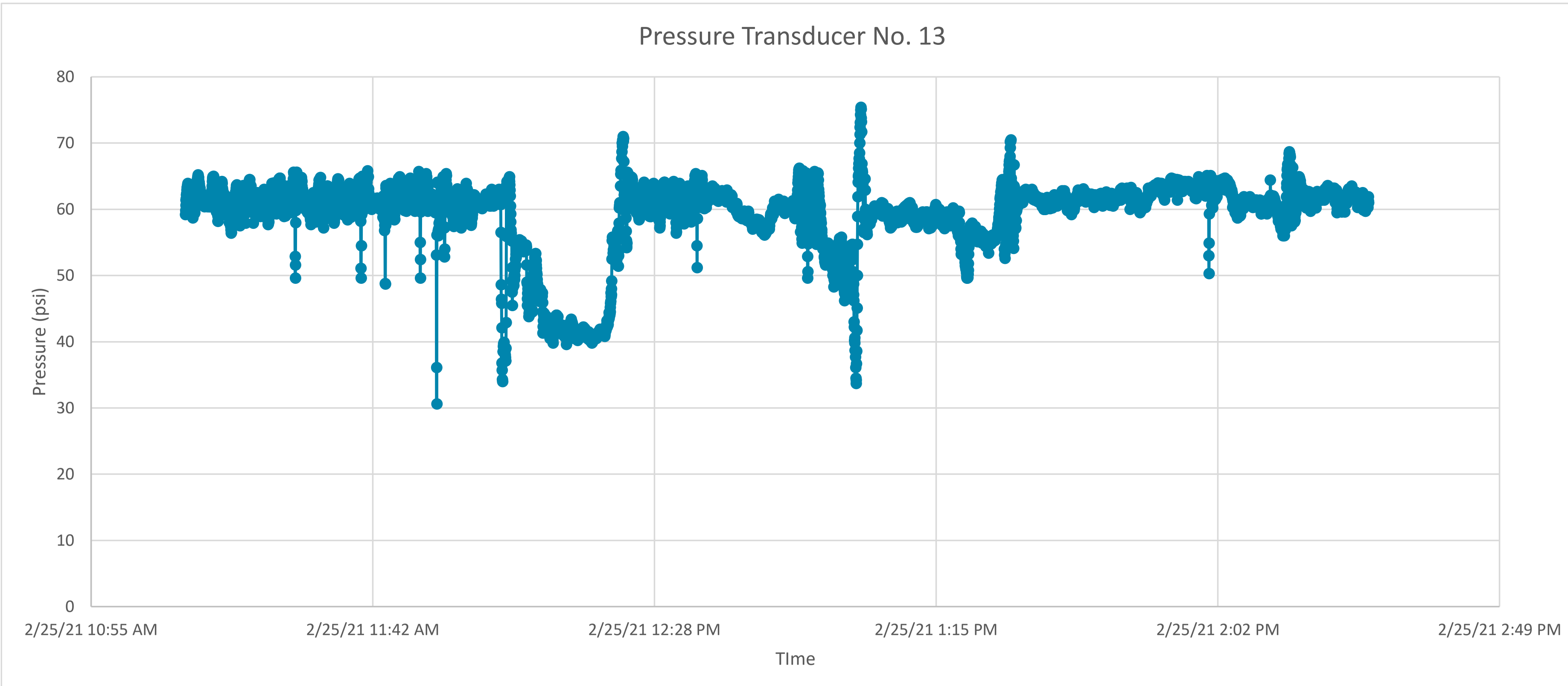
2/25/21 11:42 AM
2/25/21 12:28 PM
2/25/21 1:15 PM
2/25/21 2:02 PM
2/25/21 2:49 PM
TIme



Pressure Transducer No. 13
Pressure (psi)
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30
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10
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2/25/21 10:55 AM
2/25/21 11:42 AM
2/25/21 12:28 PM
2/25/21 1:15 PM
2/25/21 2:02 PM
2/25/21 2:49 PM
TIme