MEMORANDUM

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FROM: Chris Westerman, E.I.T. – Coeur d'Alene Regional Office

DATE: **June 18, 2016**

SUBJECT: **M-152-04 Ellisport Bay Sewer Board, Staff Analysis supporting reuse permit issuance.**

Executive Summary

Ellisport Bay Sewer District (EBSD; District) operates a wastewater collection and treatment system that serves the Hope and East Hope communities on the east shore of Lake Pend Oreille. The wastewater system was designed to support 347 equivalent residential units (ERUs) in the design year (ESBD 2016) and currently serves about 255 ERUs. There are 357 allocated to the system. The District is working with DEQ to prepare an updated facility that will address the system's capacity.

Domestic wastewater is conveyed from the collection system to the wastewater lagoons for treatment and storage. The treated, disinfected wastewater effluent (recycled water) is irrigate over 41 acres of a native forested site during the growing season (June 1st through September 30th – 122 days). Lagoon levels are lowered annually to create the capacity required for storing wastewater during the nongrowing season.

The following concerns have been noted during the current permit cycle:

1. Several lagoon seepage tests performed on the lower storage lagoon have demonstrated that the lagoon's actual seepage rates exceed the maximum allowable seepage rate of 0.25 inches per day required by the Idaho Wastewater Rules (IDAPA 58.01.16.02). The District entered into a compliance agreement schedule (CAS) with DEQ on March 18, 2014 and has committed to addressing this issue (EBSD 2013). See Section 5.3 for additional discussion.

2. There have been concerns regarding increased nitrate concentrations in a nearby ground water source well serving Hope Elementary School. The reuse site and the lower storage lagoon were identified by DEQ as a possible source for the nitrate concentrations; however no definitive source for the contamination has been confirmed and the school district continues to monitor the source well. See Section 4.5 for additional discussion.

The District has demonstrated through their annual report submittals and DEQ site inspections, substantial compliance with the terms and conditions listed the expired reuse permit (LA-

000152-03). Staff recommends that the District be reissued a new recycled water permit and that the draft permit is written with a ten (10) year term. DEQ reserves the right to modify the reuse permit as necessary.

1 Introduction

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400 for issuing recycled water reuse permits. It briefly states the principal facts and significant questions considered in preparing the draft permit and provides a summary of the basis for the draft permit conditions.

The initial reuse permit LA-000152-01 was issued on August 8, 1997; and reuse permit LA-000152-02 was issued on September 30, 2004. The current reuse permit LA-000152-03 was issued on April 15, 2011 and expired on April 15, 2016. DEQ staff met with the District's representatives on August 25, 2015 and discussed the required contents for a substantially complete permit application and technical report. The District submitted the application for permit renewal and a draft technical report supporting a decision to issue a new reuse permit was submitted to DEQ on February 10, 2016. A revised, final application was submitted to DEQ on April 25, 2016. The final application included the following support documentation:

- Recycled water reuse application form;
- A technical report titled "*Ellisport Bay Sewer District, Recycled Water Reuse Permit Application and Preliminary Technical Report, April 25, 2016*" supporting the reuse permit application;
- An updated lagoon water balance; and
- Form A, designating the responsible official and authorized representative

2 Site Location and Ownership

The wastewater treatment facility and reuse site is located near the east shore of Lake Pend Oreille at about 48°12'58"N by 116°16'12"W; roughly two (2) miles south of East Hope, Idaho (refer to Figure 1 and Figure 2).

The District owns and is responsible for the continued operation and maintenance of the sewage collection system, treatment facilities, and the reuse site. Ruth Watkins is listed as the current responsible official for the system and Dex Vogal the responsible charge operator designated as an authorized representative for the District.

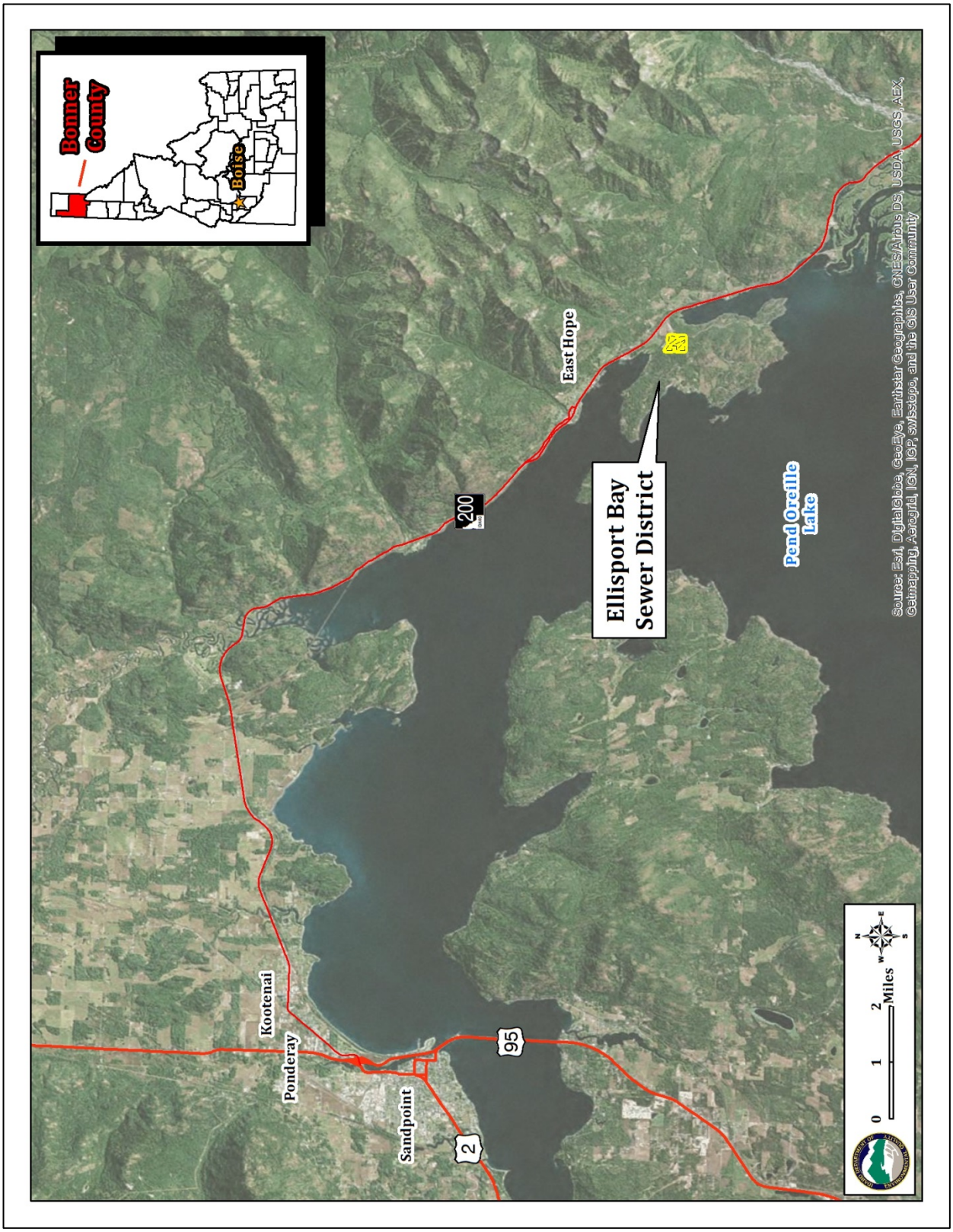


Figure 1 - Ellisport Bay Sewer District Reuse Site - Vicinity Map

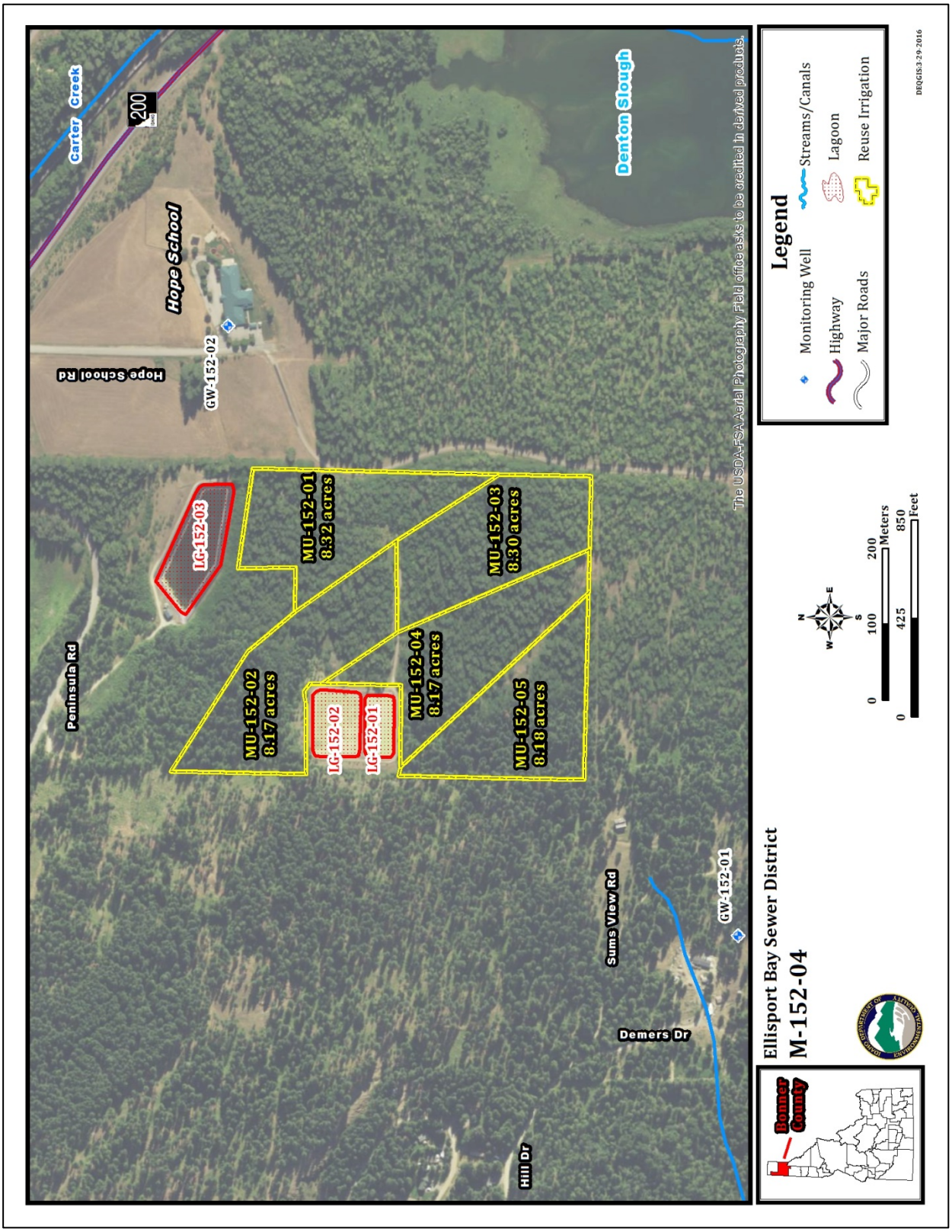


Figure 2 - Ellisport Bay Reuse Facility Map

3 Process Description

3.1 Sewer Collection System

The sewer collection system is classified as a Class I system serving the communities of Hope and East Hope on the east shore of Lake Pend Oreille. The system was designed to support 347 ERUs with an average day design flow of 69,500 gpd or 25.4 MG annually (Winter 2016).

EBSD has allocated 357 wastewater ERU's (Vogal 2016) which is beyond the original design capacity stated in the operation and maintenance manual (ESBD 2009). EBSD currently is seeking grant funding through the State Revolving Fund to complete a facility plan. It is anticipated that system capacity will be addressed in the facility plan

Raw wastewater generated from these communities is conveyed through the eight 8-inch gravity sewer mains to one of three community lift stations. Some residences have individual grinder pumps that convey raw wastewater through a pressure sewer main. The community lift stations pump wastewater sequentially from Lift Station #1 through Lift Station #4 which discharges into the upper aerated lagoon at the treatment facility. Lift station #1 (City of Hope), lift station #2 (City of East Hope) and lift station #3 (Holiday Shores) are similar in design and operation. Each of these lift stations are a wet well, duplex configuration consisting of two 300 gallon per minute (gpm) pumps. Lift station #4 is a wet well/dry well duplex configuration with two 350 gpm pumps (ESBD 2009).

3.2 Wastewater Treatment Lagoons

The upper aerated lagoon (LG-152-01) serves as the primary treatment lagoon with a total storage capacity of 2.5 million gallons (MG) and a detention time of 30 days in the design year. There are three mechanical surface aerators which provide oxygen needed to treat the wastewater and help to reduce nuisance odors. Treated wastewater effluent is transferred from the upper aerated lagoon to the adjacent, upper storage lagoon through a common control structure. The upper storage lagoon (LG-152-02) has a total storage capacity of 3.5 MG and is intended to be a future treatment lagoon in the design year (ESBD 2009). The upper lagoons are lined with a 60 mil high-density polyethylene (HDPE) flexible membrane liner and feature an underdrain system to redirect shallow ground water away from the lagoons to prevent the liner from uplifting due to buoyant forces (floating).

Treated effluent from the upper lagoons can then be transferred through an 8-inch SDR 17 gravity sewer line to the lower storage lagoon (LG-152-03). This lagoon was designed to retain a total volume of 15 MG of wastewater accumulated during the non-growing season. The lower storage lagoon provides some additional polishing through fine bubble diffusers. The lower lagoon has a 60 mil HDPE flexible membrane liner and also features an underdrain system to redirect shallow ground water away from the lower storage lagoon (ESBD 2009).

The peak storage volume is typically measured around June at which time the District can begin irrigation activities. Treated effluent is disinfected by injecting a 12.5% solution of sodium hypochlorite ($NaHCO_3$) at the pump house located adjacent to the lower storage lagoon. Chlorine contact is achieved through approximately 1,000 of 18-inch pipe which provides 35

minutes of contact time before the recycled water is discharged at the first sprinkler head. Recycled water samples are taken at a sample tap located after chlorine contact time and prior to the first sprinkler head. Annual report records indicate that the typical chlorine residuals average around 2.2 mg/L.

3.3 Reuse Site and Irrigation System

Recycled water is pumped from two 400 gpm vertical turbine pumps through approximately 1,000 of 18-inch pipe (chlorine contact piping) to one of five existing hydraulic management units or zones each consisting of about eight (8) acres (Figure 2). Laterals convey recycled water to solid set sprinkler heads set on six foot high risers and spaced at 40 foot intervals. The sprinkler head capacity is rated for 9 gpm or 0.25 inches per hour (ESBD 2009). The reuse site is a native forested area consisting of cedars, firs, hemlocks, birches, and various understory growth (Robinson, 2004).

4 Site Characteristics

4.1 Site Management History

Recycled water is irrigated to the forested site using solid set sprinklers during the growing season. The lower storage lagoon is lowered annually near the end of the growing season to provide sufficient storage capacity for the wastewater influent plus precipitation during the non-growing season.

There are currently 41.1 acres of available land owned by the District and utilized for recycled water irrigation over five (5) active hydraulic management units (MUs). The recent reuse application does not include any requests for additional management units, system expansions, or other system modifications (Winter 2016).

4.2 Climatic Characteristics

Climate characteristic data shown below in Table 1 was taken from the Coeur d'Alene 1E station 101956 from the ET-Idaho website (*http://data.kimberly.uidaho.edu/ETIdaho/stninfo.py?station=101956*). This station is located approximately 45 miles south west of the reuse site and has been shown to have similar climate characteristics as the Cabinet Gorge station used in the previous staff analysis to determine the precipitation deficit values. The irrigation water requirement in this staff analysis will use the precipitation deficit values from the Coeur d'Alene station (Section 0).

Table 1 - Climatic characteristics from the ET-Idaho Coeur d'Alene station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Precipitation (inches)	3.50	2.49	2.20	1.85	2.05	1.98	0.73	1.11	1.15	1.87	3.20	3.82
Mean Max. Temperature (°F)	33.3	34.6	39.4	45.3	53.3	60.1	66.6	69.0	65.0	56.9	47.4	37.2
Mean Min. Temperature (°F)	27.2	29.3	34.3	39.4	46.0	53.7	60.1	64.7	57.6	48.4	37.6	30.6

Based on the Coeur d'Alene station data, the mean annual precipitation total is 25.96 inches of which 7.02 inches of rainfall occurs during the growing season (May 1 through September 30 – 153 days). The highest monthly average maximum temperature is 69°F in August. The lowest monthly average minimum temperature is 27.2°F in January.

4.3 Soils

The United States Department of Agriculture National Resource Conservation Service (USDA-NRCS) has characterized the soil at the irrigation site as primarily Pend Oreille Silt Loam, 5 to 45 percent slopes with some Bonner Silt Loam, 0 to 4 percent slopes with some Pend Oreille-Rock Outcrop Complex, 5 to 45 percent slopes (Wester 2011).

Soil monitoring in the current permit (LA-000152-03) required composite soil samples to be taken in May and October 2011 and 2014 for nitrate, ammonium, pH, and plant available phosphorus (DEQ 2011). The District failed to take soil samples during the 2014 growing season as required by the expired reuse permit, but completed soil monitoring in 2015. A summary of the monitoring results are included in Table 2 below.

Table 2 - Soil Phosphorus Monitoring Results from Reuse Permit LA-000152-03 (mg/kg)

Depth	Phosphorus soil concentrations in mg/kg						
	Jun-05	Dec-08	Jun-09	May-11	Dec-11	May-15	Oct-15
0-12"	25.5	284.0	8.9	47.6	341.0	209.0	111.0
12-24"	21.2	289.0	12.9	35.1	152.0	56.2	98.2
Mean	23.4	286.5	10.9	41.4	246.5	132.6	104.6

Phosphorus (ortho-phosphate) concentrations in the soil profile between zero and 24-inches are considered *high* in the May/June sample results and *very high* in the October/December sample results. Phosphorus concentrations at depths ranging from 24 to 36-inches are unknown due to sample refusal (i.e. shallow soils). DEQ will recommend that phosphorus concentrations in the soil are less than 25 parts per million (ppm) by the Bray method at a depth of 36 inches (DEQ 2007).

4.4 Surface Water

Two major surface water features are located within one-half mile of the treatment facility and reuse site.

Ellisport Bay and Denton Slough are bays of Lake Pend Oreille and are located approximately 1,300 feet northwest and 1,200 feet east of the reuse site property respectively. Per Subsection 110.05 of the Water Quality Standards (IDAPA 58.01.02), Lake Pend Oreille has been designated for the uses listed below. Additional details regarding the designated uses can be reviewed in the listed subsections of the Water Quality Standards.

- Cold water communities, aquatic life (COLD; 100.01.a)
- Primary contact recreation (PCR; 100.02.a)
- Domestic water supply (DWS; 100.03.a)

A Total Maximum Daily Load (TMDL) was developed for the near shore waters of Lake Pend Oreille to mitigate increasing eutrophication along the shoreline. The target identified for the TMDL is an average total phosphorus concentration of 9 micrograms per liter (µg/L). The TMDL establishes an action threshold for an instantaneous concentration equal to 12 µg/L. The action target of 12 µg/L represents a value that is used in monitoring to evaluate attainment of standards based on individual sample concentrations. Due to the distance between the reuse site and the lake, there is little potential of additional nutrient, specifically phosphorus, contributions to Lake Pend Oreille through surface water runoff and groundwater/surface water interconnections at current nutrient loading rates. As discussed in Section 4.6.3, there is potential that the current irrigation site may be limited by phosphorus loading at full buildout. Carter Creek is located greater than 100 feet from the reuse site; however, the creek has not been designated as an assessment unit by DEQ at this time. Undesignated or unidentified surface waters should be presumed to be designated as cold water communities/aquatic life (COLD; 100.01.a) and secondary contact recreation (SCR;100.02.b) (Grafe 2002). It should be noted that presumed designations are subject to change as new information becomes available for the surface water unit.

DEQ does not anticipate that irrigation activities will impact these surface waters based on agronomic irrigation rates to the forested site, adequate horizontal buffer distances as recommended by DEQ guidance, general topography of the reuse site, and barring irrigation activities during or immediately after precipitation events.

4.5 Ground Water & Hydrogeology

4.5.1 Private Ground Water Sources

The nearest private ground water source well is located about 630 feet south of MU-152-03 at the closest point, up gradient from the reuse site (Table 3 and Figure 3). The nearest down gradient private well is located about 690 feet southwest of the reuse site. Well driller permits for the private ground water well listed in Table 3 are included as Appendix B and provide additional details on their construction and depth to groundwater. Ground water flow was delineated by Monks Hydro-Geoscience; a consulting company contracted by the District in September 2010. The general ground flow is shown in Figure 4.

Table 3 - Private Ground Water Source Well Locations Relative to the EBSD Property

Well ID	Distance (feet)	Relative Elevation
270442	634	Up gradient
332886	2,851	Down gradient
422393	1,478	Down gradient
332387	686	Down gradient
443246	1,373	Down gradient
271708	1,320	Down gradient
395484	1,214	Down gradient

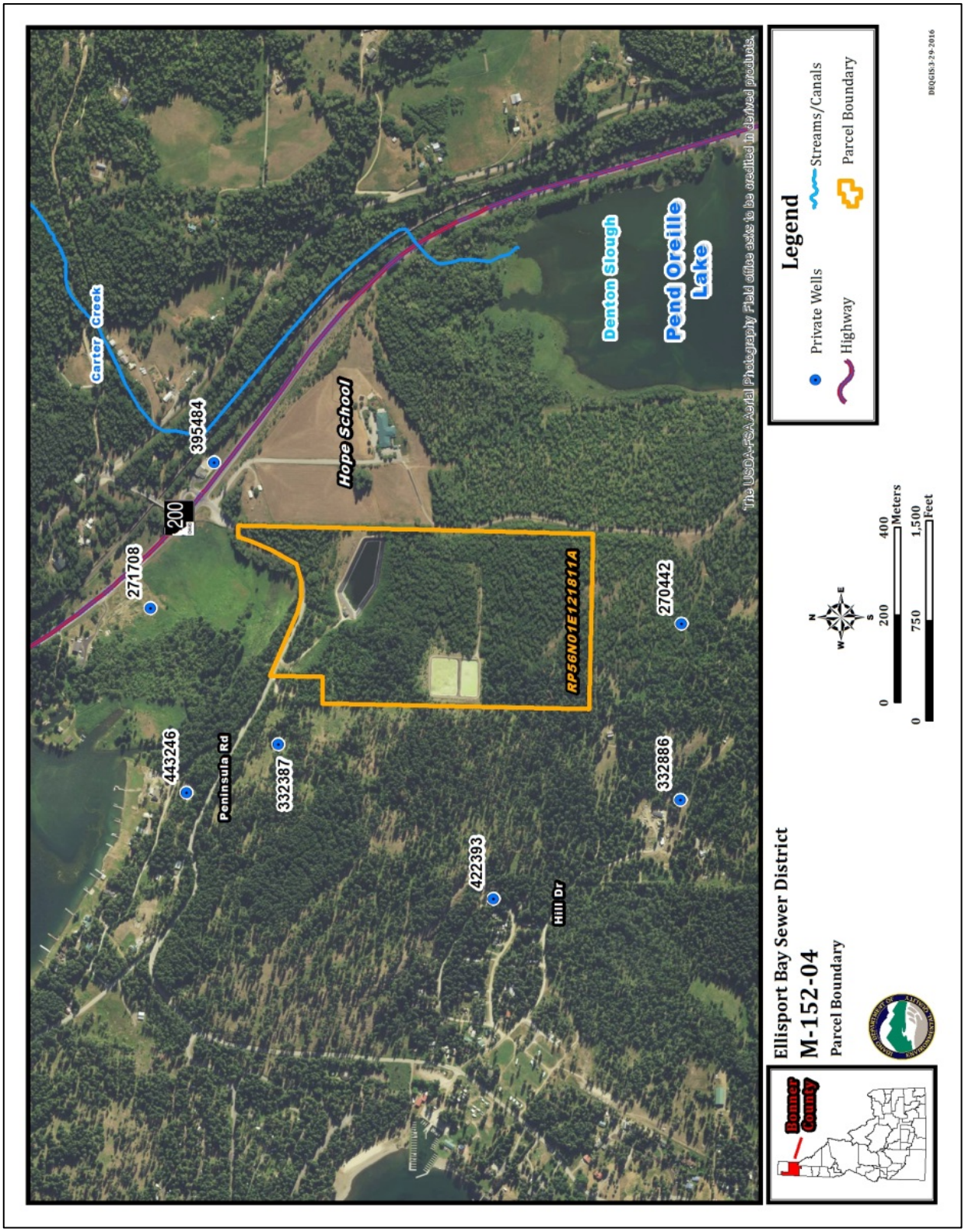


Figure 3 - Private Well Locations

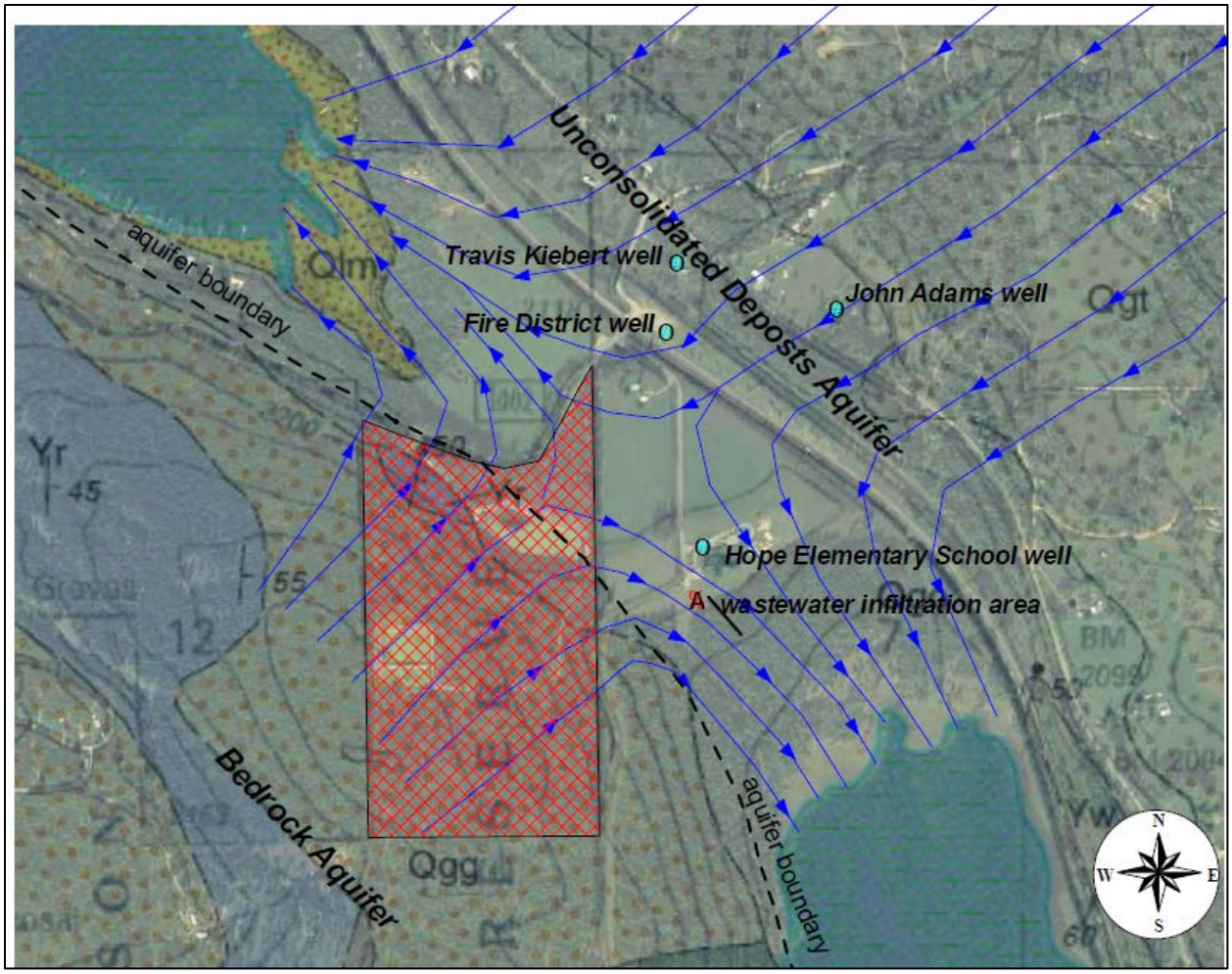


Figure 4 - Ground water flow direction (Monks 2010) – not to scale

DEQ does not anticipate impacts to the private ground water source wells based on the irrigating at agronomic rates, horizontal buffer distances, the current nutrient loading rates (see Section 4.6.3), and the general ground water flow direction.

4.5.2 Public Ground Water Sources

The nearest public ground water source well is Hope Elementary School ground water source well (PWS ID1090185) located approximately 650 feet east of the lower lagoon at the closest point (Table 3). DEQ guidance recommends that a minimum horizontal distance of 1,000 feet is maintained between a reuse site and any public source well (DEQ 2016).

The source well was initially constructed on July 29, 1987 and serves 125 persons at the elementary school through a single connection. The well was constructed with an 8-inch diameter well casing to a depth of 132 feet below ground surface and a 23 foot sanitary seal. DEQ has scored the well's construction as being *highly susceptible* to contamination in the source water assessment because its construction does not meet the current facility design requirements (DEQ 2002).

Table 4 - Hope Elementary Source Water Assessment Score

Susceptibility Scores for HOPE ELEMENTARY SCHOOL (PWS# ID1090185) WELL #1 E0005111									
System Construction	Potential Contaminant Inventory / Land Use				Hydrologic Sensitivity	Final Susceptibility Ranking			
	IOC	VOC	SOC	Microbials		IOC	VOC	SOC	Microbials
H	M	L	L	M	M	M	M	M	M
H = High Susceptibility, M = Moderate Susceptibility, L = Low Susceptibility. Auto High - see below.*									

Source: *http://www2.deq.idaho.gov/water/swaOnline/WellSummaryReport/ID1090185/E0005111*

The source water assessment also lists potential sources of contamination and has identified the lower storage lagoon and reuse site as potential sources because each is located within the estimated area of influence for the well. The hydraulic conductivity of the aquifer suggests that the time of travel within the area of influence is between 3-6 years (DEQ, 2002). A copy of the source water assessment is included as Appendix C in this staff analysis.

Reuse permit LA-000152-02 initially required that the District monitor the school well for chlorides and nitrate concentrations quarterly in the first and fifth years since the well did not meet the minimum buffer distance (Tindall, 2004).

In 2010, the Hope Elementary Well experienced a significant increase in nitrate concentrations. While the nitrate concentrations did not exceed the drinking water Maximum Contaminant Level (MCL) of 10 mg/L, the levels exceeded the Action Limit (AL) for nitrate of 5 mg/L, which triggered increased monitoring from the well. Hope Elementary is currently required to monitor the well quarterly for nitrates, however the School has elected to monitor the well monthly. A time series of the nitrate data sampled between 2005 and 2015 from the well is shown in Figure 5 below. The nitrate concentrations continue to be elevated, particularly during the winter months.

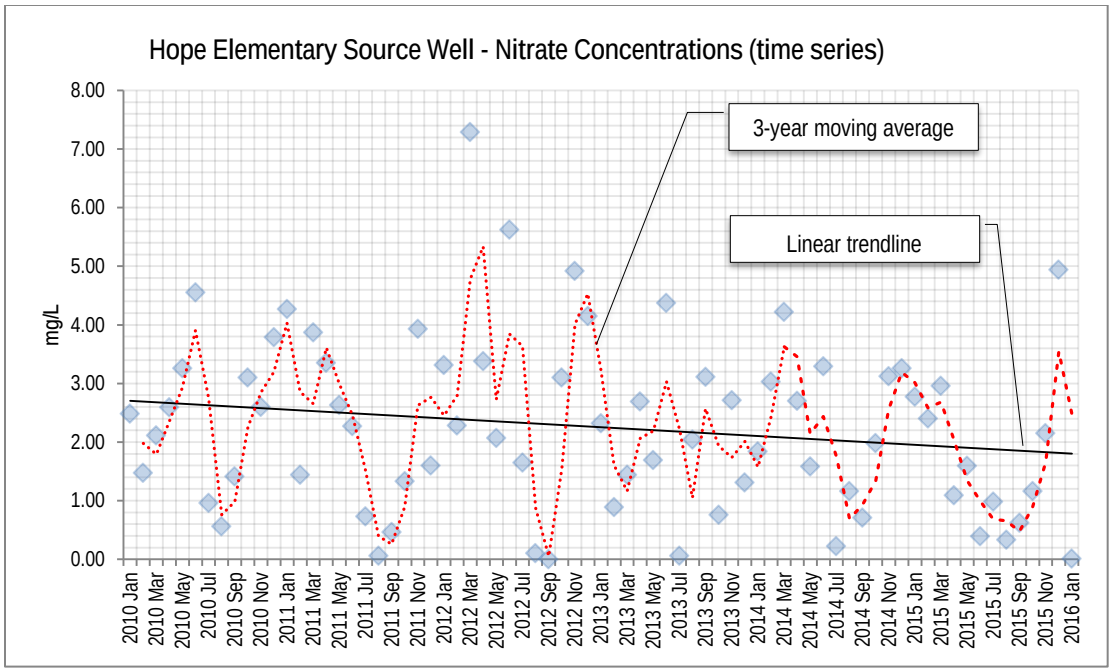


Figure 5 - Hope Elementary School source well nitrate monitoring results (time series)

4.5.3 Ground Water Investigation Report

DEQ prepared a report titled *Ground Water Investigation Report, March 21, 2013* in an effort to identify the cause of the elevated nitrate concentrations in the school's well. The report identified and reviewed several potential nitrate sources including the adjacent agricultural field, the school's abandoned drainfield, the Denton Slough, the lower storage lagoon, and the reuse site. The report concluded that based on the available data, the elevated nitrate concentrations were consistent with the leakage from the lower storage lagoon (Stevens 2013). This conclusion is supported by the excessive seepage rates through the lower storage lagoon (*see Section 5.3*), the documented wastewater releases from the site, and the potential impacts from thick understory vegetation effectively concentrating recycled water in a small area which may promote leeching past the root zone.

The District disagrees with those finding, but has been working toward addressing the above-mentioned items identified in the DEQ report.

1. **Lagoon Seepage Rates** – The District entered into a compliance agreement schedule (CAS) with DEQ and is working toward getting the lower storage lagoon into compliance with the Wastewater Rules for the maximum allowable seepage rates. Repairs to the HDPE liner are on-going and a follow-up lagoon seepage test will be performed after the repairs to determine if the repairs were successful;

2. **Ground Surface Releases -** There were two sewage release events from the reuse site in July 2010. The first incident occurred on July 7, 2010 in which 26,000 gallons of recycled water were discharged to Zone #3 (MU-152-03) at a pipe joint that had separated. The second event occurred on July 17, 2010 releasing 9,500 gallons of

recycled water from a faulty valve at Zone #1 (MU-152-01). In each instance, the recycled water discharged to the ground surface and flowed to an open field immediately west of Hope Elementary.

A hydrogeological evaluation was prepared by Monks Hydro-Geoscience to evaluate if any of the recycled water discharged to the ground surface may have potentially contaminated the surrounding ground water. The report concluded that there was no significant impact to the ground water or surface water based on the expected increase in nitrate concentrations under the worst case scenario showing an increase at the well of 0.7 mg/L and an increase at the Denton Slough of 0.01 mg/L (Monks, 2010); and

3. **Hydraulic Loading Rates and Understory Vegetation -** High density growth of the understory vegetation caused the irrigation to be dispersed over a smaller area which increased hydraulic loading rates and promoted leaching beyond the root zones (Stevens 2013). Since the ground water investigation report was prepared, the District has cleared the understory vegetation at the site. This will increase the irrigation coverage, reduce leaching beyond the root zone, and reduce potential ponding and runoff from the reuse site.

4.6 Recycled Water Characterization and Loading Rates

4.6.1 Recycled Water Characterization

Recycled water constituent concentrations are summarized below as annual averages (Table 5).

Table 5 - Annual average recycled water characterization

Year	Nitrate + nitrite as N (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
2011	0.93	8.43	9.40	3.31
2012	2.07	11.71	13.77	5.00
2013	4.83	1.20	6.04	3.32
2014	1.61	2.83	4.43	3.44
2015	2.16	12.10	12.82	4.83
Mean	2.36	7.26	9.29	3.98
Maximum[1]	7.06	15.70	17.09	9.86

1. Based on the observed values from the monitoring results included with each annual report between 2011 and 2015

The mean total nitrogen concentrations in the recycled water irrigate to the site is roughly 25% of typical low strength domestic wastewater. Phosphorus concentrations are equivalent to low-medium strength wastewater (Metcalf & Eddy 2003).

4.6.2 Hydraulic Loading Rates

4.6.2.1 Historic Hydraulic Loading Rates

The expired reuse permit required that the District irrigate recycled water at rates not to exceed those specified in the permit. The irrigation water requirement for MU-152-01 and MU-152-02 were reduced to 75% because the slopes of these management units varied between 12 and 25% and DEQ was concerned about potential runoff from the site (Wester, 2010). Recycled water irrigated to the reuse site during the recent permit cycle (from 2011 to 2015) has varied from 8.97 MG to 11.70 MG. Monthly hydraulic loading rates for each management unit during this period are compared to the irrigation water requirement from the former reuse permit (Appendix E). Irrigation rate exceedances are highlighted in red.

Hydraulic loading rates were not established for October in the former reuse permit and there are some instances where irrigation rates had exceeded the irrigation water requirement in some months. These apparent exceedances occurred in years where the District was performing lagoon seepage testing. Typically DEQ will recommend that irrigation efforts are focused in those months with the greatest potential irrigation water requirement (i.e. June, July and August); however, seepage testing requires that a significant volume of wastewater is retained in the lagoons while the test is being completed to accurately measure the potential lagoon seepage rate. This reduces the time the District has to irrigate the reuse site and decreases the capacity of the lagoons for winter time storage. As a result, DEQ has found that the irrigation exceedances in the latter half of the growing season are acceptable to protect the integrity of the lagoon dikes. DEQ expects recycled water to be irrigated at rates substantially at or below the irrigation water requirement once the lower storage lagoon is in compliance with the Wastewater Rules.

It should be noted that there are no irrigation exceedances in years where the District did not perform a lagoon seepage test and the District receive approval from DEQ prior to irrigating in October.

4.6.2.2 Proposed Hydraulic Loading Rates

Growing season hydraulic loading rates should be substantially equal to or less than the irrigation water requirement (IWR) for a natural forested site based on the precipitation deficit values determined by the University of Idaho Research and Extension Center at Kimberly, Idaho (*http://data.kimberly.uidaho.edu/ETIdaho/stninfo.py?station=101956*) for the nearest irrigated, ET-Idaho station (i.e. Coeur d'Alene 1 E NWS--101956). The irrigation water requirement in the former reuse permit was developed based on the Cabinet Gorge ET-Idaho station located approximately 13 miles south east of the reuse site. The Cabinet Gorge station is flagged as "*rainfed*" and the precipitation deficit values do not reflect the stress imposed by insufficient rainfall (Cook 2012).

The Coeur d'Alene ET-Idaho station is flagged as an "*irrigated*" site which means that the precipitation deficit data for a given crop is assumed to have sufficient water available to meet the crops' consumptive water use and as a result the evapotranspiration is higher. This effectively increases the precipitation deficit values (and irrigation water requirement); however, native tree species have adapted to northern Idaho's semi-arid climate during the growing season and would not necessarily require the additional irrigation water. To minimize hydraulic

overloading, DEQ considers the precipitation deficit values based on the 80% exceedance[1] to be an acceptable, conservative target for native species' irrigation water requirement (Cook 2012).

There is no precipitation deficit data for native forested sites specified on the ET-Idaho website. As a surrogate means to determine an appropriate IWR, areas with significant native forests (consisting of a tree canopy and understory vegetation) are approximated using a composition approach with *Orchards – Apples and Cherries no ground cover* to represent the tree canopy and *Grass Pasture, high management* used to represent the understory. Precipitation deficit data from ET-Idaho for these two (2) crops are shown in Table 6 below.

Table 6 - Precipitation deficit values for a forested site from the ET-Idaho website Coeur d'Alene Station

	Orchards - Apples and Cherries no ground cover (mm/d)	Grass Pasture - high management (mm/d)
Jan	-0.02	-0.01
Feb	-0.03	-0.02
Mar	0.07	-0.05
Apr	0.24	0.35
May	1.38	2.13
Jun	3.32	2.99
Jul	5.09	5.05
Aug	3.78	3.52
Sep	2.06	2.00
Oct	0.07	-0.27
Nov	-1.52	-1.08
Dec	-0.74	-0.03

The Silvicultural Plan prepared for the District states that the canopy composition for the forested site is 80% canopy cover (Robinson, 2004) implying a 20% understory cover.

Irrigation efficiencies (E_i) for solid set laterals range from 60% to 85% based on the DEQ reuse guidance document (DEQ 2007). DEQ staff will utilize an irrigation efficiency of 70% from the former permit. The irrigation water requirement for the site is estimated during the growing season (May 1st through October 31 – 184 days) and is based on positive precipitation deficit values indicating a need to irrigate the "crop" and the operators experience at the reuse site. ET Idaho data supports limited irrigation rates during October. DEQ staff will propose that irrigation of the forested site occur substantially at or below the irrigation water requirement to be determined by the permittee for each irrigation season and demonstrated in the annual reports submitted to DEQ. Zones #1 and #2 (MU152-01 and MU-152-02 respectively) will be required to have a reduced irrigation rate based on the excessive slopes for these management units. A recommended irrigation water requirement prepared by DEQ is demonstrate in Table 7 below.

[1] The 80% exceedance represents the values for the parameter that has an 80% chance of being exceeded that month during any particular year. Conversely, there is a 20% chance that the parameter value will be less than the value shown.

Additional details regarding the calculation methodology used to determine the irrigation water requirement are based on the *Draft 2012 Forest Guidance, 2012* included as Appendix D in this staff analysis.

Table 7 - Recommended irrigation water requirement based on the 80% exccedance

Month	Irrigation Water Requirement (inches)		Irrigation Water Requirement (million gallons)				
	100% IWR MU-152-03 MU-152-04 MU-152-05	75% IWR MU-152-01 MU-152-02	MU-152-01	MU-152-02	MU-152-03	MU-152-04	MU-152-05
May	2.67	2.00	0.452	0.444	0.601	0.592	0.593
Jun	5.49	4.12	0.930	0.914	1.237	1.218	1.220
Jul	8.86	6.65	1.501	1.474	1.997	1.966	1.968
Aug	6.50	4.87	1.101	1.081	1.465	1.442	1.444
Sep	3.46	2.59	0.586	0.575	0.779	0.767	0.768
Oct	0.10	0.07	0.017	0.017	0.022	0.022	0.022
Total	27.07	20.30	4.59	4.50	6.10	6.01	6.01

The proposed composite irrigation water requirement is an increase from the permitted irrigation water requirement of about 17% annually (Figure 6). This increase is in part the result of developing the irrigation water requirement based on the precipitation deficit values from the Coeur d'Alene ET-Idaho station (flagged as an "irrigated" site) which estimates higher evapotranspiration for the crops.

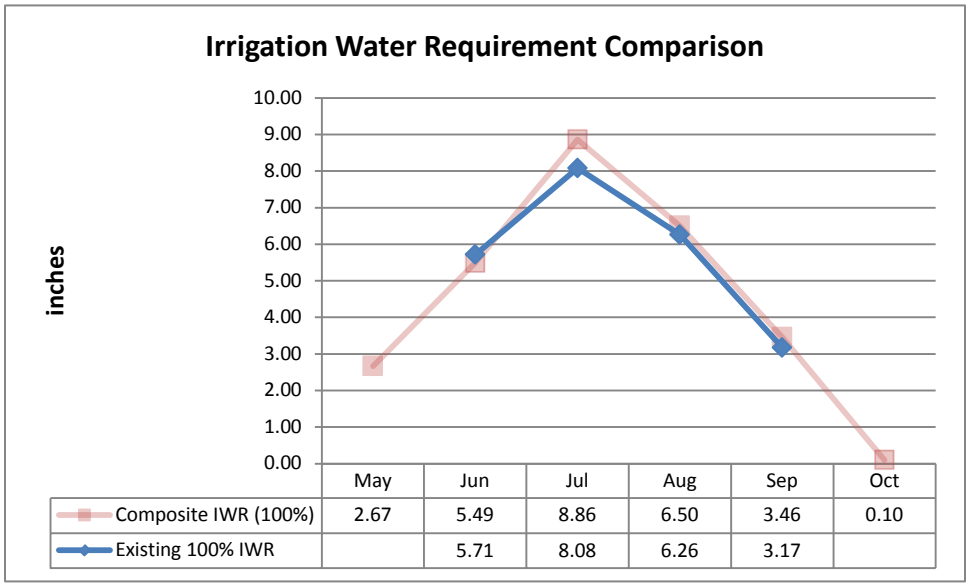


Figure 6 - Recommended IWR (red) compared to the existing IWR (blue). The proposed IWR is based on the 80% exceedance values.

4.6.3 Constituent Loading Rates

4.6.3.1 Historic Total Nitrogen Loading Rates

The expired permit requires monthly grab samples for total nitrogen (i.e. TKN+NO_3+NO_2) when irrigating recycled water and the annual total nitrogen loading rate limit is 129 lbs. N/ac based on the National Resource Conservation (NRCS) recommendations (Wester, 2011). During the current permit cycle, the District did not exceed the annual total nitrogen loading rate applied to any of the existing management units (Table 8).

Table 8 - Annual total nitrogen loading rates in lbs. N/ac for each management unit

	MU-152-01	MU-152-02	MU-152-03	MU-152-04	MU-152-05
2011	17.69	24.09	10.65	24.84	22.89
2012	19.96	31.45	18.41	30.34	32.36
2013	7.04	12.27	7.80	12.47	12.69
2014	8.09	10.07	8.83	12.48	12.16
2015	22.63	30.79	27.20	32.81	33.39
Average	15.08	21.73	14.58	22.59	22.70
Maximum	22.63	31.45	27.20	32.81	33.39

4.6.3.2 Proposed Total Nitrogen Loading Rates

DEQ estimated the nitrogen uptake for the forested site using the NRCS method described in the *Draft Guidance for Forested/Poplar Sites, July 2012* (Appendix D). The majority of the trees onsite are older stands, aged over 40 years (Robinson 2009). The draft guidance estimates the net nitrogen uptake ($N_{net\ uptake}$) as 30 pounds per acre for a stand aged over 40 years. A full, herbaceous understory has an estimated nitrogen uptake of 75 pounds per acre (Cook 2012). Nitrogen loss due to volatilization or denitrification within the soil ranges from 15% to 25% based on typical values for forests with a slightly acidic soil. The nitrogen loading based on these assumptions could be as much as 140 pounds per acre (

Equation 1); an increase from the previous nitrogen uptake by 11 pounds per acre.

Equation 1 - Nutrient loading rate calculation

$$N_{loading\ rate} = \frac{N_{net\ uptake} - N_{credit}}{1 - N_{loss}}$$

- Nitrogen uptake for Douglas fir and Pine, Older Stands – Age over 40 years = 30 pounds per acre
- N uptake for a Herbaceous Vegetation, Full Understory = 75 pounds per acre
- Nitrogen credit. Assumes there is no appreciable change in the soil storage capacity
- Nitrogen loss is roughly 25%

$$N_{loading\ rate} = \frac{\left(30\frac{lbs}{ac} + 75\,\frac{lbs}{ac}\right) - 0.00\,\frac{lbs}{ac}}{(1-0.25)} = \frac{105\ lbs/ac}{0.75} = \boxed{140 \text{ pounds per acre annually}}$$

The wastewater treatment facility was designed to support 69,500 gallons per day or 25.4 MG annually. Assuming that the permittee evenly irrigated over 41 acres during the growing season at the maximum total nitrogen concentration of 17.09 mg/L (Table 5) the annual total nitrogen loading rate in the design year would be 88.3 pounds per acre annually. Assuming the total number of customers allocated to the system (357 ERUs at 200 gallons per day) the potential annual total nitrogen loading rate would be 90.7 pounds per acre annually.

4.6.3.3 Phosphorus

Phosphorus is a nutrient affecting surface water quality and typically is typically adsorbed to the soil particles. Potential surface water contamination can be mitigated by applying phosphorus at agronomic rates and controlling soil erosion and runoff. The expired permit required that phosphorus was monitored monthly, but did not include a limit (Wester, 2011). The average phosphorus loading rate during the recent permit cycle was 8.98 pounds per acre and the maximum phosphorus loading rate was 15.86 pounds per acre (Table 9).

Table 9 - Annual phosphorus loading rates in pounds per acre

	MU-152-01	MU-152-02	MU-152-03	MU-152-04	MU-152-05
2011	6.94	9.05	4.71	9.71	8.82
2012	9.77	15.39	9.02	15.86	15.79
2013	4.03	6.83	4.44	7.37	7.64
2014	4.61	6.29	5.03	7.82	7.51
2015	8.87	11.72	10.81	13.14	13.41
Average	6.84	9.86	6.80	10.78	10.63
Maximum	9.77	15.39	10.81	15.86	15.79

Assuming that 25.4 MG of recycled water is irrigated evenly over 41 acres in the design year at the mean and maximum phosphorus concentrations (Table 5); the expected phosphorus loading rate would be between 26 pounds per acre and 51 pounds per acre annually. These potential loading rates are greater than the 20 pounds per acre the National Resources Conservation Service (NRCS) recommends for forested areas (DEQ 2012). Another factor that was considered is the phosphorus utilization at the site as indicated by the *very high* soil concentrations reported before and after the growing season (See Table 2). The permittee should evaluate the phosphorus loading rates at the reuse site as part of the updated Silvicultural Plan.

The reuse site may be limited in the future by phosphorus loading rates as the District approaches full buildout. It may be necessary to irrigate less if the phosphorus loading rate cannot achieve an appropriate agronomic rate and/or it cannot be demonstrated that the phosphorus is being utilized within the soil. Staff will recommend that the draft permit include provisions to monitor the phosphorus loading rates applied to the site. Since the permittee has not exceeded the typical loading rate of 20 lbs/ac, no loading limit will be recommended at this time. Staff can prepare a major permit modification if one is required in the future. Additionally, staff will recommend continued phosphorus monitoring in the soil and may be include as a monitoring constituent for groundwater. As part of the updated Silvicultural plan, the permittee should include a discussion to address an appropriate agronomic loading rate for the forested site.

Recycled water irrigation at the reuse site may be limited based on the phosphorus loading as the District approaches buildout and further expands the system. It may be necessary to irrigate at lower rates if the phosphorus applied cannot achieve an appropriate agronomic rate and/or the phosphorus soil concentrations continue to be high. DEQ staff will recommend that the draft permit include provisions to monitoring the phosphorus loading rates applied through the recycled water and continued soil monitoring of o-phosphorus. Staff will not recommend a phosphorus loading limit at this time. An appropriate agronomic rate should be addressed in the updated Silvicultural Plan and integrated into the plan of operation. A major permit modification can be prepared in the future if DEQ determines that one is necessary.

4.6.3.4 Chemical Oxygen Demand

The chemical oxygen demand (COD) is estimated to be about 50 mg/L. The average COD loading rate assuming the design year flows would be 2.15 lbs. COD/ac-day during the growing season. DEQ will typically set the COD loading rate limit at 50 lbs./ac-day (DEQ, 2007). The constituent loading

is not expected to change during the next permitting cycle. It should be noted that the District has not been required in the past to monitor the COD concentrations in the recycled water.

4.6.3.5 Total Dissolved Solids

Total dissolved solids are a measure of the volatile dissolved solids (VDS) plus the nonvolatile dissolved solids (NVDS). High levels of NVDS or salts may reduce soil permeability and reduce the ability for the crop to uptake nutrients. In northern Idaho, salts are typically flushed through the soils from the high precipitation in the area.

DEQ may require a permittee to monitor for TDS or the electrical conductivity (EC; an indirect measure of the TDS) in the recycled water to determine the salt loading at the irrigation site; in the soil profile to determine if there is any significant accumulation of salts; and/or as part of groundwater monitoring to determine if there are any potential impacts to groundwater as a result of excess leaching.

5 Site Management

5.1 Buffer Zones

The District will continue treating the wastewater to Class C recycled water standards and will be required to meet the following disinfection requirements from IDAPA 58.01.17.00:

- The median number of total coliform organisms does not exceed 23 total coliform organisms/100 mL, as determined from the bacteriological results of the last 5 days for which analyses have been completed. No sample shall exceed 230 total coliform organisms/100 mL in any confirmed sample.

Recommended buffer zones distances from the DEQ Rules and guidance documents for Class C recycled water in rural areas are compared to the current horizontal buffers and those recommended by DEQ staff for the draft reuse permit in Table 10 below.

Table 10 - Buffer distances to features of concern for sprinkler irrigation in rural areas (feet)

	Public water supplies	Private water supplies	Inhabited dwellings	Permanent & intermittent surface waters	Irrigation ditches & canals	Areas accessible to the public
DEQ Rules/Guidance for Class C Rural Area	1,000	500	300	100	50	0
Existing permit	650	500	300	100	50	0
Proposed MU-152-01	650	500	300	100	50	0
Proposed MU-152-02 MU-152-03 MU-152-04 MU-152-05	1,000	500	300	100	50	0

The MU-152-01 is approximately 650 feet from the Hope Elementary School's ground water source well and does not meet the 1,000 foot horizontal buffer recommended by DEQ guidance

(DEQ, 2007). DEQ is aware of elevated concentrations of nitrates detected in the source well serving the school; however, no single sample from the source has exceeded the maximum contaminant levels (MCLs).

5.2 Runoff

There have been documented runoff events in the past (Van Stone 2011). A hydrogeological evaluation concluded that the recycled water discharged to the ground surface was not expected to have a significant impact on ground water or surface water (Monks 2010). During the current permit cycle there were no sewage releases or occurrences of recycled water runoff reported to DEQ.

Zones #1 and Zone #2 have slopes ranging from 12 to 25% toward the north. Compliance activities in the expired permit required the District to prepare a Runoff Management Plan and an Irrigation Management Plan to reduce the risk of recycled water flowing off-site. The District submitted both documents to DEQ on December 19, 2011.

5.3 Seepage Rate Testing

The current permit required that all three lagoons were seepage tested in accordance with the Idaho Wastewater Rules by April 15, 2012 and every ten (10) years thereafter; or when maintenance to the liner is completed (IDAPA 58.01.16.493.04).

- DEQ approved the seepage rate testing procedures for all three (3) lagoons in an email dated August 8, 2011 and a formal approval letter dated March 21, 2012.
- Seepage testing for the aerated lagoon (LG-152-01) began on September 1, 2011 and the results indicated that the seepage rate for the aerated lagoon was less than the maximum allowable seepage rate of 0.25 inches per day (IDAPA 58.01.16.493). The results were accepted by DEQ in a letter dated March 26, 2012. The next seepage test for the aerated lagoon will need to be completed by September 30, 2021.
- Seepage testing for the upper storage lagoon (LG-152-02) began on May 15, 2012 and the results indicated that the seepage rate for the upper lagoon was less than the maximum allowable seepage rate of 0.25 inches per day (IDAPA 58.01.16.493). The results were accepted by DEQ in a letter dated October 23, 2012. The next seepage test for the upper storage lagoon will need to be completed by August 31, 2022.
- Seepage testing for the lower lagoon began on August 4, 2011 and the results indicated that the seepage rate was greater than the maximum allowable seepage rate of 0.25 per day. The District entered into a compliance agreement schedule (CAS) in a letter dated March 18, 2014 DEQ to have the lower lagoon liner repaired and demonstrate compliance with the maximum allowable seepage rate;
    - The District is continuing to repair damage to the existing liner and will complete subsequent lagoon seepage testing to determine if the repairs were successful (Winter 2016).

Staff will recommend in the draft permit that all three (3) lagoons are seepage tested in accordance with IDAPA 58.01.16.493.

5.4 Waste Solids, Biosolids, Sludge, and Solid Waste

The current O&M Manual includes general procedures for solids removal from the lagoons. Accumulated solids removal is not necessary at this time; as such DEQ staff will not recommend that a solids management plan be required as part of the update to the Plan of Operations (CA-152-01).

A waste solids management plan is required to be submitted to DEQ for review and approval prior to any sludge removal or as part of any necessary repairs to the lagoon liners in accordance with IDAPA 58.01.16.650.

5.5 Nuisance Odors

A letter prepared by Mr. Van Stone dated March 12, 2011 indicated that there have been odor issues from the lagoons as detected from the adjacent properties and Hope Elementary (Van Stone, 2011). An Odor Management Plan was required as compliance activity CA-152-01 in the expired permit and was submitted to DEQ with the updated O&M Manual.

The District installed air diffusion discs in the lower lagoons to increase the dissolved oxygen content of the wastewater and decrease the odors generated from the anoxic zones (Winter 2016). There have been no additional reports of nuisance odors from the facility.

5.6 Cropping Plan

The reuse site consists of a native forest and vegetative understory and would not require a Cropping Plan (See Section 5.9 Silvicultural Plan).

5.7 Grazing

The District does not intend to graze animals at the reuse site. DEQ recommends that the draft permit include a requirement that a grazing management plan be prepared and submitted to DEQ for approval prior to any grazing activities taking place on a permitted reuse site.

5.8 Salts

Supplemental irrigation water is not available at the reuse site. Irrigating with supplement fresh water would improve soil conditions by flushing the salts (total dissolved solids – TDS); however, northern typically Idaho receives sufficient rainfall throughout the year to ensure that the salts do not accumulate within the soil profile. Impacts of salt accumulation within the soil and vegetative root zone may potentially limit soil permeability and reduce the water and nutrient uptake. Electrical conductivity (EC) of a water extraction of soil can be used as an indirect measure of the salt content in the soil.

In a previous permit (LA-000152-02) the District monitored the electrical conductivity of the soils, but this monitoring was not required in the former reuse permit (Wester, 2010).

5.9 Silvicultural Plan

A silvicultural plan titled *Ellisport Bay Water and Sewer District, Silvicultural Plan, December 21, 2004* was prepared for the District by Inland Forest Management and updated in September 2011. This document outlines the forest management practices necessary to ensure the health of the forested site and maximize hydraulic and nutrient uptake.

The reuse site primarily consists of Western Hemlock, Western red cedar, Grand fir, Douglas fir, and birch species with the stands ranging from 60 to 80 years old. The overstory canopy at the reuse site ranges from 40 to 80% (Robinson, 2004). Periodic thinning and removal of the woody and herbaceous materials at the reuse site have been completed over the course of the current permitting cycle to promote better irrigation coverage and reduce the potential ponding and runoff.

6 Monitoring

The proposed monitoring requirements for the draft permit are described in detail in the following subsections. All monitoring will be conducted in accordance with the facility's Quality Assurance Project Plan (QAPP). See Section 7 for requirements regarding the QAPP.

6.1 Wastewater/Recycled Water Monitoring

6.1.1 Wastewater Monitoring

Influent flow monitoring into the treatment facility will be necessary for the District to track the treat capabilities of the facility and the total system capacity. Staff will recommend that the draft permit continue to require that the wastewater influent flows are monitored and reported for each month.

6.1.2 Recycled Water Monitoring

Staff will recommend that the draft permit modify the serial numbering convention for the existing management units to be in-line with the State reuse program (Table 11).

Table 11 - Hydraulic management unit serial number modification

Common Name	Area (acres)	Current Serial Number (LA-000152-03)	Proposed Serial Number (M-152-04)
Zone #1	8.32	MU-015201	MU-152-01
Zone #2	8.17	MU-015202	MU-152-02
Zone #3	8.30	MU-015203	MU-152-03
Zone #4	8.17	MU-015204	MU-152-04
Zone #5	8.18	MU-015205	MU-152-05

It is recommended that the recycled water irrigated to the site is monitored for a total chlorine residual concentration daily during periods of use. This will provide some confidence that adequate disinfection is occurring when total coliform samples are not taken. Staff will recommend that the draft permit require that total coliform grab samples are taken weekly during periods of use (IDAPA 58.01.17.601.03.a).

Monitoring requirements recommended by staff to include in the draft permit are summarized below:

- Volume of recycled water irrigated to each management unit (MG);
- Total nitrogen as N/ monthly;
- Total phosphorus as P/monthly;
- Total coliforms/weekly; and
- Chlorine residual/daily
- Underdrain monitoring (when flowing);
    - Nitrate+nitrite as N/ quarter
    - Flowrate

There is not a major concern regarding the potential for phosphorus to enter the lake based on the horizontal buffer distances, general site topography, and limited constituent transport. However, the soil monitoring data shows an increasing trend of high phosphorus concentrations in the soil profile. Staff recommends that the permittee continue monitoring the phosphorus concentrations monthly during periods of use and report on the annual phosphorus loading rate applied to each management unit. Staff does not recommend requiring phosphorus loading rate limit at this time based on the actual loading rates reported during the previous permit cycle which are below the NRCS recommendations for forested sites.

It is recommended that the facility address phosphorus loading and utilization in the updated Silvicultural Plan.

Staff recommends that the annual total nitrogen loading rate is limited to 140 pounds per acre.

6.2 Soil Monitoring

Staff recommends the permittee complete composite soil monitoring in September, in the 1st, 5th, and 9th years of the permit at each soil monitoring unit (SMU) identified in the draft permit. The

number and sample locations will be specified in the PO or QAPP. Composite soil samples will be obtained from three depths: 0-12 inches; 12-24 inches; and 24-36 inches or refusal. The following monitoring constituents will be required:

- Electrical conductivity;
- Nitrate as N;
- Ammonium as N;
- Plant available phosphorus; and
- pH

This monitoring will be required to determine if there are any trends in the data to suggest that the nutrient and hydraulic uptake from the vegetation is impacted. As stated above, phosphorus concentrations within the soil profile are high (DEQ 2007) and appears to be increasing slightly.

6.3 Ground Water Monitoring

Staff recommends that ground water monitoring be included as a requirement in the draft permit. An adequate number of monitoring wells shall be identified and constructed by the District to improve the ability to evaluate the impacts from recycled water irrigation and lagoon seepage from the lagoons. A ground water monitoring plan will need to be prepared to address the number and location of wells to be constructed and sampled at a frequency necessary to establish a statistically defensible set of data for analysis. The draft permit will include quarterly sampling for a minimum of two (2) years after the wells are constructed and then semi-annually thereafter or as determined from an analysis of the data.

Plans and specifications for the well constructions will need to be approved by DEQ prior to constructing the wells. A compliance activity (CA-152-03) has been included in the draft permit requiring that the ground water monitoring network is constructed and a monitoring plan is implemented and incorporated into the permit. The recommended minimum constituents to be monitored in the ground water are the following:

- Chloride;
- Nitrate as N (consider using low detection level sample analysis to avoid non-detect results);
- Static water level
- Temperature

Staff recommends that the District prepare and submit an analysis of the monitoring data five years after permit issuance and an updated report submitted 180 days prior to permit expiration (with the technical report). These reports will need to include trend and statistical analysis of the ground water data to determine if there are substantial impacts to the ground water quality. DEQ may be required to modify the reuse permit and include additional permit limits if it is determined that the facility is not in compliance with the Ground Water Quality Rules (IDAPA 58.01.11).

6.4 Supplemental Irrigation Water Monitoring

Supplemental irrigation water is not utilized as part of the recycled water irrigation system. Staff will not recommend any monitoring requirements for supplemental irrigation in the draft permit. If circumstances change, the District will need to contact DEQ and have a major permit modification issued prior to irrigating any supplemental water.

6.5 Crop Yield and Tissue Monitoring

Tissue analysis of woody material harvested from the trees to determine nutrient content is not practical. Also, nutrient loading rates at this time are lower than the sites' estimated nutrient uptake. DEQ does not anticipate a substantial increase in the nutrient loading during the proposed permit cycle. The District should report any harvested yields of the timber in board-feet with each annual report submittal.

6.6 Meteorological Monitoring

Staff will recommend that the permittee irrigate recycled water substantially at or below an irrigation water requirement to be determined by the permittee annually. This would allow the permittee additional flexibility to irrigate the reuse site based on the actual weather conditions each year. The permittee is responsible for demonstrating that the hydraulic loading rates are appropriate with each annual report submittal.

At a minimum staff recommends that the facility install a rain gauge on site and record the precipitation daily to demonstrate compliance. Each annual report submitted to DEQ should include a discussion of the meteorological data and demonstrate how this data was used to develop a reasonable irrigation water requirement for the growing season. This calculation methodology must be incorporated into the irrigation management plan required by Compliance Activity CA-152-01.

6.7 Calculation Methodologies

Calculation methodologies for determining permit compliance with the hydraulic loading rates must be approved by DEQ in the updated PO and supplemental planning documents per CA-152-01 in the draft permit. The permittee should refer to the Wastewater Land Application Operators Study and Reference Manual (*http://www.deq.idaho.gov/laws,-rules,-etc/deq-guidance.aspx*) or the DEQ reuse guidance document when there are questions regarding the calculation method.

7 Quality Assurance Project Plan

The Quality Assurance Project Plan (QAPP) is a written document outlining the procedures used by the permitee to ensure the data collected and analyzed meets the requirements of the permit.

In support of the agency mission, DEQ is dedicated to using and providing objective, correct, reliable, and understandable information. Decisions made by DEQ are subject to public review

and may at times, be subject to rigorous scrutiny. Therefore, DEQ's goal is to ensure that all decisions are based on data of known and acceptable quality.

The QAPP is a permit requirement and must be submitted to DEQ as a stand-alone document for review and acceptance. The QAPP is used to assist the permittee in planning for the collection, analysis, and reporting of all monitoring data in support of the reuse permit and explaining data anomalies when they occur.

DEQ does not approve QAPPs, but reviews them to determine if the minimum EPA guideline requirements are met and that the reuse permit requirements are satisfied. The reason DEQ does not approve QAPPs is that the responsibility for validation of the facility sampling data lies with the permittee's quality assurance officer and not with DEQ.

The format of the QAPP should adhere to the recommendations and references in 1) the Assurance and Data Processing sections of the DEQ Guidance and 2) EPA QAPP guidance documents. EPA QAPP guidance documents are available at the following website: *http://www.epa.gov/quality/qapps.html*

8 Site Operation and Maintenance

IDAPA 58.01.16, "Wastewater Rules" specifies that all owners of a public wastewater system must place the direct supervision of their facility under the charge of an operator who holds a valid license equal to or greater than the classification of the wastewater facility. The following information pertains to the classification of the facility and its operators:

- **Collection system classification: Class I**
- **Treatment classification: Class I**
- **Responsible charge operator (RCO):** Dex Vogel
    - WWC1-14834; Wastewater Collection Operator – Class I
    - WWT1-14834; Wastewater Treatment Operator – Class I
    - WWTL-11853; Wastewater Treatment Operator – Lagoon
    - WWTLA-15571; Wastewater Treatment Operator – Land Application
- **Substitute responsible charge operator (SRCO):** The District will retain the RCO on-call 24 hours per day, 7 days per week by phone. DEQ finds this alternative acceptable in lieu of retaining a substitute operator.

The District will need to periodically review and update the collection and treatment classifications every five (5) years or when the facilities undergoes any major modifications.

9 Compliance Activities

9.1 Status of Compliance Activities in Current Permit

The compliance status update for each compliance activity is shown in **bold text**.

Compliance Activity Number **Completion Date**	**Compliance Activity Description**
CA-152-01 *Six (6) Months after Permit Issuance*	*An updated Plan of Operation (Operation and Maintenance Manual or O&M Manual) for the wastewater reuse facilities, incorporating the requirements of this permit, shall be submitted to DEQ for review and approval unless it can be demonstrated to DEQ that the current Plan of Operation is adequate. The Plan of Operation shall be designed for use as an operator guide for actual day-to-day operations to meet permit requirements and shall include daily sampling and monitoring requirements to assess the adequacy of wastewater treatment facility operation. The Plan of Operation shall contain at a minimum all of the applicable information in the latest revision of the Plan of Operation Checklist.* **An updated Plan of Operation was submitted to DEQ on March 13, 2014.**
CA-152-02 *Six (6) Months after Permit Issuance*	*Runoff Management Plan for control and mitigation of site runoff. This plan shall include administrative procedures and practices to assure that no wastewater or runoff from the irrigation activities leaves the reuse site.* *Upon approval of the plan, the facility shall implement the identified procedures and practices. The Plan shall then be considered part of the facility O&M Manual and enforceable as such.* **The runoff management plan was submitted to DEQ on December 19, 2011.**
CA-152-03 *Six (6) Months after Permit Issuance*	*Quality Assurance Project Plan (QAPP) for monitoring required in this permit. The plan shall cover field activities; laboratory analytical methods and other activities; data verification and validation; data storage, retrieval and assessment; and monitoring program evaluation and improvement.* **The Quality Assurance Project Plan was submitted to DEQ on March 12, 2014.**

Compliance Activity Number **Completion Date**	**Compliance Activity Description**
CA-152-04 *Four (4) Months after Permit Issuance to submit the Silviculture Management Plan* *Twelve (12) Months after Permit Issuance to Implement Plan*	*The permittee shall submit to the Department for review and approval an updated Silviculture Management Plan for the wastewater reuse site. The plan shall include nutrient and hydraulic balance evaluations for all tree species intended for planting on the site during the permit cycle, as available, as well as a schedule for necessary activities identified by the plan.* *Upon approval of the plan, the facility shall implement the identified procedures and practices. The Plan shall then be considered part of the facility O&M Manual and enforceable as such.* **An updated Silvicultural plan was submitted with the updated Plan of Operation on March 13, 2014.**
CA-152-05 *Four (4) Months after Permit Issuance to submit the Reuse Site Maintenance Plan* *Twelve (12) Months after Permit Issuance to Implement Plan*	*Submit a Reuse Site Maintenance Plan that evaluates the current condition of the wastewater treatment and irrigation systems and identifies preventative maintenance practices needed to maintain system efficiency and effectiveness. The plan shall include a schedule for necessary activities identified by the plan as well as operator inspection procedures and checklists for mechanical equipment and forest management measures to protect and maintain irrigation laterals and sprinklers.* *Upon approval of the plan, the facility shall implement the identified procedures and practices. The Plan shall then be considered part of the facility O&M Manual and enforceable as such.* **A Reuse Management Plan was submitted to DEQ on March 13, 2014 with the updated Plan of Operations.**

Compliance Activity Number **Completion Date**	**Compliance Activity Description**
CA-152-06 *Eight (8) Months after Permit Issuance to submit the Seepage Testing Procedure Plan.* *April 15, 2012 to complete seepage testing of all required structures*	*Submit a seepage testing plan that defines the approach and testing procedures to conduct seepage testing in accordance with methods approved by DEQ on all wastewater lagoons at this site.* *Upon DEQ approval of the plan, conduct the seepage testing of the structures in the approved plan and submit test results to DEQ. The seepage performance standard must meet the Operating Standard as required in IDAPA 58.01.16.493.03b, "Wastewater Rules."* *If a properly tested lagoon leaks at a rate higher than the Operating Standard, then the permittee must meet the requirements for Lagoons Leaking Above the Allowable Amount as found in IDAPA 58.01.16.493.04, "Wastewater Rules."* **Seepage rate testing procedures were approved by DEQ in a letter dated July 13, 2011. Subsequent testing results demonstrating that the upper lagoon was not exceeding the allowable seepage rate were approved by DEQ for the upper lagoon in a letter dated October 23, 2014.** **Initial seepage test results for the lower lagoon indicated that the lagoon was exceeding the maximum allowable seepage rate. The District entered into a Compliance Agreement Schedule (CAS) with DEQ. Repairs to the lagoon liner were completed in October 2015 and the District will complete a seepage test in Spring 2016 (Winter 2016).**
CA-152-07 *One hundred eighty (180) days prior to permit expiration*	*Submit an application package to DEQ for permit renewal.* **The District submitted the application package for permit renewal to DEQ on April 25, 2016.**

9.2 Compliance Activities Required in New Permit

The following Compliance Activities are specified in the draft permit:

Compliance Activity (CA) Number and Completion Due Date	Compliance Activity Description
CA-152-01 Twelve (12) months after permit issuance	**Updated Plan of Operation (PO)**: The permittee shall submit for review and approval an updated Plan of Operation that reflects current operations and incorporates the requirements of this permit. The updated PO shall comply with the applicable requirements stated in IDAPA 58.01.17.300.05 and shall address applicable items in the Plan of Operation Checklist in the DEQ Guidance. The PO shall include the following site management plans or the permittee may submit the site management plans individually: 1. Buffer zone plan; 2. Emergency operating plan; 3. Irrigation management and scheduling plan; 4. Nuisance and Odor management plan; 5. Runoff management plan; 6. Waste solids management plan; 7. Ground water monitoring and statistical analysis of data plan. The PO shall be updated as needed to reflect current operations. The permittee shall notify DEQ of material changes to the PO and copies shall be kept on site and made available to DEQ upon request. A ground water monitoring plan shall be prepared and incorporated into the PO (See CA-152-03).

Compliance Activity (CA) Number and Completion Due Date	Compliance Activity Description
CA-152-02 Eighteen (18) months after permit issuance	**Updated Quality Assurance Project Plan (QAPP)**: The permittee shall update and implement a QAPP that incorporates all monitoring and reporting required by this permit. A copy of the QAPP along with written notice that the permittee has implemented the QAPP shall be provided to DEQ. The QAPP shall be designed to assist in planning for the collection, analysis, and reporting of all monitoring in support of this permit and in explaining data anomalies when they occur. At a minimum, the QAPP must include the following: 1. Details on the number of measurements, number of samples, type of sample containers, preservation of samples, holding times, analytical methods, analytical detection, and quantitation limits for each target compound, type and number of quality assurance field samples, precision and accuracy requirements, sample preparation requirements, sample shipping methods, and laboratory data delivery requirements. 2. Maps indicating the location of each monitoring, and sampling point. 3. Qualification and training of personnel. 4. Names, addresses, and telephone numbers of the laboratories used by or proposed to be used by the permittee. 5. Example formats and tables that will be used by the permittee to summarize and present all data in the annual report. The format and content of the QAPP should adhere to the recommendations and references in the Quality Assurance and Data Processing sections of the DEQ Guidance. The permittee shall amend the QAPP whenever there is a modification in sample collection, sample analysis, or other procedure addressed by the QAPP. The permittee shall notify DEQ of material changes to the QAPP and copies shall be kept on site and made available to DEQ upon request.
CA-152-03 Five (5) years after permit issuance	**Ground Water Monitoring Plan:** Submit to DEQ for review and approval a ground water monitoring plan to be used in the design of a ground water monitoring well network. This evaluation must be prepared by an Idaho licensed professional engineer (PE) or an Idaho licensed professional geologist (PG). The plan must address the adequate number and locations of monitoring wells, the constituents to be monitored, the monitoring frequency and number of samples required for a statistically defensible analysis of the data; and a Quality Assurance Project Plan (QAPP) addressing ground water monitoring. These documents will be incorporated into this permit once approved. Concurrent to this submittal, the permittee shall submit to DEQ for review and approval plans and specifications for the construction of the ground water monitoring wells. After DEQ has approved the P&S, the permittee must construct the ground water monitoring network.

<table>
<tr><th>Compliance Activity (CA) Number and Completion Due Date</th><th>Compliance Activity Description</th></tr>
<tr><td>As specified in the approved Ground Water Monitoring Plan</td><td>Ground Water Monitoring Report: The permittee shall submit a report to DEQ to determine if there is a statistical degradation of ground water quality from the wastewater facility. If applicable, the permittee must recommend best management practices (BMPs) or other actions to be taken to protect ground water quality.</td></tr>
<tr><td>CA-152-04
Two (2) years after permit issuance</td><td>Updated Silvicultural Plan – The permittee shall submit an updated silvicultural plan to DEQ. The following items will need to be addressed as part of the document:
Approximate canopy and understory coverage for each management unit;
Recommended thinning schedule; and
Recommendations to optimize nutrient and hydraulic uptake</td></tr>
<tr><td>CA-152-05
As specified in the activity description</td><td>Seepage Testing: The following table shows the date by which the permittee shall complete seepage testing on the specified lagoons:
<table>
<tr><th>Lagoon:</th><th>Seepage Test Due Date:</th></tr>
<tr><td>Upper aerated lagoon
LG-152-01</td><td>September 2021</td></tr>
<tr><td>Upper storage lagoon
LG-152-02</td><td>August 2022</td></tr>
<tr><td>Lower storage lagoon
LG-152-03</td><td>Per the existing CAS and in accordance with IDAPA 58.01.16.493.</td></tr>
</table>
Submit to DEQ for review and approval a proposed schedule and procedure for performing the required seepage tests at least 42 days prior to the planned seepage test. Guidance for developing seepage test procedures are available at: http://www.deq.idaho.gov/water-quality/wastewater/lagoon-seepage-testing.aspx
The seepage test procedures shall be sealed by the Idaho licensed professional engineer or professional geologist in responsible charge for the test.
Seepage tests shall be completed in accordance with the procedures approved by DEQ. The seepage test report shall be sealed by the person in responsible charge and submitted within 90 days after completion of the seepage test.
For municipal lagoons, the leakage rate for lagoons constructed after April 15, 2007 shall be no more than zero point one hundred twenty-five (0.125) inches (1/8 inch) per day. The leakage rate for existing lagoons constructed prior to April 15, 2007 shall be no more than zero point twenty-five (0.25) inches (1/4 inch) per day. See IDAPA 58.01.16.493.03. Requirements for lagoons leaking above the allowable amount are outlined in IDAPA 58.01.16.493.04. </td></tr>
</table>

Compliance Activity (CA) Number and Completion Due Date	Compliance Activity Description
CA-152-06 Twelve (12) months prior to permit expiration	**Pre-Application Workshop:** If the permittee intends to continue operating the reuse facility beyond the expiration date of this permit, the permittee shall contact DEQ and schedule a pre-application workshop to discuss the compliance status of the facility and the content required for the reuse permit application package.
CA-152-07 180 days prior to permit expiration	**Renewal Permit Application:** The permittee shall submit to DEQ a complete permit renewal application package, which fulfills the requirements specified at the pre-application workshop identified in CA-152-05.

10 Recommendations

Staff recommends the draft reuse permit be issued. The permit specifies hydraulic and constituent loading limits and establishes monitoring and reporting requirements to evaluate system performance, environmental impacts, and permit compliance.

11 References

DEQ 2002. *Source Water Assessment Report: Hope Elementary School (PWS# ID1090185) Well #1 E0005111*

DEQ 2011. *Municipal Wastewater Reuse Permit LA-000152-03*.

DEQ 2016. *Draft Municipal Reuse System Buffer Zone Guidance*. Updated October 28, 2015.

EBSD 2013. *Re: Ellisport Bay Sewer District (ESBD) Follow-up Work on Lower Lagoon Leakage Testing. Project No. S100330*. Permit LA-000152-03.

EBSD 2009. *Ellisport Bay Sewer District, Operation and Maintenance Plan*. Permit LA-000152-03.

Grafe C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, D.T. Mosier, 2002. *The Idaho Department of Environmental Quality Water Body Assessment Guidance, Second Edition-Final*. Idaho Department of Environmental Quality; Boise Idaho.

Metcalf & Eddy 2003. Wastewater Engineering Treatment and Reuse, 4th Edition.

Robinson 2004. Ellisport Bay Water and Sewer District, Silvicultural Plan, December 21, 2004. Permit LA-000152-02.

Stevens 2013. *Hope Elementary School Ground Water Investigation*. Report DEQ-CRO-01-13

Tindall 2004. *Memorandum, Staff Analysis for Ellisport Bay Wastewater Land Application Permit (Hope and East Hope)*, LA-000152-02.

Van Stone 2011. Ref: *Comments to the Ellisport Bay Sewer Permit Renewal, March 12, 2011*. Permit LA-000152-03.

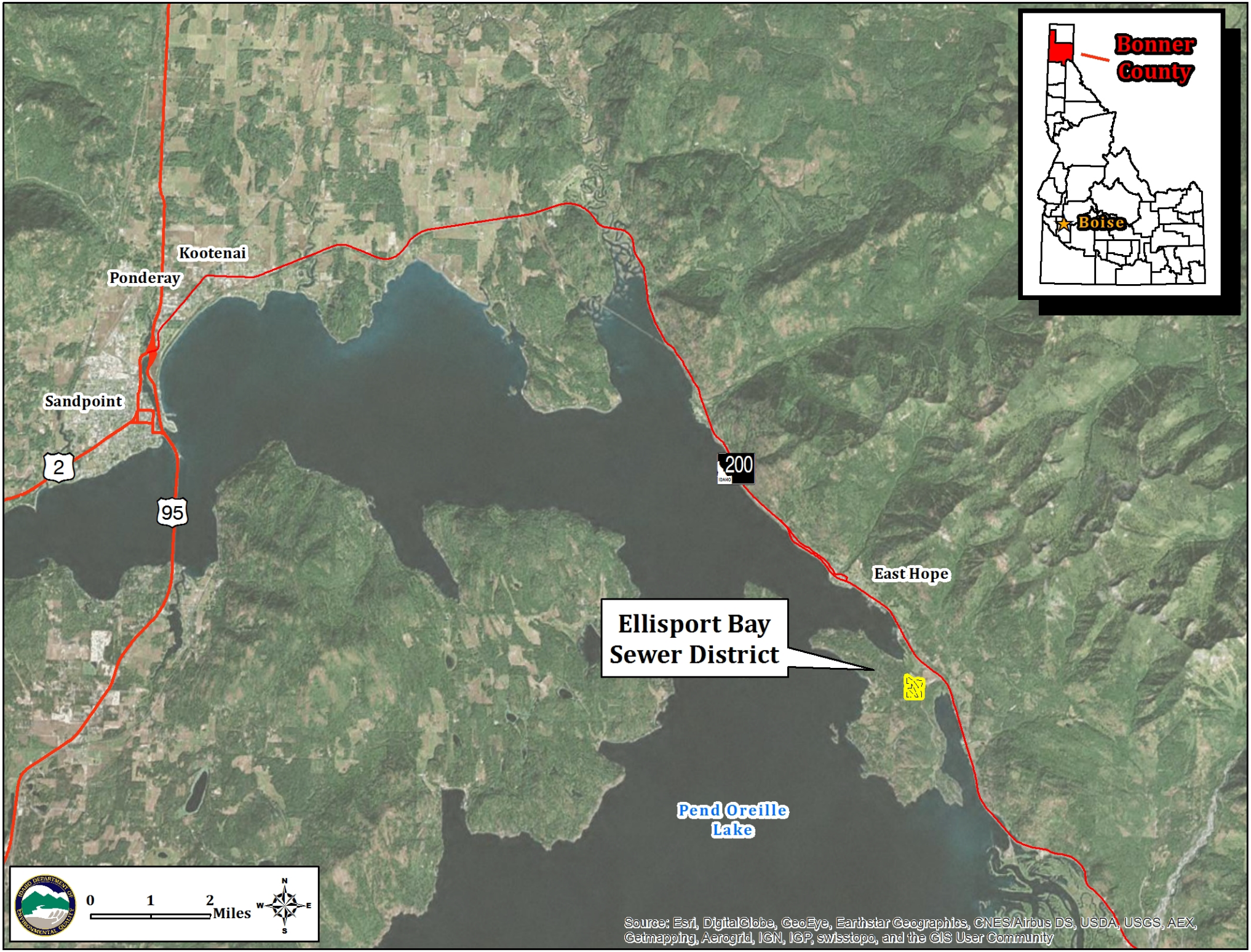
Vogal 2016. Subject: Voice message: from "Unknown". April 2, 2015

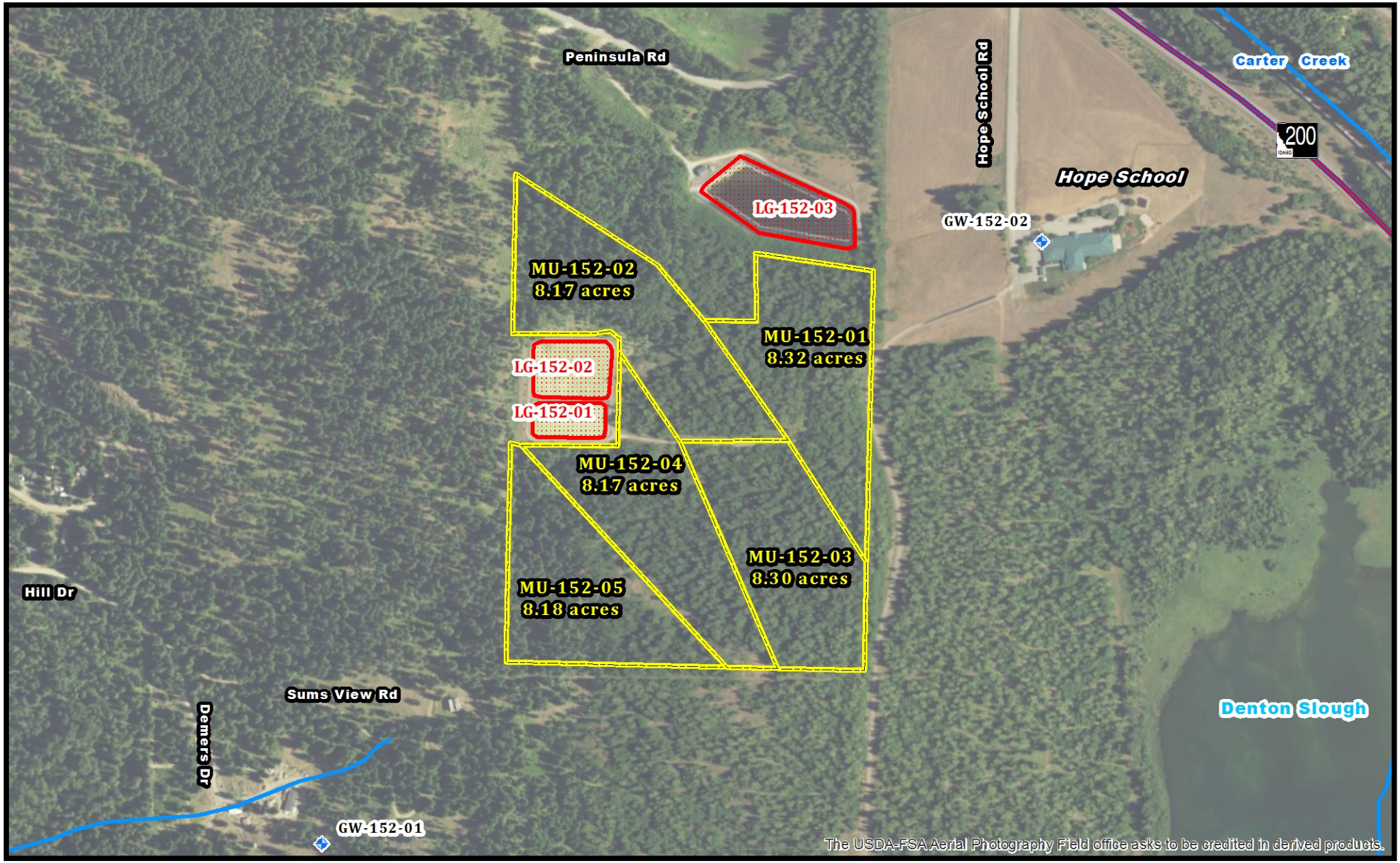
Wester 2011. *Memorandum, Staff Analysis for Draft Wastewater Reuse Permit LA-000152-03 (Municipal Wastewater) – Ellisport Bay Sewer District.* Permit LA-000152-03

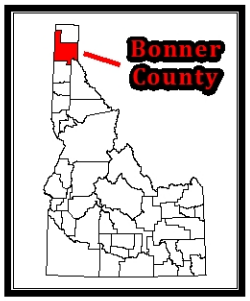
Winter 2016a. *Wastewater Reuse Permit Renewal Application for the Ellisport Bay Sewer District.* Permit M-152-04

Winter, 2016b. Wastewater Classification Form for Ellisport Bay Sewer District

Appendix A. Site Maps


Bonner County
Boise
Kootenai
Ponderay
Sandpoint
2
95
200
East Hope
Ellisport Bay Sewer District
Pend Oreille Lake
0 1 2 Miles
N
W
E
S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





Ellisport Bay Sewer District

M-152-04

N
W E
S

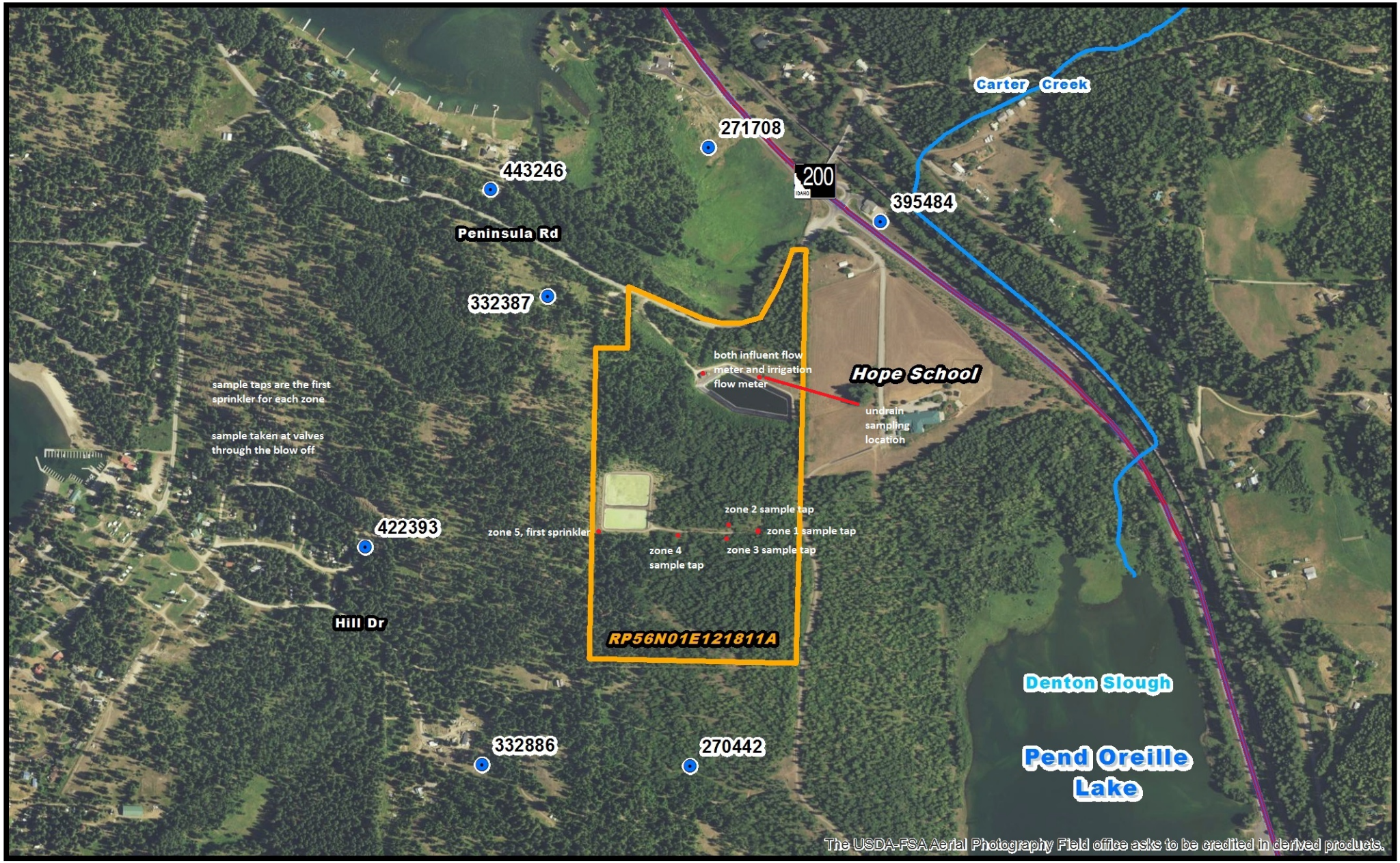
0 100 200 Meters

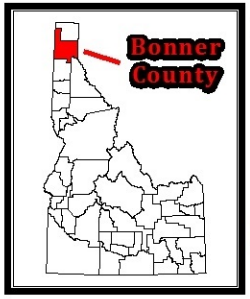
0 425 850 Feet

Legend

- Monitoring Well
- Streams/Canals
- Highway
- Lagoon
- Major Roads
- Reuse Irrigation

DEQGIS:3-29-2016





Ellisport Bay Sewer District

M-152-04

Parcel Boundary

N
W E
S

0 200 400 Meters

0 750 1,500 Feet

Legend

- Private Wells
- Streams/Canals
- Highway
- Parcel Boundary

DEQGIS:3-29-2016

Appendix B. Private Ground Water Source Wells – Well Driller Permits

Form 238-7
1-79

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

USE TYPEWRITER OR BALLPOINT PEN

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name: WAYNE PARENTEAU

Address: HOPE, Id

Owner's Permit No. 96-79-N-38

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe method of abandoning) _____

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	6 inches +	1 feet	80 feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet

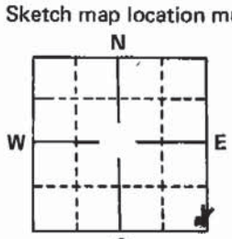
Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☒ Knife ☐ Torch
Size of perforation 1/4 inches by 4 inches

Number	From	To
24 perforations	67 feet	77 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 60 Material used in seal: ☐ Cement grout ☐ Puddling clay ☒ Well cuttings
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing ☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld ☐ Cemented between strata
Describe access port _____

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____

County BONNER

SE ¼ SE ¼ Sec. 12, T. 56 N/S, R. 1 E/W.

7. WATER LEVEL

Static water level 37 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature ____ °F. Quality _____

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
7.5	78'	1 hr

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
6	0	3	Top soil + Boulders		—
	3	37	Soft sandstone + Boulders		—
	37	66	Fine pasty sand	✓	
	66	80	Gravel + sand	✓	

COAST

RECEIVED
JUN 7 1979
Department of Water Resources
Northern District Office

10.

Work started 5-30-79 finished 5-31-79

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name BRAND X WATER WELLS Firm No. 289
Address Ripley Id Date 6-1-79
Signed by (Firm Official) Lindon Condon
and
(Operator) Lindon Condon

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

USE TYPEWRITER OR BALL POINT PEN

State of Idaho
Department of Water Administration

WELL DRILLER'S REPORT

RECEIVED RECEIVED

State law requires that this report be filed with the Director, Department of Water Administration within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name Larry T. Parson

Address 645 Pueblo Dr. Thousand Oaks, Calif.

Owner's Permit No. 96-72-N-8

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement

☐ Abandoned (describe method of abandoning)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test

☐ Municipal ☐ Industrial ☐ Stock

4. METHOD DRILLED

☒ Cable ☐ Rotory ☐ Dug ☐ Other

5. WELL CONSTRUCTION

Diameter of hole 6 inches Total depth 90 feet

Casing schedule: ☒ Steel ☐ Concrete

Thickness	Diameter	From	To
250 inches	6 inches	+ 2 feet	90 feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet

Was a packer or seal used? ☐ Yes ☒ No

Perforated? ☒ Yes ☐ No

How perforated? ☐ Factory ☐ Knife ☒ Torch

Size of perforation 3/16 inches by 4 inches

Number	From	To
24 perforations	84 feet	89 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No

Manufacturer's name

Type Model No.

Diameter Slot size Set from feet to feet

Diameter Slot size Set from feet to feet

Gravel packed? ☐ Yes ☒ No Size of gravel

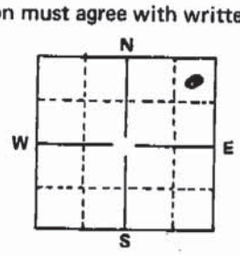
Placed from feet to feet

Surface seal? ☒ Yes ☐ No To what depth 20 feet

Material used in seal ☐ Cement grout ☒ Puddling clay

6. LOCATION OF WELL

Sketch map location must agree with written location.



County Bonner

NE ¼ NE ¼ Sec. 12, T. 56 N/~~S~~, R. 1 E/~~W~~

7. WATER LEVEL

Department of Water Administration

Static water level 0 feet below land surface

Flowing? ☒ Yes ☐ No G.P.M. flow 1/2

Temperature 43 °F. Quality good

Artesian closed-in pressure 0 p.s.i.

Controlled by ☐ Valve ☒ Cap ☐ Plug

8. WELL TEST DATA

☒ Pump ☐ Bailer ☐ Other

Discharge G.P.M.	Draw Down	Hours Pumped
18	80	6½

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
6	0	1	topsoil		—
	1	29	Peat soil		—
	29	56	clay		—
	56	80	gravel and clay		—
	80	90	gravel	—	

003120

10.

Work started 10-2-72 finished 10-9-72

11. DRILLER'S CERTIFICATION

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

Bob Pitts Welldrilling 235
Driller's or Firm's Name Number

415 S. Ella Sandpoint Idaho
Address

Bob Pitts 10-18-72
Signed By Date

USE ADDITIONAL SHEETS IF NECESSARY

FORWARD THE WHITE, BLUE, AND PINK COPIES TO THE DEPARTMENT

Form 238-7
6/02

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Well ID No.
Inspected by
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0035444
DRILLING PERMIT NO. 824842
Water Right or Injection Well No.

2. OWNER:
Name Sam Owen Fire District
Address PO. 344
City Hope State Id. Zip 83836

3. LOCATION OF WELL by legal description:
You must provide address or Lot, Blk, Sub. or Directions to well.
Twp. 56 North ☒ or South ☐
Rge. 2 East ☒ or West ☐
Sec. 7, ____ 1/4 (10 acres) ____ 1/4 (40 acres) ____ 1/4 (160 acres)
Gov't Lot 1 County Bonner
Lat: : : Long: : :
Address of Well Site 17 Old Sam Owen Dr.
(Give at least name of road + Distance to Road or Landmark) City
Lt. ____ Blk. ____ Sub. Name

4. USE:
☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

5. TYPE OF WORK check all that apply (Replacement etc.)
☒ New Well ☐ Modify ☐ Abandonment ☐ Other

6. DRILL METHOD:
☒ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
Bentonite	0	20	300 lbs	Over Bore

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 125'
Was drive shoe seal tested? ☒ Y ☐ N How? Air pressure

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6	+1	-125	250	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe ____
Packer ☐ Y ☒ N Type

9. PERFORATIONS/SCREENS PACKER TYPE NONE
Perforation Method
Screen Type & Method of Installation

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						☐	☐
						☐	☐
						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
35 ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices:
Bolted Well Cap
56 N 2E 7

12. WELL TESTS:
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
100 +			

Water Temp. Cold Bottom hole temp. Cold
Water Quality test or comments: Good
Depth first Water Encounter 117

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
8	0	20			
6	20	140			
	0	5	Brown Clay & Top soil		X
	5	9	Large gravel		X
	9	25	Sandy Clay & Sand Streaks		X
	25	117	grey sandy Clay		X
	117	130	Lg. Gravel & Sand	X	
	130	140	Brown Clay		X

AQUA DRILLING
& EXPLORATION INC.
PO BOX 2850
HAYDEN, ID 83835-2850

Completed Depth 125 (Measurable)
Date: Started 9-27-04 Completed 9-29-04

14. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was released.
Company Name AQUA DRILLING & EXPLORATION INC. Firm No. 163
Principal Driller Scott N. Brunthaver Date
and
Driller or Operator II Wayne Miller Date 10-1-04
Operator I Date
Principal Driller and Rig Operator *Required.*
Operator I must have signature of Driller/Operator II.

FORWARD WHITE COPY TO WATER RESOURCES

Form 238-7
11/97

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

RECEIVED
DEC 13 1999
IDWR/North

77160

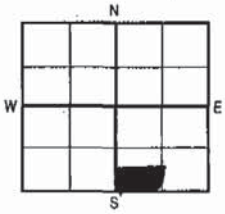
Office Use Only
Inspected by _____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0010768
DRILLING PERMIT NO. 96-99-N-289
Other IDWR No.

2. OWNER:
Name Bernice Demers & Glenn Demers
Address PO Box 275
City Hope State Id Zip 83836

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.

POSTED



Twp. 56 North ☒ or South ☐
Rge. 1 East ☒ or West ☐
Sec. 12, S ½ (10 acres) SW 1/4 (40 acres) SE 1/4 (160 acres)
Gov't Lot ____ County Bonner
Lat: : : Long: : :
Address of Well Site 166 Demers
Drive - Peninsula to Demers City Hope
(Give at least name of road + Distance to Road or Landmark)

Lt. ____ Blk. ____ Sub. Name ____

4. USE:
☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other ____

5. TYPE OF WORK check all that apply (Replacement etc.)
☒ New Well ☐ Modify ☐ Abandonment ☐ Other ____

6. DRILL METHOD
☒ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other ____

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
Casing Seal	0	21	7	Poured

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 21'
Was drive shoe seal tested? ☒ Y ☐ N How? Air pressure

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6	+1	-21	250	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe ____

9. PERFORATIONS/SCREENS
Perforations None Method ____
Screens Screen Type ____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						☐	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
113 ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices: Bolted Cap

11. WELL TESTS:
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
3			

Water Temp. Cool Bottom hole temp. Cool
Water Quality test or comments: Good
Depth first Water Encounter 200'

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
8	0	21			
6	21	600			
	0	3	Top Soil		
	3	15	Brown Shale		
	15	27	Blue Shale		
	27	55	Brown Shale		
	55	452	Blue Shale	X	
	452	602	Blue Shale w/ Green Shale	X	

Completed Depth 602 (Measurable)
Date: Started 11-8-99 Completed 11-10-99

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name AQUA DRILLING & EXPLORATION INC. Firm No. 163

Firm Official Scott M. Braun Date 11-11-99
and
Driller or Operator Wayne M. [illegible] Date 11-11-99
(Sign once if Firm Official & Operator)

56 N 1E 12

FORWARD WHITE COPY TO WATER RESOURCES

Form 238-7
11/97

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

RECEIVED
NOV 20 1998
IDWR/North

781117

Office Use Only
Inspected by _____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 5319

DRILLING PERMIT NO. 96-98-N-210

Other IDWR No. _____

2. OWNER:

Name Ellisport Bay Sewer District

Address P.O. Box 455

City Hope State ID Zip 83836

3. LOCATION OF WELL by legal description:

Sketch map location must agree with written location.

N / W / E / S

Twp. 56 North ☒ or South ☐

Rge. 1 East ☒ or West ☐

Sec. 12, NE 1/4 (10 acres) SW 1/4 (40 acres) NE 1/4 (160 acres)

Gov't Lot ____ County Bonner

Lat: : : Long: : :

Address of Well Site Samowen Road

City Hope

(Give at least name of road + Distance to Road or Landmark)

Lt. ____ Blk. ____ Sub. Name ____

POSTED

4. USE:

☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other ____

5. TYPE OF WORK check all that apply (Replacement etc.)

☒ New Well ☐ Modify ☐ Abandonment ☐ Other ____

6. DRILL METHOD

☒ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other ____

7. SEALING PROCEDURES

SEAL/FILTER PACK			AMOUNT	METHOD
Material	From	To	Sacks or Pounds	
CS Granular	0'	18'	450lbs.	Overdrill

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 22'

Was drive shoe seal tested? ☐ Y ☒ N How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6"	+2'	22'	.250	C.S.	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe ____

9. PERFORATIONS/SCREENS

Perforations Method ____

Screens Screen Type ____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						☐	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

____ ft. below ground Artesian pressure ____ lb.

Depth flow encountered ____ ft. Describe access port or control devices: ____

11. WELL TESTS:

☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
Dry Hole	N.A.	N.A.	N.A.

Water Temp. ____ Bottom hole temp. ____

Water Quality test or comments: ____

Depth first Water Encountered [redacted]

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
10"	0'	6'	Fill-Boulders & Dirt		X
10"	6'	22'	Large Cobbles, Sand&Gravel		X
6"	22'	26'	Shale		X
			NOTE: Well was not drilled deeper due to encountering shale at 22'. This was done per the site engineer. Well cap was welded solid. The well was left as is.		

Completed Depth 26' (Measurable)

Date: Started 10/01/98 Completed 10/02/98

13. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name Tacoma Pump & Drilling Firm No. 423

Firm Official [signature] Date 10/09/98

and

Driller or Operator ____ Date ____

(Sign once if Firm Official & Operator)

56N 1E 12

FORWARD WHITE COPY TO WATER RESOURCES

Form 238-7
11/97 JGE

IDAHO DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

Office Use Only
Inspected by
Twp Rge Sec
1/4 1/4 1/4
Lat: : : Long: :

1. WELL TAG NO. D 0054786

DRILLING PERMIT NO. 852624
Other IDWR No.

2. OWNER:

Name HAROLD AND YVONNE THOMSON
Address PO BOX 1146
City FORSYTH State MT Zip 59327

3. LOCATION OF WELL by legal description:

Sketch map location must agree with written location

N W E S

Twp. 56 North [X] or South [ ]
Rge. 1 East [X] or West [ ]
Sec. 14 ___ 1/4 (10 acres) SE 1/4 (40 acres) NE 1/4 (160 acres)
Gov't Lot County BONNER
Lat: 48 12 12.1 Long: 116 17 36.6
Address of Well Site CIRCLE DRIVE
City HOPE
(Give at least name of road + Distance to Road or Landmark)
Lt. 20 Blk. 2 Sub. Name LA BAHAI DEL SOL

4. USE:

[X] Domestic [ ] Municipal [ ] Monitor [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Other

5. TYPE OF WORK: check all that apply (Replacement etc.)

[X] New Well [ ] Modify [ ] Abandonment [ ] Other

6. DRILL METHOD:

[X] Air Rotary [ ] Cable [ ] Mud Rotary [ ] Other

7. SEALING PROCEDURES:

Seal/Filter Pack Material	From	To	AMOUNT Sacks or Pounds	METHOD
BENTONITE	0	18	300#	TEMP CASE

Was drive shoe used? [X] Y [ ] N Shoe Depth(s) 85
Was drive shoe seal tested? [X] Y [ ] N How? AIR

8. CASING/LINER:

Diameter	From	To	Guage	Material	Casing	Liner	Welded	Threaded
6	+1.5	85	.250	STEEL	[X]	[ ]	[X]	[ ]
4	80	300	200#	PVC	[ ]	[X]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Length of Headpipe Length of Tailpipe

9. PERFORATIONS/SCREENS:

[X] Perforations Method DRILL
[ ] Screens Screen Type

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
280	300	1/2	25	4	PVC	[ ]	[X]
						[ ]	[ ]
						[ ]	[ ]

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

85 ft. below ground Artesian pressure lb.
Depth flow encountered 175 ft. Describe access port or control devices: WELL CAP

11. WELL TESTS:

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
2	300	300	1 HR

Water Temp. COLD Bottom hole temp. COLD
Water Quality test or comments:
Depth first Water Encounter 175

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
8	0	18	BROKEN ROCK/CLAY		
6	18	75	BROKEN ROCK/CLAY		
6	75	175	GREY SHALE/MED		
6	175	180	GREY SHALE/SOFT/2GPM	X	
6	180	300	GREY SHALE/MED		

RECEIVED
SEP 08 2008
IDWR/North

Completed Depth 300 (Measurable)
Date: Started 8/1/2008 Completed 8/1/2008

13. DRILLER'S CERTIFICATION:

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name MINDEN WATER WELLS,INC. Firm No. 320
Firm Official Edward A Minden Date 8/4/2008
and
Driller or Operator Date 8/4/2008
(Sign once if Firm Official & Operator)

56 N 01 14

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Form 238-7
6/07

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

1. WELL TAG NO. D D0069827

Drilling Permit No. 877505

Water right or injection well #

2. OWNER: Jay + Robin Price

Name Jay + Robin Price

Address 3136 Rojo Flats Rd

City Bakers Field State CA Zip 93308

3. WELL LOCATION:

Twp. 56 North ☒ or South ☐ Rge. 01 East ☒ or West ☐

Sec. 12 ___ 10 acres 1/4 NW 40 acres 1/4 NE 160 acres 1/4

Gov't Lot ___ County Bonner

Lat. 48 ° 13.254 ___ (Deg. and Decimal minutes)

Long. 116 ° 16.506 ___ (Deg. and Decimal minutes)

Address of Well Site 295 E Cedar Ln

(Give at least name of road + Distance to Road or Landmark) City Hope

Lot. ___ Blk. ___ Sub. Name ___

4. USE:

☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation ☐ Thermal ☐ Injection
☐ Other ___

5. TYPE OF WORK:

☒ New well ☐ Replacement well ☐ Modify existing well
☐ Abandonment ☐ Other ___

6. DRILL METHOD:

☒ Air Rotary ☐ Mud Rotary ☐ Cable ☐ Other ___

7. SEALING PROCEDURES:

Seal material	From (ft)	To (ft)	Quantity (lbs or ft³)	Placement method/procedure
Bentonite	0	38	17 Bags	Pour

8. CASING/LINER:

Diameter (nominal)	From (ft)	To (ft)	Gauge/ Schedule	Material	Casing	Liner	Threaded	Welded
6	-2	40	.25	Steel	☒	☐	☐	☒
4	20	800	200	plastic	☐	☒	☐	☒
					☐	☐	☐	☐
					☐	☐	☐	☐

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 40

9. PERFORATIONS/SCREENS:

Perforations ☒ Y ☐ N Method Saw

Manufactured screen ☐ Y ☒ N Type ___

Method of installation ___

From (ft)	To (ft)	Slot size	Number/ft	Diameter (nominal)	Material	Gauge or Schedule

Length of Headpipe ___ Length of Tailpipe ___

Packer ☐ Y ☒ N Type ___

10. FILTER PACK:

Filter Material	From (ft)	To (ft)	Quantity (lbs or ft³)	Placement method

11. FLOWING ARTESIAN:

Flowing Artesian? ☐ Y ☒ N Artesian Pressure (PSIG) ___

Describe control device Well Cap

12. STATIC WATER LEVEL and WELL TESTS:

Depth first water encountered (ft) 480 Static water level (ft) 40

Water temp. (°F) Cold Bottom hole temp. (°F) Cold

Describe access port Well Cap

Well test:

Drawdown (feet)	Discharge or yield (gpm)	Test duration (minutes)	Test method: Pump	Bailer	Air	Flowing artesian
800	3.5	1 Hour	☐	☐	☒	☐
			☐	☐	☐	☐

Water quality test or comments: Clean

13. LITHOLOGIC LOG and/or repairs or abandonment:

Bore Dia. (in)	From (ft)	To (ft)	Remarks, lithology or description of repairs or abandonment, water temp.	Water Y	Water N
10	0	38	Seal		X
6	0	20	Clay gravel		X
6	20	38	Dry clay Blue		X
6	38	300	Shale, gray, Dry		X
6	300	480	Shale, gray, cracks 1gpm	X	
6	480	600	Shale, gray, cracks 2gpm	X	
6	600	800	Shale, gray, Brown, Cracks, 3.5gpm	X	

RECEIVED
DEC 31 2015
IDWR / NORTH

Completed Depth (Measurable): 800

Date Started: Dec 1-15 Date Completed: Dec 3-15

14. DRILLER'S CERTIFICATION:

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name Universal Drilling Co. No. 650

*Principal Driller [signature] Date Dec 6-15

*Driller [signature] Date Dec 6-15

*Operator II [signature] Date Dec 6-15

Operator I ___ Date ___

* Signature of Principal Driller and rig operator are required.

Appendix C. Hope Elementary (PWS #1090185) – Source Water Assessment

Protecting Public Health and the Environment

Department of Environmental Quality

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Source Water Assessment Summary Report: HOPE ELEMENTARY SCHOOL (PWS# ID1090185) WELL #1 E0005111

Introduction

Submit a Comment Print Summary Report

The US Environmental Protection Agency (EPA) requires the Idaho Department of Environmental Quality (DEQ) to assess every public water system in Idaho for its relative susceptibility to contaminants that are regulated by the federal Safe Drinking Water Act. DEQ conducts source water assessments based on an inventory of potential contaminants and land uses within the delineated source water assessment area, construction of the well, sensitivity factors associated with the drinking water source, and local aquifer characteristics. The ultimate goal of each source water assessment is to provide data that communities can use to develop protection strategies for their drinking water sources.

The resources and time available to accomplish source water assessments are limited. Therefore, an in-depth, site-specific investigation to identify each significant potential source of contamination for every public water system is not possible. Instead, DEQ uses computer databases and geographic information system (GIS) maps to produce a potential contaminant inventory that can then be built upon by the system or other stakeholder with an on-the-ground investigation. The results of source water assessments should not be used as an absolute measure of risk, nor should they be used to undermine public confidence in the public water system. A particular susceptibility score does not imply that any regulatory or legal actions will occur. This report is intended to summarize information about public water systems in Idaho. Using or distributing the data contained in this report in a form other than that in which it is presented may inaccurately portray the data.

DEQ strongly encourages each public water system and community to use its source water assessment, combined with local knowledge and concerns, to develop strategies to protect drinking water sources. Multiple resources are available to help communities implement drinking water source protection programs, including DEQ's Source Water Protection Activity Guide and source water protection plan template (coming soon).

Various governmental entities and organizations also play a role in protecting drinking water sources in Idaho and can be a resource for protection efforts. Drinking water source protection activities should be coordinated with these entities to maximize results and leverage resources. For example, activities related to agricultural practices should be coordinated with the Idaho State Department of Agriculture, Idaho Soil and Water Conservation Commission, local Soil and Water Conservation District, and Natural Resources Conservation Service. Visit the Idaho Source Water Collaborative website for more information on potential partners and resources.

For assistance in developing protection strategies, contact DEQ's COEUR D ALENE REGIONAL OFFICE or the Idaho Rural Water Association.

This report was completed August 05, 2002. Potential contaminant information was updated on May 04, 2015.

What Was Assessed

This report evaluates HOPE ELEMENTARY SCHOOL (PWS# ID1090185) WELL #1 E0005111 located in BONNER county. The system serves approximately 125 people through 1 connections.

Defining the Source Water Assessment Area

The first step of a source water assessment is to delineate the source water assessment area. The delineation process includes mapping the boundaries of the land area above the aquifer that could contribute water and pollutants to the water supply. The boundaries also illustrate areas of the aquifer that supply water to the well. Up to three separate TOT zones are established. TOT represents the number of years necessary for a particle of water to travel in the aquifer to reach the well.

The following three TOT zones are mapped:

Zone I

Zone IA refers to the sanitary setback, or the 50-foot radius around the well. The goal of this zone is to prevent contamination from nearby sources, particularly microbial contamination from sources such as sewer lines, livestock, surface waters, and septic systems.

Zone IB refers to the 0–3 year TOT zone. Water in this zone takes 0–3 years to travel in the aquifer to reach the well.

Zone II refers to the 3–6 year TOT zone. Water in this zone takes 3–6 years to travel in the aquifer to reach the well.

Zone III refers to the 6–10 year TOT zone. Water in this zone takes 6–10 years to travel in the aquifer to reach the well.

DEQ uses a refined analytical model approved by EPA to delineate the three separate TOT zones. The analytical model uses site-specific data assimilated from a variety of sources, including well logs and hydrogeologic reports. DEQ also uses a calculated fixed radius method when site-specific data are not and will not be available. Generalized, existing, hydrogeologic data from the major aquifer types in Idaho, and data from the well pump rate are used in the average velocity equation to derive radii for 3-, 6-, and 10-year TOT zones.

The source water assessment delineation for WELL #1 is illustrated in the map provided. The data used to determine the source water assessment delineation for WELL #1 are included in the References section or available from DEQ upon request.

Susceptibility Analysis

The susceptibility analysis determines the likelihood that the water supply will become contaminated. For each well, spring, or surface water intake in a public water system, susceptibility to contamination is scored as high, moderate, or low. Susceptibility scores for wells take into account three factors, which are described in more detail in later sections:

1. System Construction: Construction of the well being assessed
2. Potential Contaminant Inventory/Land Use: Potentially significant sources of contamination to the source water, and land use characteristics above the aquifer
3. Hydrologic Sensitivity: Hydrologic and geologic conditions surrounding the well

Each of the factors listed above receives a score of high, medium, or low to reflect how susceptible it is to allowing contamination of the source water. Note that deriving susceptibility scores is a qualitative, screening-level step that, in many cases, uses generalized assumptions and best professional judgment. Once completed, susceptibility scores are only updated upon request by the public water system.

Potential contaminant inventory (PCI)/land use scores and final susceptibility scores consist of four individual scores, one for each of four categories of contaminants:

Inorganic chemicals (IOC)

Volatile organic chemicals (VOC)

Synthetic organic chemicals (SOC)

Microbial contaminants

High susceptibility to one potential contaminant does not mean that the water system is at the same risk for all other potential contaminants. The susceptibility scores for your public water system are shown in the table below.

Susceptibility Scores for HOPE ELEMENTARY SCHOOL (PWS# ID1090185) WELL #1 E0005111									
System Construction	Potential Contaminant Inventory / Land Use				Hydrologic Sensitivity	Final Susceptibility Ranking			
	IOC	VOC	SOC	Microbials		IOC	VOC	SOC	Microbials
H	M	L	L	M	M	M	M	M	M
H = High Susceptibility, M = Moderate Susceptibility, L = Low Susceptibility. System Construction refers to the well, spring, or surface water intake.									
Auto High - see below.*			Report Date: 8/5/2002			Click for Map		Click for details	

***Auto-High Score:** Several situations cause automatic assignment of a high susceptibility score: 1) any detection of a VOC or SOC, 2) detection of an IOC at a concentration greater than the drinking water maximum contaminant level set by EPA, or 3) a confirmed microbial detection at the drinking water source, or 4) the presence of potential contaminant sources within 50 feet of a well or 1000 feet of a surface water intake. Despite the land use of the area, any of the first three conditions will trigger an auto high score because a pathway for contamination already exists. Note that MCLs, detections, and potential contaminants can change over time and are not automatically updated in the score. Refer to the susceptibility score details page for more information on the contaminant source or detections resulting in an auto-high score.

System Construction Score

The first of the three factors scored in a source water assessment is the system construction. System construction refers to the construction of the well that serves as the drinking water source. A well's construction directly affects its ability to protect the aquifer from contaminants. System construction scores are lower when information shows that potential contaminants will have a more difficult time reaching the intake of the well. The system construction score depends on these five factors:

Compliance with all current construction standards for public water system wells

Maintenance of the wellhead and surface seal

Placement of the well casing and annular seal into geologic units that are not highly permeable

Production of water from more than 100-feet below static water level

Location of the well outside of a 100-year floodplain

Current construction standards for public water system wells can be more stringent than standards in effect when a well was constructed. Hence, your system construction score may be higher due to not meeting current well construction standards. The Idaho Department of Water Resources has rules regulating well construction (" Well Construction Standards Rules" [IDAPA 37.03.09]). These rules require all public water systems to also follow DEQ's well construction standards (" Idaho Rules for Public Drinking Water Systems" [IDAPA 58.01.08.510]). DEQ standards include screening requirements, aquifer pump tests, use of a down-turned casing vent, and thickness of casing.

Your system construction score may also be higher if adequate information about the well being assessed is not available. Refer to the susceptibility score details page for more information about the construction of the well assessed in this report.

Potential Contaminant Inventory/Land Use Scores

The second of the three factors scored in a source water assessment is the potential contaminant inventory (PCI)/land use. A potential contaminant is defined as any facility or activity that meets these criteria:

Stores, uses, or produces, as a product or by-product, the contaminants regulated under the federal Safe Drinking Water Act.

Has a sufficient likelihood of releasing the contaminants at levels that could potentially harm drinking water sources.

As part of each source water assessment, DEQ conducts an inventory of potential sources of contamination. The goal of the inventory is to locate and describe facilities, land uses, and environmental conditions that are potential sources of ground water contamination.

The inventory is a two-step process. First, DEQ identifies and documents potential contaminant sources in the source water assessment area using computer databases and GIS maps developed by DEQ and various state and federal agencies. Although DEQ uses the best information available, DEQ does not make any warranty for the accuracy or completeness of any information or data provided. For example, DEQ may not be able to obtain the exact location for each potential contaminant or may not be notified immediately of new sites or changes to existing sites. DEQ typically updates each inventory annually; however, DEQ may update, modify, or revise the data used at any time, without notice. The exact date inventories are updated can be found in the PCI table. Second, DEQ contacts the public water system to verify sources identified in the first step and add additional sources not already identified. Although the public water system is only contacted by DEQ after the initial PCI is conducted, the public water system can review the PCI and correct or add any additional sources not identified at any time. Comments can be submitted to DEQ.

When agriculture is the predominant land use in the area, the likelihood of agricultural chemicals, particularly fertilizer, entering the ground water system may increase. During the PCI, agricultural land results in more points assessed for the IOC category in the 0-3 year TOT zone. Depending on the percentage of agricultural land in the area, potential contaminant/land use susceptibility scores may be influenced.

Understanding Potential Contaminant Source Information

A release may never occur from a potential source of contamination, provided the facility or landowner uses best management practices to deal with the potential contaminant. Many potential sources of contamination are regulated at the federal or state level, or both, to reduce the risk of release. Therefore, when businesses, facilities, or properties are identified as potential contaminant sources, it does not mean that they are in violation of any local, state, or federal environmental law or regulation. What it does mean is that the potential for contamination exists due to the nature of the business, industry, or operation.

Public water systems can use various methods such as educational visits and inspections of stored materials to work cooperatively with landowners and facilities that have potential sources of contamination. Many landowners may not even be aware that they are located near the source of a public water supply.

The table below lists the potential contaminants for HOPE ELEMENTARY SCHOOL public water system. The public water system is not located within a nitrate priority area.

You are currently viewing: HOPE ELEMENTARY SCHOOL (PWS# ID1090185)
Source Number: E0005111
Source Name: WELL #1
Potential Contaminants:

Export to Excel

TOT *	Description of Potential Contaminant Source [1, 4]	Potential Contaminant(s)	Name	Data Source [2]	Updated Date [3]
0-3 year	Major And Minor Roads	IOC, VOC, SOC, Microbe		GIS	3/15/2013

TOT *	Description of Potential Contaminant Source [1, 4]	Potential Contaminant(s)	Name	Data Source [2]	Updated Date [3]
3-6 year	**Major And Minor Roads**				
3-6 year	Wastewater Lagoon	IOC, Microbe	Lower Storage Lagoon	GIS	5/4/2015
3-6 year	Water Reuse Area	IOC, Microbe	Ellisport Bay Sewer District	GIS	5/4/2015
6-10 year	Major And Minor Roads	IOC, VOC, SOC, Microbe		GIS	3/15/2013

Footnotes:

1. The GIS datasets used to identify potential contaminants are gathered from various agencies and are updated on different intervals. Click here to view the update schedule of various GIS layers.
2. During the first phase of the PCI, known as the primary contaminant inventory, DEQ staff use GIS datasets and aerial photos to identify and document potential contaminant sources within the water system's source water assessment delineation. During the second phase of the PCI, known as the enhanced inventory, potential contaminants not already identified through GIS (e.g., septic systems, business sites, and land use activities) can be added to the PCI.
3. Date Updated refers to the most recent date each potential contaminant was last verified within the GIS datasets. This update is typically conducted annually. Potential contaminants identified through aerial photos or enhanced inventories are updated less often.
4. Restriction of Liability for GIS Data: Neither the State of Idaho nor DEQ, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information or data provided. Metadata are provided for all datasets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical errors. DEQ may update, modify, or revise the data used at any time, without notice.

* TOT = time of travel zone

IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Refer to the susceptibility score details page for more information about the potential contaminants and land use within this delineation.

Hydrologic Sensitivity Score

The last of the three factors in a source water assessment is hydrologic sensitivity. Hydrologic sensitivity describes the movement of water through the subsurface of the earth. A well's hydrologic sensitivity score depends on these four factors:

Composition of surface soil

Material in the vadose zone (the zone between the land surface and water table)

Depth at which ground water is first encountered

Presence of a low permeable unit (a layer of rock or sediment that does not transmit water easily, thus protecting the aquifer from contamination)

For the purpose of this source water assessment, DEQ considers a low permeable unit at least 50 feet thick to be protective of the aquifer.

Slowly draining soils, such as silt and clay, typically protect ground water better than quickly draining soils, such as sand and gravel. Fine-grained sediments in the subsurface and a water depth of more than 300 feet are also more protective of ground water.

Refer to the susceptibility score details page for more information on the hydrologic conditions for this source.

Conclusion

Local communities can use the information gathered through the assessment process to create a broader source water protection program to address current problems and prevent future threats to the quality of their drinking water supplies. Preventing contaminants from entering a public water system supply minimizes the problems that can occur from contaminants in the drinking water supply, such as increased health risks, expanded drinking water monitoring requirements, additional water treatment requirements, or expensive environmental cleanup activities. For assistance developing protection strategies, contact DEQ's COEUR D ALENE REGIONAL OFFICE or the Idaho Rural Water Association. Also consider the following resources:

Idaho Source Water Protection Website

Idaho Source Water Protection Activities Guide

Idaho Source Water Protection Plan Template and Guidance (Coming Soon)

www.protectthesource.org

List of Acronyms and Abbreviations/Glossary

Acronyms and Abbreviations/Glossary

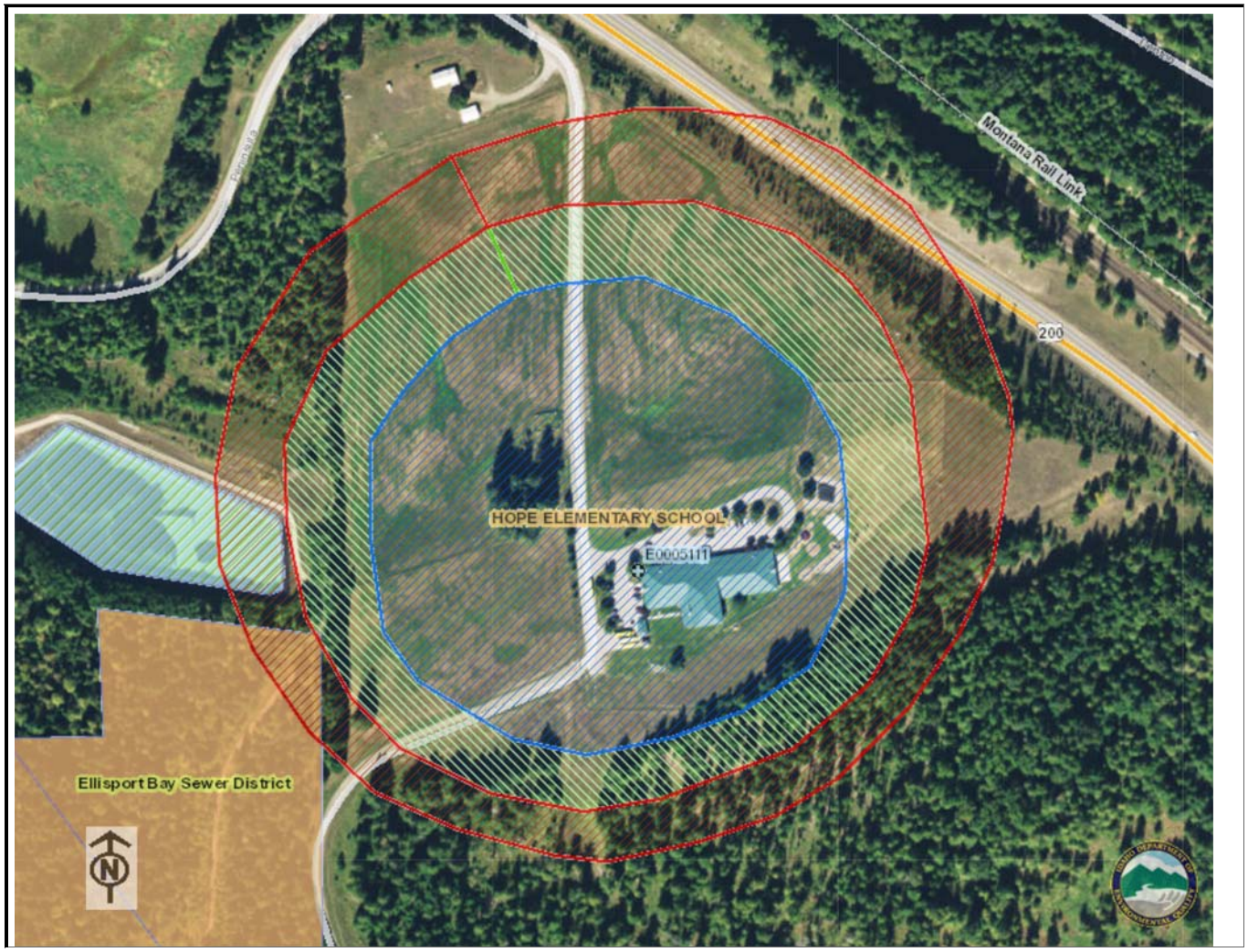
References

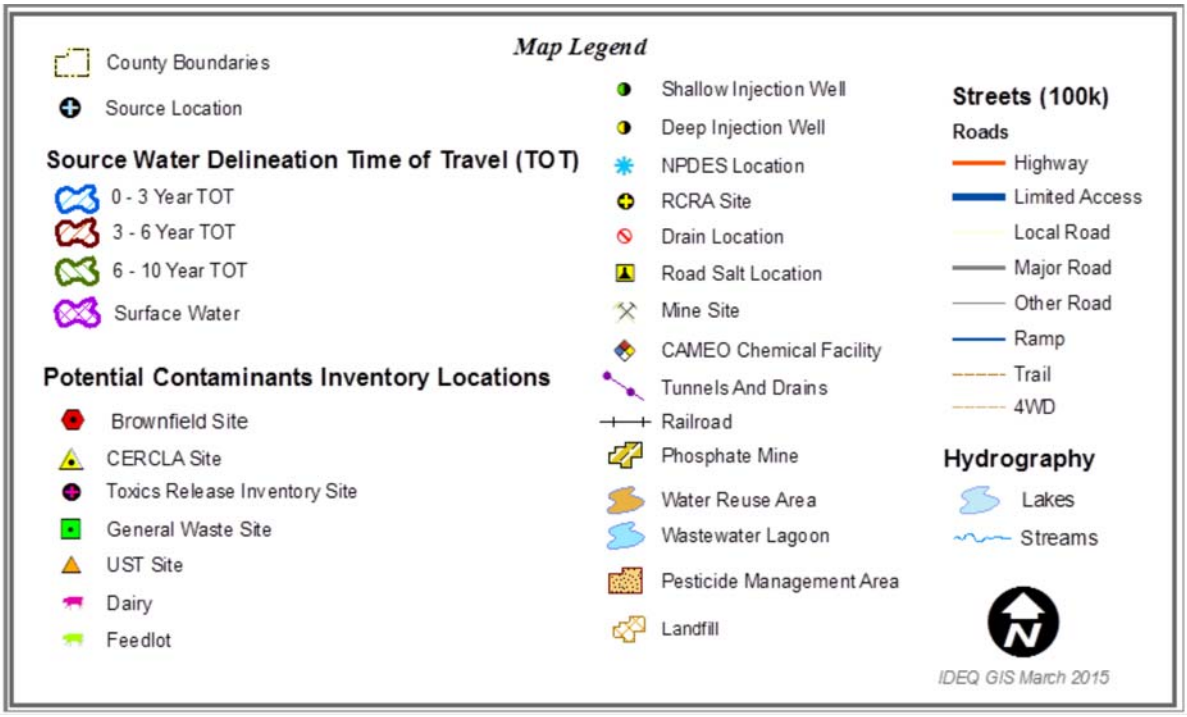
Contact DEQ

Map

The public water system is not located within a nitrate priority area.

Click here for dynamic map.
To save the map or legend right click on the images below and select save as.
(This map may take several seconds to load. We appreciate your patience.)





DEQ Intranet DEQ Website

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Appendix D. DEQ - 2012 Draft Forest Guidance

4.1 Hydraulic Loading

4.1.3 Forest and Poplar Site Hydraulic Loading

This section provides information on determining appropriate hydraulic loading rates for both forested and poplar plantation reuse sites. Hydraulic loading largely depends on the rates of precipitation and evapotranspiration (ET).

- Where ET is referred to without qualifiers, it refers to the generalized concept.
- Where ET is qualified, such as actual ET (ET_{act}) or potential ET (ET_{pot}), specific definitions are associated with these terms that are important in the section discussion.

Idaho-specific consumptive irrigation requirements and terminology definitions are comprehensively discussed in Allen and Robison (2007). Idaho-specific ET data and other parameters related to consumptive irrigation requirements are found in the ETIdaho website:

http://www.kimberly.uidaho.edu/ETIdaho/

The following topics are discussed:

- In Section 4.1.3.1, a methodology is provided for calculating an estimate of the hydraulic loading capacity during the nongrowing season for forested and poplar sites.
- Sections 4.1.3.2 and 4.1.3.3 discuss methodologies for estimating ET-related parameters used in determining irrigation requirements in growing and nongrowing seasons for forest and poplar sites, respectively.

Both of these sections include example calculations.

4.1.3.1 Nongrowing Season Hydraulic Loading for Forest and Poplar

There may be instances where nongrowing season recycled water loading is allowed on forest and poplar reuse sites. Equation **1** is used to calculate a guideline hydraulic loading rate. This rate is equal to the available water-holding capacity (AWC) of the soil plus the ET_{act} values for the nongrowing season, less the nongrowing season gross precipitation (PPT_{ngs}). The calculated estimate of the nongrowing season recycled water application capacity of the system is referred to as the nongrowing season hydraulic loading rate (HLR_{ngs}).

$$HLR_{ngs} = AWC + ET_{act} - PPT_{ngs}$$

Equation 1. Nongrowing season hydraulic loading rate

where:

HLR_{ngs} = nongrowing season hydraulic loading rate

AWC = available water holding capacity

ET_{act} = actual ET

PPT_{ngs} = gross precipitation in the nongrowing season

DRAFT

The term ET_{act} is defined in Allen and Robison (2007, 43). Values for ET_{act} and PPT_{ngs} can be obtained on the ETIdaho website. To obtain estimated ET_{act} values, follow the directions provided in section 4.1.3.2.1. Actual ET (ET_{act}) values during the nongrowing season predominantly represent evaporation from soil following precipitation rather than any ET from dormant vegetation. In the case of nongrowing season land application, where the soil is wetted more frequently, the ET may be greater than ET_{act} and be nearer to the potential ET (ET_{pot}) rates provided in ETIdaho. However, nongrowing season recycled water application, if allowed, is generally practiced sparingly on forested or poplar municipal land application sites, so ET_{act} should be used.

This methodology makes no adjustment to ET for tree canopy density although such adjustment is made for the growing season (see section 4.1.3.2.2).

Further discussion of nongrowing season hydraulic loading rates is provided in section 4.4.9. DEQ (2009, 7–10) provides related discussion of growing and nongrowing season hydraulic balances.

4.1.3.2 Forest Evapotranspiration and Irrigation Water Requirement Determinations

To determine recycled water loading rates for the growing season, values for the net irrigation requirement (IR_{net}), referred to here as precipitation deficit (P_{def}), first need to be determined. P_{def} is then divided by the irrigation efficiency (E_i) of the irrigation system to yield the irrigation water requirement (IWR), as shown in Equation 2.

$$IWR = \frac{P_{def}}{E_i}$$

Equation 2. Irrigation water requirement .

The relationship of P_{def} to ET is shown in Equation 3:

$$P_{def} = ET - PPT_e$$

Equation 3. Precipitation deficit.

where:

PPT_e = effective precipitation (see section 4.1.1.2.2)

Irrigation-related terms and calculations are discussed in section 4.1.1.2.2. Note that native species (such as forests) are adapted to natural precipitation and do not need irrigation. Terminology related to irrigated agriculture (IR_{net} or P_{def}, IWR, E_i) is used for expedience but has limited applicability for native species living in native conditions.

The next three sections provide instructions on how to determine ET_{act}, P_{def}, and IWR for scenarios that are commonly encountered in recycled water application on forested sites. First, weather station and crop selection are discussed, then canopy density corrections, and, last, an example scenario is provided.

DRAFT

4.1.3.2.1 Weather Station and Crop Selection

Both a weather station and a *crop* must be selected to obtain P_{def} and ET_{act} values from ETIdaho. The weather station and crop selected in ETIdaho determine whether the P_{def} and ET_{act} values obtained are for an irrigated scenario or a nonirrigated scenario, as follows:

- A weather station may be designated (flagged) as irrigated, indicating that managed agricultural crops are typically irrigated. A weather station may not have a flag, indicating that managed agricultural crops are typically not irrigated. See Allen and Robison (2007), Appendix 5, Table 5.2. See the web site:

http://data.kimberly.uidaho.edu/ETIdaho/ETIdaho_Report_April_2007_with_supplement.pdf

- Similarly, a particular crop may be designated as always nonirrigated, always irrigated, or irrigated/nonirrigated depending on the weather station irrigation flag.
- For reuse purposes, values for P_{def} and ET_{act} for an irrigated scenario must be chosen, and care must be exercised to ensure that values for a nonirrigated scenario are not inadvertently selected.

The instructions for the data selection process are provided here.

To obtain P_{def} and ET_{act} data from ETIdaho for forests irrigated with recycled water, do the following:

1. Select the weather station nearest to the site. For example, the Sandpoint KSPT station is selected.
2. Consider the weather station irrigation flags in Allen and Robison (2007), Appendix 5, Table 5.2. Determine whether the particular station that was initially selected has an irrigation flag of 1 or 0 (or no flag).
   - If the weather station irrigation flag = 1, *managed agricultural crops are typically irrigated* (see Allen and Robison [2007], Appendix 5, Table 5.2 footnote), the P_{def} and ET_{act} values obtained for that station would be higher than for a water-limiting nonirrigated scenario because more water would be available to evapotranspire in a water-sufficient scenario.
   - If the station irrigation flag = 0 (or no value), the station has a rainfed (nonirrigated) scenario, and P_{def} and ET_{act} values will not reflect stress imposed by insufficient rainfall.

     For the Sandpoint KSPT station initially chosen for this example, the irrigation flag = 0.
3. After determining the weather station irrigation flag, look up the crop number in Allen and Robison (2007), Table 6 (pages 22-23). For forest sites, use *Orchards—no cover,* crop no. 20 (Allen 2008).
4. Consult Allen and Robison (2007), Table 7 (pages 24-29) to determine the irrigation flag for the particular crop. To determine whether the crop irrigation flag reflects irrigated or nonirrigated conditions, consider the following:

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- If the crop irrigation flag = 0 (Allen and Robison 2007, 23), values will always be for nonirrigated conditions, regardless of the weather station flag, so the associated P_{def} and ET_{act} values reflect nonirrigated conditions.
- If the crop irrigation flag = 3, values are always for irrigated conditions, regardless of the weather station irrigation flag, so the associated P_{def} and ET_{act} values reflect irrigated conditions.
- If the crop irrigation flag = 1 or 2, values are for irrigated conditions if the weather station irrigation flag = 1 and for nonirrigated conditions if the weather station flag = 0.

  In this example scenario, crop no. 20 carries a crop flag = 1 (Allen and Robison 2007, Table 7), so determining whether values are for irrigated or nonirrigated conditions depends on the weather station irrigation flag.

5. This combination of flags (flag = 0 for the Sandpoint KSPT weather station and flag = 1 for crop no. 20, *Orchards—no cover*) indicates that the P_{def} and ET_{act} values obtained from ETIdaho—for this station and crop combination—would be for nonirrigated conditions, which probably do not appropriately reflect reuse purposes. However, the following should also be considered:

   - If the effluent loadings are relatively small in relation to precipitation inputs, nonirrigated values would be appropriate (nonirrigated values are not available for all locations but generally are available for locations in northern Idaho.).
   - If effluent loadings are substantial, and somewhat follow potential ET (ET_{pot} is defined in Allen and Robison 2007, 43), then nonirrigated P_{def} and ET_{act} values would not reflect a crop being irrigated. A crop yielding irrigated values should be selected instead (Allen 2008).

     In this example (for a forested site), we are limited to using crop no. 20 and must go on to step 6).

6. As stated above, in this forested site example, only crop 20 can be used. Instead of selecting a different crop, select a different but nearby weather station, one that does not have a station flag = 0, to obtain P_{def} and ET_{act} values that reflect an irrigated scenario.

   In Allen and Robison (2007), Appendix 5, Table 5.2, the Coeur d'Alene 1E station has an irrigation flag = 1, so P_{def} and ET_{act} values from this station for crop no. 20, *Orchards—no cover* would reflect irrigated conditions appropriate for this example.

The type of P_{def} and ET_{act} values obtained from ETIdaho (i.e., whether for irrigated or nonirrigated conditions) for each combination of weather station irrigation flag and crop irrigation flag is shown in Table 1.

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Table 1. Type of P_{def} and ET_{act} values obtained for combinations of weather station and crop irrigation flags.

Weather Station Irrigation Flag	Crop Irrigation Flag	Type of P_{def} and ET_{act} Values
Flag = 0 (rainfed or nonirrigated conditions)	Flag = 0 (always nonirrigated)	Nonirrigated
	Flag = 1 or 2 (depends on weather station flag)	Nonirrigated
	Flag = 3 (always irrigated)	Irrigated
Flag = 1 (managed agricultural crops typically irrigated)	Flag = 0 (always nonirrigated)	Nonirrigated
	Flag = 1 or 2 (depends on weather station flag)	Irrigated
	Flag = 3 (always irrigated)	Irrigated

Application to Christmas Tree Farms

For a cropped forested site, such as a Christmas tree farm managed as a commercial farm, reuse permits will likely require irrigation at rates that are substantially according to IWR. This requirement presupposes that the site manager will take precipitation events and other meteorological conditions into account in the course of actively managing the irrigation needs of the crop. Monthly P_{def} average values should be used as a guide for irrigation management.

Application to Minimally Managed Native Forested Sites

Considering the special case of native forested sites, which are not managed as commercial crops, reuse permits will likely not require the manager to account for precipitation events and other meteorological conditions. Such sites would likely be required to apply recycled water at predetermined monthly irrigation volumes not to exceed a certain fixed limit expressed as an IWR.

To minimize hydraulic overloading, the IWR in the case of the native forest would likely be based on the more conservative (i.e., lower) estimate of P_{def} that is designated in ETIdaho as P_{def} 80% exceedance—that is, a P_{def} that has an 80% chance of being exceeded in a given month, rather than the P_{def} monthly average, which has only a 50% chance of being exceeded in a given month because the value is higher and therefore less likely to be exceeded.

4.1.3.2.2 Canopy Density Correction

The ET of forests during the growing season will vary substantially depending on the density of the trees. A dense forest would be somewhat similar to an orchard (Allen 2008). ET values used in this guidance for forested sites assume a full tree canopy. However, for tree canopies that are not dense enough to fully cover the ground, the understory vegetation will influence the ET rate.

In the case of the forested site where there is no understory at all, ET (and thus P_{def}) will be reduced as canopy cover is reduced. The relationship between P_{def} and canopy cover is shown in Equation 4.

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$$P_{def}\ (adj) = d_f * P_{def} = \sqrt{C_f} * P_{def}$$

Equation 4. P_{def} adjustment for canopy cover.

where:

P_{def} (adj) = P_{def} adjusted for canopy cover

C_f = canopy cover fraction

d_f = canopy density factor: $\sqrt{C_f}$

P_{def} is proportionate to approximately the square root of the fraction of forest ground covered by the canopy (i.e., the canopy cover fraction [Allen 2008]). For example, if the canopy cover fraction (C_f) is 0.8 (80%), then the canopy density factor (d_f) would be 0.9, and the P_{def} would be adjusted as follows:

$$P_{def}\ (adj) = \sqrt{0.8} * P_{def} = 0.89 * P_{def}$$

For convenience, Table 2 provides precalculated canopy density factors for common canopy cover fractions.

Table 2. Canopy density correction factors to modify orchard—no cover (no understory) in estimating forest P_{def}.

Fraction of Forest Canopy Covering the Ground (C_f)	Factor to Modify P_{def} for Orchard—No Cover (d_f)
1.0	1.0
0.9	0.95
0.8	0.89
0.7	0.84
0.6	0.77
0.5	0.71
0.4	0.63
0.3	0.55

There may be significant changes in forest composition and canopy cover through time on sites used for recycled water land application. These changes may result in a need to reassess canopy and understory cover at the end of a permit cycle and recalculate P_{def} if necessary.

If there is green understory, then the ET rate will likely be similar to that for full canopy cover, and the P_{def} would not be adjusted (i.e., 1.0 * P_{def}), but the ET rate will be weighted based upon the percent canopy cover and percent understory cover (see section 4.1.3.2.4).

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The ET rate for conditions in which there is no understory, but the soil is nearly continuously wet due to frequent effluent land application, would also be similar to that for full canopy cover. However, continuously wet conditions from recycled water land application are seldom encountered in forested sites. In cases of full canopy cover or continuously wet conditions, ET will approach a maximum rate governed by energy available for evaporation (Allen 2008).

4.1.3.2.3 Example Calculation—Forest with no Appreciable Understory

This section provides an example calculation showing how to determine P_{def} and ET_{act} for the forest scenario described in Table 3.

Table 3. Forest P_{def}, IWR, and ET_{act} determination example conditions.

	Example Conditions
Vegetation	–Douglas-fir juvenile plantation, 8 years old –Forest canopy covers 50% of the site –Sparse herbaceous understory; <10%
Location	Sandpoint, ID
Operations	–Recycled water irrigations approach ET_{act} values during the growing season, albeit soils are not continually wet. –The growing season defined by the reuse permit is May–September. –Recycled water irrigations in the nongrowing season are infrequent to none, and soils are not continually wet. –Irrigation efficiency of handline system: E_i = 0.75 –Soil AWC = 4.3 inches

For the nongrowing season, the HLR_{ngs} equation (Equation **1**) is used. ET_{act} values from ETIdaho for the Coeur d'Alene 1E weather station and crop no. 20, *Orchards—no cover*, which were identified earlier as the appropriate selections for this example, are reproduced in Table 4.

PPT_{ngs} values from ETIdaho for the Sandpoint KSPT station (not the Coeur d'Alene station) are also reproduced in Table 4. Values from the Sandpoint station are used because it is the nearest weather station and would likely have better estimates of PPT than Coeur d'Alene.

In ETIdaho, values are expressed in millimeters per day (mm/day) and are then typically converted to inches per month as shown. This conversion is done on all succeeding calculation examples in this section, with all values expressed in inches per month. To emphasize the fact that ET_{act} values have application for the nongrowing season, the growing season months have been shaded out.

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Table 4. Example ET_{act} and PPT calculations for a forested site.

Month	ET_{act} (mm/day)	ET_{act} (in/month)	Precipitation PPT (mm/day)	Precipitation PPT (in/month)
January	0.28	0.34	3.35	4.09
February	0.76	0.84	2.80	3.09
March	1.27	1.55	2.25	2.75
April	1.83	2.16	1.9	2.24
May				
June				
July				
August				
September				
October	2.22	2.71	2.04	2.49
November	0.75	0.89	4.11	4.85
December	0.22	0.27	3.86	4.71
Nongrowing season totals	—	8.76	—	24.22

The HLR_{ngs} in this example is negative and would therefore be considered zero, as shown in the following calculation:

$$HLR_{ngs} = AWC + ET_{act} - PPT_{ngs} = 4.3 + 8.76 - 24.22 = -11.16\ inches$$

For the growing season, P_{def} (80% exceedance) values obtained from ETIdaho for the Coeur d'Alene 1E station for crop no. 20, *Orchards—no cover* are reproduced in Table 5. A canopy cover density correction factor of 0.71 was used to adjust P_{def} for 50% canopy cover (Table 2). To emphasize that P_{def} values have application during the growing season, the nongrowing season months in Table 5 have been shaded out. Shading conventions in Table 4 and Table 5 are followed throughout the rest of this section.

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Table 5. Example P_{def} and IWR calculations for a forested site.

Month	P_{def} (mm/day)	P_{def} (in/month)	Canopy Density Factor (d_f) (from Table 2) (unitless)	Adjusted P_{def} (in/month)	Irrigation Water Requirement (in/month)
January					
February					
March					
April					
May	1.26	1.54	0.71	1.09	1.46
June	3.23	3.81	0.71	2.71	3.61
July	5.03	6.14	0.71	4.36	5.81
August	3.67	4.48	0.71	3.18	4.24
September	2.13	2.52	0.71	1.79	2.38
October					
November					
December					

4.1.3.2.4 Example Calculation—Forest with Appreciable Understory

This section provides an example calculation showing how to determine P_{def} and ET_{act} for the forest scenario with appreciable understory described in Table 6:

Table 6. Forest P_{def}, IWR, and ET_{act} determination example conditions.

	Example Conditions
Vegetation	–Douglas-fir juvenile plantation, 8 years old –Forest canopy covers 50% of the site –Appreciable herbaceous understory; 50%
Location	Sandpoint, ID
Operations	–Recycled water irrigations approach ET_{act} values during the growing season, albeit soils are not continually wet. –The growing season defined by the reuse permit is May–September. –Recycled water irrigations in the nongrowing season are infrequent to none, and soils are not continually wet. –Irrigation efficiency of handline system: E_i = 0.75 –Soil AWC = 4.3 inches

Both forest ET_{act} values and PPT_{ngs} values are used from the previous example for nongrowing season hydraulic loading limit calculations. Since this example has appreciable understory, the P_{def} and ET_{act} for a crop that represents the understory should be used. The P_{def} and ET_{act} can be estimated by selecting *Grass Pasture—high management* from the Coeur d'Alene 1E station for reasons described in section 4.1.3.3.4. Compute, for both P_{def} and ET_{act}, acreage-weighted values, based on the percent of the site with tree canopy cover and the percent of the site with understory, as shown in Table 7.

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Table 7. Example ET_{act} and PPT calculations for a forested site with appreciable understory.

Month	Forest (50%) ET_{act} (in/month)	Pasture, High Management (50%) ET_{act} (mm/d)	Pasture, High Management (50%) ET_{act} (in/month)	Weighted ET_{act} (in/month)	Precipitation PPT (in/month)
January	0.34	0.14	0.17	0.26	4.09
February	0.84	0.41	0.45	0.65	3.09
March	1.55	0.85	1.04	1.29	2.75
April	2.16	2.45	2.89	2.53	2.24
May					
June					
July					
August					
September					
October	2.71	1.97	2.40	2.55	2.49
November	0.89	0.54	0.64	0.76	4.85
December	0.27	0.12	0.15	0.21	4.71
Nongrowing season totals	8.76	—	7.74	8.25	24.22

The HLR_{ngs} in this example is negative and would therefore be considered zero, as shown in the following calculation:

$$HLR_{ngs} = AWC + ET_{act} - PPT_{ngs} = 4.3 + 8.25 - 24.22 = -11.67\ inches$$

For the growing season, P_{def} (80% exceedance) values obtained from ETIdaho for the Coeur d'Alene 1E station for crop no. 20, *Orchards—no cover* are reproduced in Table 8. No canopy cover density correction factor is used to adjust P_{def}; rather, the value will be weighted by 50%. To emphasize that P_{def} values have application during the growing season, the nongrowing season months in Table 8 have been shaded out.

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Table 8. Example P_{def} and IWR calculations for a forested site with appreciable understory.

Month	Forest (50%) P_{def} (in/month)	Pasture, High Management (50%) P_{def} (mm/d)	Pasture, High Management (50%) P_{def} (in/month)	Weighted P_{def} (in/month)	Irrigation Water Requirement (in/month)
January					
February					
March					
April					
May	1.54	4.84	5.91	3.73	4.97
June	3.81	5.62	6.64	5.23	6.97
July	6.14	6.36	7.76	6.95	9.27
August	4.48	5.82	7.10	5.79	7.72
September	2.52	3.81	4.50	3.51	4.68
October					
November					
December					

4.1.3.3 Poplar Evapotranspiration and Irrigation Water Requirement Determinations

The following sections discuss determination of P_{def} and ET_{act} in juvenile, maturing and mature poplar stands. Example calculations are also provided.

4.1.3.3.1 Maturing and Mature Poplar Stands

ETIdaho has a selection for *Poplar Trees–third year and older*. This selection is described as trees planted relatively densely and ground cover that is kept mostly bare through tillage for weed control. If this is not the case, other options, which are discussed below, should be considered.

For the growing season, determining poplar P_{def} on recycled water land application sites should be done as follows.

- For poplar plantations that are 3 years and older, use the P_{def} provided in ETIdaho for corresponding conditions. Use these values only after consulting Tables 6 and 7 and Allen and Robison (2007), Appendix 5, Table 5.2, as described in section 4.1.3.2.1 (steps 2, 3, and 4) to see whether values obtained are for irrigated conditions.
- Note that for certain weather stations on ETIdaho, the poplar crop may be assumed to be rainfed and will have P_{def} values considerably lower than for irrigated poplar. For a rainfed crop, the estimated ET rate will not include the evaporation stemming from irrigation events. The ET_{act} will be similar to ET_{pot} if the plantation is irrigated in an amount approaching the IWR. If the plantation is rainfed only, ET_{act} will generally be less than ET_{pot}, and ET_{act} values will be similar to precipitation. If P_{def} values obtained are for rainfed (i.e., nonirrigated) conditions, do as described in section 4.1.3.3.3 (steps 5

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and 6) to obtain more appropriate irrigated condition P_{def} values for a different but nearby weather station.

For the nongrowing season, determine poplar ET_{act} on recycled water land application sites as follows:

- For poplar plantations that are 3 years and older, use the ET_{act} value from the ETIdaho website for corresponding conditions. As with the growing season, use this value only after consulting Tables 6 and 7 and Allen and Robison (2007), Appendix 5, Table 5.2, as described in section 4.1.3.2.1 (steps 2, 3, and 4), to see whether values obtained are for irrigated conditions.
- If ET_{act} values are for a rainfed (i.e., nonirrigated) scenario, do as described in section 4.1.3.2.1 steps 5 and 6 to obtain more appropriate irrigated scenario ET_{act} values for a different but nearby weather station.

4.1.3.3.2 Juvenile Poplar Stands

For recently planted poplar plantations (less than 3 years) with ground cover, the P_{def} and ET_{act} for a crop that represents the ground cover surrounding the young trees should be used, especially if the young poplars do not have appreciable canopy cover on the field. The P_{def} and ET_{act} can be estimated by selecting *Grass Pasture—high management*.

In the case where the poplars are starting to grow but are not as large as a stand of 3-year old poplars, or where poplars are more than 3 years old but are sparse and not dominant, compute, for both P_{def} and ET_{act}, acreage-weighted average values based on the percent of the site having trees and the percent of the site having ground cover. Use values from ETIdaho for the *Poplar Trees—third year and older* category and the ground-cover type (e.g., *Grass Pasture—high management*).

4.1.3.3.3 Using the Agrimet Website to Determine Hydraulic Loading Rates

An alternative means to find appropriate hydraulic loading rates is to obtain crop coefficients in the Agrimet website and use these to modify reference ET (ET_r) values as described in the "All About Crop Coefficients" text file on the Agrimet website. There are crop coefficient values for first-, second-, third-year poplar growth stages. Values for ET_r can be found on both Agrimet and ETIdaho websites. P_{def} values can then be calculated as described in section 4.1.1.2.2. For the crop coefficients see this website:

http://www.usbr.gov/pn/agrimet/cropcurves/crop_curves.html

4.1.3.3.4 Example Calculation—Poplar

In the following example, poplar P_{def} and ET_{act} are calculated, for the scenario provided in Table 9.

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Table 9. Poplar P_{def}, IWR, and ET_{act} determination example conditions.

	Example Conditions
Vegetation	–Poplar plantation, 4 years old; commercially managed –Sparse poplar canopy; canopy covers 40% of the site –Partial grass understory; ~60% cover
Location	Sandpoint, Idaho
Operations	–Recycled water irrigations approach ET_{act} values during the growing season, albeit soils are not continually wet. –The growing season defined by the reuse permit is May–September. –Recycled water irrigations in the nongrowing season are infrequent to none, and soils are not continually wet. –Irrigation efficiency of handline system: E_i = 0.75 –Soil AWC = 4.3 inches

For the nongrowing season, ET_{act} values were obtained for this poplar-understory scenario by selecting *Poplar Trees—third year and older* ET_{act} and *Grass Pasture—high management* ET_{act} from ETIdaho for the Coeur d'Alene 1E station (as was done for the growing season).

ET_{act} values for *Poplar—third year and older* and *Grass pasture—high management* from ETIdaho are reproduced in Table 10.

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Table 10. Example poplar ET_{act} calculation.

Month	Poplar 3 Years and Older (40%)		Pasture = High Management (60%)		Weighted
	ET_{act}	ET_{act}	ET_{act}	ET_{act}	Average ET_{act}
	(mm/day)	(in/month)	(mm/day)	(in/month)	(in/month)
January	0.19	0.23	0.14	0.17	0.20
February	0.52	0.57	0.41	0.45	0.50
March	0.91	1.11	0.85	1.04	1.07
April	1.18	1.39	2.45	2.89	2.29
May					
June					
July					
August					
September					
October	2.54	3.10	1.97	2.40	2.68
November	0.66	0.78	0.54	0.64	0.69
December	0.16	0.20	0.12	0.15	0.17
Nongrowing season totals	—	7.38	—	7.74	7.60

The HLR_{ngs} in this case is negative, and, therefore, would be considered zero, as shown in the following calculation:

$$HLR_{ngs} = AWC + ET_{act} - PPT_{ngs} = 4.3 + 7.60 - 24.22 = -12.32\ inches$$

For the growing season, P_{def} values for this poplar-understory scenario were determined by initially selecting values for *Poplar Trees—third year and older* P_{def} and *Grass Pasture—high management* P_{def} from ETIdaho for the Sandpoint KSPT weather station. However, according to Allen and Robison (2007), Appendix 5, Table 5.2, this particular station has an irrigation flag = 0 (blank). This indicates a rainfed (nonirrigated) scenario at this weather station, with ET reduced to reflect stress imposed by insufficient rainfall, so this station should not be used for this example scenario.

The crop numbers in Allen and Robison (2007), Table 6 (pages 22-23), *Poplar Trees—third year and older* and *Grass Pasture—high management* are crop nos. 34 and 15, respectively. In Table 7 (pages 24-29), the crop irrigation flags are 1 and 2, respectively, indicating that values are for nonirrigated conditions at the Sandpoint station, which has a flag = 0. As discussed above for forests (*Orchards—no cover*), Allen and Robison 2007, Appendix 5, Table 5.2 shows that the Coeur d'Alene 1E station has an irrigation flag = 1, so values for both of these crops from this weather station should reflect irrigated conditions. This weather station should be used for this example scenario (see Table 1 for a summary of the type of P_{def} and ET_{act} values obtained [i.e.,

irrigated or nonirrigated] for various combinations between weather station irrigation flag and crop irrigation flag).

Values of P_{def} and ET_{act} obtained from ETIdaho are reproduced in Table 11. Both *Poplar—third year and older* and *Grass Pasture—high management* were used. As stated in section 4.1.3, P_{def} is divided by E_i to calculate the IWR. This example is for a commercially managed plantation so monthly P_{def} rather than P_{def} (80% exceedance) should be used, and permit requirements should reflect a hydraulic loading limit that is substantially equal to the IWR.

Table 11. Example poplar P_{def} and IWR calculations.

Month	Poplar 3 Years and Older (40%)		Pasture—High Management (60%)		Weighted Average P_{def} (in/month)	Irrigation Water Requirement (in/month)
	P_{def} (mm/day)	P_{def} (in/month)	P_{def} (mm/day)	P_{def} (in/month)		
January						
February						
March						
April						
May	2.08	2.54	4.84	5.91	4.56	6.08
June	4.87	5.75	5.62	6.64	6.28	8.37
July	6.99	8.53	6.36	7.76	8.07	10.76
August	6.06	7.40	5.82	7.10	7.22	9.63
September	3.73	4.41	3.81	4.50	4.46	5.95
October						
November						
December						

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4.2 Wastewater Constituent Loading

4.2.2.4.3 Forest and Poplar Plantation Nutrient Loading

Information presented in this section regarding the nitrogen (N) uptake of forested sites in the Pacific Northwest has largely been taken from *Managing Nitrogen from Biosolids* (Henry et al. 1999) and specifically from Tables 6.1, 6.5, and 6.6. This source is an important reference in that the authors have distilled a vast and varied body of research into land-treatment nutrient application recommendations for common Pacific Northwest tree species.

Nutrient Balance Assumptions

Henry et al. (1999) specifically discuss biosolids as a nutrient source. Biosolids, by nature, are residuals that are recalcitrant to some degree and when land-applied have various mineralization rates, making nitrogen available for plant uptake over a period that spans several years. A simplifying assumption made for this guidance is that nitrogen in municipal recycled water is readily available, resulting in mineralization reactions taking place relatively quickly. Therefore, a 100% mineralization rate is assumed. This assumption likely applies to many, but not all, food processing recycled water (Smith and Hayden 1984).

Another simplifying and conservative assumption that *could* be made for regulatory expedience would be to disregard soil immobilization of nitrogen during first-time application. As shown in Henry et al. (1999) Table 6.2, first-year nitrogen immobilization values can be significant (175 pounds of nitrogen per acre [lb N/ac]). It may not be so important to consider first-year nitrogen immobilization if long-term nitrogen loadings are set at recommended annual uptake rates (Table 12, Table 13, and Table 14).

This is typical permitting practice. Recycled water land application sites are typically used year after year for 10 to 30 years. Sites are typically owned by a sewer district or privately owned by a cooperator, and irrigation systems are usually installed for the long term. During reuse permitting and re-permitting, design loading rates are determined for at least the life of the permit, generally 5 years.

Consulting Henry et al. (1999) Table 6.6, first-year loadings on a Douglas-fir plantation with understory and a 30:1 carbon-to-nitrogen ratio in the duff layer would allow 375 lb N/ac. For example, on a 40-acre reuse site with nitrogen in recycled water applied at a rate of 3,600 pounds of nitrogen over the entire site per year (lb N/site-yr), the first year of operations could use just one parcel of approximately 10 acres, then the second, third, and fourth 10-acre parcels could be used in successive years, for the first four years of the permit. Then, from the fifth year on, loading rates could drop back from 375 to approximately 90 lb N/ac-yr over the entire for 40 acres, which could be used from the fifth year on. Alternatively, the initial design operations could be based on the fifth and following year operations and apply approximately 90 lb N/ac over the entire 40 acres from the start of the permit operation. Lower nitrogen loadings would not induce rapid decomposition of the duff layer as higher nitrogen loadings would.

Documented decreases in forest productivity and increases in tree mortality have been observed in certain studies because of long-term nitrogen additions to forests (Aber and Magill 2004).

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Given the potential for significant changes in forest health over time, there may be a need to reassess the site at the end of a permit cycle and revise nutrient loading rates if necessary.

Nutrient Uptake Values and Calculations

Nitrogen uptake values for hybrid cottonwood, Douglas fir, pine (semiarid conditions), and both herbaceous and woody understory are reproduced primarily from Henry et al. (1999). These values represent the *net N uptake rate*, which is defined in Henry et al. (1999, 6-6) as the *gross* nitrogen uptake of the plant less the nitrogen contribution to uptake provided by nitrogen releases from litterfall decomposition and nitrogen cycling on the forest floor. The net N uptake rate can be modified to provide credit for nitrogen from other sources (e.g., residual soil nitrogen) to yield the *net N requirement*. If analysis of soil nutrient data shows little substantial change in available soil nitrogen concentrations (nitrate and ammonia) at benchmark seasons (every spring for example), there may be little need to make a correction for residual soil nitrogen.

The net N requirement should then be adjusted for denitrification and volatilization losses of applied recycled water. For recycled water applications, these losses are mainly from denitrification and typically range from 15% to 25% (EPA 1981, 4-4). Volatilization of ammonia would be expected to be low as pH in forest soils is typically neutral or slightly acidic, rendering cationic ammonium rather than the gaseous ammonia form as the dominant species. Denitrification losses ranging from 15% to 25% result in nitrogen uptake efficiency factors (e_f) of 0.85 and 0.75, respectively. The e_f values of 0.85 and 0.75 amount to allowable nitrogen loading rates of 117% and 133% of the net N requirement, respectively. These calculations are summarized in Equation 5.

Equation 5. Calculation of the net N requirement.

$$N_{rate} = \frac{(N_{uptake} - N_{cr})}{(1 - N_{loss})} = \frac{N_{req}}{(e_f)}$$

where:

N_{rate} = N loading rate

N_{loss} = N losses from denitrification and volatilization

e_f = uptake efficiency factor (1 - N_{loss})

N_{uptake} = N net uptake

N_{cr} = N credits

N_{req} = N_{uptake} - N_{cr} = N net requirement

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Table 12, Table 13, and Table 14 show net nitrogen uptake values for hybrid cottonwood, Douglas fir and white pine, and forest understory, respectively.

Table 12. Hybrid Cottonwood net N uptake rates.

Year of Growth	Tree N Uptake (lb/ac-yr)[a]	Understory N Uptake (lb/ac-yr)	Total N Uptake (lb/ac-yr)
1	50	100	150
2	120	50	170
3	200	0	200
4	220	0	220
5–10	240	0	240

Source: Henry et al. 1999, Tables 6.1 and 6.6
a. Pounds per acre year

Table 13. Douglas fir and pine net N uptake rates.

Condition	Douglas Fir N Uptake (lb/ac-yr)[a]	Pine (Semiarid Environment) N Uptake (lb/ac-yr)
Planted 1 year ago	0	0
Planted 2 years ago	0	0
Juvenile Plantations 3–25 years		
Canopy covers 100% of site	110	80
Canopy covers 50% of site	55	40
Older Stands		
Age over 25 years	45	30
Age over 40 years	25	30

Source: Henry et al. 1999, Tables 6.1 and 6.6
a. Pounds per acre year

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Table 14. Forest understory net N uptake rates.

Condition	Understory N Uptake; lb/ac-yr[a]
Woody Vegetation	
Full understory (covers 100% of site)	40
Partial understory (covers 50% of site)	20
Thin understory (covers 20% of site)	10
Sparse understory (covers 0–10% of site)	0
Herbaceous Vegetation	
Full understory (covers 10% of site)	75[b]
Partial understory (covers 50% of site)	35
Thin understory (covers 20% of site)	15
Sparse understory (covers 0–10% of site)	0
New Plantation (see values for woody and herbaceous understory)	

Source: Henry et al. 1999, Tables 6.1 and 6.6
a. Pounds per acre year
b. Brown (2008).

In particular, the National Resource Conservation Service (NRCS) guidance "Nutrient Uptake and Removal–Nutrients Available from Livestock Manure Relative to Crop Growth Requirements" (Appendix I, Part C) (NRCS 1998) provides general recommendations for both nitrogen and phosphorus (P) application rates for nongrazed privately owned woodlands as follows: 100 lb N/ac and 20 lb P/ac, respectively. NRCS (1998) also recommends applying a 70% *nitrogen recovery factor* (i.e., e_f , the uptake efficiency factor) to the recommended values. An e_f of 0.7 amounts to an allowable nitrogen loading of 143% of the net N requirement, calculated as follows: the reciprocal of e_f (0.7) is 1.43, or as expressed as a percent, 143%. Multiply this value by the net N requirement to calculate the nitrogen loading rate, as shown in Equation 5. See the following NRCS website for more information:

http://www.nrcs.usda.gov/technical/land/pubs/nlapp1a.html

A commercial poplar plantation may require specific nitrogen application rates for profitable production. If the allowable volume of land-applied recycled water does not supply the minimum nitrogen amount, supplemental fertilization may be necessary. On the other hand, forested sites used for land application in many cases would otherwise have no additional recycled water or nutrients, so, even in the case where the net N requirement cannot be met there would be no need for supplemental fertilization.

Nutrient Loading Rate Calculation Example

In this example, Table 15 shows the values used to calculate the nitrogen loading rate.

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Table 15. Nutrient uptake calculation example conditions.

Condition	Value
Douglas-fir juvenile plantation, 8 years old; Forest canopy covers 50% of the site	55 lb/ac N uptake (Table 13)
Partial herbaceous understory	35 lb/ac N uptake (Table 14)
Denitrification/volatilization rate	20%
Assume no appreciable change in soil storage from initial time of recycled water application to the end of permit cycle.	0 lb N/ac credit

The values are then substituted in Equation 1 to calculate the example nitrogen loading rate:

$$N_{rate} = \frac{\left(N_{uptake} - N_{cr}\right)}{(1 - N_{loss})} = \frac{[(55 + 35) - 0]}{(1 - 0.20)} = \frac{90}{0.80} = 112.5\ lb\ \ N/ac - yr$$

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Henry, C., D. Sullivan, R. Rynk, K. Dorsey, and C. Cogger. 1999. *Managing Nitrogen from Biosolids*. Olympia, WA: Washington State Department of Ecology and Northwest Biosolids Management Association.

Smith, J.H., and C.W. Hayden. 1984. "Nitrogen Availability from Potato-Processing Wastewater for Growing Corn. *Journal of Environmental Quality* 13(1) January–March.

NRCS (Natural Resource Conservation Service). 1998. "Nutrients Available from Livestock Manure Relative to Crop Growth Requirements." *Appendix I: Nutrient Uptake and Removal–Part C, Non-Grazed Privately Owned Woodland. http://www.nrcs.usda.gov/technical/NRI/pubs/nlapp1a.html*.

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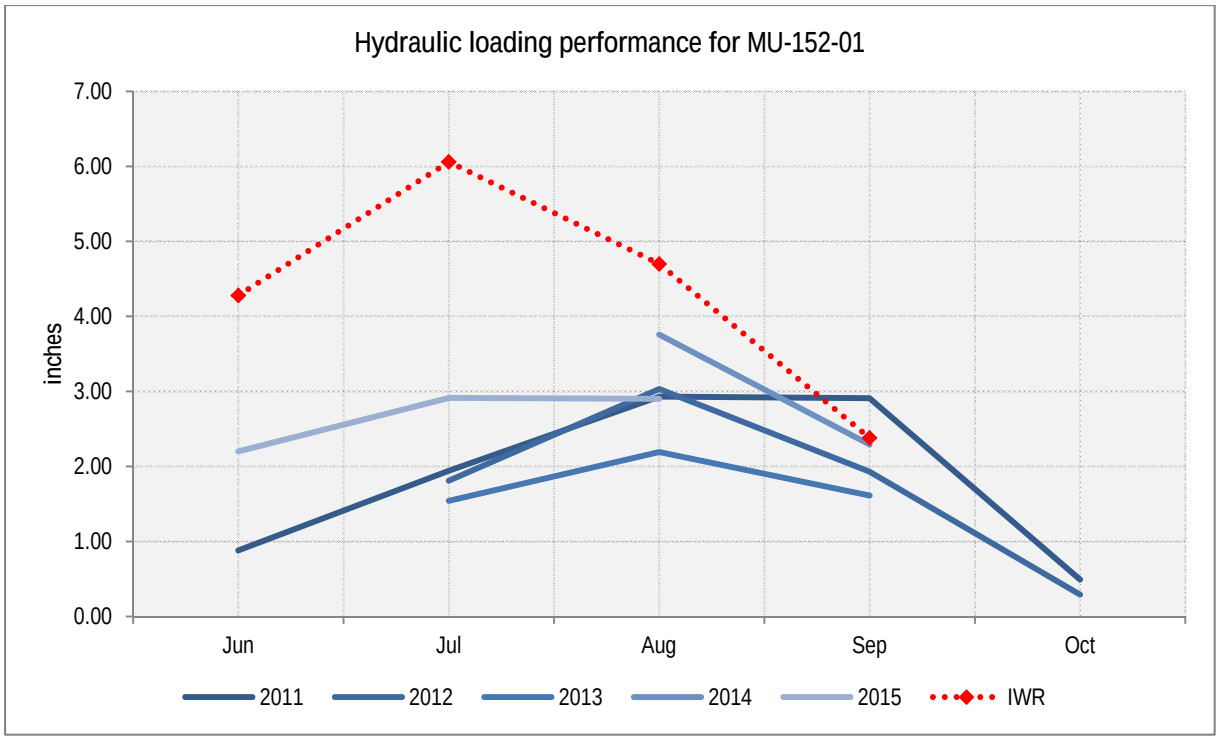
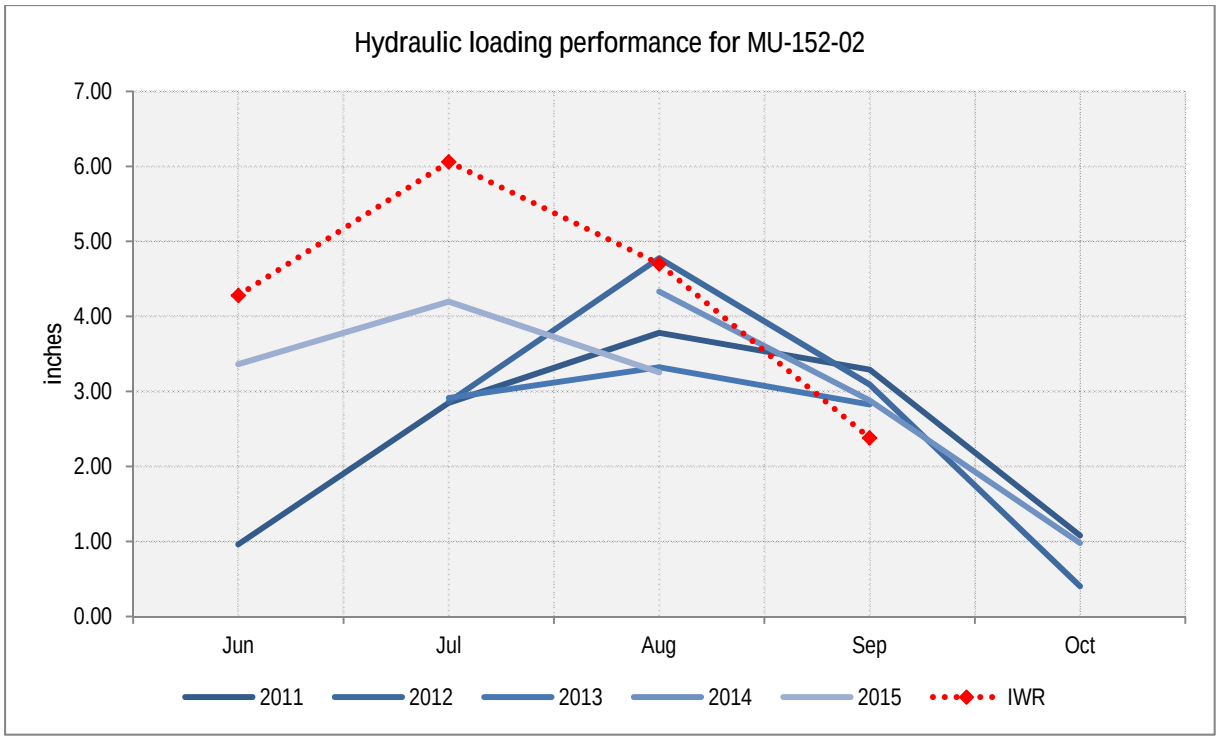
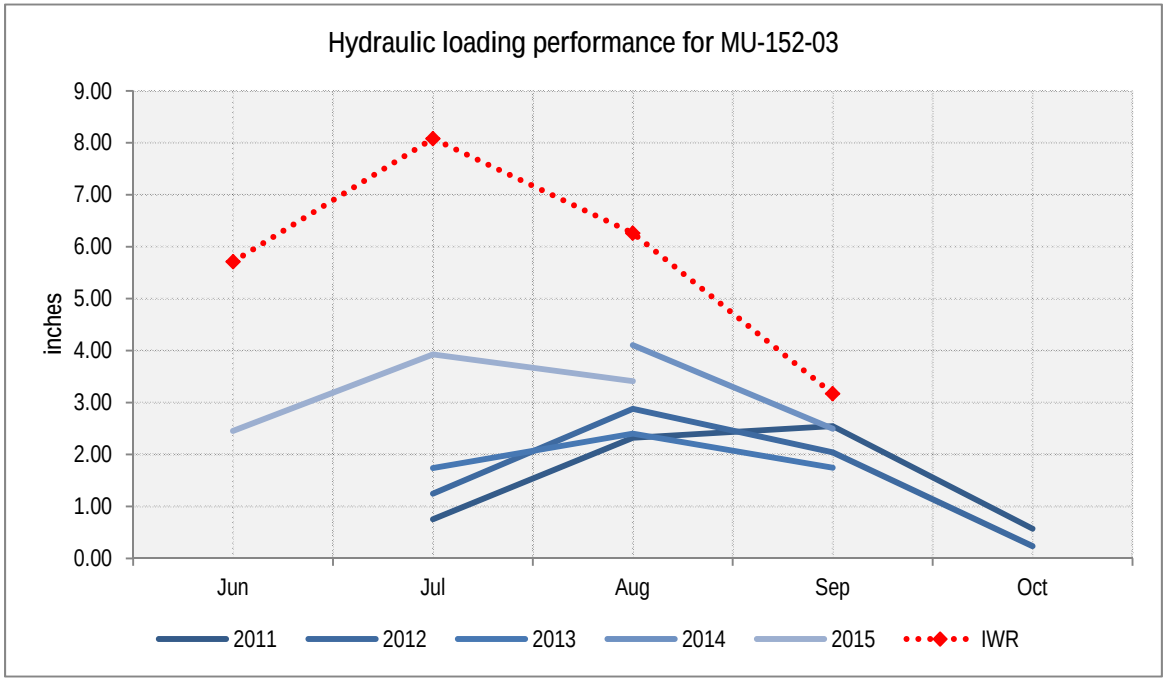
Appendix E. Hydraulic and Nutrient Loading Data



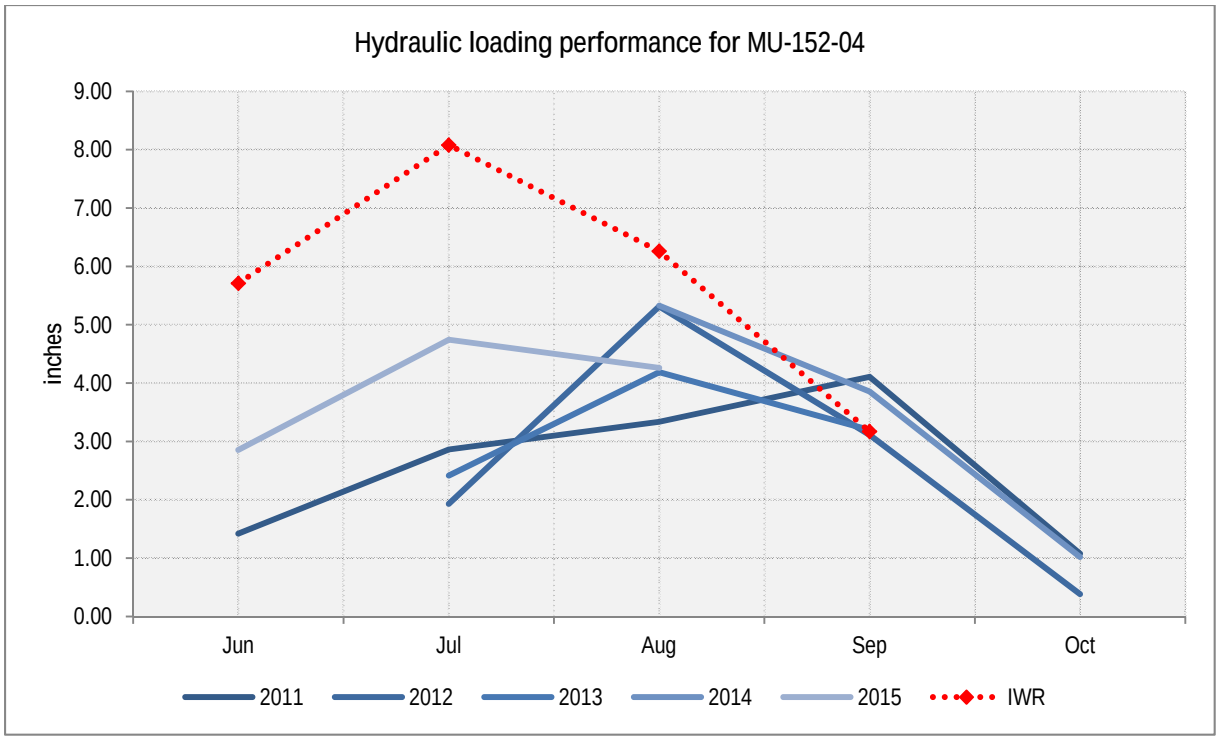
Annual hydraulic loading rates for MU-152-01 (inches)						
Years	2011	2012	2013	2014	2015	IWR
Jun	0.88	-	-	-	2.20	4.28
Jul	1.94	1.81	1.54		2.91	6.06
Aug	2.93	3.03	2.19	3.76	2.90	4.70
Sep	2.91	1.93	1.61	2.29	-	2.38
Oct	0.49	0.29	-	-	-	-
Total	9.15	7.06	5.34	6.05	8.01	17.42



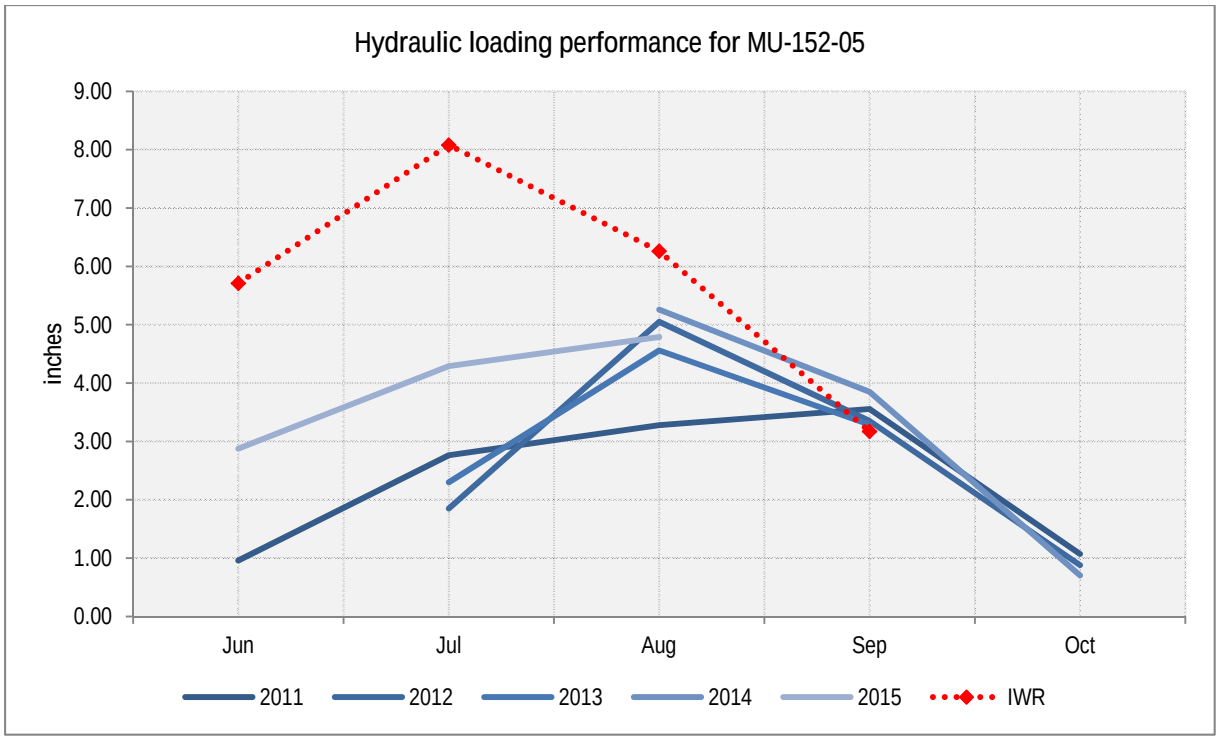
Annual hydraulic loading rates for MU-152-02 (inches)						
Years	2011	2012	2013	2014	2015	IWR
Jun	0.96	-	-	-	3.36	4.28
Jul	2.85	2.86	2.91	-	4.20	6.06
Aug	3.78	4.78	3.32	4.33	3.25	4.70
Sep	3.29	3.09	2.83	2.88	-	2.38
Oct	1.08	0.40	-	0.98	-	-
Total	11.96	11.13	9.06	8.19	10.81	17.42



Annual hydraulic loading rates for MU-152-03 (inches)						
Years	2011	2012	2013	2014	2015	IWR
Jun	-	-	-	-	2.45	5.71
Jul	0.75	1.25	1.74		3.93	8.08
Aug	2.32	2.88	2.40	4.10	3.41	6.26
Sep	2.55	2.04	1.74	2.50	-	3.17
Oct	0.57	0.24	-	-	-	-
Total	6.19	6.40	5.88	6.60	9.79	23.22



Annual hydraulic loading rates for MU-152-04 (inches)						
Years	2011	2012	2013	2014	2015	IWR
Jun	1.42	-	-	-	2.85	5.71
Jul	2.86	1.93	2.42	-	4.74	8.08
Aug	3.34	5.31	4.19	5.33	4.26	6.26
Sep	4.11	3.11	3.20	3.85	-	3.17
Oct	1.08	0.38	-	1.02	-	-
Total	12.80	10.74	9.80	10.20	11.85	23.22



Annual hydraulic loading rates for MU-152-05 (inches)						
Years	2011	2012	2013	2014	2015	IWR
Jun	0.96	-	-	-	2.88	5.71
Jul	2.76	1.85	2.30	-	4.29	8.08
Aug	3.28	5.05	4.56	5.26	4.79	6.26
Sep	3.56	3.35	3.29	3.85	-	3.17
Oct	1.07	0.88	-	0.70	-	-
Total	11.63	11.13	10.15	9.81	11.96	23.22