Lewiston Orchards Surface Water Monitoring Report

State of Idaho
Department of Environmental Quality
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1 Introduction

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This report is intended to support the ongoing work to implement the Lindsay Creek watershed assessment, TMDL, and nitrate priority area (NPA) documents.

The following sections present the results of surface water samples collected by the Idaho Department of Environmental Quality (DEQ) in April and May 2017 at a site in the eastern portion of the Lewiston Orchards, Idaho, in the Lindsay Creek watershed. These samples were collected to identify the nonpoint source contributors of surface water contamination at the site, which based on land use, may be precipitation, stormwater runoff, livestock, irrigation, and septic systems. Monitoring focused on nitrate and nitrite as nitrogen (nitrate+nitrite-N), total Kjeldahl nitrogen (TKN), total phosphorus (P), and *Escherichia coli* (*E. coli*), as well as caffeine, free chlorine, pH, temperature, and specific conductivity.

This report also uses ground water data from eight ground water domestic wells in the Lindsay Creek NPA. Well depths ranged from 200 feet to 950 feet, and data were collected from 2008–2016 (DEQ 2017).

1.1 Lindsay Creek Watershed Assessment and Total Maximum Daily Load

The Lindsay Creek watershed encompasses approximately 28,000 acres in Nez Perce County, Idaho. The main stem of Lindsay Creek originates from springs at a wetland just below Mann's Reservoir and flows northwest through farmland in the upper reaches, then through a canyon until it converges with the Clearwater River. Lindsay Creek is a 3rd-order tributary to the Clearwater River within the subbasin designated by hydrologic unit code 17060306. The designated beneficial uses for Lindsay Creek are cold water aquatic life and secondary contact recreation. Primary land uses in the watershed include dry-land agriculture, small livestock operations, and suburban uses in the northeast section of Lewiston, Idaho.

Lindsay Creek Watershed Assessment and Total Maximum Daily Loads (DEQ 2007) addresses the water quality problems in the Lindsay Creek watershed that were included in Idaho's 2002 Integrated Report (DEQ 2005). The assessment of Lindsay Creek defines the extent and causes

of water quality problems in the watershed. The TMDL quantifies existing pollutant loads and allocates responsibility for load reductions needed to meet state water quality standards. Lindsay Creek assessment units ID17060306CL003_02 and ID17060306CL003_03 were listed as not meeting state water quality standards on the 2002 §303(d) list (DEQ 2005).

Pollutants affecting Lindsay Creek are bacteria, dissolved oxygen, nutrients, sediment, stream temperature, flow alteration, and habitat alteration. Since flow alteration and habitat alteration are not pollutants that can be quantified and allocated for loadings, TMDLs were not developed for them. Measured nitrate+nitrite-N concentrations in samples collected during the TMDL development (February 27, 2001, through February 25, 2002) from Lindsay Creek ranged from non-detect (below the method detection limit) to 11.0 milligrams per liter (mg/L) (IASCD 2002; DEQ 2007). The collective average was 4.85 mg/L. The largest range in concentrations was seen near the mouth of the South Fork Lindsay Creek, while the lowest range was near the headwaters (IASCD 2002; DEQ 2007).

Lindsay Creek Total Maximum Daily Load Implementation Plan for Agriculture (ISCC 2008) was developed through consultation with the Lindsay Creek Watershed Advisory Group and supporting agencies. The implementation plan included actions to address the NPA nitrate concentrations, since ground water base flow was identified as a contributing source of nitrogen to the creek.

1.2 Lindsay Creek Nitrate Priority Area

Ground water monitoring in the Lewiston Orchards and the Lindsay Creek NPA has demonstrated elevated nitrate concentrations in the uppermost ground water in the area's basalt interbeds, traditionally used for private water wells (DEQ 2009). The quality of the water in these localized interbeds is of a quality that impacts domestic use and Lindsay Creek base flows. Data collected during routine ambient monitoring in the area show the area meets the criteria for an NPA. This NPA covers approximately 28,360 acres in the vicinity of Lewiston, Idaho. Out of the 34 NPAs in the state designated in 2014, the Lindsay Creek NPA ranks 3rd highest in terms of severity of ground water quality degradation from nitrate (DEQ 2014).

2 Sample Site Location

Monitoring was conducted at a culvert outfall in the Lewiston Orchards on the north side of Burrell Avenue near 20th Street (Table 1; Figure 1).

Table 1. Site location coordinates.

Description	Latitude	Longitude
Culvert	46.376964°	-116.929036°

Figure 1. Sampling location with inset of culvert outfall.

3 Sampling Procedure and Methods

All sampling and analyses conducted for this investigation followed commonly accepted procedures and methods. Field sampling followed DEQ's standard operating procedures for pollutant sampling in surface water and the associated quality assurance project plan. Nitrate+nitrite-N, TKN, total P, *E. coli*, caffeine, and free chlorine analyses were conducted by Anatek Laboratories of Moscow, Idaho. Field measurements were taken for pH, specific conductivity, and temperature.

Water samples were collected on two days. The first sample was collected on April 6, 2017; prior to this date, the region had received adequate amounts of precipitation to generate overland flow, soil saturation, and solute transport. The second water sample was collected on May 17, 2017; at that time, the region had received 9.73 inches of precipitation, above the average of 5.17 inches (National Weather Service 2017).

4 Results

Results of these two sampling events are provided in Table 2 and are discussed in the following sections.

Table 2. Results.

Parameters	Units	Methods	Results	
			April 6, 2017	May 17, 2017
Nitrate+nitrite-N	mg/L	SM 4500 NO3F	12.8	14.6
TKN	mg/L	SM 4500NORGC	1.03	0.764
Total P	mg/L	EPA 365.4	0.387	0.408
E. coli	MPN/100mL	SM 9223B	<1	26.9
Caffeine	µg/L	HPLC/MS/MS	0.0346	0.0567
Free Chlorine	mg/L	DPD	0.05	0.09
pH	s.u.	Field	7.31	7.54
Temperature	ºC	Field	10.0	11.9
Specific Conductivity	µS/cm	Field	6,780	6,460

Notes: mg/L = milligram per liter; MPN/100mL = most probable number per 100 milliliters of sample; µg/L = microgram per liter; s.u. = standard unit; ºC = degree Celsius; µS/cm = microSiemen per centimeter

4.1 Nutrients

One of Idaho's narrative water quality standards is used to protect cold water aquatic life beneficial uses from excessive nutrients. This standard states that "surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses" (IDAPA 58.01.02.200.06).

Nitrogen concentrations in ground water are typically measured as nitrate+nitrite-N. Nitrite (NO_2) is a compound that is short an oxygen molecule comparatively and changes to nitrate (NO_3) when exposed to oxygen. Nitrogen can originate in septic system drain fields, fertilizer, and animal manure and, as a chemical, can travel longer distances than bacteria.

Naturally occurring concentrations of nitrate+nitrite-N typically do not exceed 2 mg/L in surface water, and concentrations exceeding this level are considered outside the range of natural conditions. The concentration levels of nitrate+nitrite-N measured in the samples collected for this report were 12.8 and 14.6 mg/L, exceeding 2 mg/L in surface water concentrations and Idaho's maximum contaminant level of 10 mg/L for ground water.

Idaho's water quality standards do not have numeric criteria for nutrients that are based on prevention of nuisance algae and impairment to beneficial uses of surface water. The US Environmental Protection Agency (EPA) developed a recommendation threshold for nuisance algae and aquatic life for Total P of 0.030 mg/L specific to the Columbia Plateau subecoregion streams (Williamson et al. 1998).

Wastewater dischargers in Idaho are typically limited to less than 0.1 mg/L; greater concentrations are considered detrimental to surface water (EPA 1986). At the site, Total P was measured at 0.387 and 0.408 mg/L and TKN was measured at 1.03 and 0.764 mg/L; these are likely the result of anthropogenic sources.

4.2 *E. coli* Bacteria

E. coli is a bacteria found in the normal intestinal flora of warm-blooded animals. Its presence in water indicates that the water has been in contact with, or been contaminated by, fecal material. *E. coli* can be used as an indicator for other bacteria and pathogens associated with human and animal waste.

Nonpoint sources of bacteria in the eastern portion of the Lewiston Orchards include livestock, septic systems, pets, and wildlife. Manure from pastures, rangeland, corrals, and yards is the most manageable source of bacteria since it can be collected, diverted, or moved before it reaches the Lindsay Creek watershed. Manure is flushed into creeks and absorbed into ground water in a variety of ways, most commonly by rainwater, snowmelt, or runoff. Though bacteria typically do not live long enough to travel far underground, septic system drain fields can be a source of bacteria.

The *E. coli* concentrations measured in samples collected for this report are below the maximum allowable concentration of 576 MPN/100mL for waters designated as secondary contact recreation (IDAPA 58.01.02.251.01.i).

4.3 Caffeine

Samples were analyzed for the presence of caffeine as an indicator of septic system influence. Caffeine in the two samples was detected below the practical quantitation limit of 0.5 micrograms per liter (µg/L) referenced in the *Lindsay Creek Watershed Assessment and Total Maximum Daily Loads* (DEQ 2007). Idaho has no water quality standards for caffeine.

4.4 Total Chlorine and Free Chlorine

Total chlorine residual concentrations are not to exceed 0.019 mg/L as a criterion continuous concentration or 0.011 mg/L as a criterion maximum concentration for surface waters with an aquatic life beneficial use (IDAPA 58.01.02.210.01).

To determine whether chlorine concentrations in Lindsay Creek exceed the allowable criteria, four samples from two sites were collected and analyzed for total chlorine concentrations on January 27, 2006. All four samples analyzed were below the method detection limit (DEQ 2007), and additional analyses for total chlorine were not conducted in 2017.

Samples in 2017 were analyzed for the presence of free chlorine as an indicator of domestic water uses. Free chlorine was detected at very low levels in the two samples, suggesting that the domestic water use is a cumulative addition to the surface water analyzed.

4.5 Field Parameters

Samples were analyzed for pH, temperature, and specific conductivity as an indicator of water origin.

4.5.1 pH

Water pH indicates the balance between acidic hydrogen ions and basic hydroxide ions. In this area, ground water pH is usually more basic than surface water pH. Lindsay Creek surface water pH readings range from 6.92–8.75 and ground water readings range from 8.09–9.20 (DEQ 2007, 2009). The 2017 sample pHs of 7.31 and 7.54 are within the typical surface water range for the area and Idaho's pH water quality criterion of no less than 6.5 and no greater than 9, although precipitation infiltration through paved surfaces can increase the alkalinity.

4.5.2 Temperature

The 2017 sample temperatures of 10.0 and 11.9 degrees Celsius are consistent with earlier Lindsay Creek temperature readings range from 5.1–15.4 degrees Celsius for this time of year and ground water readings range from 7.2–21.4. In this area, ground water temperature may be higher than surface water temperature in the winter and opposite in the summer (DEQ 2007, 2009).

4.5.3 Specific Conductivity

The 2017 sample conductivity readings of 6,780 and 6,480 microSiemens per centimeter (μS/cm) are elevated compared to 2015 monitoring data of (1,033 μS/cm for surface water and 62–1,080 μS/cm for groundwater) (DEQ 2009). This is an indicator of the concentration of dissolved salts and inorganic materials in the water. Ion concentrations greater than surface water and ground water indicate greater precipitation events may be the origin.

5 Conclusion

The near-absence of caffeine and free chlorine suggests the sampled water is likely sourced by overland flow rather than septic drainage, although specific conductivity suggests septic drainage could provide some source water. The samples collected had non-detect or very low concentrations of *E. coli* bacteria, also suggesting the water is not coming from a failed septic system. However, given an appropriate amount of distance from the source, soil adsorption could remove any bacteria prior to the water surfacing.

Temperature and specific conductivity results contradicted each other. While site temperature readings are consistent with surface and ground water in the watershed, specific conductivity was elevated above surface and ground water concentrations in the watershed. The specific conductivity results suggest influence from overland flow due to greater precipitation.

Site nitrogen results are elevated above surface and ground water concentrations in the watershed, suggesting cumulative anthropogenic influences are contributing to elevated concentrations. The high nitrogen results warrant continued investigation to determine the best actions to control pollutant loading to surface water.

References

DEQ (Idaho Department of Environmental Quality). 2007. *Lindsay Creek Watershed Assessment and Total Maximum Daily Loads*. Lewiston, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2009. *Ground Water Well Monitoring Report Lindsay Creek Nitrate Priority Area Lewiston Nez Perce County*. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2014. 2014 *Nitrate Priority Area Delineation and Ranking Process*. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2017. "Ground Water Quality Monitoring and Protection" map. Boise, ID: DEQ. *https://mapcase.deq.idaho.gov/gwq/*

EPA (US Environmental Protection Agency). 1986. *Quality Criteria for Water*. EPA 44015-86001. Washington, D.C.: EPA.

IASCD (Idaho Association of Soil Conservation Districts). 2002. *Lindsay Creek Monitoring Report 2002*. Technical Results Summary CDM-LZ-02. Moscow, Idaho: IASCD.

IDAPA. 2017. "Idaho Water Quality Standards." Idaho Administrative Code. IDAPA 58.01.02.

ISCC (Idaho Soil Conservation Commission). 2008. *Lindsay Creek Watershed Total Maximum Daily Load Implementation Plan for Agriculture.* Prepared for DEQ by ISCC in cooperation with Nez Perce Soil and Water Conservation District.

National Weather Service. 2017. "Advanced Hydrologic Prediction Service." Silver Spring, MD: National Weather Service. *http://water.weather.gov/precip/*

US Congress. 1972. Clean Water Act (Federal Water Pollution Control Act). 33 USC §1251–1387.

Williamson, A.K., M.D. Munn, S.J. Ryker, R.J. Wagner, J.C. Ebbert, and A.M. Vanderpool. 1998. *Water Quality in the Central Columbia Plateau, Washington and Idaho, 1992-95*. US Geological Survey Circular 1144.