Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Bureau of Land Management Ophir Creek Campground - Well #1 Public Drinking Water System, Fairbanks Area, Alaska PWSID # 314255.001

DRINKING WATER PROTECTION REPORT 1789

Alaska Department of Environmental Conservation

February, 2009

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The Drinking Water Protection (DWP) section of the Drinking Water Program is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (DEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the DWP staff at the following toll-free number 1-866-956-7656.

February, 2009

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Source Water Assessment for BLM Ophir Creek Campground - Well 1 Source of Public Drinking Water, Fairbanks Area, Alaska

Drinking Water Protection
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for the Bureau of Land Management's (BLM) Ophir Creek Campground – Well 1is a Class B (transient/non-community) water system consisting of one well located at the confluence of Ophir Creek and Nome Creek, near Mile 60 of the Steese Highway, north of Fairbanks, Alaska. The wellhead received a susceptibility rating of **Medium** and the aquifer received a susceptibility rating of **High**. Combining these two ratings produces a **Medium** rating for the natural susceptibility of the well. Identified potential and existing sources of contaminants for BLM Ophir Creek Campground - Well 1 public drinking water source include: placer metals mining (active or inactive). This identified potential and/or existing source of contamination is considered as a source of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for BLM Ophir Creek Campground - Well 1 received a vulnerability rating of **Low** for all three contaminant categories. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of BLM to protect public health.

BLM OPHIR CREEK CAMPGROUND - WELL 1 PUBLIC DRINKING WATER SYSTEM

BLM Ophir Creek Campground – Well 1 public water system is a Class B (transient/non-community) water system. The system consists of one well located in the Ophir Creek Campground, at the confluence of Nome Creek and Ophir Creek. Well 1 is in the northwest corner of the campground, near the main entrance The campground lies 12 miles down the Nome Creek Valley off the Steese Highway, in the White Mountains, Alaska (see Map A in Appendix A).

The White Mountains are located between the Elliot and Steese Highways, approximately 40 miles north of Fairbanks. The area receives 67.8 inches of snowfall a year, and a total of 11.5 inches of precipitation annually. Average January temperatures range from -19 to -2 degrees Fahrenheit, while average July temperatures range from 49 to 71 degrees Fahrenheit (ADCCED, 2009).

Groundwater in the area is recharged by local precipitation. Outflow of ground water in the uplands primarily occurs two ways: in areas under artesian pressure (pressure caused by overlying permafrost), water can flow to the surface through thawed conduits within the permafrost, otherwise groundwater will flow under the permafrost (if present) and out to the groundwater beneath the adjacent flood plain or creek valley. Groundwater in the bedrock is principally contained in fractures (Nelson, 1978).

According to the well log, Well 1 at BLM Ophir Creek Campground extends approximately 50 feet below the ground surface and is completed in an unconfined fractured bedrock aquifer. Bedrock in this area is predominantly schist locally intruded by granitic rocks (Nelson, 1978).

This system operates seasonally from early June to late September and serves twenty-five non-residents through one service connection.

BLM OPHIR CREEK CAMPGROUND - WELL 1 DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the Drinking Water Protection Area. The Drinking Water Protection Area is the area circling the well (the area influenced by pumping) and also the area upgradient of the well, usually forming a parabola shape. Because releases of contaminants within the protection area are most likely to impact the well, this area will serve as the focus for voluntary protection efforts.

There are many different methods for calculating the size of protection areas. Drinking Water Protection (DWP) uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the protection zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The protection zone calculated by DWP is an estimate using the available information and resources, and may differ slightly from the actual capture zone. Because of

uncertainties and changing site conditions, a factor of safety is added to the protection zone to form the drinking water protection area for the well.

The parameters used to calculate the shape of this protection zone are general for the whole alluvial plain and were obtained from various United States Geological Survey (USGS) reports, area well logs, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry 1979).

The protection areas established for wells by the DEC are usually separated into two zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. An analytical calculation was used to determine the size and shape of the protection area.

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the two protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	Several months time-of-travel
B	Less than the 2 year time-of-travel

The Drinking Water Protection Area for BLM Ophir Creek Campground - Well 1 was determined using an analytical calculation and includes Zones A and B (see Map A in Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

DWP has completed an inventory of potential and existing sources of contamination within the BLM Ophir Creek Campground - Well 1 drinking water protection area. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class B public water system assessments, the following three categories of drinking water contaminants were inventoried:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile organic chemicals

The sources are displayed on Map C of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

The single potential contaminant source located within the protection area for this system did not have pose any risk to drinking water from bacteria and viruses, nitrates and/or nitrites, or volatile organic chemicals.

VULNERABILITY OF BLM OPHIR CREEK CAMPGROUND - WELL 1 DRINKING WATER SYSTEM

Vulnerability of a drinking water source to contamination is a combination of two factors:

- Natural Susceptibility; and
- Contaminant Risks.

A score for the Natural Susceptibility of the well is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0-25 Points)
+
Susceptibility of the Aquifer (0-25 Points)
=
Natural Susceptibility of the Well (0-50 Points)

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings	
40-50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Factors contributing to the susceptibility of the wellhead are: whether the sanitary seal is in place, protection from flooding, and if the well casing is properly grouted.

The wellhead for Well 1at BLM Ophir Creek Campground received a **Medium** susceptibility rating, mainly due to its location within a known floodplain. However, should a flood occur in the area, the wellhead is well protected, with proper precautions taken. The most recent sanitary survey (06/11/2003) indicates that a sanitary seal is installed on the well, the land surface is sloped away from the well, and the well is grouted according to DEC regulations. Sanitary seals prevent potential contaminants from entering the well, while sloping of the land surface away from the wellhead provides adequate surface water drainage, and concrete or grouting around the wellhead helps to prevent potential contaminants from traveling down the outside of the well casing.

Factors contributing to the susceptibility of the aquifer are: whether the aquifer is confined or unconfined, whether the well is completed in unconsolidated or fractured bedrock, whether wells and bore holes are penetrating the aquifer and, if applicable, the depth and thickness of the confining layer.

BLM Ophir Creek Campground - Well 1 draws water from an unconfined aquifer consisting of schist. It received a **High** susceptibility rating because of its relatively shallow, unconfined status. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface it is susceptible to contamination from outside sources. For this reason, deeper aquifers provide more protection than shallow ones.

Table 2 summarizes the Susceptibility scores and ratings for the BLM Ophir Creek Campground - Well 1 system.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	10	Medium
Susceptibility of the Aquifer	17	High
Natural Susceptibility	27	Medium

Contaminant risks are derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40-50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants for the BLM Ophir Creek Campground - Well 1 system.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	0	Low
Nitrates and/or Nitrites	0	Low
Volatile Organic Chemicals	0	Low

Finally, an overall vulnerability score is assigned for each water system by combining each of the contaminant risk scores with the natural susceptibility score:

Natural Susceptibility (0-50 Points)
+
Contaminant Risks (0-50 Points)
=
Vulnerability of the Drinking Water Source to Contamination (0-100 Points)

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80-100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

Table 4 contains the overall vulnerability scores (0-100) and ratings for each of the three categories of drinking water contaminants for the BLM Ophir Creek Campground - Well 1 system. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	25	Low
Nitrates and/or Nitrites	25	Low
Volatile Organic Chemicals	25	Low

Bacteria and Viruses

The contaminant risk to the drinking water well for bacteria and viruses is determined to be **Low**. No contaminant sources were identified.

Coliforms (a bacteria) are found naturally in the environment and while not necessarily a direct health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically fecal coliforms and E. coli. These bacteria only come from human and animal fecal waste and can cause diarrhea, cramps, nausea, headaches, and other symptoms (EPA 2008).

Samples testing positive for bacteria and viruses increase the overall vulnerability of the drinking water source by indicating that the source is susceptible to bacteria and virus contamination. Only a small number of bacteria and viruses are required to endanger public health. Bacteria and viruses have not been detected during the last five years of sampling at BLM Ophir Creek Campground - Well 1 (data reviewed in April, 2008).

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Low**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites for BLM Ophir Creek Campground - Well 1 is determined to be **Low**. No contaminant sources were identified.

The sampling history for BLM Ophir Creek Campground - Well 1 indicates that nitrates and nitrites have not been detected within the last five years (data reviewed in April, 2008).

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Low**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is determined to be **Low**. No contaminant sources were identified.

The drinking water at BLM Ophir Creek Campground - Well 1 has not recently been sampled for volatile organic chemicals (data reviewed in April, 2008).

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Low**.

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of BLM Ophir Creek Campground to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the BLM Ophir Creek Campground drinking water source.

REFERENCES

Alaska Department of Commerce, Community and Economic Development (ADCCED), Accessed 2009 [WWW document]. URL: http://www.commerce.state.ak.us/dca/commdb/CF_COMDB.htm

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

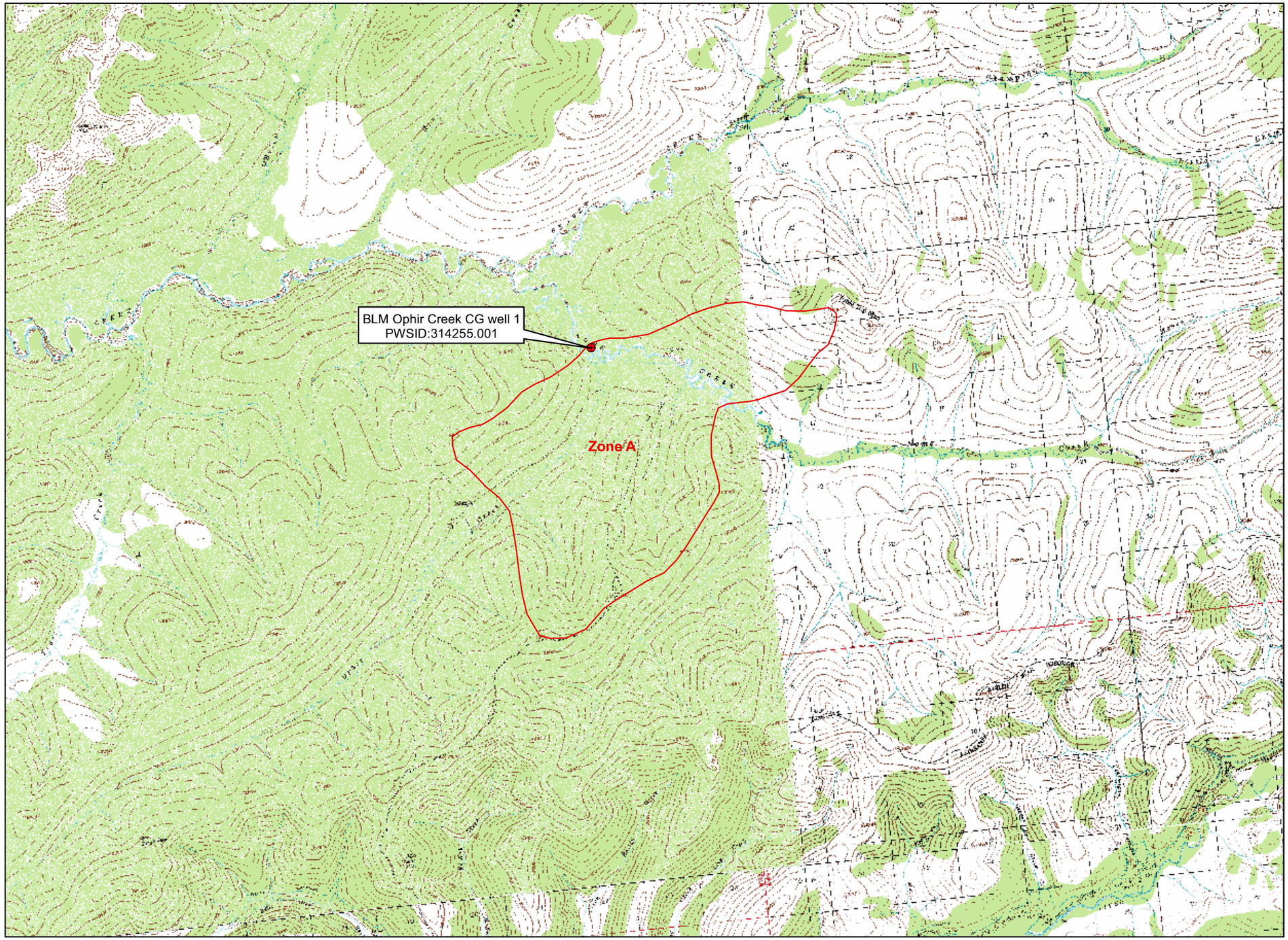
Nelson, Gordon L., 1978, Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska. US Department of the Interior Geological Survey Open File Report 78-959, 47p.

United States Environmental Protection Agency (EPA), Accessed 2008 [WWW document]. URL: http://www.epa.gov/safewater/contaminants/index.html.

APPENDIX A

BLM Ophir Creek Campground - Well 1
Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #314255.001 BLM Ophir Creek Campground - Well 1



Legend

Class B Public Water System

Groundwater Protection Zones

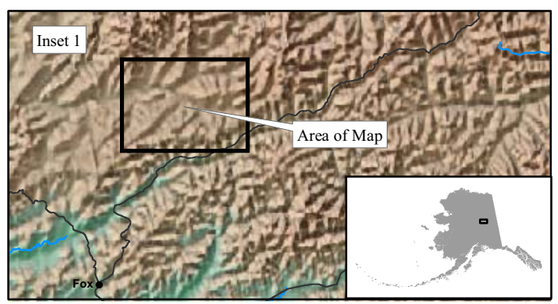
Zone A Protection Area - Several Months Travel Time

Data Sources:
Contaminant Sources, Public Water System Wells, Alaska Department of Environmental Conservation (ADEC)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



Alaska DEC

N
W E
S

0 2 4 8 Miles

BLM Ophir Creek Campground - Well 1
PWS 314255.001

Appendix A Map A

APPENDIX B

Contaminant Source Inventory for BLM Ophir Creek Campground - Well 1 (Table 1)

Table 1

Contaminant Source Inventory for

BLM Ophir Creek CG well 1

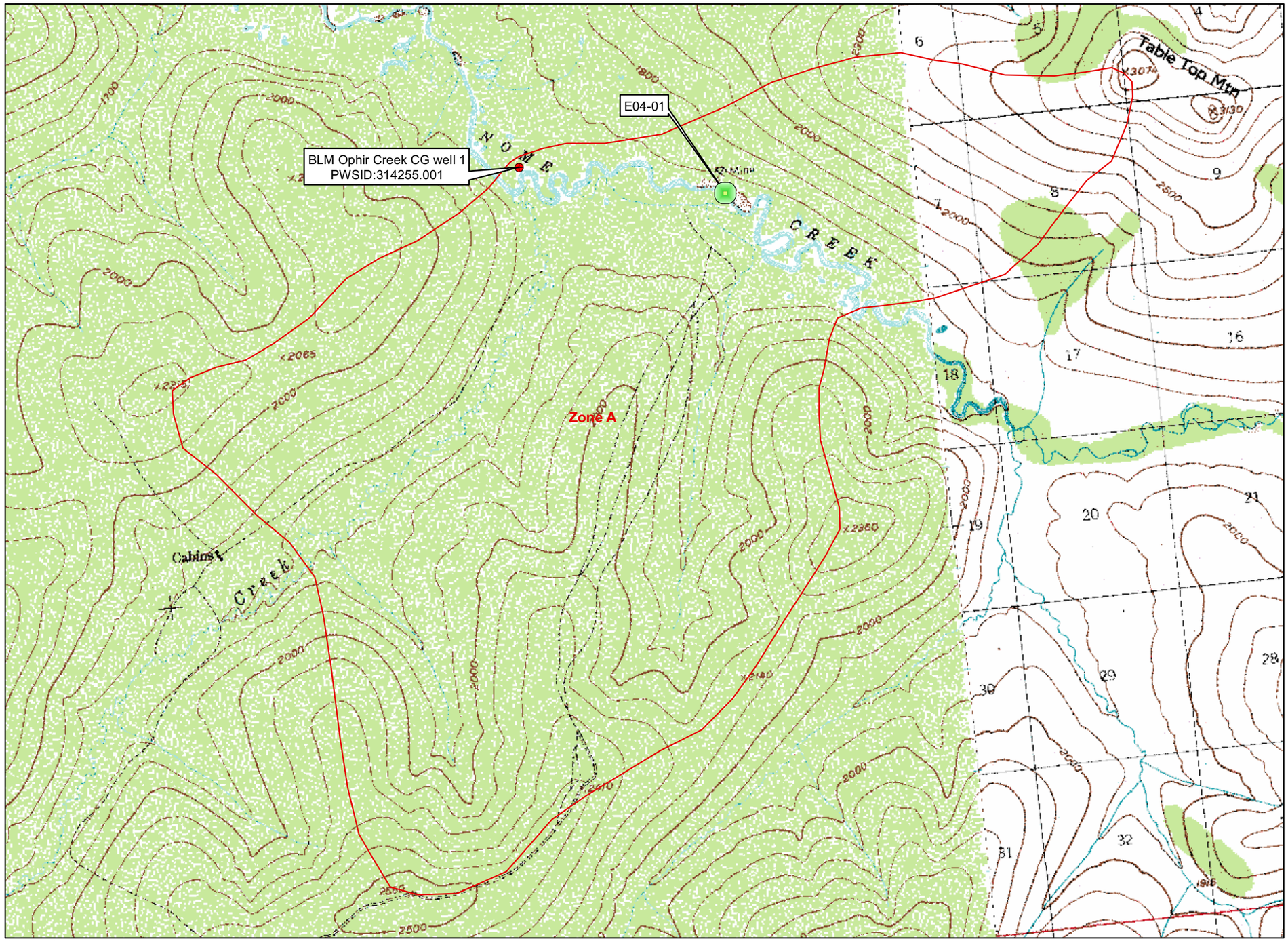
PWSID 314255.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Metals mining, placer (active or inactive?)	E04	E04-01	A	C	

APPENDIX C

BLM Ophir Creek Campground - Well 1
Drinking Water Protection Area and
Potential and Existing Contaminant Sources
(Map C)

Public Water Well System for PWS #314255.001 BLM Ophir Creek Campground - Well 1
Showing Potential and Existing Sources of Contamination



Legend

Groundwater Protection Zones

Zone A Protection Area - Several Months Travel Time

Existing or Potential Contaminant Sources

Metals mning, placer (active/inactive) (E04)

Data Sources:
Contaminant Sources, Public Water System Wells, Alaska Department of Environmental Conservation (ADEC)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

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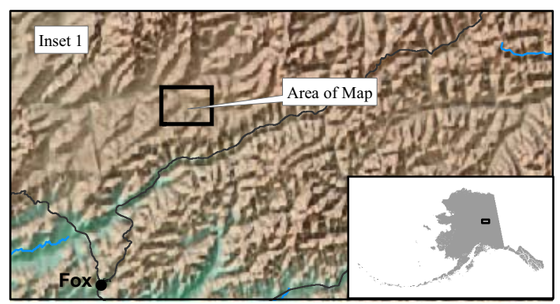

N
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0 1 2 4 Miles

BLM Ophir Creek Campground - Well 1
PWS 314255.001

Appendix C Map C