Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Camp Li -Wa Public Drinking Water System, Fairbanks Area, Alaska PWSID # 310976.001

DRINKING WATER PROTECTION REPORT 1781

Alaska Department of Environmental Conservation

December, 2008

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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 number: 1-866-956-7656.

December, 2008

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Source Water Assessment for Camp Li-Wa Source of Public Drinking Water, Fairbanks Area, Alaska

Drinking Water Protection
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Camp Li-Wa is a Class B (transient/non-community) water system consisting of one well north of Fairbanks, Alaska. The wellhead received a susceptibility rating of **Low** 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 current sources of contaminants for Camp Li-Wa public drinking water source include: two roads, construction areas, domestic wastewater sludge land application areas, septic systems, and residential heating oil tanks. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Camp Li-Wa received a vulnerability rating of **High** for bacteria and viruses, as well as nitrates and nitrites. The system received a vulnerability rating of **Medium** for volatile organic chemicals. 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 Camp Li-Wa to protect public health.

CAMP LI-WA PUBLIC DRINKING WATER SYSTEM

Camp Li-Wa public water system is a Class B (transient/non-community) water system consisting of one well north of Fairbanks, Alaska (See Map A of Appendix A). Fairbanks and its surrounding communities are located in the Fairbanks North Star Borough which is near the center of Alaska (Please see the inset of Map A in Appendix A for location). The Borough's current population is 96,888 making it the second-largest population center in the state (ADCED, 2008). Communities located within the Borough include : College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers.

The majority of residents in the Fairbanks area have individual wells and septic systems, and the remainder haul water (ADCED, 2008). Heating oil (stored in both above and below ground 275 to 500-gallon tanks) is used for heating homes and buildings. Refuse is transported to the Fairbanks North Star Borough landfill.

The Fairbanks area includes two distinct topographic areas: the floodplain of the Tanana River and the Chena River, and the uplands north of this floodplain. The average annual precipitation in Fairbanks is 10.37 inches (ADCED, 2008).

According to the most recent sanitary survey (10/07/04), the well extends 115 feet below the ground surface. No well log is available for this system, but it is assumed to be completed in a confined aquifer based on information from a nearby public water system.

This system operates from May to August and serves approximately 125 non-residents through five service connections.

CAMP LI-WA 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 Camp Li-Wa is limited by its immediate watershed and includes only Zone A (see Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

DWP has completed an inventory of potential and existing sources of contamination within the Camp Li-Wa 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.

Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

VULNERABILITY OF CAMP LI-WA 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 Camp Li-Wa received a **Low susceptibility** rating. The most recent sanitary survey (10/07/04) indicates the well is capped with a sanitary seal and the land surface is appropriately sloped away from the well, but that the well is not properly grouted. 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 confining layer.

No well log is available for this system, but Camp Li-Wa is assumed to draw water from a confined aquifer based on information from a nearby public water system. The aquifer received a **High** susceptibility rating because of the presence of other wells penetrating the vadose zone of the protection area. Other wells penetrating the vadose zone of the protection zone can allow contaminants to travel into the shared aquifer with precipitation and runoff.

Table 2 summarizes the Susceptibility scores and ratings for the Camp Li-Wa system.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	17	High
Natural Susceptibility	22	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 Camp Li-Wa system.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	25	Medium

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 Camp Li-Wa system. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	70	High
Nitrates and/or Nitrites	70	High
Volatile Organic Chemicals	45	Medium

Bacteria and Viruses
The contaminant risk for bacteria and viruses is **Very High** with the domestic wastewater sludge land application areas, septic systems and roads representing the risk to the drinking water well.

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses have been detected during recent water sampling of the system at Camp Li-Wa (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 **High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with the domestic wastewater sludge land application areas, septic systems and roads representing the risk to this source of public drinking water. Nitrates are very mobile, moving at approximately the same rate as water.

The sampling history for Camp Li-Wa well indicates that nitrates have been detected in the water, with the highest concentration of 0.328 mg/L detected on 11/28/2007 (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 **High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Medium** with the construction areas, domestic wastewater sludge land application areas, septic systems, residential heating oil tanks and roads representing the risk for volatile organic chemicals.

The drinking water at Camp Li-Wa 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 **Medium**.

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 continuous efforts 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 Camp Li-Wa drinking water source.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), Accessed 2008 [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.

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

APPENDIX A

Camp Li-Wa
Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #310976.001 Camp LI - WA

Legend

Class B Public Water System

Groundwater Protection Zones

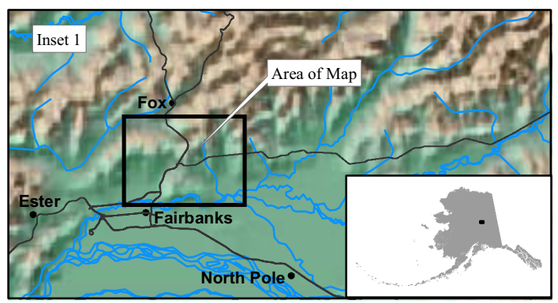
Zone A Protection Area - Several Months Travel Time

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

All other data:
Alaska Statewide Digital Mapping Initiative (SDMI)

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.



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Camp LI - WA
PWS 310976.001

Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Camp Li-Wa (Tables 1-4)

Table 1

Contaminant Source Inventory for
CAMP LI - WA

PWSID 310976.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Numbe*	*Comments*
Construction Trade Areas and Materials	C09	C09-01	A	C	
Domestic Wastewater Sludge Land Application Areas	D04	D04-01	A	C	
Large Capacity Septic System	D10	D10-01	A	C	
127 Residential Heating Oil Tanks (above ground)	R08	R08	A	C	
Road	X20	X20	A	C	
Road	X20	X20	A	C	

Table 2

Contaminant Source Inventory and Risk Ranking for CAMP LI - WA Sources of Bacteria and Viruses

PWSID 310976.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic Wastewater Sludge Land Application Areas	D04	D04-01	A	High	C	
Large Capacity Septic System	D10	D10-01	A	High	C	
Road	X20	X20	A	Low	C	
Road	X20	X20	A	Low	C	

Table 3

Contaminant Source Inventory and Risk Ranking for CAMP LI - WA Sources of Nitrates/Nitrites

PWSID 310976.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic Wastewater Sludge Land Application Areas	D04	D04-01	A	High	C	
Large Capacity Septic System	D10	D10-01	A	High	C	
Road	X20	X20	A	Low	C	
Road	X20	X20	A	Low	C	

Table 4

Contaminant Source Inventory and Risk Ranking for CAMP LI - WA

Sources of Volatile Organic Chemicals

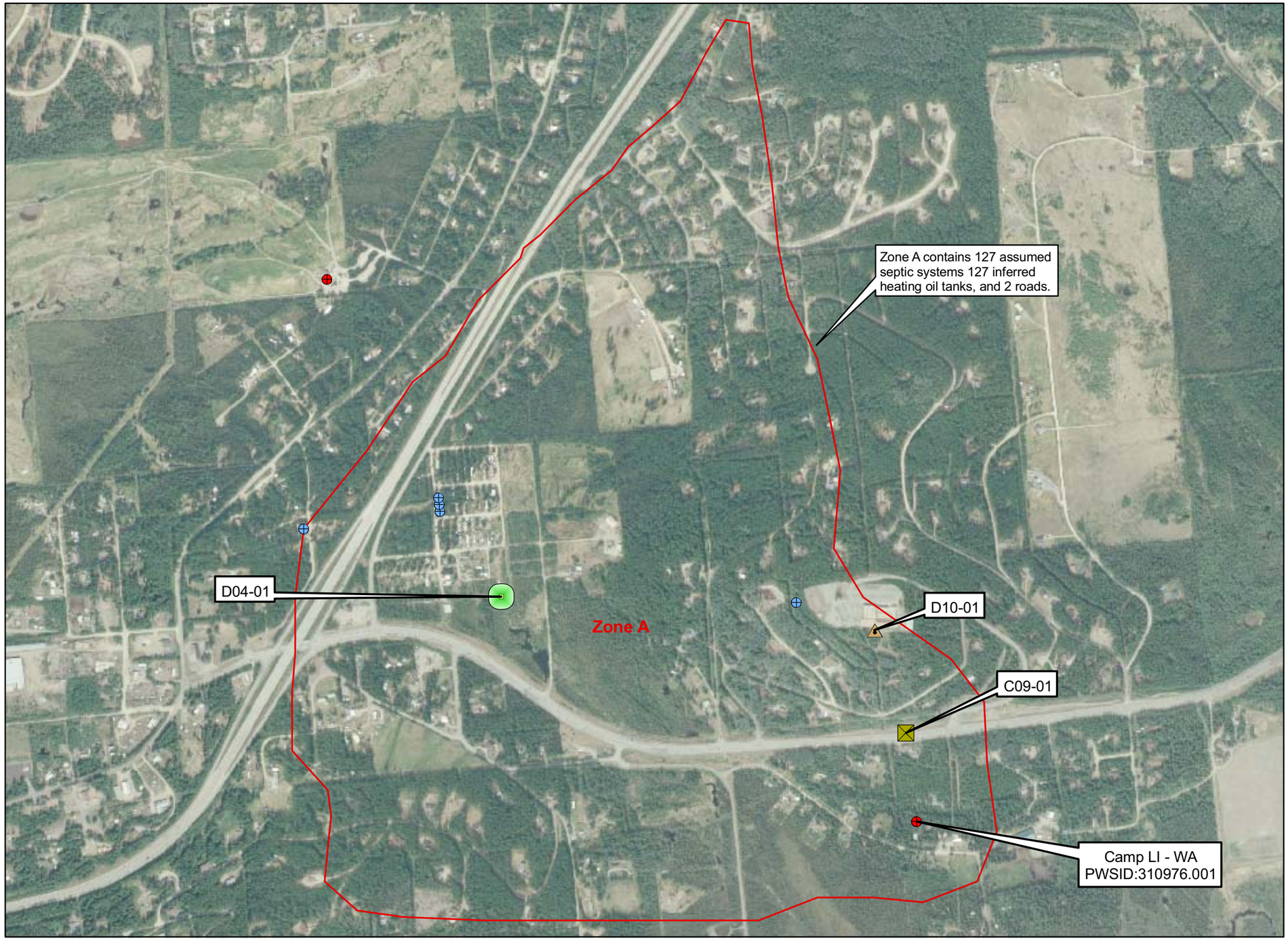
PWSID 310976.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Construction Trade Areas and Materials	C09	C09-01	A	Low	C	
Domestic Wastewater Sludge Land Application Areas	D04	D04-01	A	Low	C	
Large Capacity Septic System	D10	D10-01	A	Low	C	
127 Residential Heating Oil Tanks (above ground)	R08	R08	A	Medium	C	
Road	X20	X20	A	Low	C	
Road	X20	X20	A	Low	C	

APPENDIX C

Camp Li-Wa
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map C)

Public Water Well System for PWS #310976.001 Camp LI - WA
Showing Potential and Existing Sources of Contamination



Legend

- Class A Public Water System
- Class B Public Water System

Groundwater Protection Zones

- Zone A Protection Area - Several Months Travel Time

Existing or Potential Contaminant Sources

- Construction trade areas and materials (C09)
- Domestic wastewater sludge land application areas (D04)
- Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) (D10)

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

All other data:
Alaska Statewide Digital Mapping Initiative (SDMI)

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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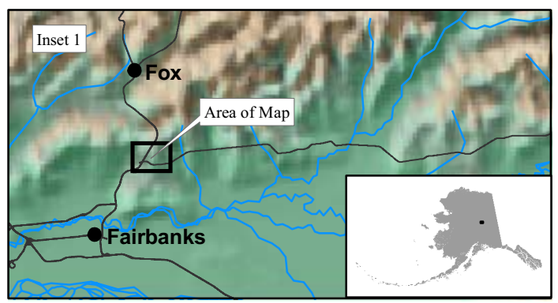

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Camp LI - WA
PWS 310976.001

Appendix C Map C