Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Sunshine Community Center, Willow, Alaska

Sunshine Community Center

PWSID # 220053

DRINKING WATER PROTECTION REPORT 1598

Alaska Department of Environmental Conservation

November 2006

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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 (ADEC), 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 Program Coordinator of DWP, (907) 269-7521.

November 2006

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Drinking Water Protection
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Sunshine Community Center is a Class B (non-community) water system consisting of one well near the Parks Highway in Wasilla. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produces a **Low** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Sunshine Community Center public drinking water source include: roads, injection wells, and residential areas. 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 Sunshine Community Center 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 Sunshine Community Center to protect public health.

SUNSHINE COMMUNITY CENTER PUBLIC DRINKING WATER SYSTEM

Sunshine Community Center public water system is a Class B (non-community) water system. The system consists of one well near the Parks Highway in Willow.

Big Lake, Houston, and Willow are part of the Matanuska-Susitna Borough. The borough encompasses 24,694 square miles and had a population of 59,322 in 2000. The borough is contained within the watersheds of the Matanuska and Susitna Rivers, which have their source in meltwater from glaciers in the Alaska Range, the Talkeetna Mountains, and the Chugach Mountains. Both rivers flow to tidewater in the Knik Arm of Upper Cook Inlet (*Jokela, Munter and Evans*, *1991*). The area bounded by the Matanuska and Susitna Rivers is commonly referred to as "the Mat-Su Valley," or simply "the Valley."

The three communities have experienced dramatic growth in the last 10 years. Big Lake and Houston nearly doubled their population from 1990 to 2000, while Willow saw an almost sixfold increase. Together, the three communities constitute nearly 10% of the borough's population

Willow is a community of 1,658 residents (2000 Census) located along the Parks Highway between Mile 60 and Mile 80.7. The community encompasses almost 685 square miles. Almost all of the households in Willow have private drinking water wells and septic systems, but approximately 60% of the homes are vacant or used only seasonally (*ACED Community Database, 2001*).

The regional geology and groundwater conditions of the Mat-Su Valley vary greatly depending on location. The terrain is dominated by distinctive landforms created by repeated glacial advances and retreats during the Pleistocene epoch (2 million years to 10,000 years before present). The unconsolidated layers (layers of sediment that are not cemented together) comprise well-sorted sands and gravels. Most of the wells in the Mat-Su Valley are located in unconsolidated layers. These layers vary substantially in size and distribution throughout the Valley. In general, the unconsolidated layers increase in thickness throughout the Cook Inlet *(Jokela, Munter and Evans, 1991)*. Throughout the area, numerous confining layers ranging from less than 1 foot to 60 feet thick separate the unconsolidated layers.

In the Mat-Su Valley, the groundwater is recharged mainly by snowmelt and precipitation infiltrating into the foothill slopes of the Talkeetna or Chugach Mountains, and by direct precipitation and snowmelt throughout the area.

Water wells in the Big Lake, Houston, and Willow areas are located in unconfined and confined aquifers. Studies indicate that the direction of groundwater flow in the Big Lake area is mainly toward the lake. The direction of groundwater flow in the upper unconfined aquifers is more variable because of the influence of surficial topography and close connection of those aquifers with surface water bodies *(Jokela, Munter, and Evans, 1991)*. Less research has been completed for water wells in the Houston and Willow areas; however, available data suggest that groundwater tends to flow toward the Susitna River in the west, and locally toward major surface water bodies and smaller tributaries.

This system serves 2 residents and 5 non-residents through 2 service connections.

SUNSHINE COMMUNITY CENTER 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 area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area. Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An outline of the immediate watershed was used to determine the size and shape of the protection area for Sunshine Community Center.

Available geology was also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The protection areas established for wells by the ADEC are usually separated into four 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 input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources (*Jokela et. al., 1991*).

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 rotection 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

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Sunshine Community Center DWPA. 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, three categories of drinking water contaminants were inventoried. They include:

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

The sources are displayed on Map 2 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 time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant.

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 SUNSHINE COMMUNITY CENTER

The vulnerability of public drinking water systems to regulated contaminants is determined by assessing the susceptibility of the wellhead, the susceptibility of the aquifer and the potential contaminant sources identified within the protection area.

The Drinking Water Protection developed a vulnerability assessment tool that assigns a vulnerability risk ranking based upon various factors associated with the well, aquifer and potential and existing contaminants identified within the protection area.

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

The wellhead for the Sunshine Community Health Center received a **Low** susceptibility rating. The most recent sanitary survey (8/14/2003) indicates the well is capped with a sanitary seal, the land surface is sloped away from the well, and the well is grouted. A sanitary seal prevents potential contaminant from entering the well while sloping of the land surface and grouting help 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.

The aquifer the Sunshine Community Center well is completed in received a **Medium** susceptibility rating. The aquifer is fairly well confined by clay, which helps to keep surface contaminants from percolating down through the soil to contaminate the aquifer. Table 2 summarizes the Susceptibility scores and ratings for Sunshine Community Center.

Table 2: Susceptibility

	Rating
Susceptibility of the Wellhead	Low
Susceptibility of the Aquifer	Medium
Natural Susceptibility	Low

The Contaminant Risk has been 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.

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

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

Bacteria and Viruses

The contaminant risk for bacteria and viruses is low with the class V injection well representing the greatest risk to the drinking water well

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses have not been detected during recent water sampling of the system at Sunshine Community Center. 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 is low with the class V injection well representing the greatest risk to this source of public drinking water. Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for Sunshine Community Center well indicates that nitrates have not been detected in the water. 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 low with the roads creating the greatest risk for volatile organic chemicals.

The drinking water at Sunshine Community Center has not been sampled for Volatile Organic Chemicals recently. 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 Ptarmigan Heights 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 Sunshine Community Center drinking water source.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

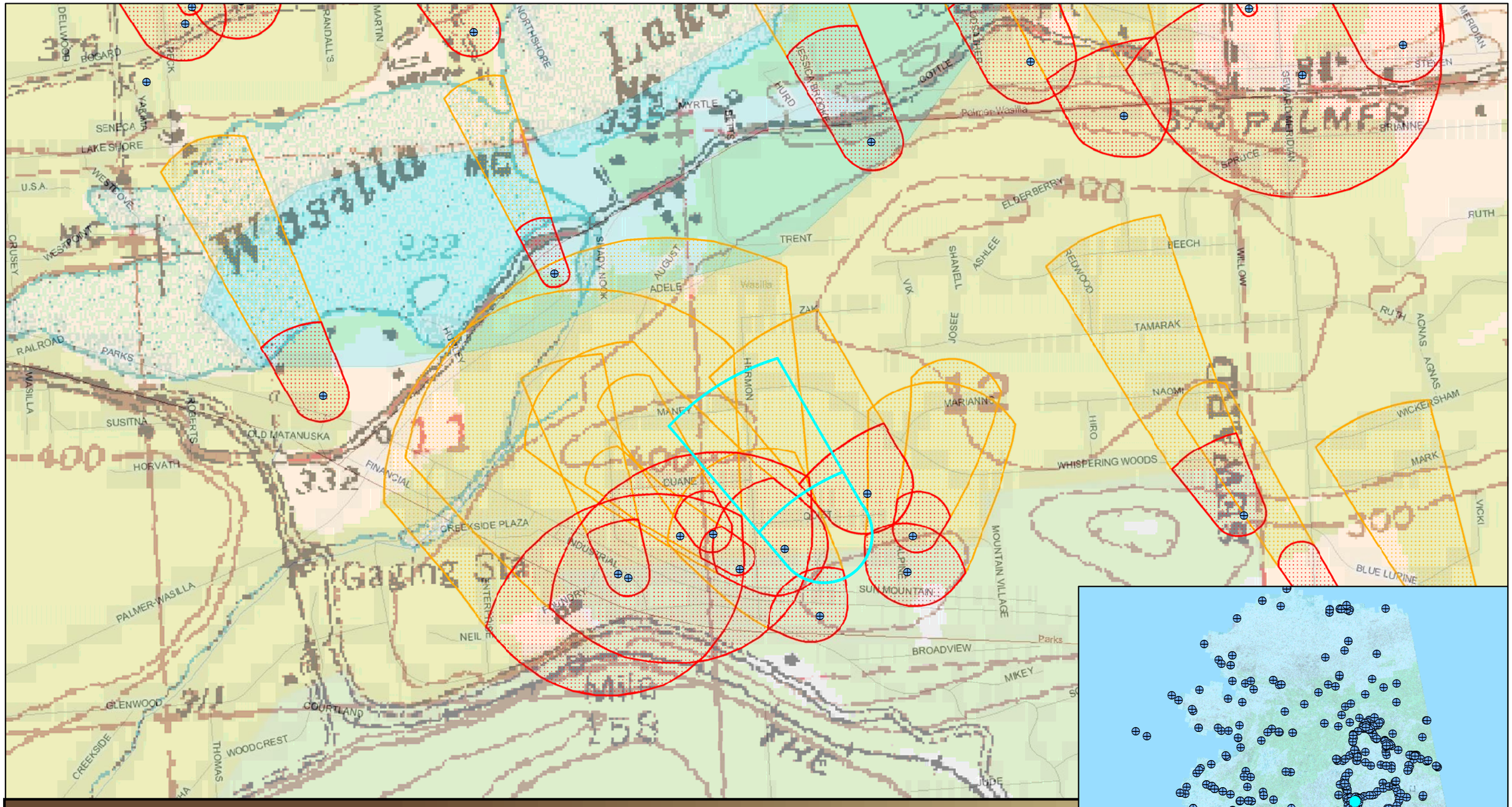
Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

Jokela, J.B., Munter, J.A., and Evans, J.G., 1991, Ground-water resources of the Palmer-Big Lake area, Alaska: a conceptual model. Division of Geological &Geophysical Surveys Reports of Investigations 90-4, State of Alaska Department of Natural Resources, Fairbanks, AK.

United States Environmental Protection Agency (EPA), 2006 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Sunshine Community Center
Drinking Water Protection Area Location Map
(Map 1)



Map 1- Quiet Circle Apartments and Surrounding Water Systems

PWSID: 224476.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

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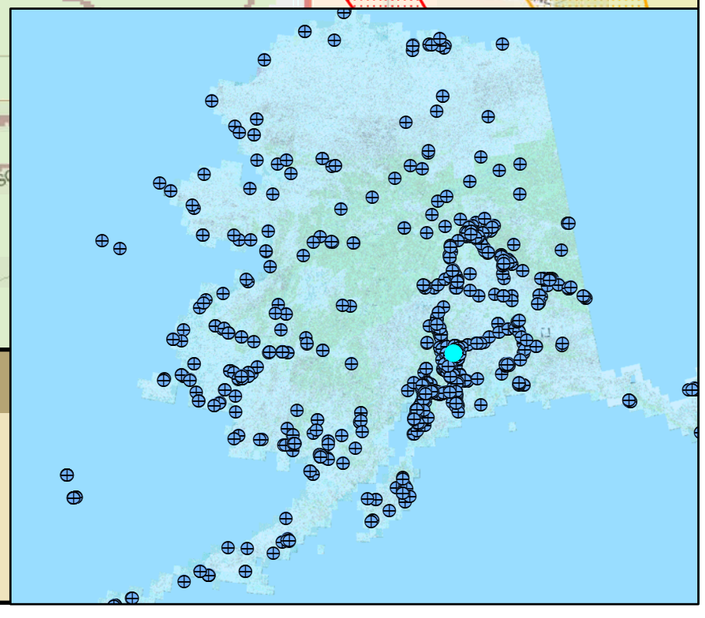
Data Sources:
Mat-Su Borough: Roads and parcels
Potential Sources of Contamination: ADEC

- Public Water Sources
- Zone A Protection Area
- Zone B Protection Area



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Sunshine Community Center (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Quiet Circle Apartments***

PWSID 224476.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Hardware stores	C17	C17-01	A	1	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-1	A	1	2 sewerlines in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A		
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-1	A		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	1	2 roads in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	B	1	2 large capacity septic systems in Zone B
Septic systems (serves one single-family home)	R02	R02-1-4	B	1	4 residential septic systems in Zone B
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	1	4 roads in Zone B

Table 2

Contaminant Source Inventory and Risk Ranking for Quiet Circle Apartments Sources of Bacteria and Viruses

PWSID 224476.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-1	A	Medium	1	2 sewerlines in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	High		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	1	2 roads in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	B	High	1	2 large capacity septic systems in Zone B
Septic systems (serves one single-family home)	R02	R02-1-4	B	Low	1	4 residential septic systems in Zone B
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	1	4 roads in Zone B

Table 3

Contaminant Source Inventory and Risk Ranking for Quiet Circle Apartments Sources of Nitrates/Nitrites

PWSID 224476.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Hardware stores	C17	C17-01	A	Low	1	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-1	A	Medium	1	2 sewerlines in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	High		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	1	2 roads in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	B	High	1	2 large capacity septic systems in Zone B
Septic systems (serves one single-family home)	R02	R02-1-4	B	Low	1	4 residential septic systems in Zone B
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	1	4 roads in Zone B

Table 4

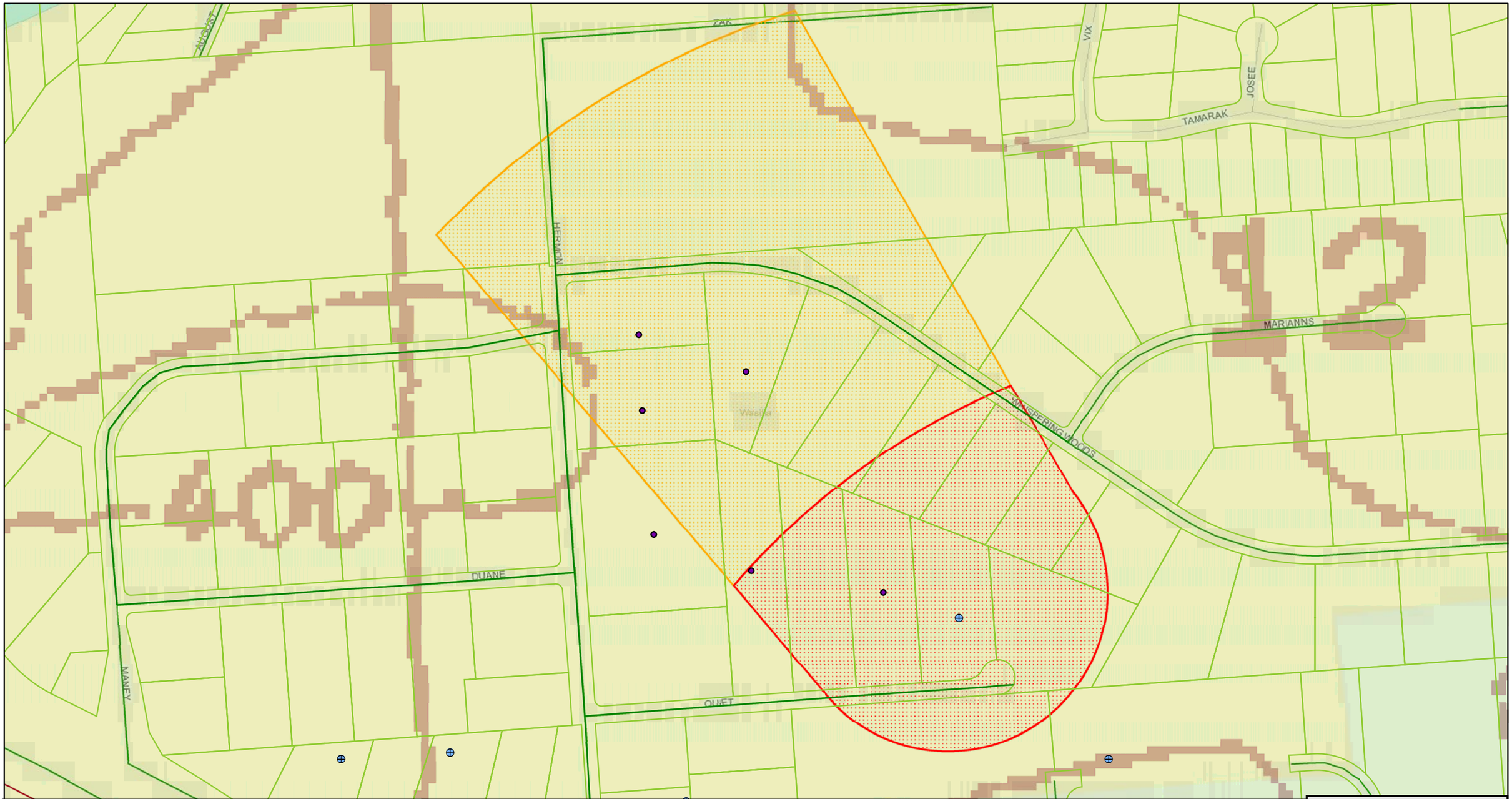
Contaminant Source Inventory and Risk Ranking for Quiet Circle Apartments Sources of Volatile Organic Chemicals

PWSID 224476.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Hardware stores	C17	C17-01	A	Low	1	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-1	A	Low	1	2 sewerlines in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	1	2 roads in Zone A
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	B	Low	1	2 large capacity septic systems in Zone B
Septic systems (serves one single-family home)	R02	R02-1-4	B	Low	1	4 residential septic systems in Zone B
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	1	4 roads in Zone B

APPENDIX C

Sunshine Community Center
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)



Map 2- Quiet Circle Apartments Potential Contaminants

PWSID: 224476.001

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Data Sources:
Mat-Su Borough: Roads and parcels
Potential Sources of Contamination: ADEC

- Zone A Protection Area
- Zone B Protection Area
- parcels
- Public Water Sources
- Septics
- Roads