



Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Glacier Inn,
Hyder, Alaska
PWSID #120779

DRINKING WATER PROTECTION PROGRAM REPORT NO. 701

Alaska Department of Environmental Conservation

Source Water Assessment for Glacier Inn Hyder, Alaska PWSID #120779

DRINKING WATER PROTECTION PROGRAM REPORT NO. 701

The Drinking Water Protection Program (DWPP) 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 DWPP, (907) 269-7521.

CONTENTS

SECTION	Executive Summary	1
	Drinking Water System and Area Overview	1
	Glacier Inn Water Treatment Plant Drinking Water Protection Area	1
	Inventory of Potential and Existing Contaminant Sources	2
	Ranking of Contaminant Risks	2
	Vulnerability of the Glacier Inn Water Treatment Plant Drinking Water System	2
	References	5

TABLES

TABLE	1. Definition of Zones	2
	2. Susceptibility of the Glacier Inn Water Treatment Plant Water Source	3
	3. Glacier Inn Water Treatment Plant Contaminant Risks	3
	4. Glacier Inn Water Treatment Plant Overall Vulnerability	3

APPENDICES

APPENDIX	A. Glacier Inn Drinking Water Protection Area (Map 1)	
	B. Contaminant Source Inventory for Glacier Inn (Table 1)	
	Contaminant Source Inventory and Risk Ranking for Glacier Inn - Bacteria and Viruses (Table 2)	
	Contaminant Source Inventory and Risk Ranking for Glacier Inn – Nitrates/Nitrites (Table 3)	
	Contaminant Source Inventory and Risk Ranking for Glacier Inn – Volatile Organic Chemicals (Table 4)	
	C. Glacier Inn Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)	
	Glacier Inn Drinking Water Protection Area and Additional Potential and Existing Contaminant Sources (Map 3)	
	D. Vulnerability Analysis for Contaminant Source Inventory and Risk Ranking for Glacier Inn Public Drinking Water Source (Charts 1 – 8)	

Source Water Assessment for Glacier Inn, Hyder, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Glacier Inn is a Class B (transient/non-community) water system consisting of one well. The Glacier Inn is located in Hyder, Alaska. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produces a **Very High** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Glacier Inn public drinking water source include: large-capacity and single-family septic systems, underground, open-pit and placer metals mining; water supply wells; dirt/gravel highways and roads; and cemeteries. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Glacier Inn received a vulnerability rating of **Very High** for both bacteria and viruses and nitrates and nitrites, and **High** for volatile organic chemicals.

GLACIER INN PUBLIC DRINKING WATER SYSTEM

Glacier Inn public water system is a Class B (transient/non-community) water system. The system consists of one well. The Glacier Inn is located in Hyder, Alaska. Hyder is located at the head of Portland Canal, a 70-mile fjord forming a portion of the US/Canadian Border. Hyder is 2 miles from the US/Canadian Border, approximately 75 air miles from Ketchikan. It is the only community in southern Alaska accessible by road (please see the inset of Map 1 in Appendix A for location). The population of Hyder is approximately 90.

Hyder averages about 78 inches of precipitation per year; and approximately 162 inches of snow. The groundwater aquifers underlying the area are recharged through the infiltration of precipitation and surface water. Groundwater aquifers in the region generally occur in the fractured bedrock and unconsolidated sediments deposited by glaciers and/or rivers. The elevation for Hyder is sea level.

According to a Sanitary Survey from August 4, 1998 and a Well Log, the existing well was installed in 1996. The depth of the well is 55 feet below the ground surface, and the well screen was installed between 32 and 38 feet in unconsolidated sand.

The Sanitary Survey (8/04/98) for the water system indicates the land surface is not appropriately sloped away from the well, which would provide adequate surface water drainage. The well is not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year round and serves approximately 80 non-residents through one service connection.

GLACIER INN 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 (DWPA). Because releases of contaminants within the DWPA are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attribute 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*). Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DPWA (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The DWPA's established for wells by the ADEC are usually separated into four zones. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well.

The TOT 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 four protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than the 2 year time-of-travel
C	Less Than the 5 year time-of-travel
D	Less than the 10 year time-of-travel

The DWPA for Glacier Inn is limited by the Salmon River watershed. Development in the vicinity of the well is basically limited to Zones A, B, and C (See Map 1 of Appendix A).

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 Glacier Inn 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 TOT for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only “Very High” and “High” rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

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 GLACIER INN DRINKING WATER SYSTEM

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

- Natural susceptibility; and
- Contaminant risks.

Appendix D contains eight charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

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

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
(Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

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

Natural Susceptibility Ratings

40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

The well for the Glacier Inn is completed in an unconfined aquifer. Because unconfined aquifers are recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Susceptibility scores and ratings for Glacier Inn

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	50	Very High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. 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 to 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.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	12	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).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings

80 to 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. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	100	Very High
Nitrates and Nitrites	100	Very High
Volatile Organic Chemicals	60	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with the large-capacity septic system and other septic systems located within Zone A representing the risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

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 the Glacier Inn. However, after combining the contaminant risks from the large-capacity septic systems and the single-family septic systems and the dirt/gravel highways and roads with the overall natural susceptibility of the well, the vulnerability of the well to contamination by bacteria and viruses is **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with the large-capacity septic system and single-family septic systems and the dirt/gravel highways and roads representing the risk to this source of public drinking water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Sampling history for Glacier Inn well indicates that nitrates have been detected in the water, but only in very low concentrations (most recently at 0.1 mg/L on 10/15/2002) or 1% of the Maximum Contaminant Level (MCL). The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as 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 by nitrates and nitrites is **Very High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low** with the large-capacity septic systems and the single-family septic systems and the dirt/gravel highways and roads creating the only known risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

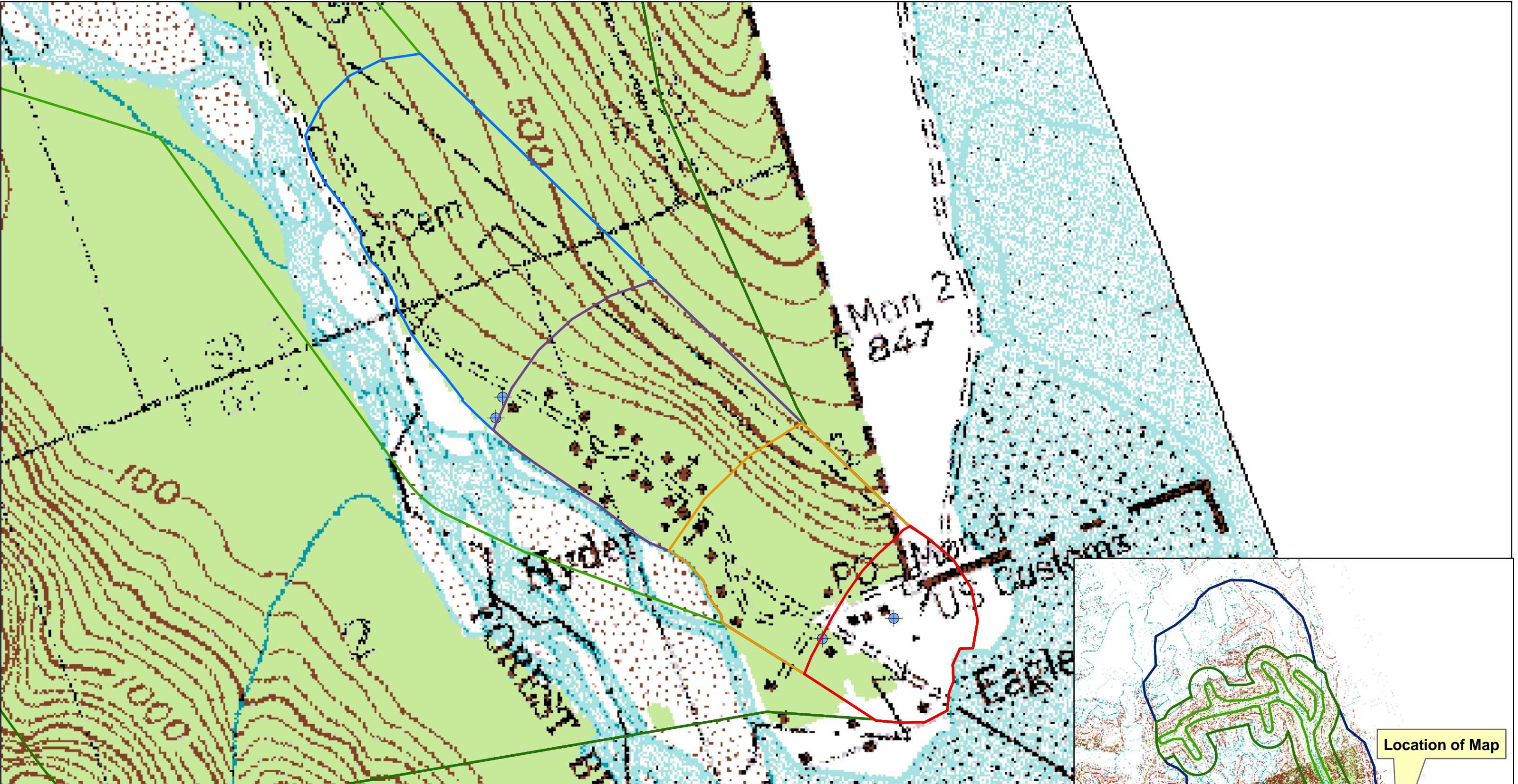
The drinking water at Glacier Inn has not recently been sampled for volatile organic chemicals. However, after combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination by volatile organic chemicals is **High**.

REFERENCES

- Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.
- Alaska Geospatial Data Clearinghouse, 2003. URL: <http://agdc.usgs.gov/data/datasets.html>.
- Gehrels, G.E., Berg, H.C., Geologic Map of Southeastern Alaska: U.S. Geological Survey Map (scale 1:600,000), Map I-1867, 1sheet.
- 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.
- King, P.B., compiler, 1969, Tectonic map of North America: US Geological Survey Map, (scale 1:5,000,000) 2 sheets.
- Patrick, L.D., Brabets, T.P., and Glass, R.L., 1989, Simulation of ground-water flow at Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 88-4139, 41p.
- United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL: <http://www.epa.gov/safewater/mcl.html>.


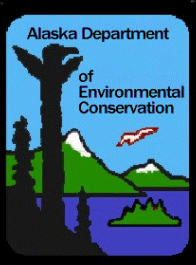
APPENDIX A

Glacier Inn Drinking Water Protection Area Location Map (Map 1)



Map 1: Glacier Inn Drinking Water Protection Areas

PWSID: 120779.001



0 455 910 1,820 2,730 3,640 Feet

1:10,004

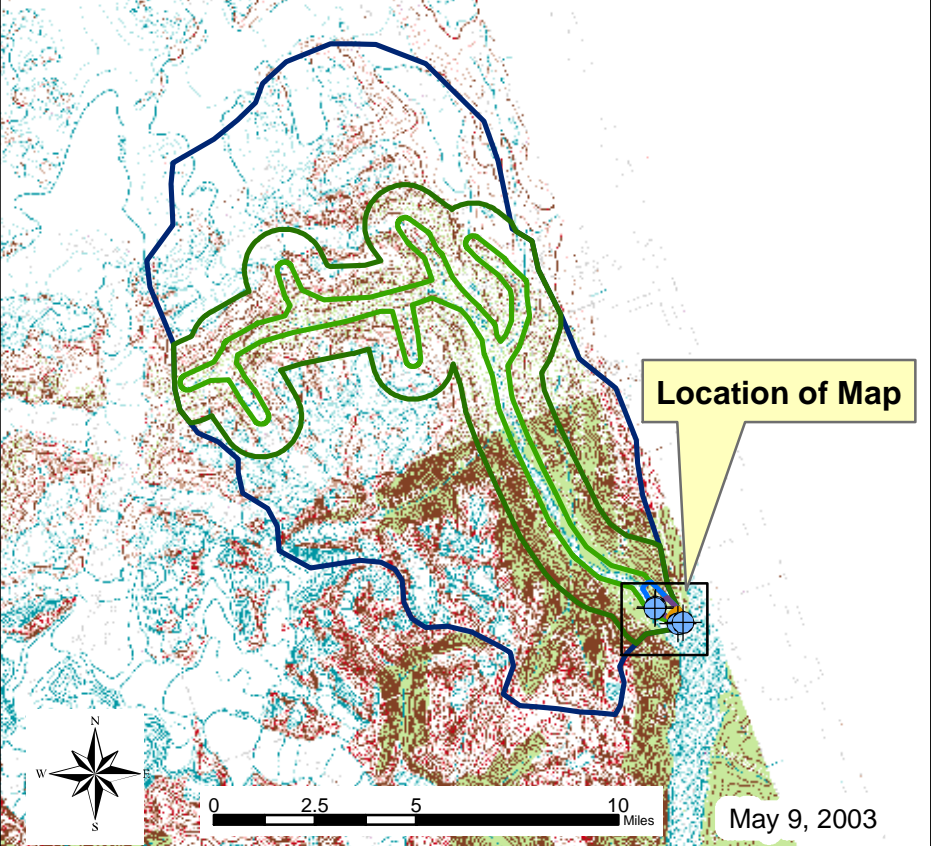
Data Sources:

Background image - USGS 1:250,000 map

Protection zones were delineated based upon streams noted on USGS 1:250,000 map.

Legend

Public Drinking Water Systems	Zone D Protection Area
Zone A Protection Area	Less than 10 Years Travel Time
Several Months Travel Time	Zone E Protection Area
Zone B Protection Area	1000 Feet from Surface Water Body
Less than 2 Years Travel Time	Zone F Protection Area
Zone C Protection Area	1 Mile from Surface Water Body
Less than 5 Years Travel Time	Zone G Protection Area
	Entire Watershed



Location of Map

0 2.5 5 10 Miles

May 9, 2003

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Glacier Inn (Tables 1-4)

Table 1**Contaminant Source Inventory for
Glacier Inn****PWSID 120779.001**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Sealaska Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	2	Glacier Inn
Metals mining, underground (active or inactive?)	E05	E05-1	A	3	Six Mile Mine
Septic systems (serves one single-family home)	R02	R02-1	A	2	Residence
Septic systems (serves one single-family home)	R02	R02-2	A	2	Residence
Septic systems (serves one single-family home)	R02	R02-3	A	2	Residence
Water supply wells	W09	W09-1	A	2	Sealaska Inn
Water supply wells	W09	W09-2	A	2	Residence
Water supply wells	W09	W09-3	A	2	Residence
Water supply wells	W09	W09-4	A	2	Residence
Water supply wells	W09	W09-5	A	2	Residence
Highways and roads, dirt/gravel	X24	X24-1	A	2	Southwest of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-2	A	2	North of Glacier Inn
Septic systems (serves one single-family home)	R02	R02-4	B	2	Residence
Septic systems (serves one single-family home)	R02	R02-5	B	2	Residence
Septic systems (serves one single-family home)	R02	R02-6	B	2	Residence
Septic systems (serves one single-family home)	R02	R02-7	B	2	Residence
Septic systems (serves one single-family home)	R02	R02-8	B	2	Residence
Water supply wells	W09	W09-10	B	2	Residence

Table 1 (continued)

*Contaminant Source Inventory for
Glacier Inn*

PWSID 120779.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Water supply wells	W09	W09-6	B	2	Residence
Water supply wells	W09	W09-7	B	2	Residence
Water supply wells	W09	W09-8	B	2	Residence
Water supply wells	W09	W09-9	B	2	Residence
Highways and roads, dirt/gravel	X24	X24-3	B	2	West of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-4	B	2	Northwest of Glacier Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	2	Grandview Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	2	Hyder Water Bottling
Septic systems (serves one single-family home)	R02	R02-10	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-11	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-12	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-13	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-14	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-15	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-16	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-17	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-18	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-19	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-20	C	2	Residence

*Table 1 (continued)**Contaminant Source Inventory for
Glacier Inn**PWSID 120779.001*

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Septic systems (serves one single-family home)	R02	R02-21	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-22	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-9	C	2	Residence
Water supply wells	W09	W09-11	C	2	Residence
Water supply wells	W09	W09-12	C	2	Residence
Water supply wells	W09	W09-13	C	2	Residence
Water supply wells	W09	W09-14	C	2	Residence
Water supply wells	W09	W09-15	C	2	Residence
Water supply wells	W09	W09-16	C	2	Residence
Water supply wells	W09	W09-17	C	2	Residence
Water supply wells	W09	W09-18	C	2	Residence
Water supply wells	W09	W09-19	C	2	Residence
Water supply wells	W09	W09-20	C	2	Residence
Water supply wells	W09	W09-21	C	2	Residence
Water supply wells	W09	W09-22	C	2	Residence
Water supply wells	W09	W09-23	C	2	Residence
Water supply wells	W09	W09-24	C	2	Residence
Water supply wells	W09	W09-25	C	2	Residence
Water supply wells	W09	W09-26	D	2	Hyder Water Bottling
Water supply wells	W09	W09-27	D	2	Grandview Inn

Table 1 (continued)

*Contaminant Source Inventory for
Glacier Inn*

PWSID 120779.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Cemeteries	X01	X01-1	D	2	Hyder Cemetery
Metals mining, open pit (active or inactive?)	E03	E03-1	E	3	Howard Mine
Metals mining, open pit (active or inactive?)	E03	E03-2	E	3	Virginia Mine
Metals mining, open pit (active or inactive?)	E03	E03-3	E	3	Border Mine
Metals mining, open pit (active or inactive?)	E03	E03-4	E	3	McGraw Mine
Metals mining, open pit (active or inactive?)	E03	E03-5	E	3	Silver Bar Mine
Metals mining, open pit (active or inactive?)	E03	E03-6	E	3	Bevacque Mine
Metals mining, open pit (active or inactive?)	E03	E03-7	E	3	Fitzgerald Claim Mine
Metals mining, placer (active or inactive?)	E04	E04-1	E	3	New W Mine
Metals mining, placer (active or inactive?)	E04	E04-2	E	3	Bonus & Loydam Mine
Metals mining, placer (active or inactive?)	E04	E04-3	E	3	Mineral Hill Mine
Metals mining, underground (active or inactive?)	E05	E05-2	E	3	Riverside Mine
Metals mining, underground (active or inactive?)	E05	E05-3	E	3	Cripple Creek Mine
Metals mining, underground (active or inactive?)	E05	E05-4	E	3	Iron Ridge Mine
Metals mining, underground (active or inactive?)	E05	E05-5	E	3	Fish Creek Mine
Septic systems (serves one single-family home)	R02	R02-23	E	2	Residence
Water supply wells	W09	W09-28	E	2	Residence
Metals mining, open pit (active or inactive?)	E03	E03-10	F	3	Mountain View Mine
Metals mining, open pit (active or inactive?)	E03	E03-11	F	3	Brigadier Mine
Metals mining, open pit (active or inactive?)	E03	E03-12	F	3	Eureka Mine

Table 1 (continued)

*Contaminant Source Inventory for
Glacier Inn*

PWSID 120779.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Metals mining, open pit (active or inactive?)	E03	E03-13	F	3	Alaska Premier Mine
Metals mining, open pit (active or inactive?)	E03	E03-14	F	3	Judy Ronnie Mine
Metals mining, open pit (active or inactive?)	E03	E03-15	F	3	Daly-Alaska Mine
Metals mining, open pit (active or inactive?)	E03	E03-16	F	3	Hobo Mine
Metals mining, open pit (active or inactive?)	E03	E03-17	F	3	Stoner Mine
Metals mining, open pit (active or inactive?)	E03	E03-18	F	3	Grandu & Filcrano
Metals mining, open pit (active or inactive?)	E03	E03-19	F	3	Charles, Nelson, & Pitcher Mine
Metals mining, open pit (active or inactive?)	E03	E03-20	F	3	West Baseline Mine
Metals mining, open pit (active or inactive?)	E03	E03-21	F	3	Nothingner Mine
Metals mining, open pit (active or inactive?)	E03	E03-22	F	3	Quartz Mine
Metals mining, open pit (active or inactive?)	E03	E03-23	F	3	Iron Cap Mine
Metals mining, open pit (active or inactive?)	E03	E03-24	F	3	Hummel Mine
Metals mining, open pit (active or inactive?)	E03	E03-25	F	3	Dog Hole Adit Mine
Metals mining, open pit (active or inactive?)	E03	E03-26	F	3	Double Anchor Mine
Metals mining, open pit (active or inactive?)	E03	E03-27	F	3	Stampede Mine
Metals mining, open pit (active or inactive?)	E03	E03-28	F	3	Keno Mine
Metals mining, open pit (active or inactive?)	E03	E03-29	F	3	Juneau Mine
Metals mining, open pit (active or inactive?)	E03	E03-8	F	3	Silver Falls Mine
Metals mining, open pit (active or inactive?)	E03	E03-9	F	3	Onilone Mine
Metals mining, underground (active or inactive?)	E05	E05-10	F	3	Blasher Mine

*Table 1 (continued)**Contaminant Source Inventory for
Glacier Inn**PWSID 120779.001*

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Metals mining, underground (active or inactive?)	E05	E05-11	F	3	Hyder Lead Mine
Metals mining, underground (active or inactive?)	E05	E05-12	F	3	Engineer Mine
Metals mining, underground (active or inactive?)	E05	E05-13	F	3	Marietta Mine
Metals mining, underground (active or inactive?)	E05	E05-6	F	3	Monarch Mine
Metals mining, underground (active or inactive?)	E05	E05-7	F	3	Cantu Mine
Metals mining, underground (active or inactive?)	E05	E05-8	F	3	Ninty-Six Mine
Metals mining, underground (active or inactive?)	E05	E05-9	F	3	Homestake Mine
Metals mining, open pit (active or inactive?)	E03	E03-30	G	3	Bishop Mine
Metals mining, open pit (active or inactive?)	E03	E03-31	G	3	Victoria Group Mine
Metals mining, open pit (active or inactive?)	E03	E03-32	G	3	Silver Point Mine
Metals mining, open pit (active or inactive?)	E03	E03-33	G	3	Shaft Creek Copper Mine
Metals mining, open pit (active or inactive?)	E03	E03-34	G	3	Hyder Skookum Mine
Metals mining, open pit (active or inactive?)	E03	E03-35	G	3	Thurwin Mine
Metals mining, open pit (active or inactive?)	E03	E03-36	G	3	Bartholf Mine
Metals mining, placer (active or inactive?)	E04	E04-4	G	3	Alaska State Mine
Metals mining, underground (active or inactive?)	E05	E05-14	G	3	

Table 2***Contaminant Source Inventory and Risk Ranking for******PWSID 120779.001******Glacier Inn******Sources of Bacteria and Viruses***

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Sealaska Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	Glacier Inn
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Residence
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Southwest of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	North of Glacier Inn
Septic systems (serves one single-family home)	R02	R02-6	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-7	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-8	B	Low	2	Residence
Highways and roads, dirt/gravel	X24	X24-3	B	Low	2	West of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-4	B	Low	2	Northwest of Glacier Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	High	2	Grandview Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	High	2	Hyder Water Bottling

Contaminant Source Inventory and Risk Ranking for

PWSID 120779.001

Table 3

Glacier Inn

Sources of Nitrates/Nitrites

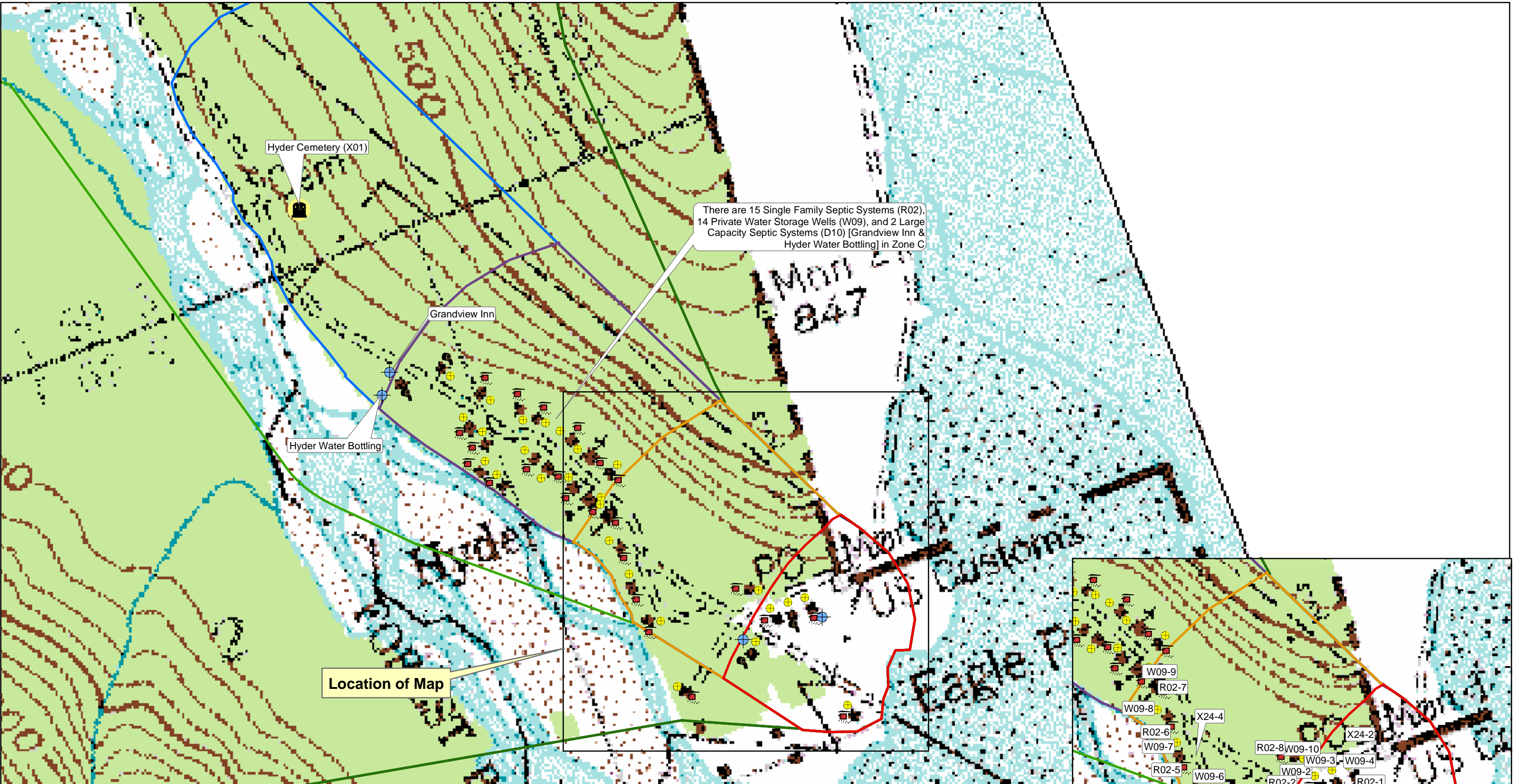
<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Sealaska Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	Glacier Inn
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Residence
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Southwest of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	North of Glacier Inn
Septic systems (serves one single-family home)	R02	R02-5	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-6	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-7	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-8	B	Low	2	Residence
Highways and roads, dirt/gravel	X24	X24-3	B	Low	2	West of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-4	B	Low	2	Northwest of Glacier Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	High	2	Grandview Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	High	2	Hyder Water Bottling
Septic systems (serves one single-family home)	R02	R02-10	C	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-11	C	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-12	C	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-9	C	Low	2	Residence

Table 4**Contaminant Source Inventory and Risk Ranking for****PWSID 120779.001****Glacier Inn****Sources of Volatile Organic Chemicals**

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Sealaska Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	Low	2	Glacier Inn
Septic systems (serves one single-family home)	R02	R02-1	A	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-3	A	Low	2	Residence
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Southwest of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	North of Glacier Inn
Septic systems (serves one single-family home)	R02	R02-6	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-7	B	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-8	B	Low	2	Residence
Highways and roads, dirt/gravel	X24	X24-3	B	Low	2	West of Glacier Inn
Highways and roads, dirt/gravel	X24	X24-4	B	Low	2	Northwest of Glacier Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	Low	2	Grandview Inn
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	Low	2	Hyder Water Bottling
Septic systems (serves one single-family home)	R02	R02-10	C	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-11	C	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-12	C	Low	2	Residence
Septic systems (serves one single-family home)	R02	R02-9	C	Low	2	Residence

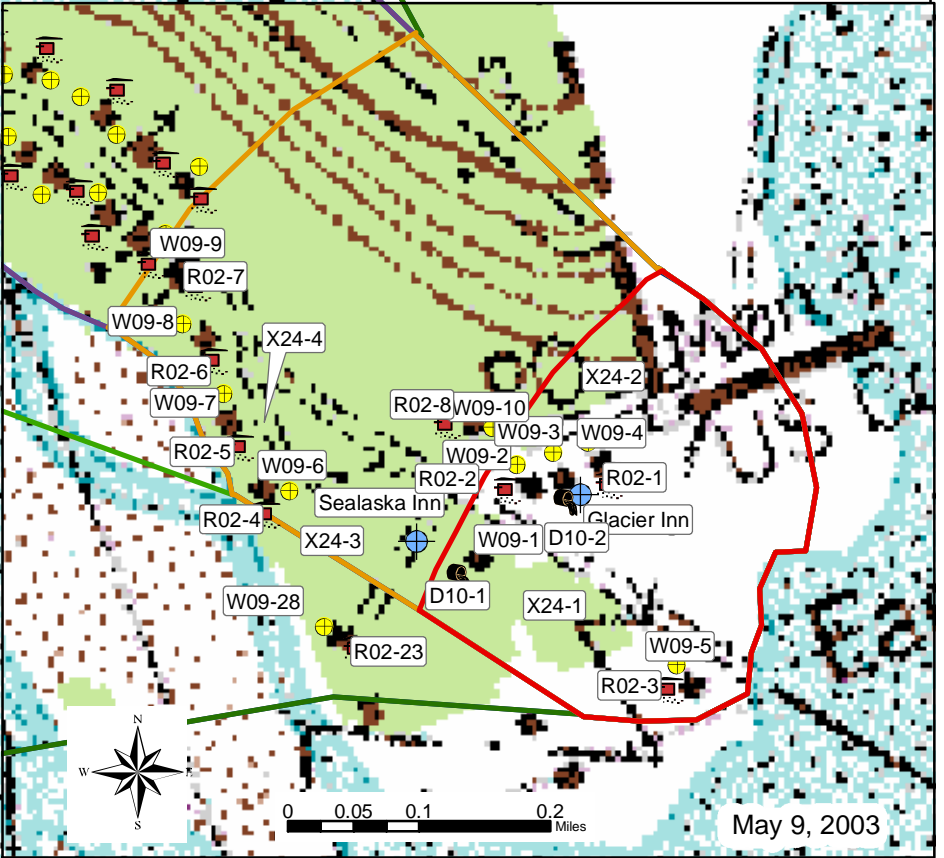
APPENDIX C

Glacier Inn Drinking Water Protection Area and Potential and Existing Contaminant Sources (Maps 2 and 3)



Map 2: Drinking Water Protection Areas for Glacier Inn and Potential and Existing Sources of Contamination

PWSID: 120779.001



0 420 840 1,680 2,520 3,360 Feet

1:9,049

Data Sources:

Background image - USGS 1:63,000 map

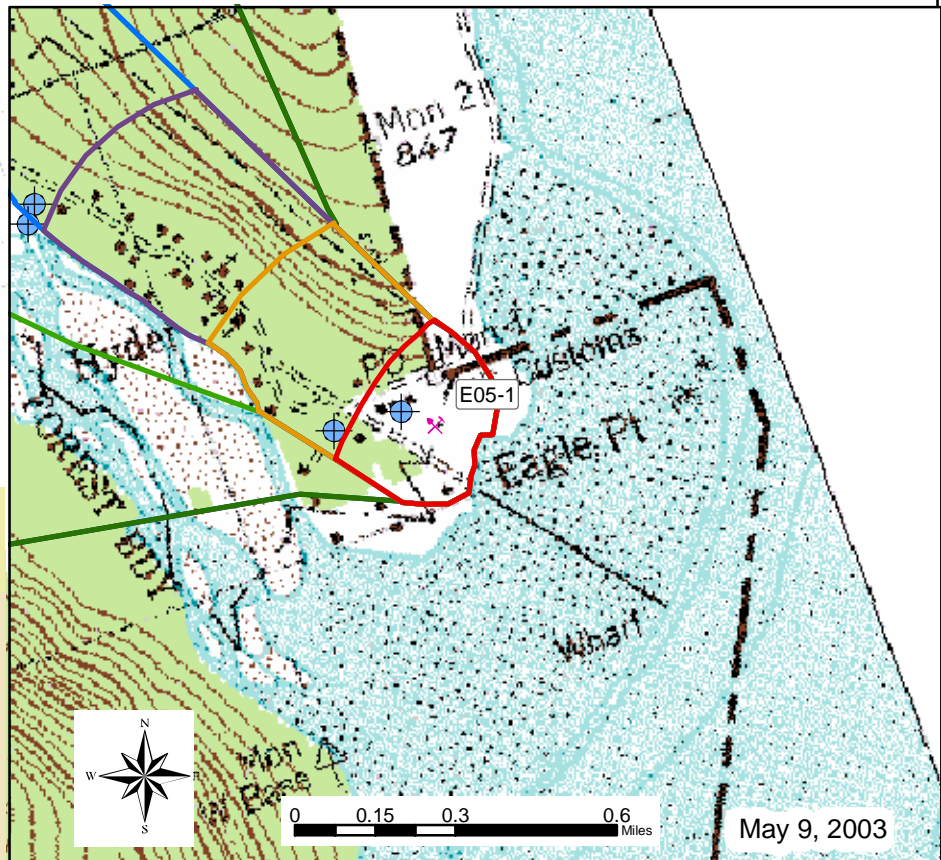
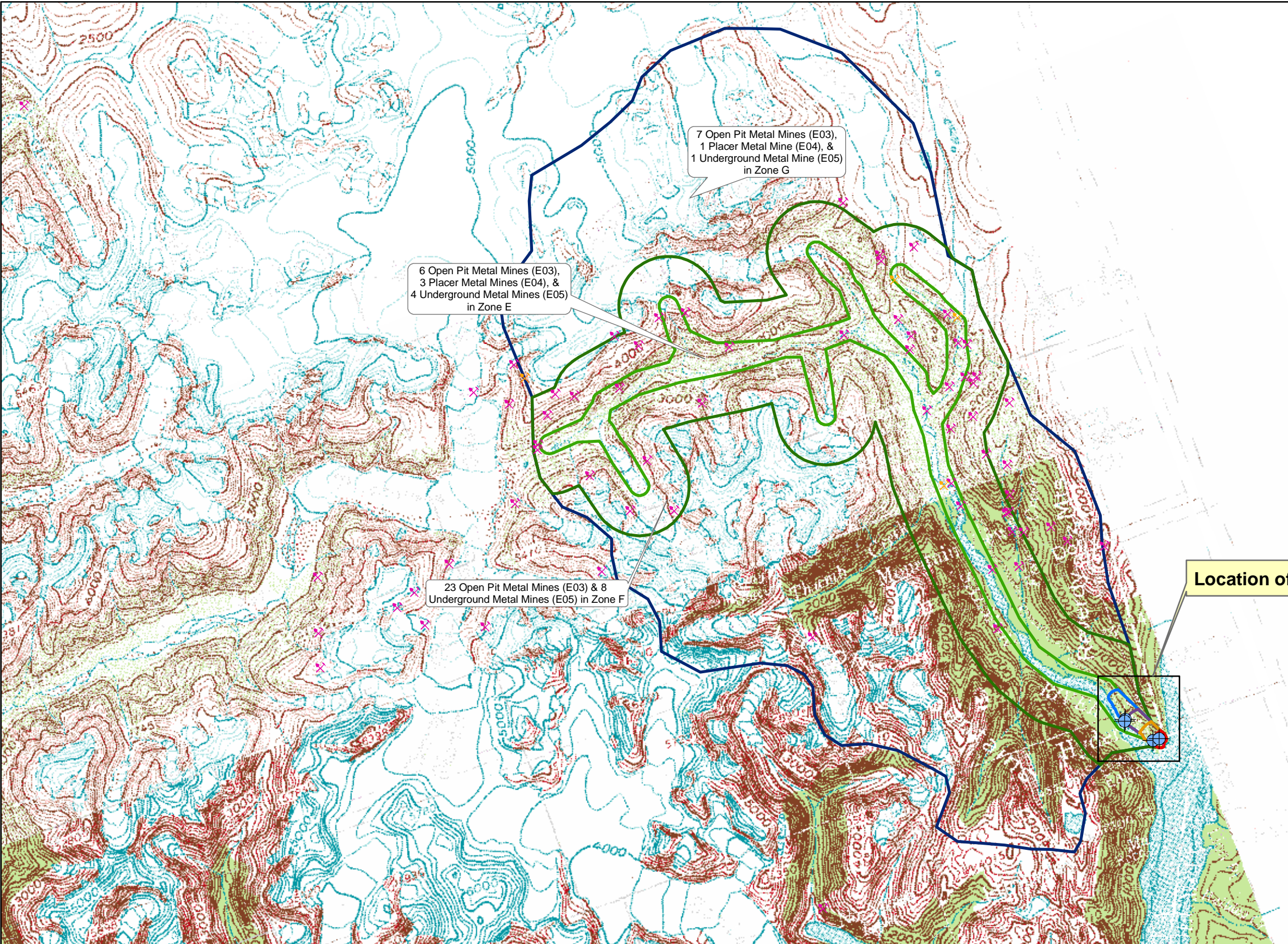
Protection zones were delineated based upon streams noted on USGS 1:250,000 map.

Legend

- Public Drinking Water Systems
- Large Capacity Septic System (D10)
- Single Family Septic System (R02)
- Private Water Supply Well (W09)
- Cemetery (X01)
- Zone A Protection Area
Several Months Travel Time

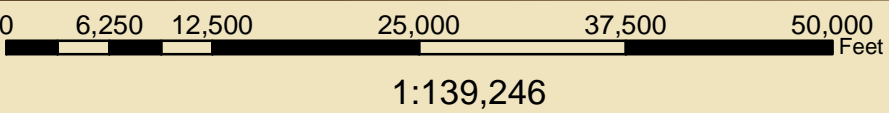
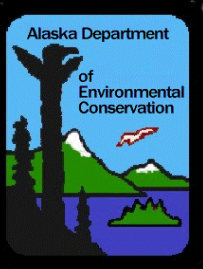
- Zone B Protection Area
Less than 2 Years Travel Time
- Zone C Protection Area
Less than 5 Years Travel Time
- Zone D Protection Area
Less than 10 Years Travel Time
- Zone E Protection Area
1000 Feet from Surface Water Body
- Zone F Protection Area
1 Mile from Surface Water Body
- Zone G Protection Area
Entire Watershed

May 9, 2003



Map 3: Drinking Water Protection Areas for Glacier Inn and Additional Potential and Existing Sources of Contamination

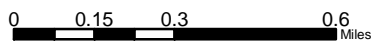
PWSID: 120779.001



Data Sources:
Background image - USGS 1:63,000 map

Protection zones were delineated based upon streams noted on USGS 1:250,000 map.

- Legend**
- Public Drinking Water Systems
 - Placer Mining Claim
 - Other Mining Claim
 - Zone A Protection Area**
Several Months Travel Time
 - Zone B Protection Area**
Less than 2 Years Travel Time
 - Zone C Protection Area**
Less than 5 Years Travel Time
 - Zone D Protection Area**
Less than 10 Years Travel Time
 - Zone E Protection Area**
1000 Feet from Surface Water Body
 - Zone F Protection Area**
1 Mile from Surface Water Body
 - Zone G Protection Area**
Entire Watershed



May 9, 2003

APPENDIX D

Vulnerability Analysis for Glacier Inn Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Glacier Inn

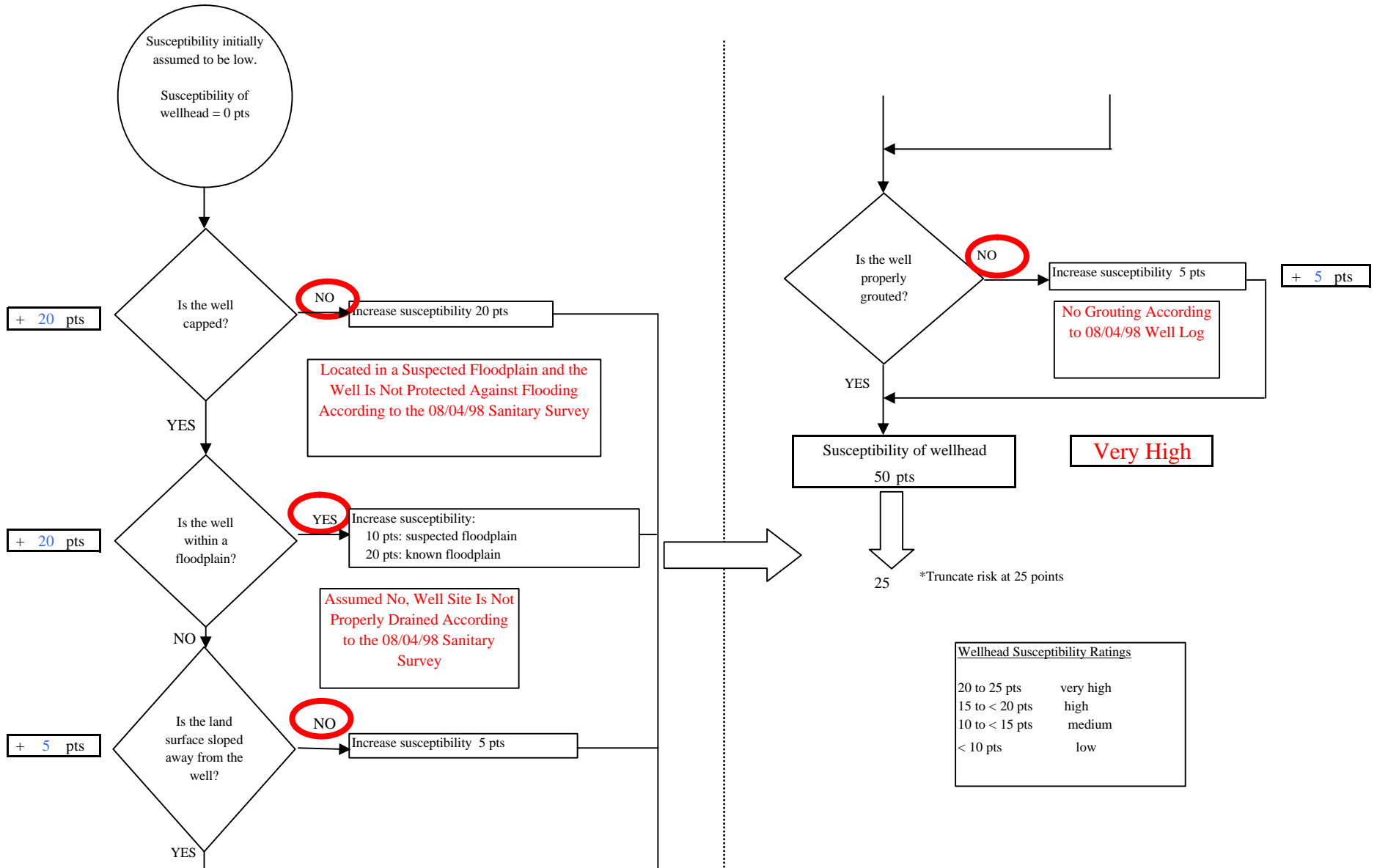


Chart 2. Susceptibility of the aquifer - Glacier Inn

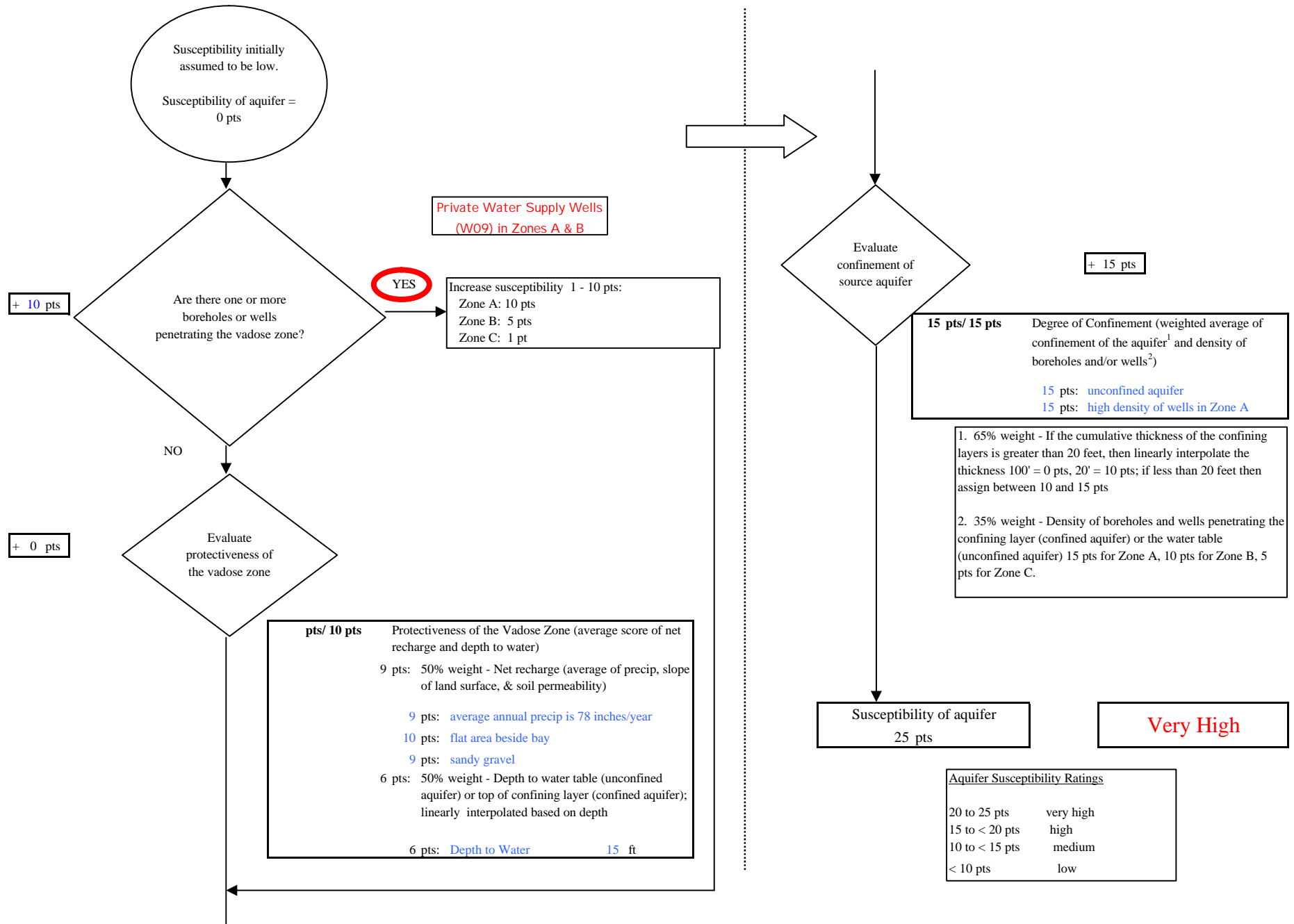
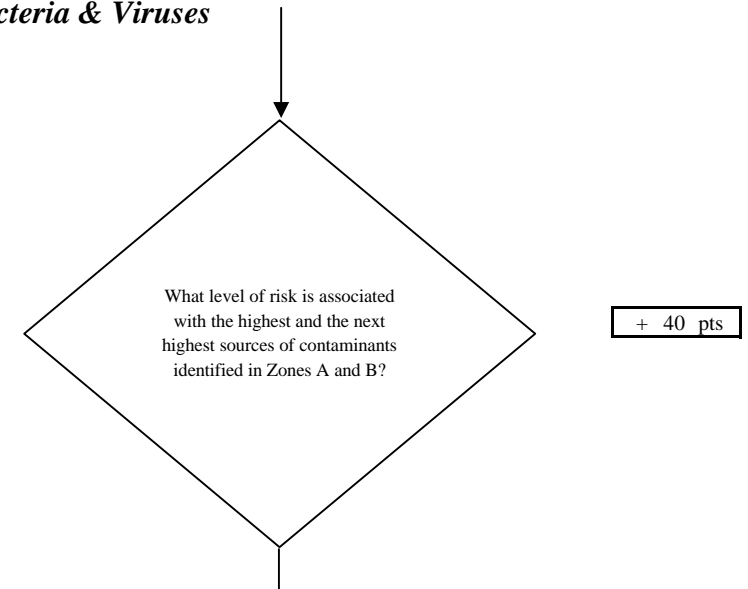
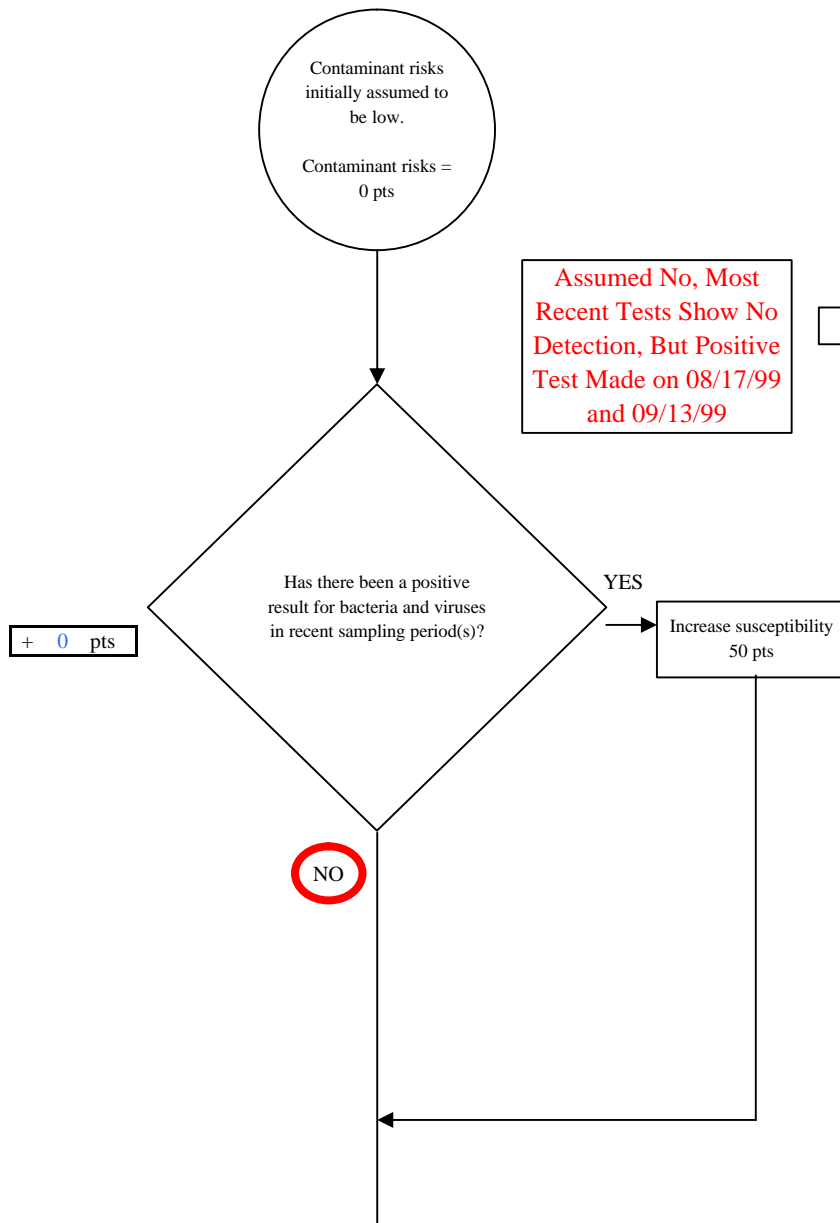


Chart 3. Contaminant risks for Glacier Inn - Bacteria & Viruses



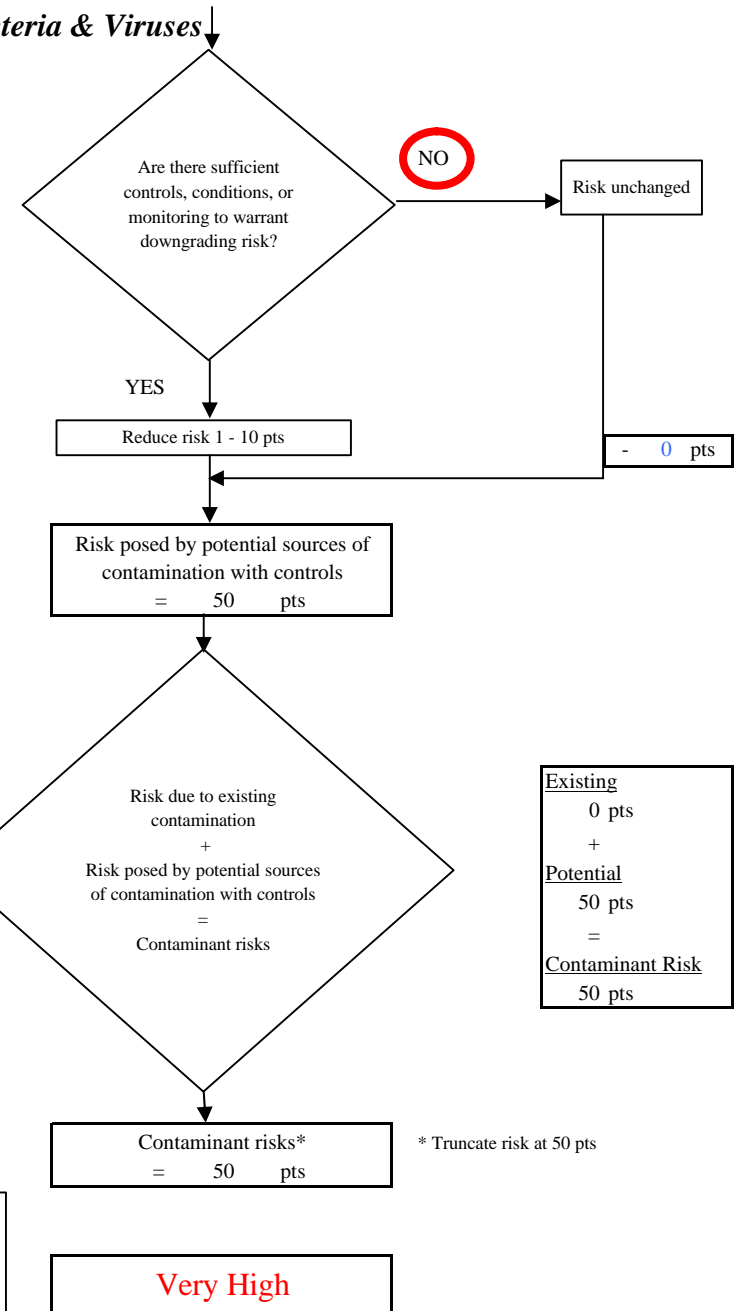
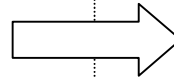
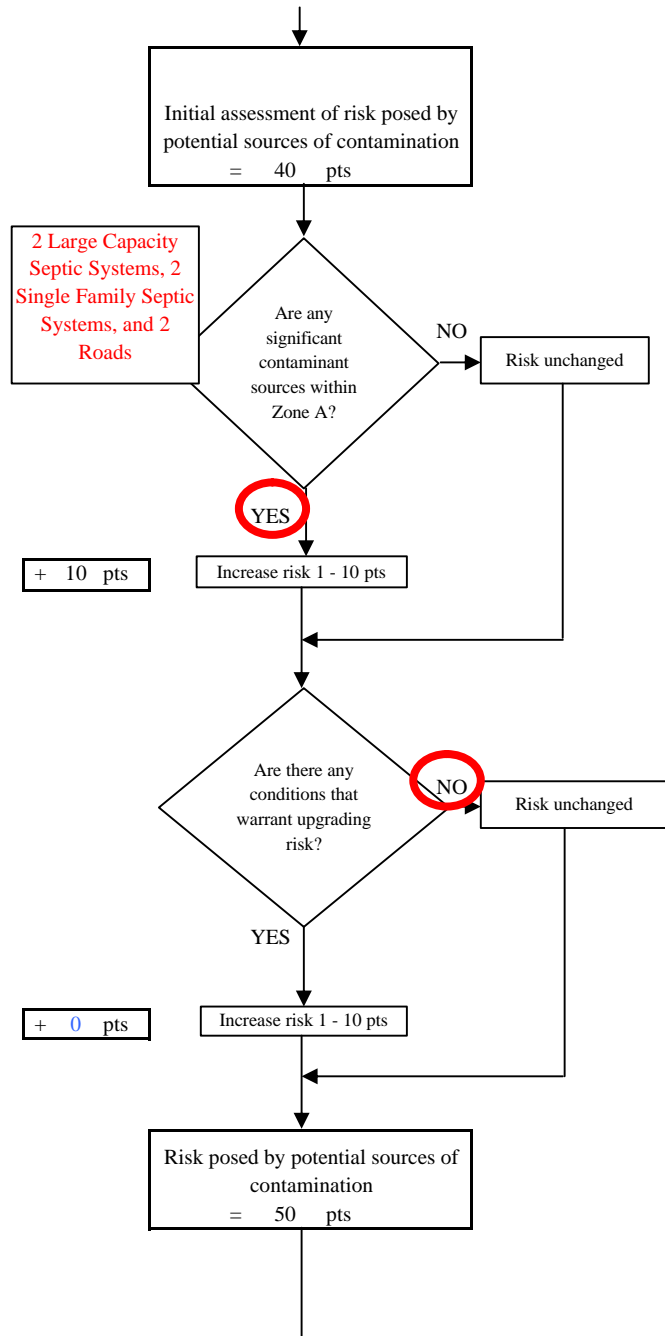
Risk Rankings for Contaminant Sources Identified in Zones A and B			
	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	2	0	2
Medium(s)	0	0	0
Low(s)	3	2	5

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

Chart 3. Contaminant risks for Glacier Inn - Bacteria & Viruses



Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 4. Vulnerability analysis for Glacier Inn - Bacteria & Viruses

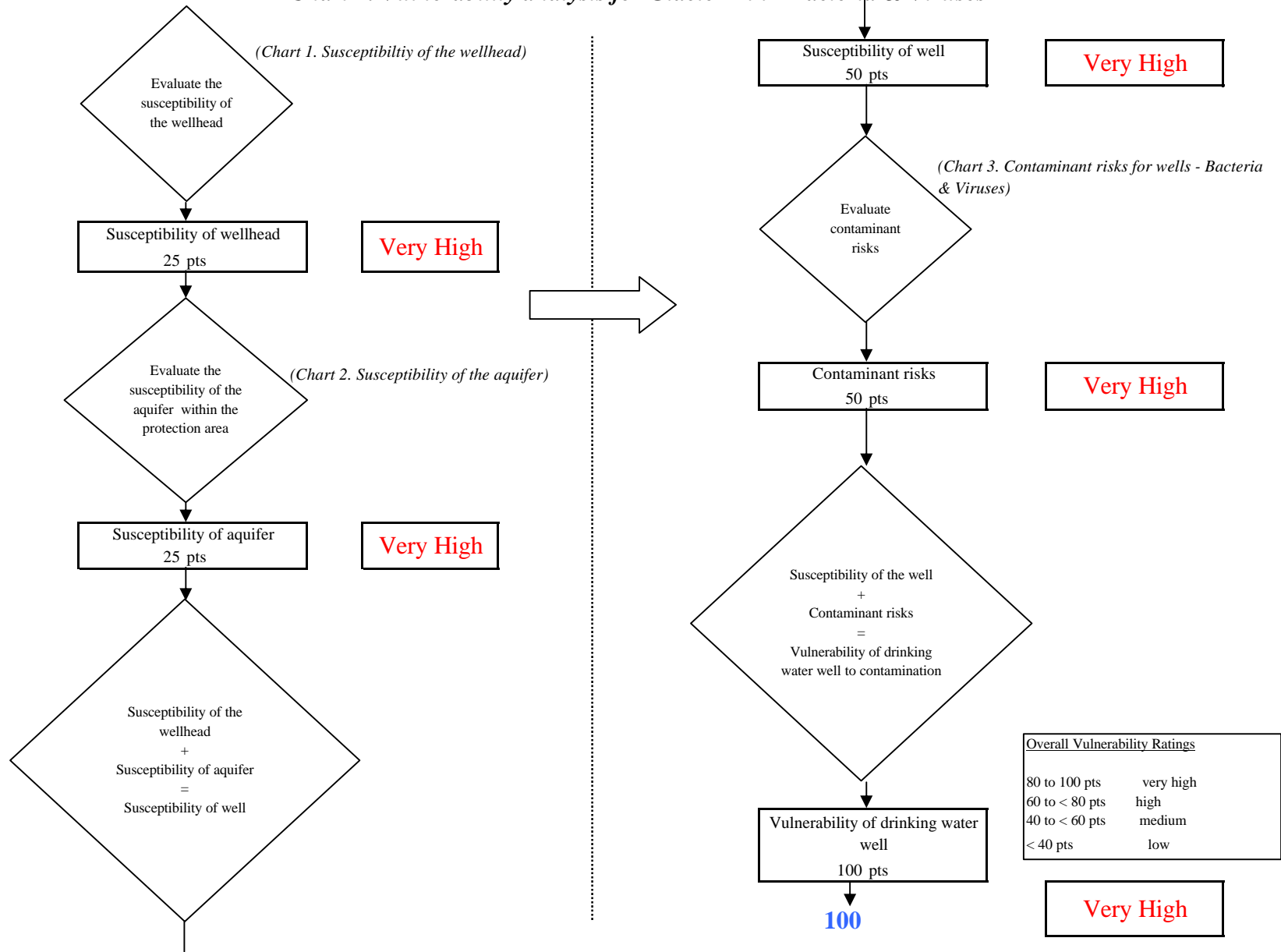


Chart 5. Contaminant risks for Glacier Inn - Nitrates and Nitrites

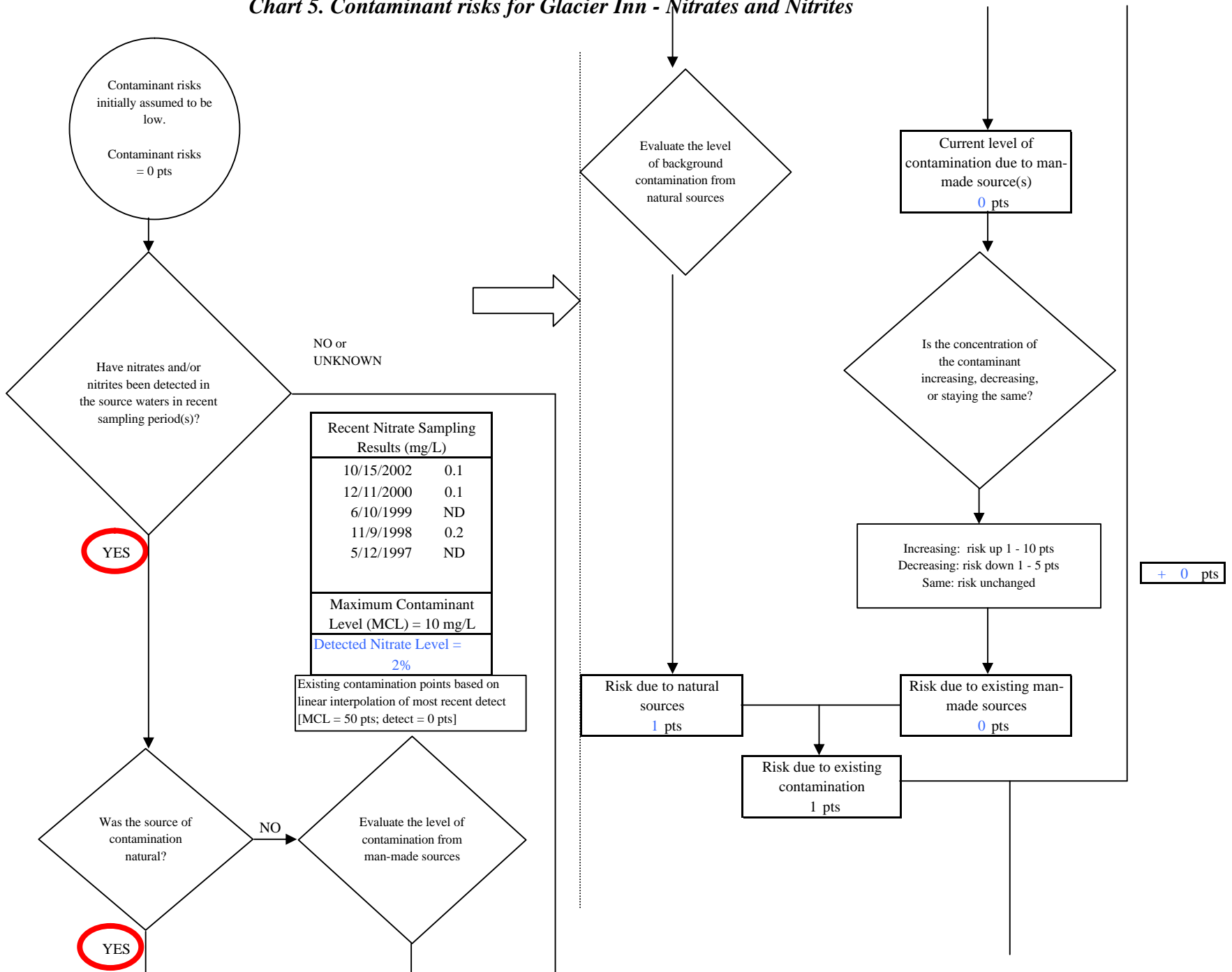


Chart 5. Contaminant risks for Glacier Inn - Nitrates and Nitrites

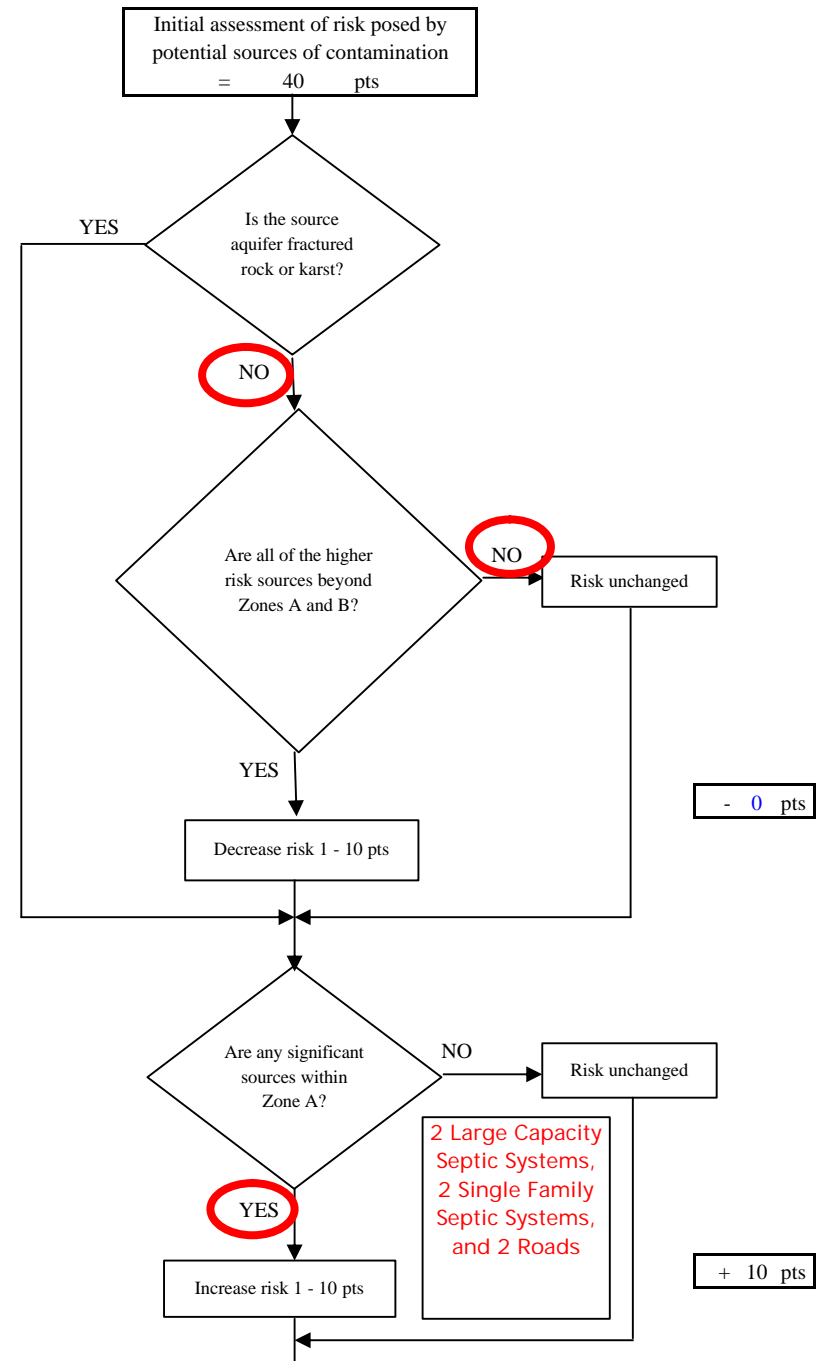
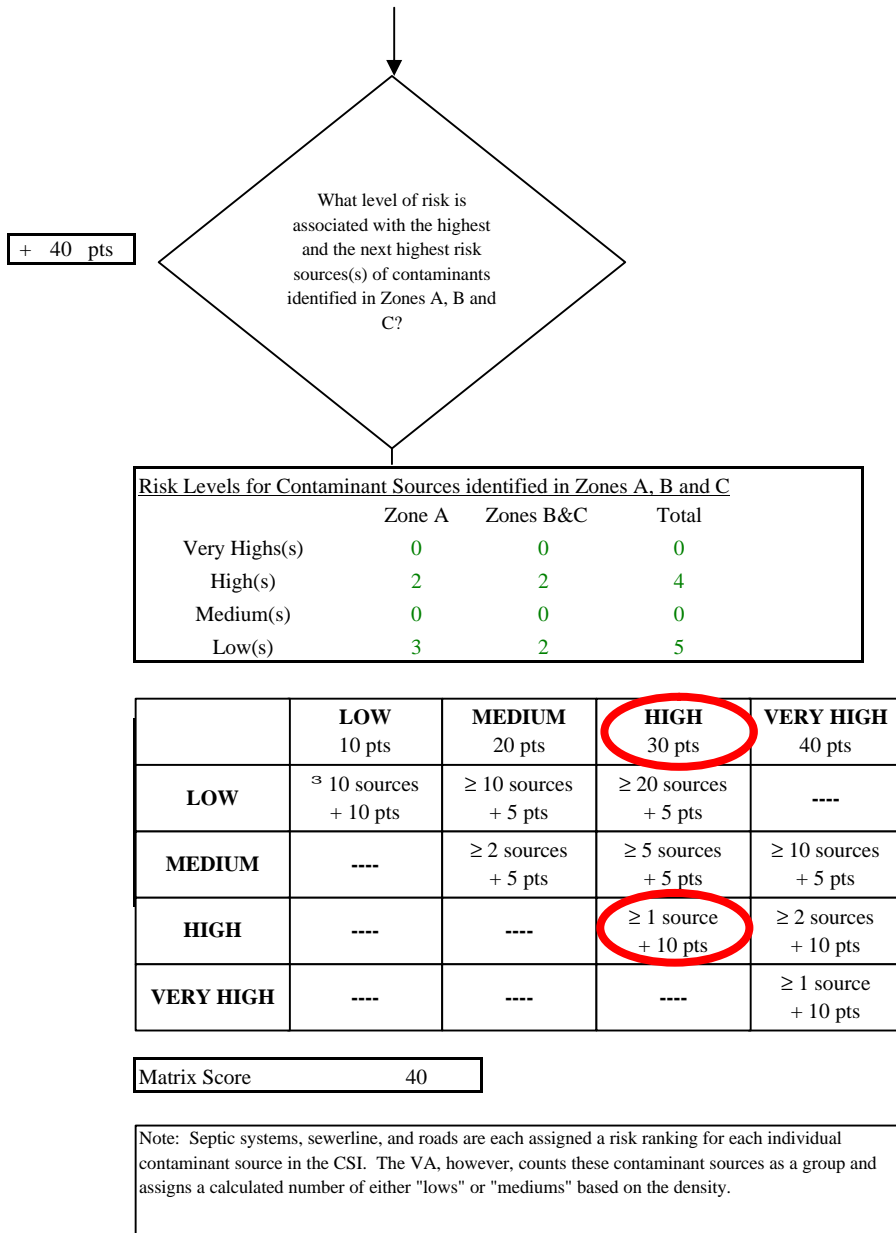


Chart 5. Contaminant risks for Glacier Inn - Nitrates and Nitrites

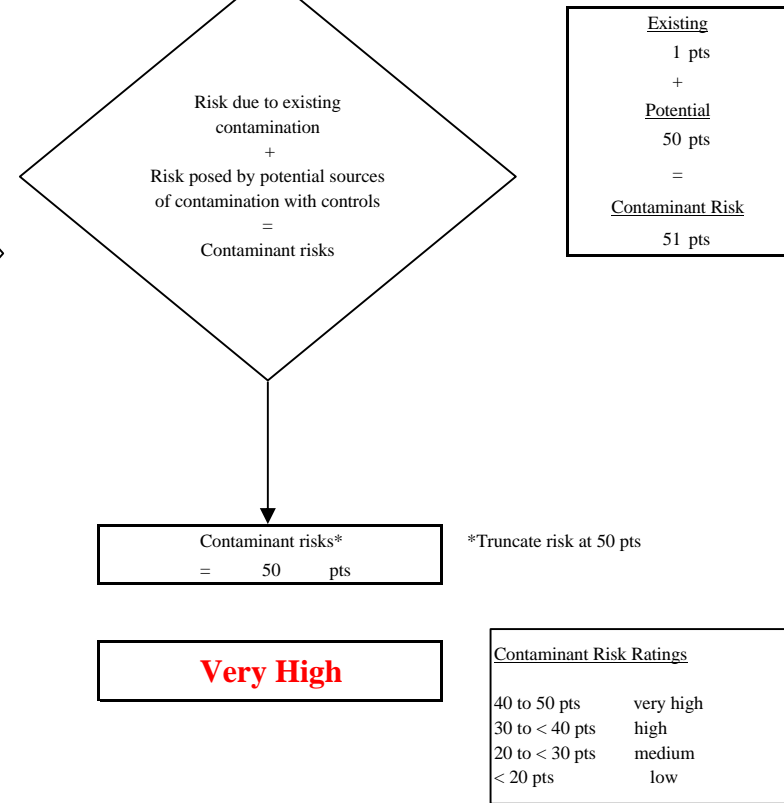
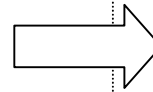
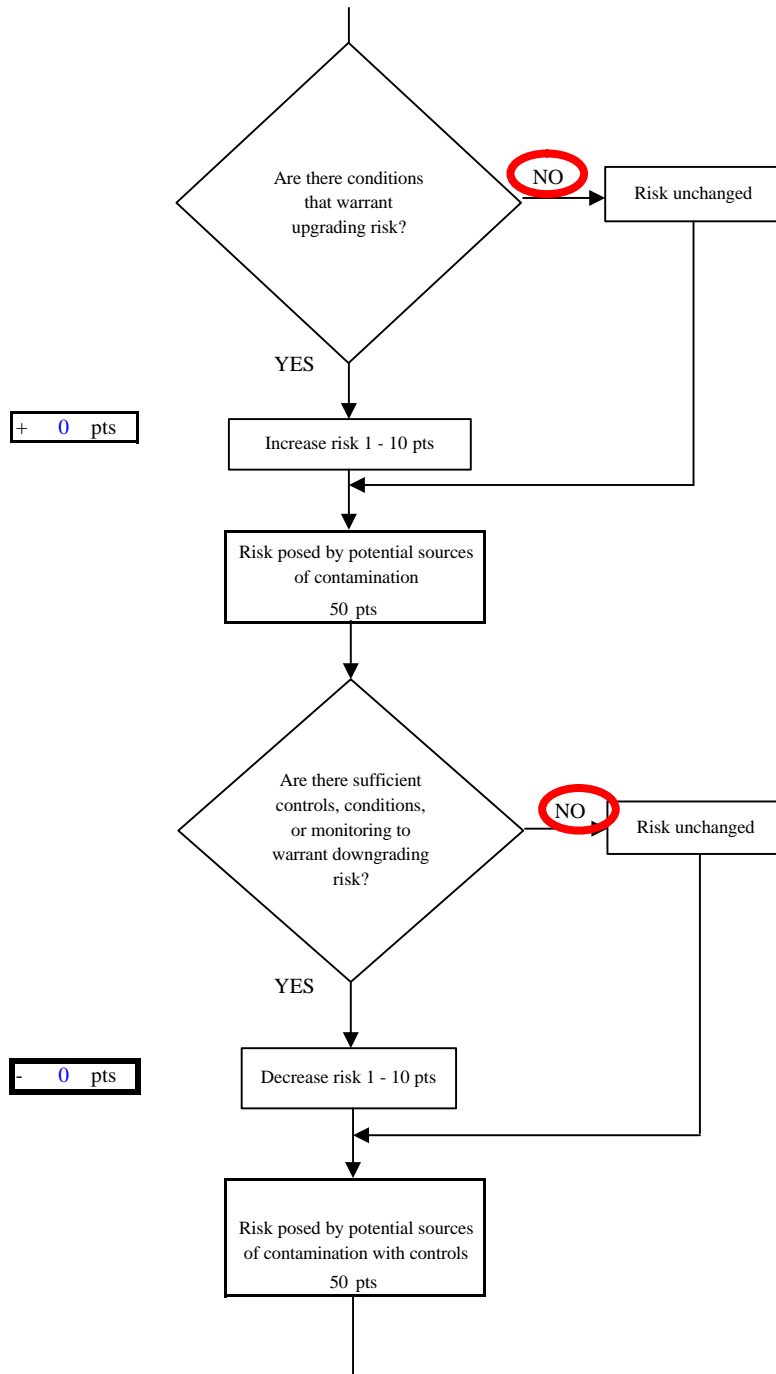


Chart 6. Vulnerability analysis for Glacier Inn - Nitrates and Nitrites

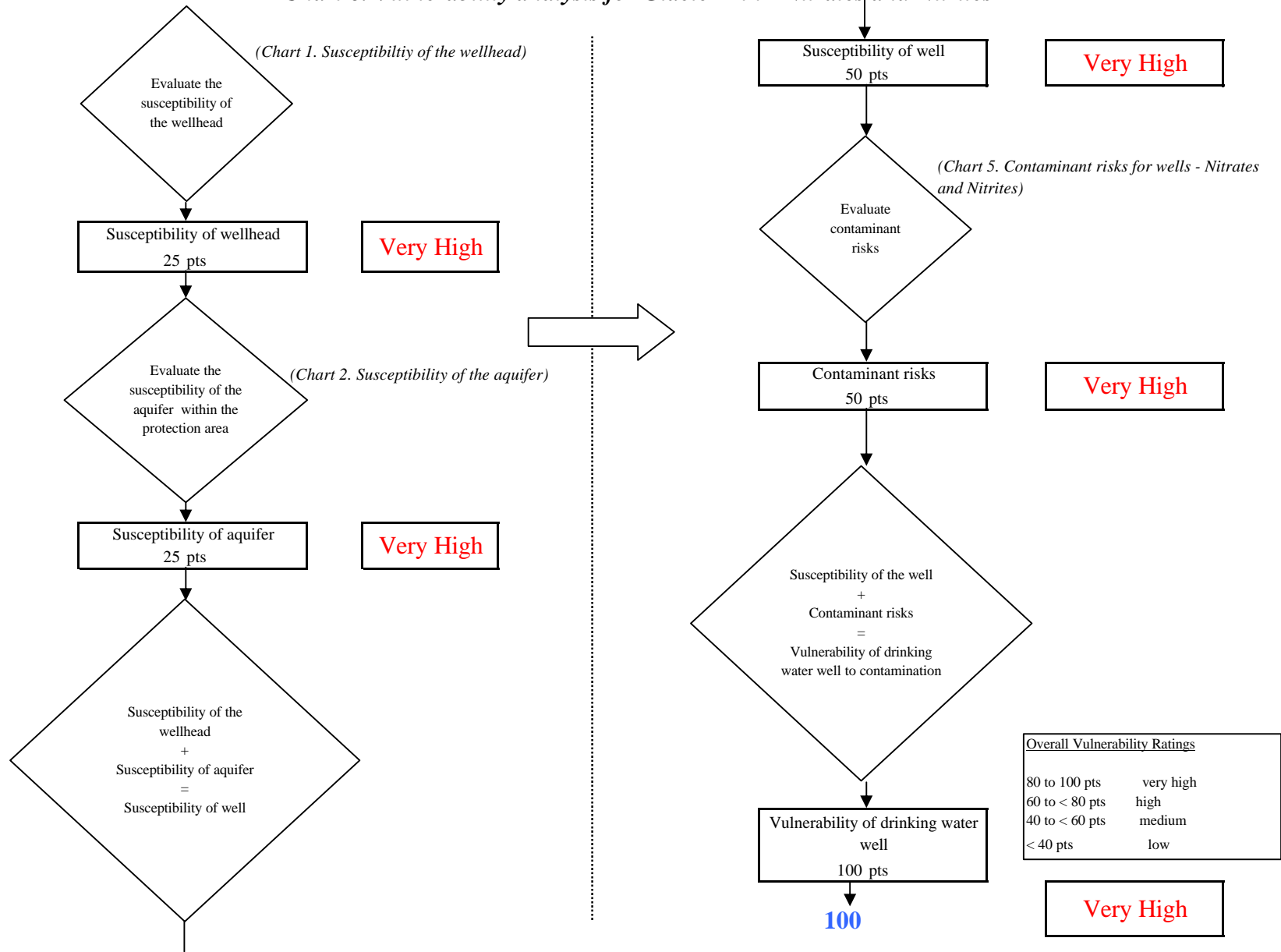


Chart 7. Contaminant risks for Glacier Inn - Volatile Organic Chemicals

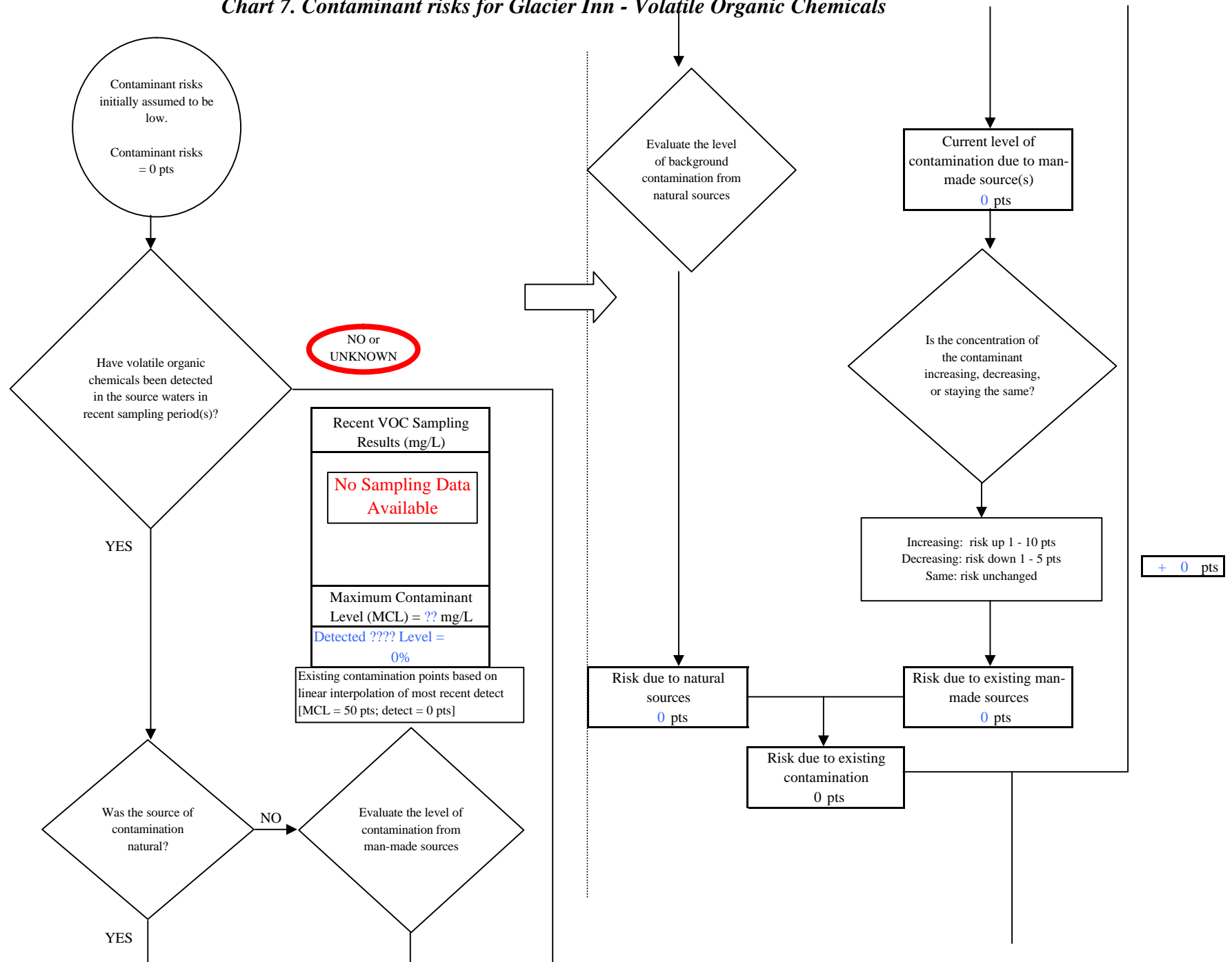
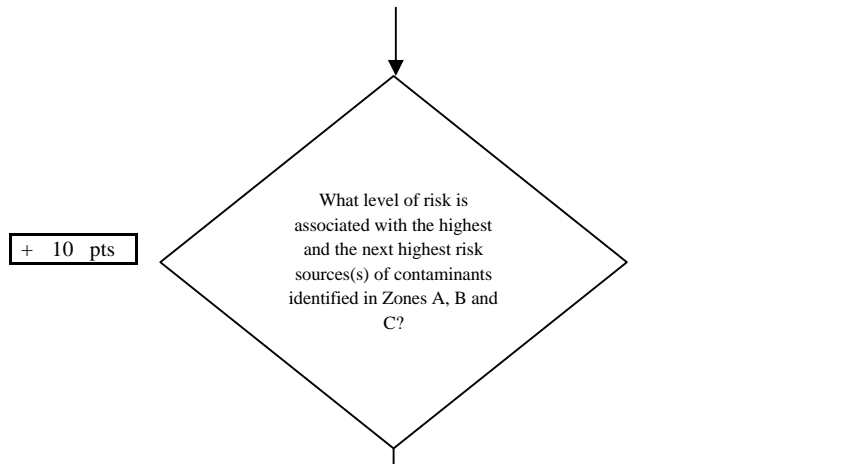


Chart 7. Contaminant risks for Glacier Inn - Volatile Organic Chemicals



Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	4	4	8

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≤ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 10

Note: Septic systems, sewerline, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

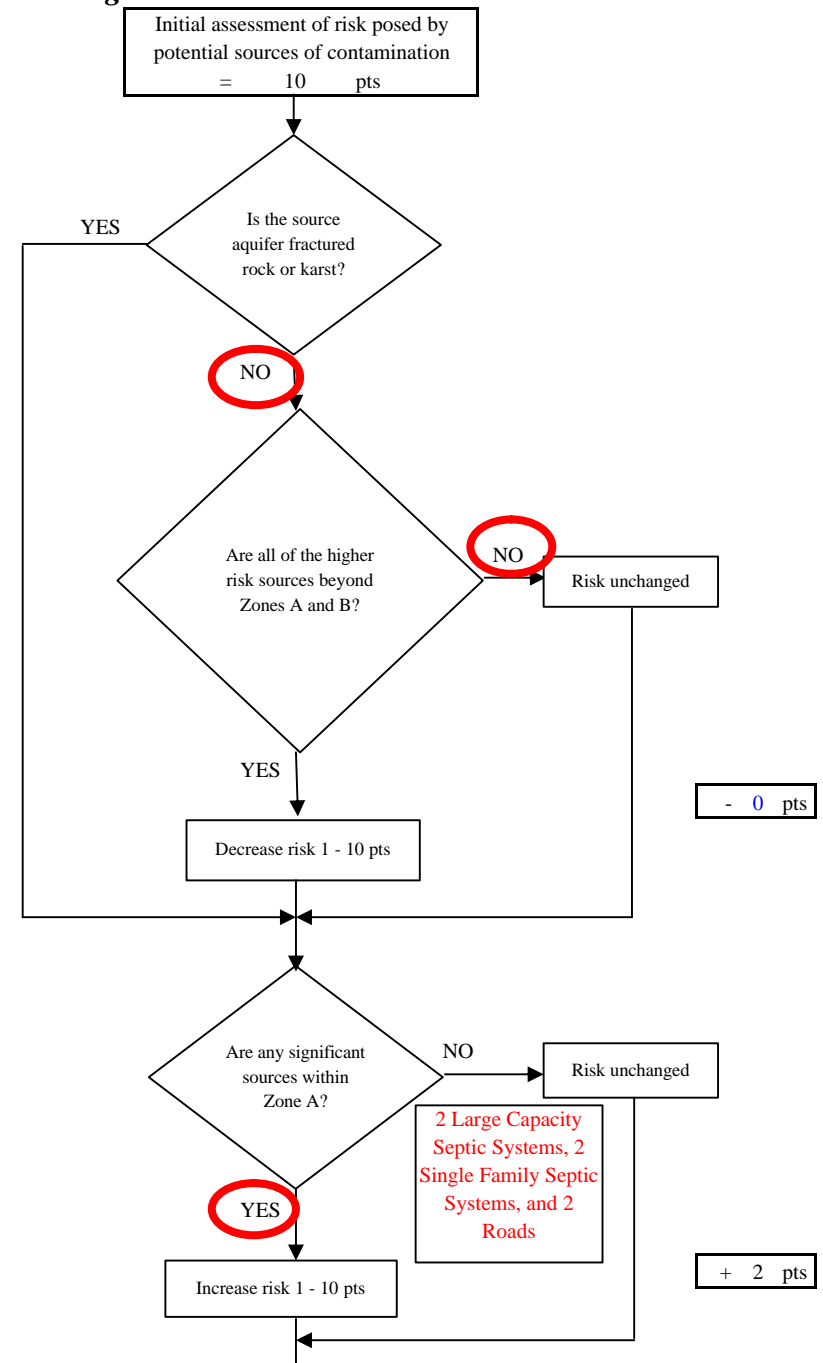
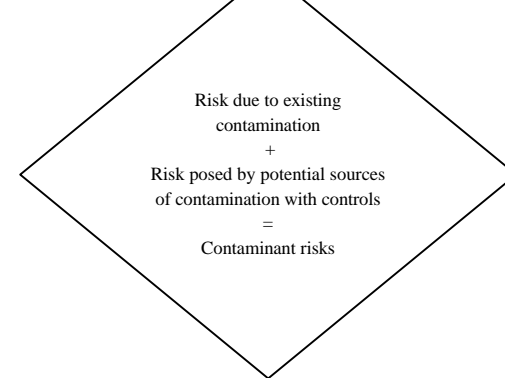
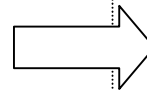
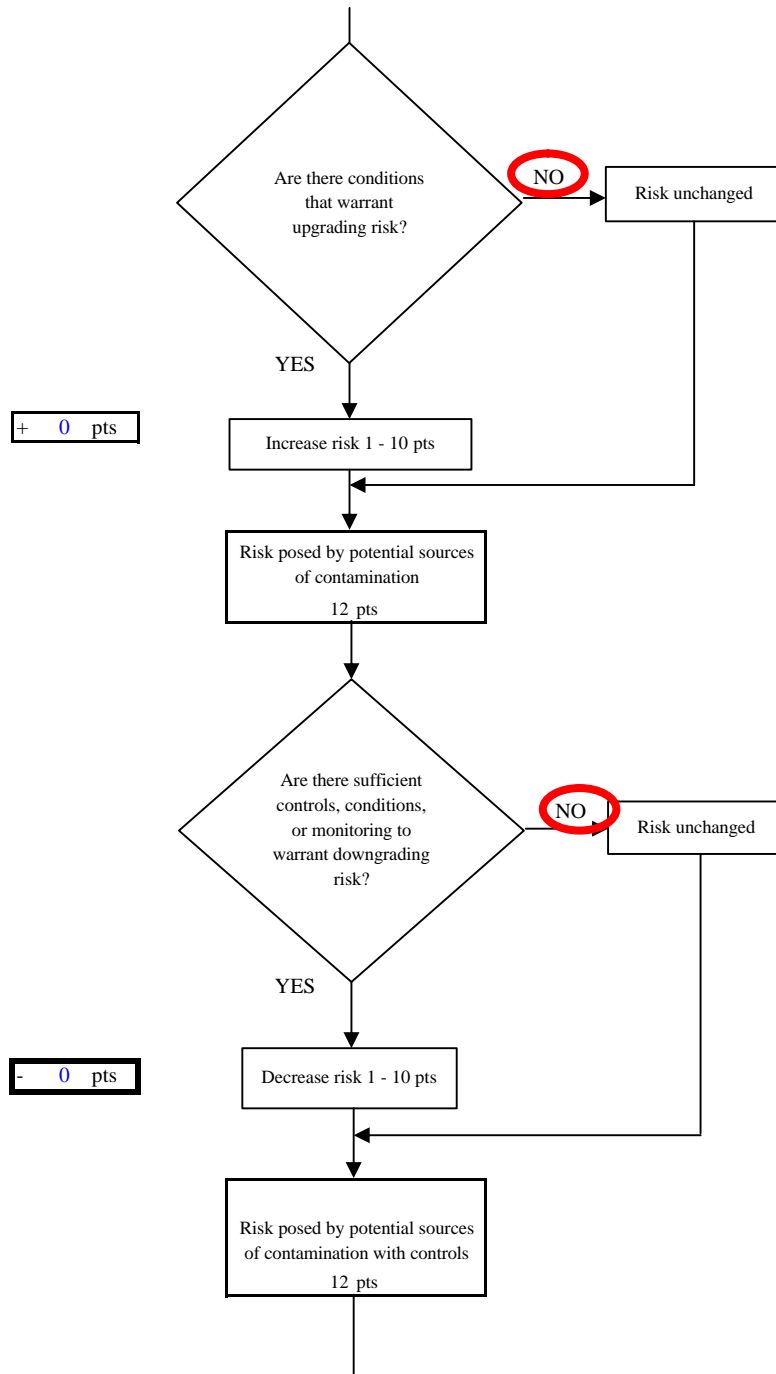


Chart 7. Contaminant risks for Glacier Inn - Volatile Organic Chemicals



Contaminant risks*
= 12 pts

*Truncate risk at 50 pts

Low

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Existing
0 pts
+
Potential
12 pts
=
Contaminant Risk
12 pts

Chart 8. Vulnerability analysis for Glacier Inn - Volatile Organic Chemicals

