Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for
Kenai Fjords Tours
Drinking Water System,
Seward, Alaska
PWSID # 248925
June 2003

DRINKING WATER PROTECTION PROGRAM REPORT # 666
Alaska Department of Environmental Conservation

Source Water Assessment for Kenai Fjords Tours Drinking Water System, Seward, Alaska PWSID # 248925

By Ecology & Environment, Inc.

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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.

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Source Water Assessment for Kenai Fjords Tours Source of Public Drinking Water, Seward, Alaska

By Ecology & Environment, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

Executive Summary

Kenai Fjords Tours is a Class B (transient/non-community) water system consisting of one surface water source on Fox Island, south of Seward, Alaska. The surface water source received a susceptibility rating of **Very High**. There are no identified potential or current sources of contaminants for Kenai Fjords Tours public drinking water source that are considered a source of bacteria and viruses, and nitrates and/or nitrites. Overall, the public water source for Kenai Fjords Tours received a vulnerability rating of **Medium** for bacteria and viruses, Medium for nitrates and nitrites, and Medium for volatile organic chemicals.

Introduction

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system. Ecology and Environment, Inc. has been contracted to perform these assessments under the supervision of ADEC.

This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

Description of the Seward Area

Location

The Seward area is located at the beginning of the Seward Highway on the east coast of the Kenai Peninsula (see Inset of Map 1 of Appendix A).

Precipitation

The Seward area averages about 66 inches of precipitation per year, with approximately 80 inches of snowfall (ACRC 2002).

Topography and Drainage

Seward lies at the mouth of the Resurrection River at the head of Resurrection Bay, in a valley surrounded by steep mountains to the east and west. Drainage is typically off the mountains towards the Bay.

Groundwater Use

Water is supplied by eight municipal wells, and is treated and distributed throughout Seward. Sewage is collected and piped to a secondary treatment lagoon. Almost all homes are fully plumbed (ADCED 2002).

Geology and Soils

The surface geology of the Seward area is predominantly composed of unconsolidated surficial deposits. These deposits are chiefly of glaciofluvial origin. This alluvium comprises an unconfined aquifer. The exposed rock surrounding Seward is predominantly the Jurassic or Cretaceous Valdez Group. The Valdez Group is comprised of weakly metamorphosed metagraywacke, metasiltstone, and argillite (Tysdal and Case 1979).

Kenai Fjords Tours Public Drinking Water System

Kenai Fjords Tours is a Class B (transient/non-community) water system. The system consists of one surface water source drawing water from an unnamed creek on Renard Island (Fox Island) in Resurrection Bay near Seward, Alaska.

The system's intake is a stream in mountainous terrain with an estimated discharge of less than 20,000 cfs. The most recent Sanitary Survey (7/25/02) indicates the intake is inadequately constructed, lacking a screen to protect against debris entry and protection against siltation. Protection against ice build-up is not necessary since the water source is utilized only in summer.

This system operates in the summer months and serves approximately 10 residents and more than 300 non-residents.

Kenai Fjords Tours 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. Some areas are more likely to allow contamination to reach the surface water source than others.

The most probable area for contamination to reach the drinking water source is the area that contributes water to the surface water source. This area is designated as the Drinking Water Protection Area (DWPA). Because a release of contaminants within the DWPA is most likely to impact the drinking water source intake, this area will serve as the focus for voluntary protection efforts.

The Drinking Water Protection Areas established for surface water bodies by the Alaska Department of Environmental Conservation (ADEC) are separated into zones. The Drinking Water Protection Areas for the Kenai Fjords Tours source contains three zones, Zone A through Zone C (See Map 1 in Appendix A). These zones identify areas along the unnamed creek and its main feeder tributaries. Contaminants released within these areas can potentially pollute the drinking water source.

Zone A corresponds to an area within 1000 feet of the unnamed creek and its main tributaries. Zone B identifies the area within one mile, and Zone C identifies the entire watershed. (Please refer to the Guidance Manual for Class B Water Systems for additional information).

The following is a summary of the three DWPA zones:

Table 1. Definition of Zones

Zone	Definition
A	1000 Feet from Surface Water Source
B	1 Mile from Surface Water Source
C	Entire Watershed of Surface Water Source

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 Kenai Fjords Tours 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 water system assessments, three categories of drinking water contaminants were inventoried. They include:

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

Inventoried potential sources of contamination within Zone A were associated with residential and light industrial type activities. The sources are displayed on Map 2 of Appendix C and summarized in the tables in Appendix B.

Ranking of Contaminant Risks

Once the potential and existing sources of contamination have been identified, they are sorted and ranked 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. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the surface water 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. 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 C due to the probability of contaminant dilution by the time the contaminants get to the surface water intake.

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 Kenai Fjords Tours Drinking Water Source

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

- Susceptibility of the Surface Water Source; 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 Surface Water Source' to contamination by looking at the construction of the water intake, the potential for runoff in the protection area and the capacity of the water body to dilute contaminants. Chart 2 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 surface water intake. Lastly, Chart 3 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 4 through 7 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

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

Susceptibility of Surface Water Source Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 2 shows the Susceptibility scores and ratings for Kenai Fjords Tours (see Chart 1).

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Surface Water Source	45	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 or 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 (see Charts 2, 4, and 6).

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	0	Low
Nitrates and/or Nitrites	2	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:

Susceptibility of Surface Water Source (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 (see Charts 3, 5, 7).

Table 4. Overall Vulnerability to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	45	Medium
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	45	Medium

Bacteria and Viruses
The contaminant risk for bacteria and viruses is Low, with no identified bacteria and virus contaminant sources (See Chart 2 – Contaminant Risks for Bacteria and Viruses in Appendix D). However, the Sanitary Survey indicates the presence of birds in the area. Bird nesting activity can pose a risk for bacteria and virus contamination. Because the location of the bird nesting activity is unknown, it has not been factored into the risk for bacteria and viruses; however, the owner/operator of this water system should be aware that it could pose a potential risk to the water supply if it is located within the DWPA for the surface water source.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the surface water source, the overall vulnerability of the water source to contamination is Medium.

Nitrates and Nitrites
The contaminant risk for bacteria and viruses is Low, with no identified bacteria and virus contaminant sources (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). However, the Sanitary Survey indicates the presence of birds in the area. Bird nesting activity can pose a risk for nitrates and nitrites contamination. Because the location of the bird nesting activity is unknown, it has not been factored into the risk for nitrates and nitrites; however, the owner/operator of this water system should be aware that it could pose a potential risk to the water supply if it is located within the DWPA for the surface water source. Nitrates are very mobile, moving at approximately the same rate as water.

The sampling history for Kenai Fjords Tours surface water intake indicates that nitrates have been detected in the water, but only in low concentrations (most recently at 3% mg/L on 5/8/97). After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the surface water source, the overall vulnerability of the water source to contamination is Medium.

Volatile Organic Chemicals
The contaminant risk for volatile organic chemicals is Low, with no identified contaminants creating a risk for volatile organic chemicals (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Buildings in the area typically are heated with various types of on-site fuel sources, including propane and heating oil stored in aboveground or underground storage tanks. Although this report does not address heating oil tanks (unless their location is known), they can pose a risk of volatile organic chemical contamination to drinking water sources. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Secondary containment around the tank and regular system maintenance can help prevent many of these harmful fuel leaks and help protect the drinking water supply.

Class B water systems generally are not required to test for volatile organic chemicals. After combining the potential contaminant risk for volatile organic chemicals with the natural susceptibility of the surface water source the overall vulnerability of the water source to contamination by volatile organic chemicals is Medium.

References Cited

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Tysdal, R.G., and Case, J.E., 1979, *Geologic Map of the Seward and Blying Sound Quadrangles, Alaska*, United States Geological Survey, Reston, Virginia.

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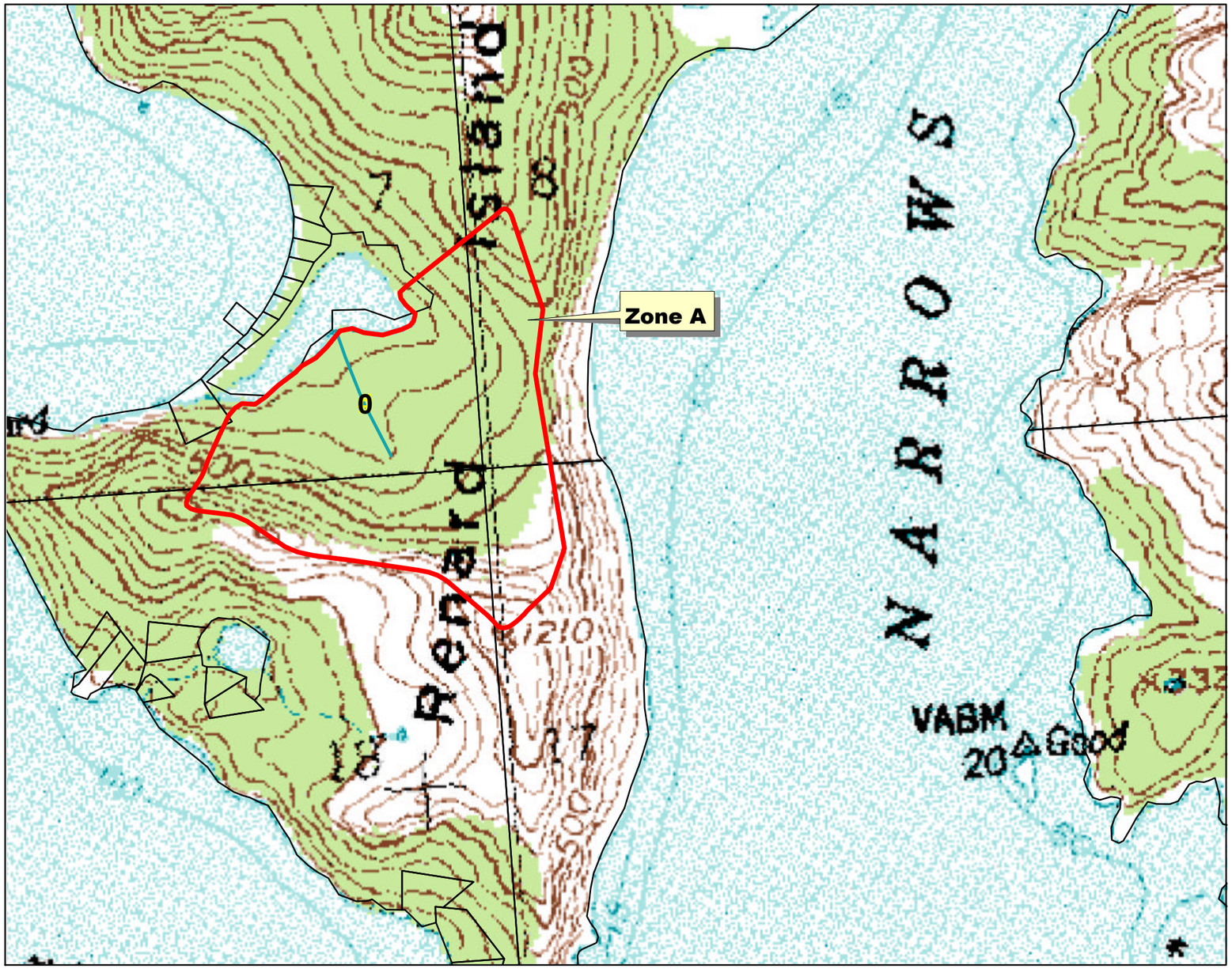
APPENDIX A

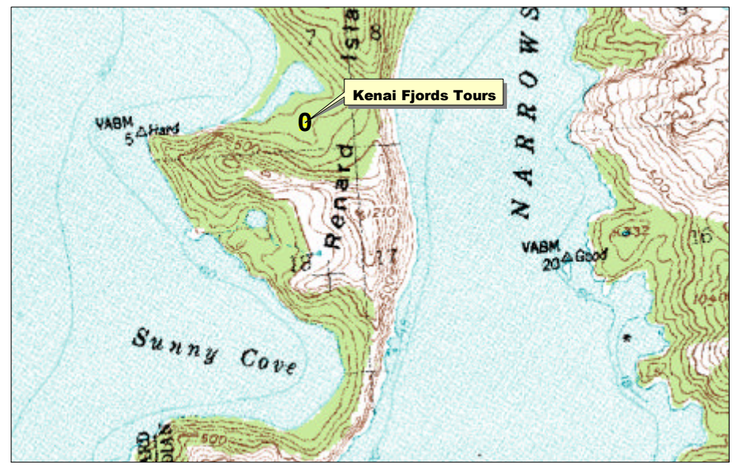
Kenai Fjords Tours
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Area for Kenai Fjords Tours Intake



0 Kenai Fjord Tours Intake
Zone A (Entire Watershed)

N
W E
S



2000 0 2000 4000 6000 Feet

PWSID 248925.001

Map 1

APPENDIX B

Contaminant Source Inventory and
Risk Ranking for Kenai Fjords Tours
(Tables 1-4)

Not Applicable- No Known Contaminants

APPENDIX C

Kenai Fjords Tours
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Not Applicable- No Known Contaminants

APPENDIX D

Vulnerability Analysis for Kenai Fjords Tours
Public Drinking Water Source
(Charts 1-8)

Chart 1. Susceptibility of the surface water source - Kenai Fjords Tours

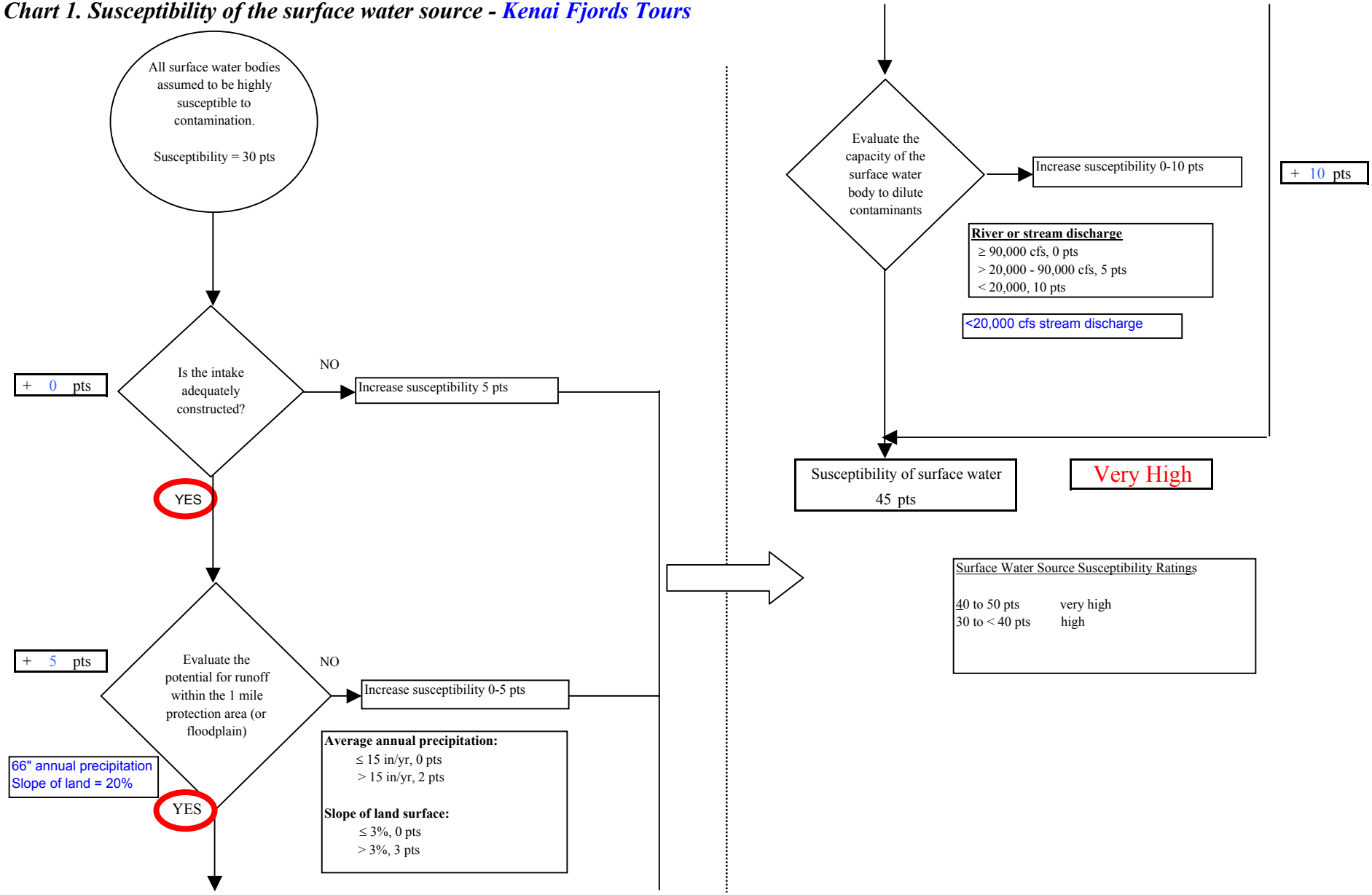
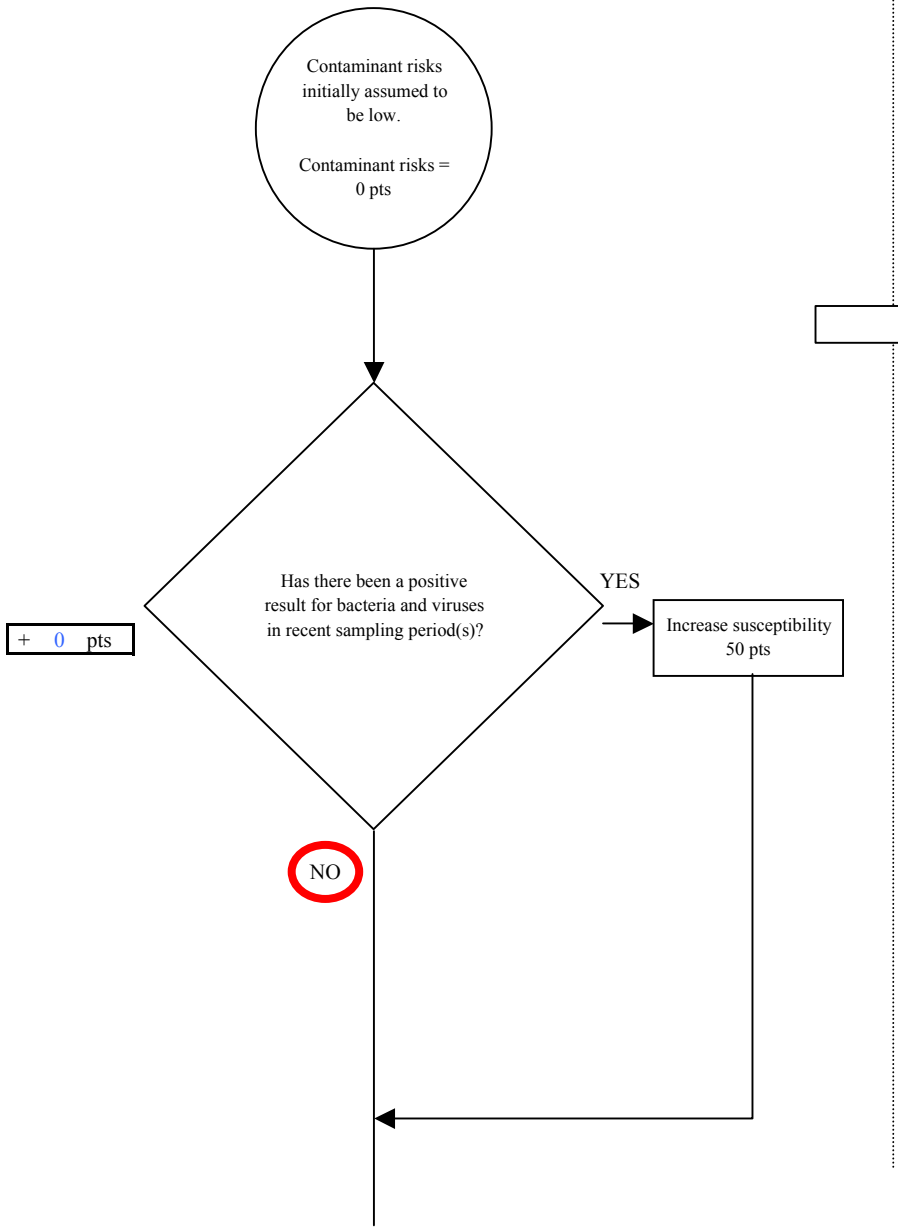
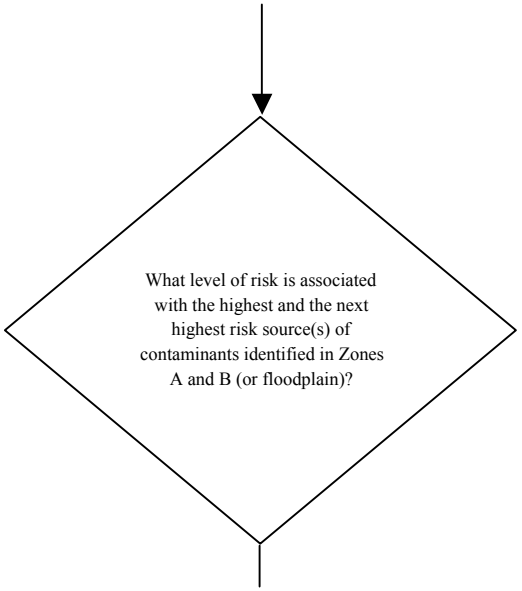


Chart 2. Contaminant risks for Kenai Fjords Tours - Bacteria & Viruses





+ 0 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0		0
Low(s)	0		0

	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 0

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 2. Contaminant risks for Kenai Fjords Tours - Bacteria & Viruses

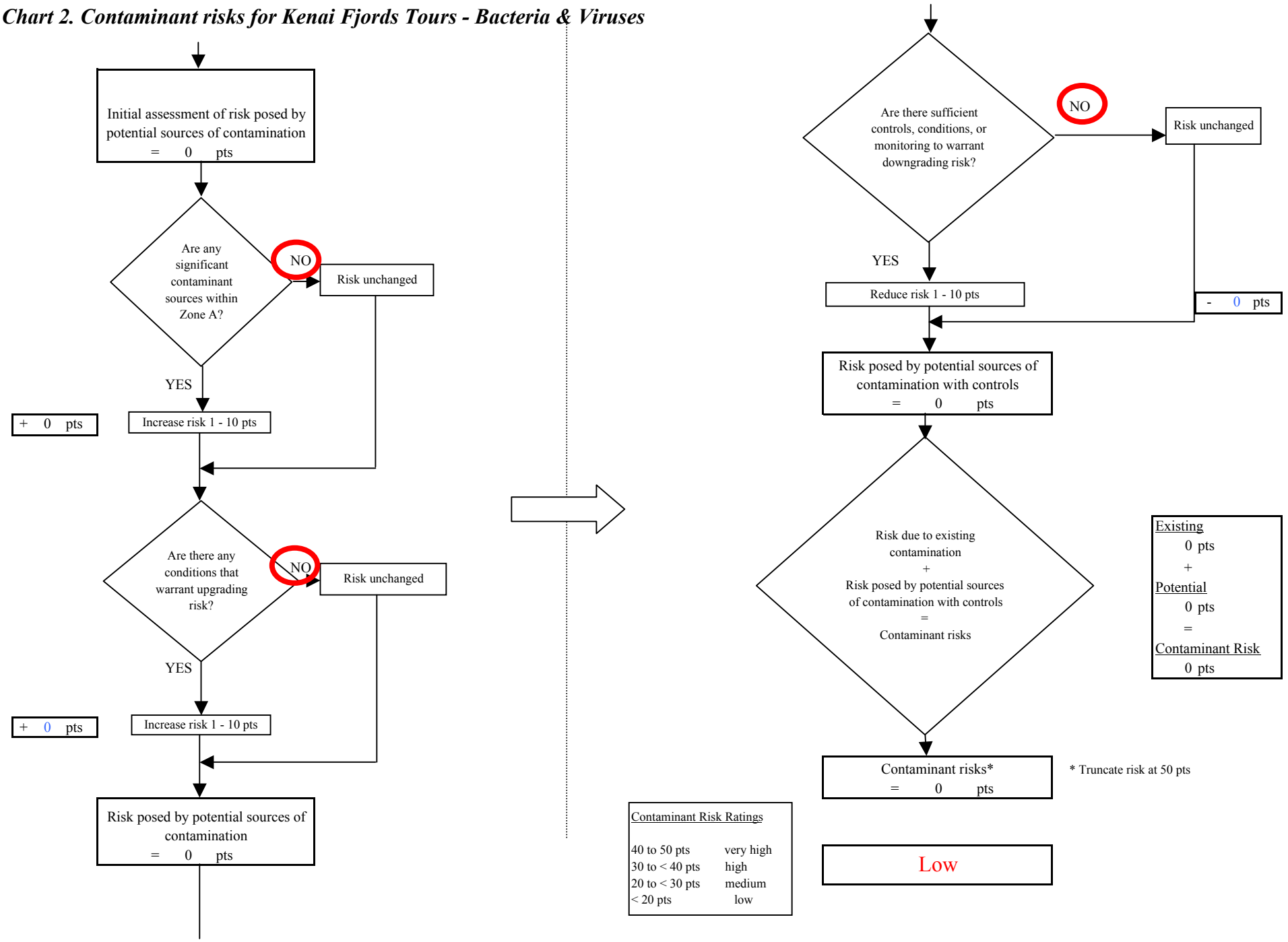


Chart 3. Vulnerability analysis for Kenai Fjords Tours - Bacteria & Viruses

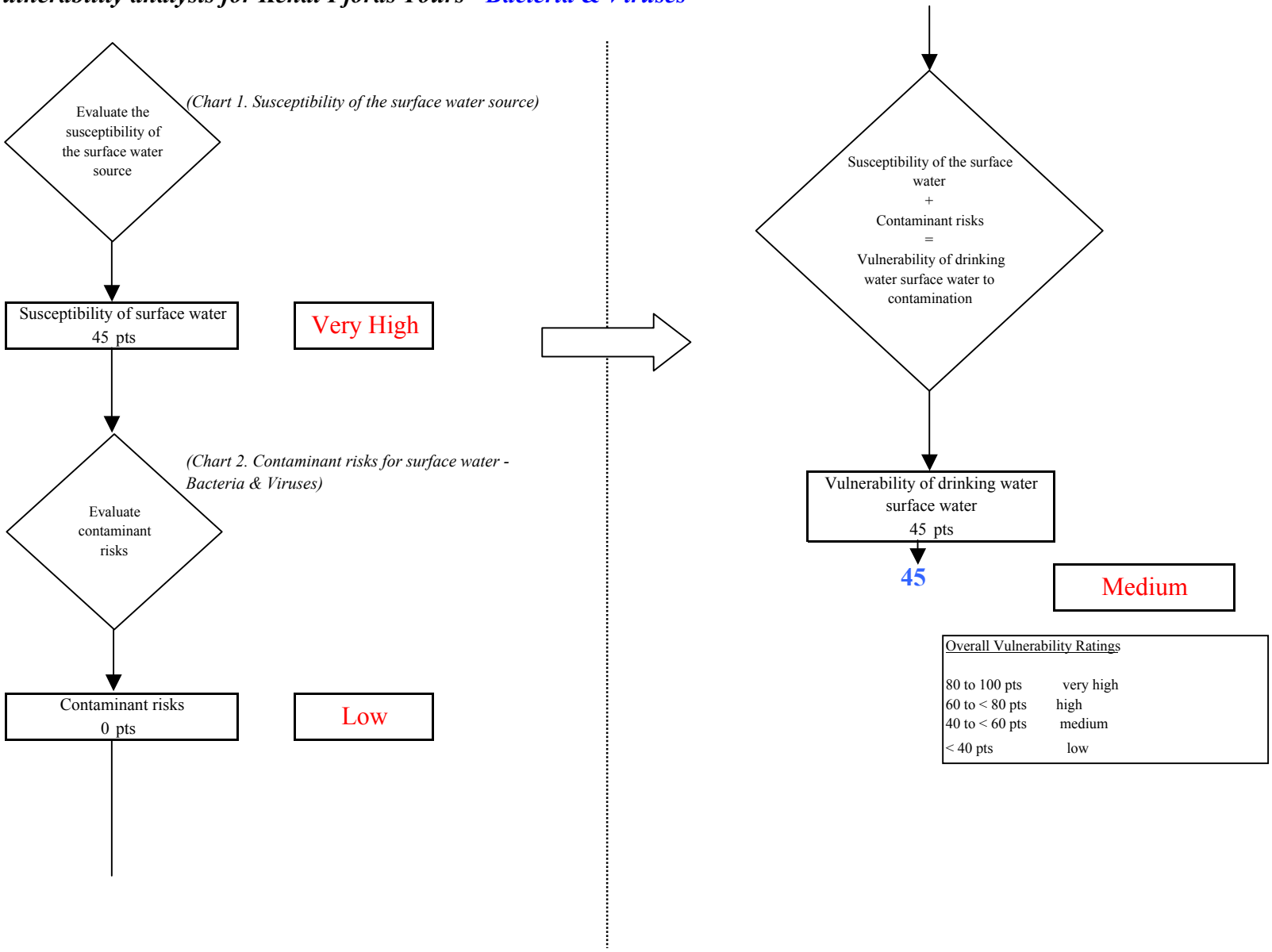


Chart 4. Contaminant risks for Kenai Fjords Tours - Nitrates and Nitrites

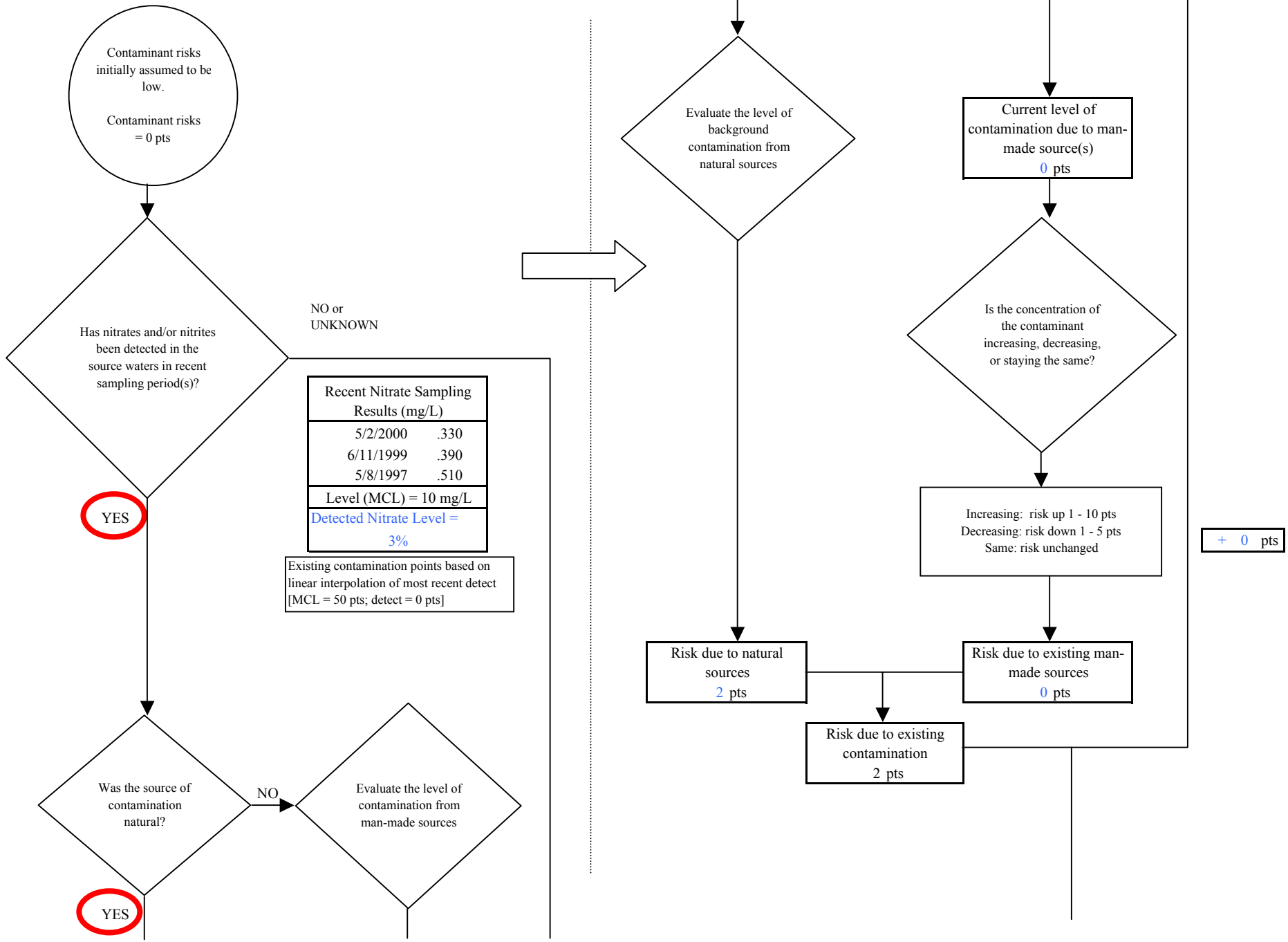


Chart 4. Contaminant risks for Kenai Fjords Tours - Nitrates and Nitrites

+ 0 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Risk Levels for Contaminant Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0		0
Low(s)	0		0

	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 0

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.

Initial assessment of risk posed by potential sources of contamination = 0 pts

Are any significant sources in Zone A?

NO

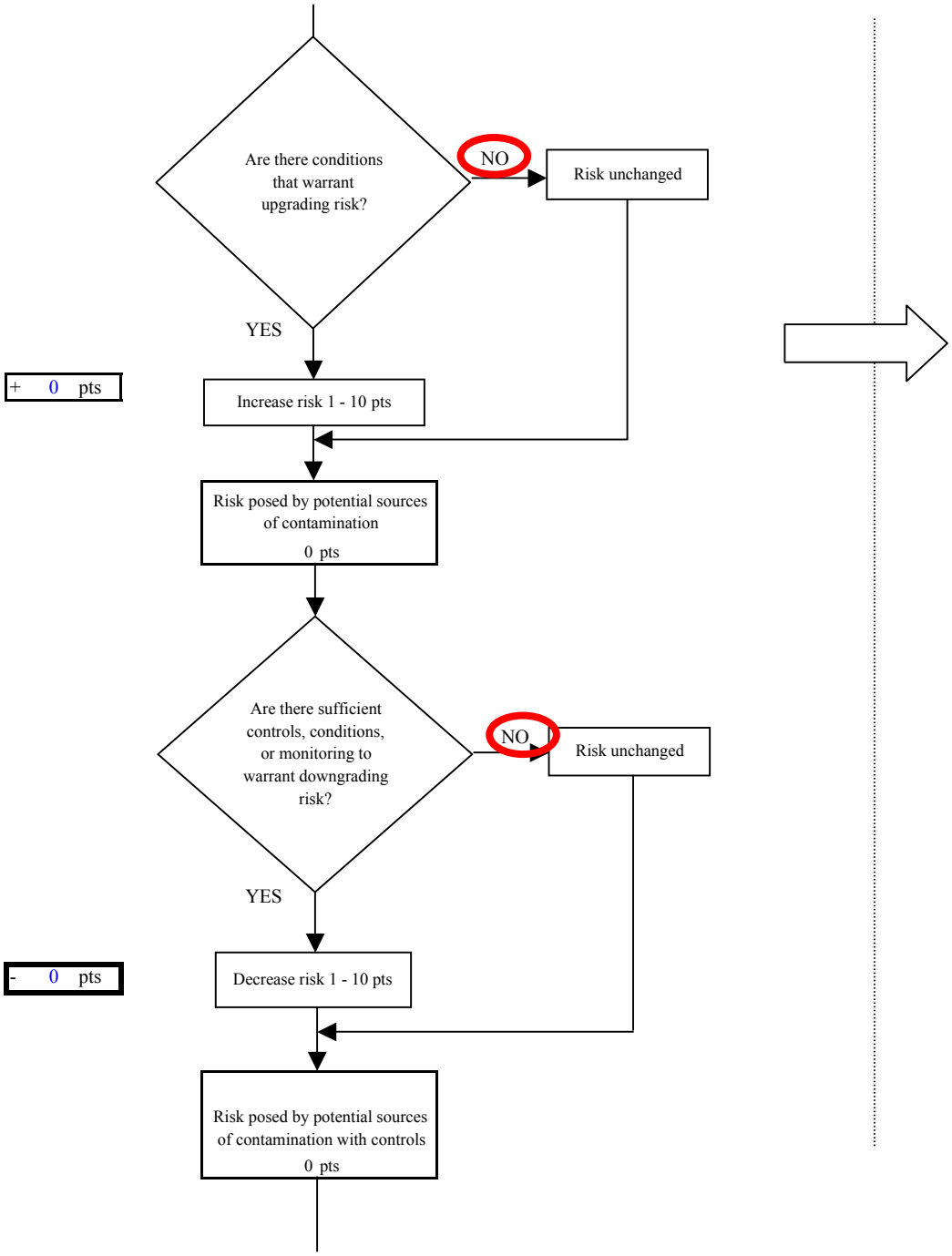
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 4. Contaminant risks for Kenai Fjords Tours - Nitrates and Nitrites



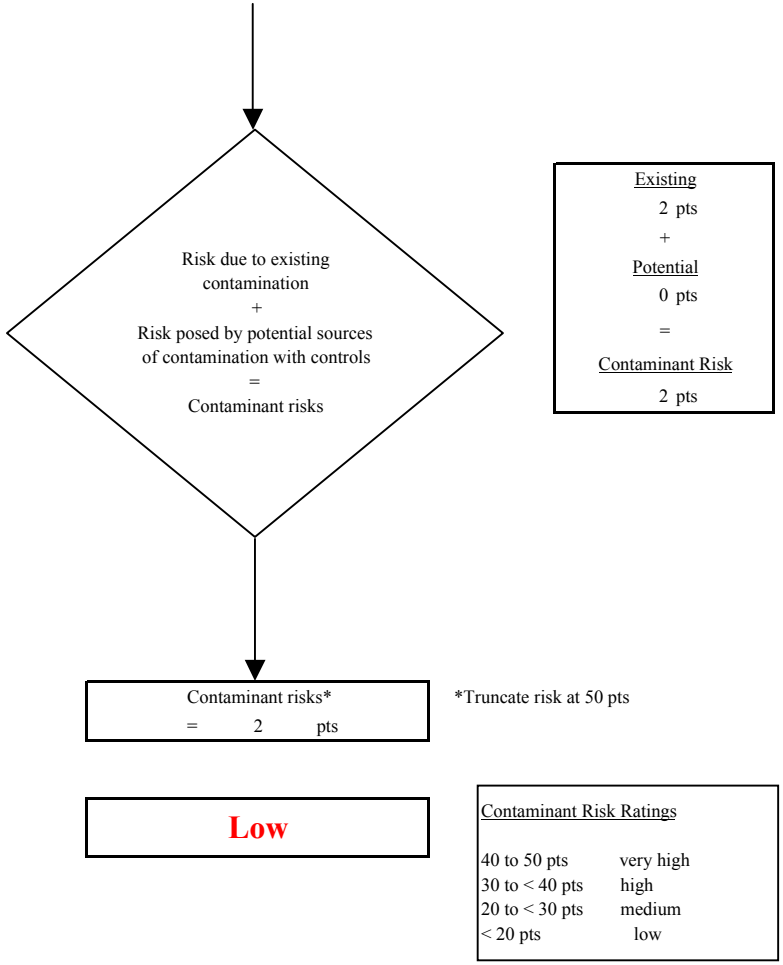


Chart 5. Vulnerability analysis for Kenai Fjords Tours - Nitrates and Nitrites

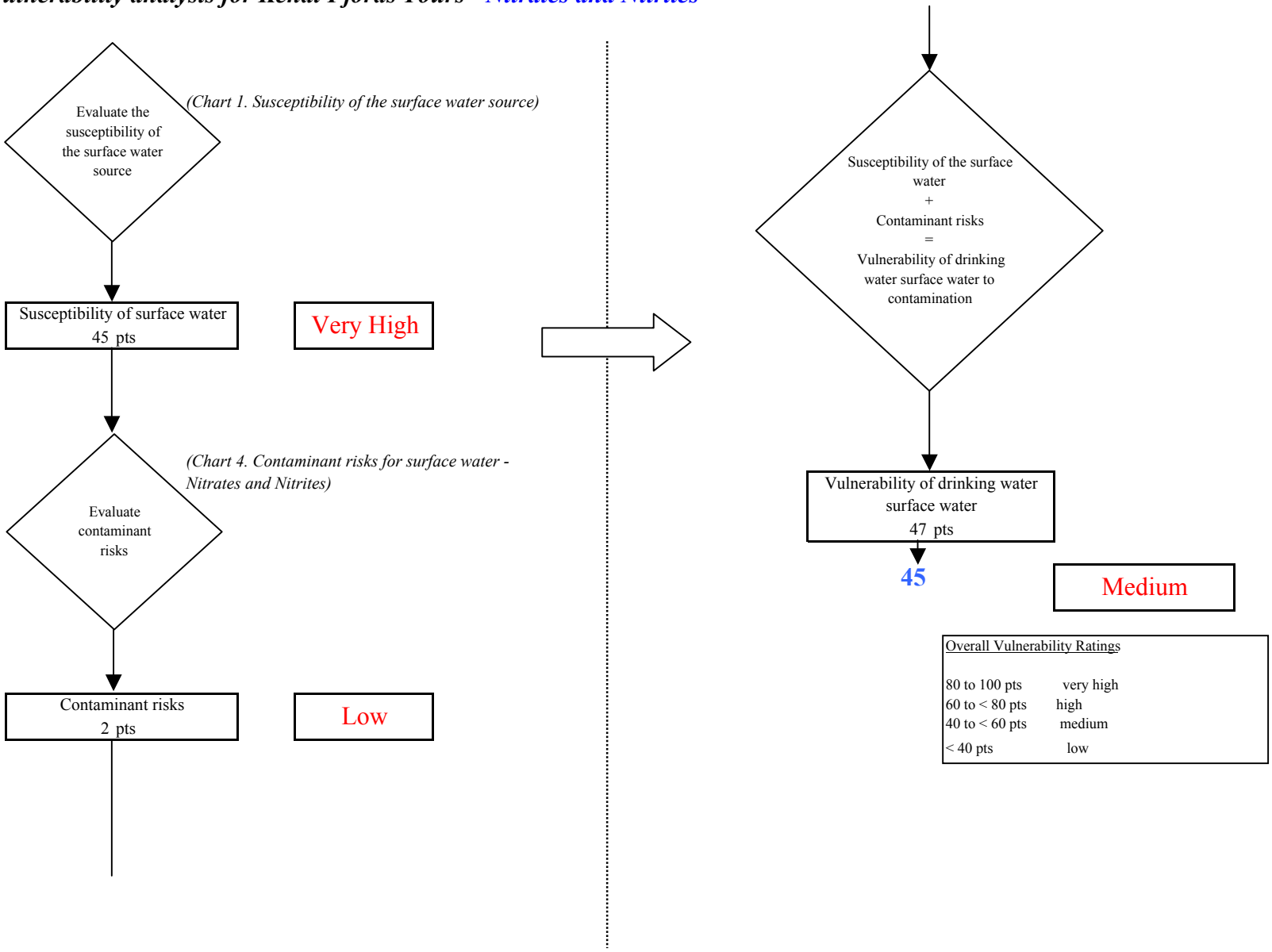


Chart 6. Contaminant risks for Kenai Fjords Tours - Volatile Organic Chemicals

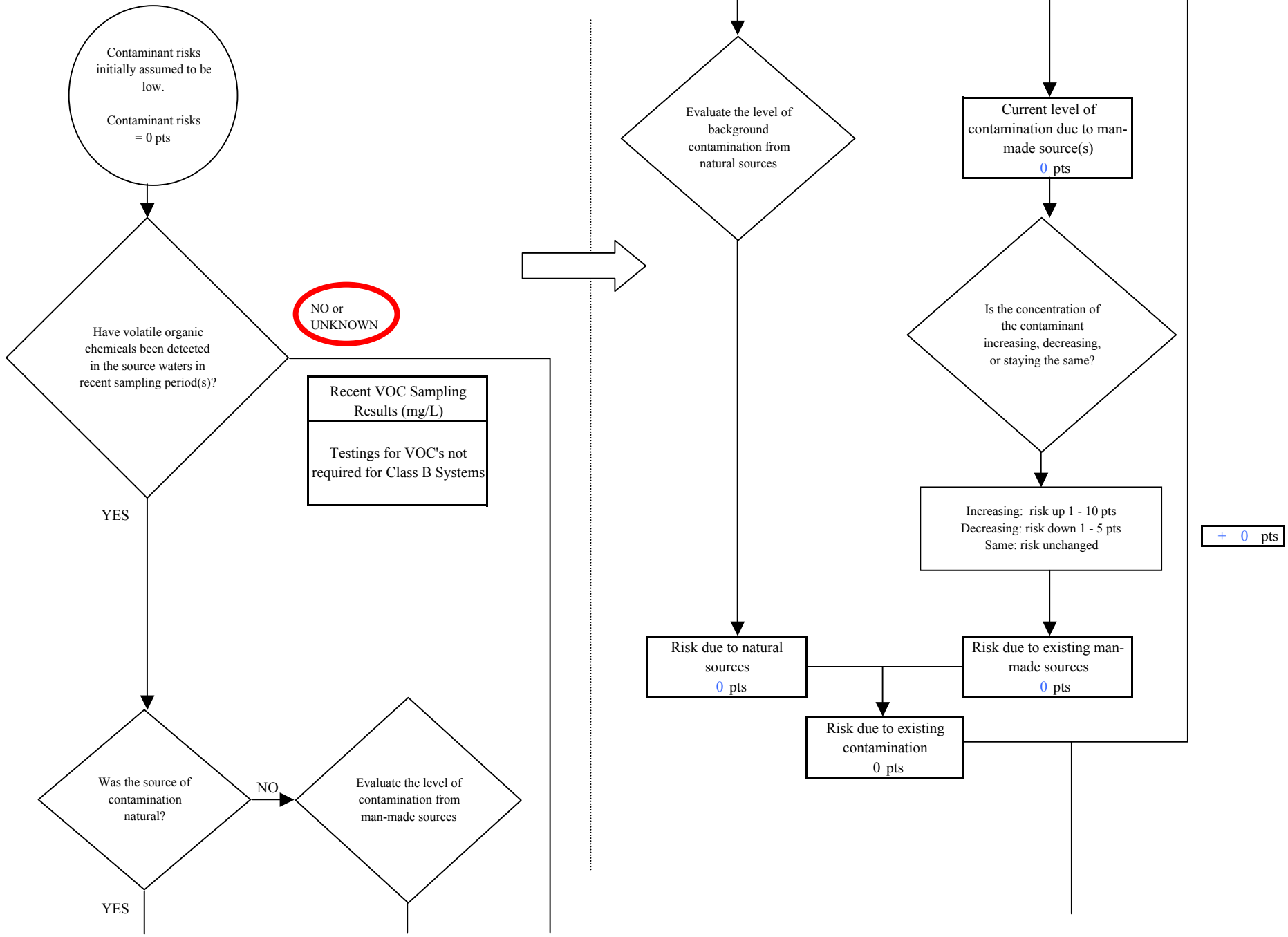
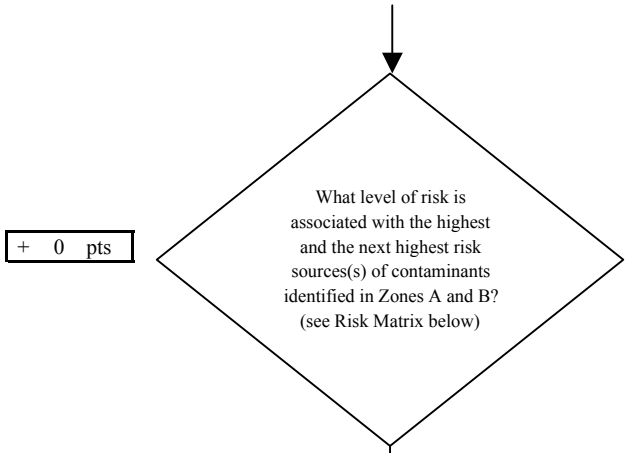


Chart 6. Contaminant risks for Kenai Fjords Tours - Volatile Organic Chemicals



+ 0 pts

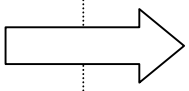
Risk Levels for Contaminant Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0		0
Low(s)	0		0

	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 0

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.



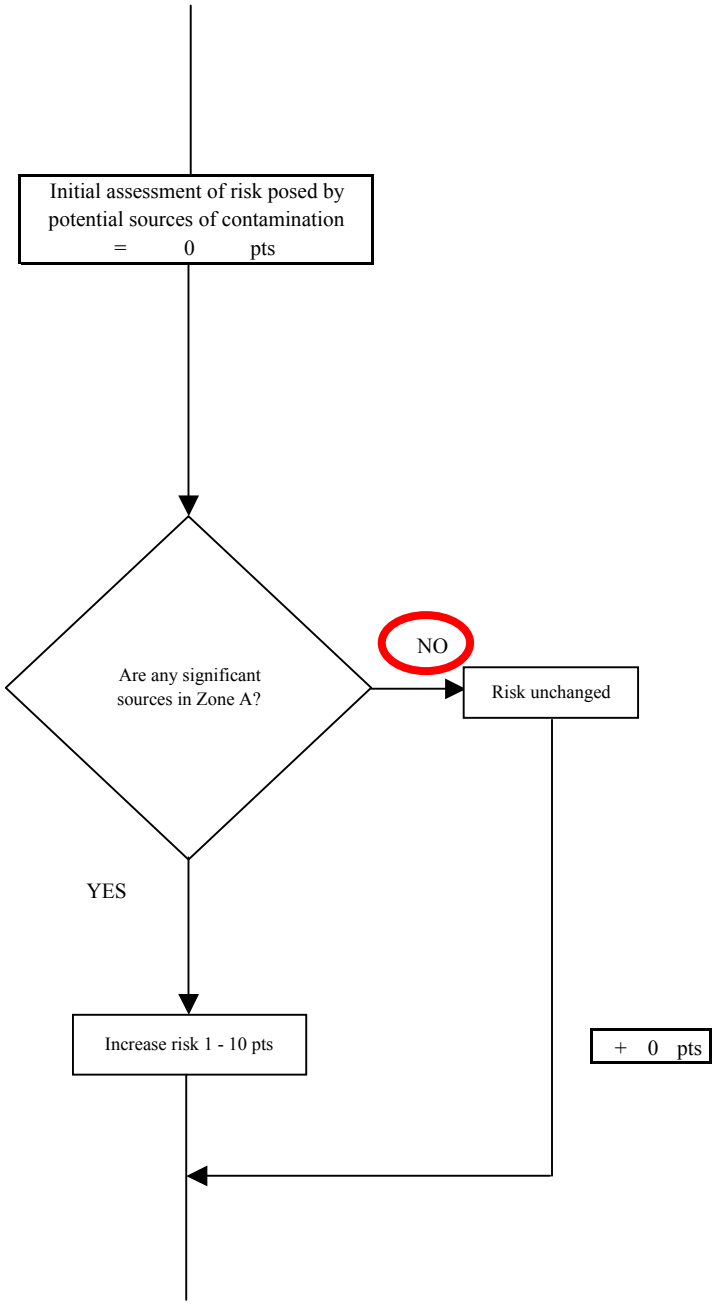
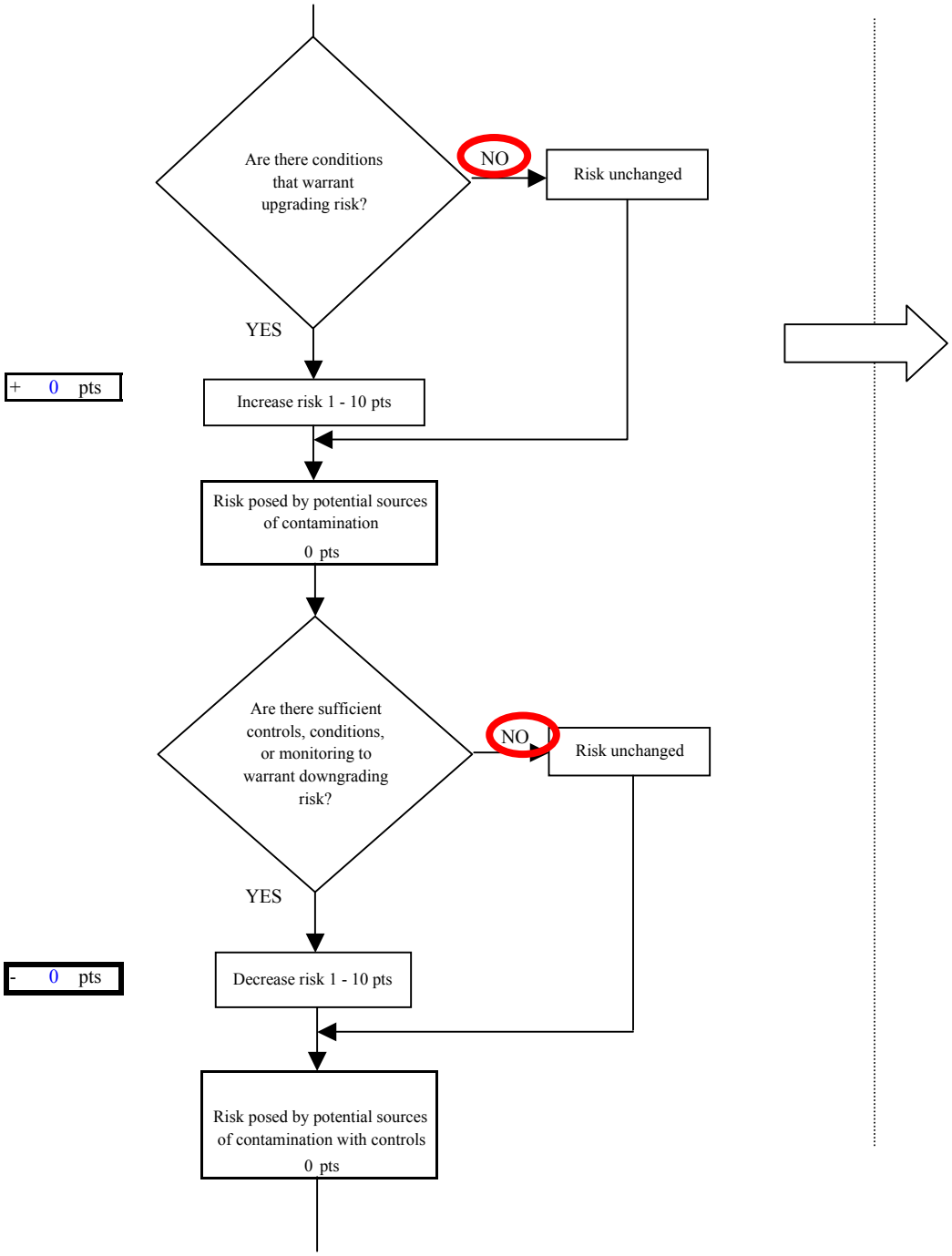
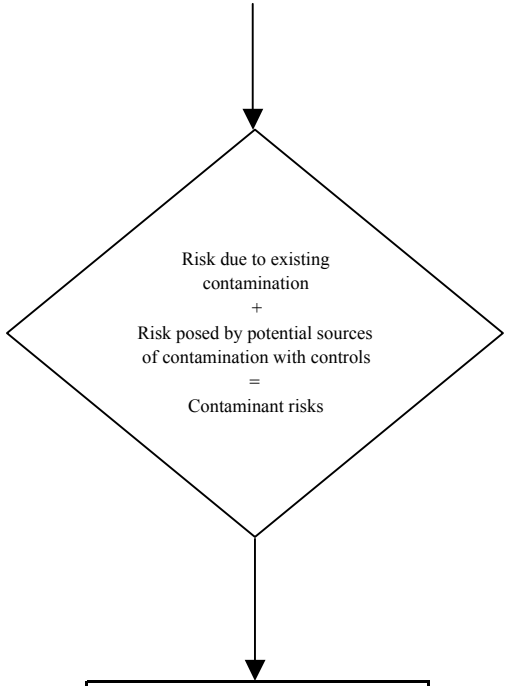


Chart 6. Contaminant risks for Kenai Fjords Tours - Volatile Organic Chemicals





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

Contaminant risks*
= 0 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

Chart 7. Vulnerability analysis for Kenai Fjords Tours - Volatile Organic Chemicals