Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Denali - Eielson Visitor Center Drinking Water System, Denali National Park, Alaska PWSID # 390609

DRINKING WATER PROTECTION PROGRAM REPORT # 276
Alaska Department of Environmental Conservation

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By Ecology & Environment, Inc.

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The Drinking Water Protection 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. 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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By Ecology & Environment, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Denali - Eielson Visitor Center is a Class B (transient/non-community) water system consisting of one surface water source in Denali National Park, Alaska. Although no potential and current sources of contaminants for for Denali - Eielson Visitor Center's public drinking water source were identified, surface water sources are inherently susceptible to contamination. The vulnerability of the public water source identifies a risk of contamination from any future, or unidentified, sources of contaminants. Overall, the public water sources for Denali - Eielson Visitor Center 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 DENALI NATIONAL PARK AREA

Location

The entrance to Denali National Park is located 237 miles north of Anchorage and 120 miles south of Fairbanks, along the George Parks Highway. The park is accessed via the 89-mile Denali Park Road. Private vehicle access is restricted past mile 15. The road dead-ends in the Kantishna area. (Figure 1)

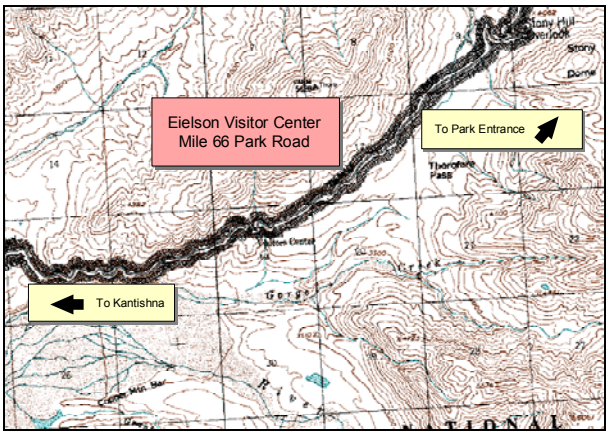


Figure 1

Precipitation

The Denali National Park area averages approximately 15 inches of precipitation per year, with approximately 81 inches of annual snowfall (ACRC 2002).

Topography and Drainage

The high peaks of the Alaska Range dominate the topography of Denali National Park. Drainage is typically off the mountains and alpine glaciers south of the road into the Savage, Sanctuary, Teklanika, and Toklat Rivers, among others, which flow generally north.

Groundwater Use

There are no permanent residences in the Park. Lodging establishments in the Kantishna area obtain their water from surface water sources or springs. Campgrounds within the Park obtain potable water from wells. (ADCED 2002).

Geology and Soils

The surficial geology along the road is mainly composed of alluvial sand and gravel,with some glacial deposits. Mountainous terrain in the vicinity of the Kantishna Hills and Mounts Healy, Margaret, and Wright is typically composed of metamorphic quartziteand mica schist, with quartz schist and marble. Volcanic basalts and rhyolites, together with sandstone, shale and conglomerate of the Cantwell Formation, also are present in some areas along the road (Gilbert 1979).

DENALI - EIELSON VISITOR CENTER PUBLIC DRINKING WATER SYSTEM

Denali - Eielson Visitor Center is a Class B (transient/non-community) water system. The system consists of one surface water source at mile 66 of the McKinley Park Road in Denali National Park.

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 (7/29/92) indicates the intake is adequately constructed, including a screen to protect against debris entry and protection against siltation.

This system operates mid-May to mid-September and serves 1 resident and more than 1500 non-residents through one service connection.

DENALI - EIELSON VISITOR 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 source. Some areas are more likely to allow contamination to reach the surface water source than others are.

The most probable area for contamination to reach the drinking water well 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, 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 Denali - Eielson Visitor Center source contains three zones, Zone A through Zone C (See Map 1 in Appendix A). These zones identify areas along the Denali - Eielson Visitor Center source 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 Denali - Eielson Visitor Center source and its main tributaries. Zone B identifies the area within one mile, and Zone C encompasses 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 Denali - Eielson Visitor 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 source 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.

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.

VULNERABILITY OF DENALI - EIELSON VISITOR CENTER DRINKING WATER SOURCE

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

- Natural susceptibility; and
- Contaminant risks.

Each of the three categories of drinking water contaminants has been analyzed and an overall vulnerability score of 0 to 100 is ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

A score for the natural susceptibility to contamination is achieved by examining the construction of the intake, potential for runoff, and the capacity of the water body to dilute contaminants. The Denali - Eielson Visitor Center water source has an inherent susceptibility simply because it is a surface water body. Surface water generally has more debris and dirt particles (higher turbidity) and biological contamination. Contaminants are able to flow directly into the water source. Table 1 shows the overall susceptibility score and rating for Denali - Eielson Visitor Center.

Appendix D contains seven 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' to contamination by looking at the construction of the well and its surrounding area. 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 well. 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.

Table 2 shows the Susceptibility score and rating for Denali - Eielson Visitor Center (see Chart 1).

Table 2. Natural Susceptibility - Susceptibility of the Surface Water Source to Contamination

	Score	Rating
Susceptibility of the Surface Water	43	Very High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data 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. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants (see Appendix D: Charts 2, 4, and 6).

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	0	Low
Nitrates and/or Nitrites	1	Low
Volatile Organic Chemicals	0	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 Appendix D: Charts 3, 5, and 7).

Table 4. Overall Vulnerability of Denali - Eielson Visitor Center to Contamination by Category

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

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

Only a small amount of bacteria and viruses are required to endanger public health. If bacteria and

viruses have been detected during recent water sampling of the system at Denali - Eielson Visitor Center, the result is a maximum score on Chart 2 in Appendix D.

The sampling history for Denali - Eielson Visitor Center source indicates that nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils [Wang, Strelakos, Jokela, 2000]. Existing nitrate concentration in the Denali - Eielson Visitor Center surface water source is approximately 0.1 mg/L or 1% of the Maximum Contaminant Level (MCL) of 10mg/L. 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. Though existing nitrate contamination was detected at the site, concentrations remain at safe levels with respect to human health (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Class B Public Water systems are not required to test for volatile organic chemicals (VOCs); therefore, no score for pre-existing contamination has been assigned. The vulnerability score for VOCs reflects the potential for contamination from the sources indicated on Table 4 in Appendix B.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Denali - Eielson Visitor Center. The overall vulnerability of this source to contamination is **Medium** for bacteria and viruses, **Medium** for nitrates and nitrites, and **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 Denali - Eielson Visitor Center 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 Denali - Eielson Visitor Center public drinking water source.

REFERENCES CITED

Alaska Climate Research Center (ACRC), 2002 [WWW document]. URL http://climate.gi.alaska.edu/climatology/data.html.

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

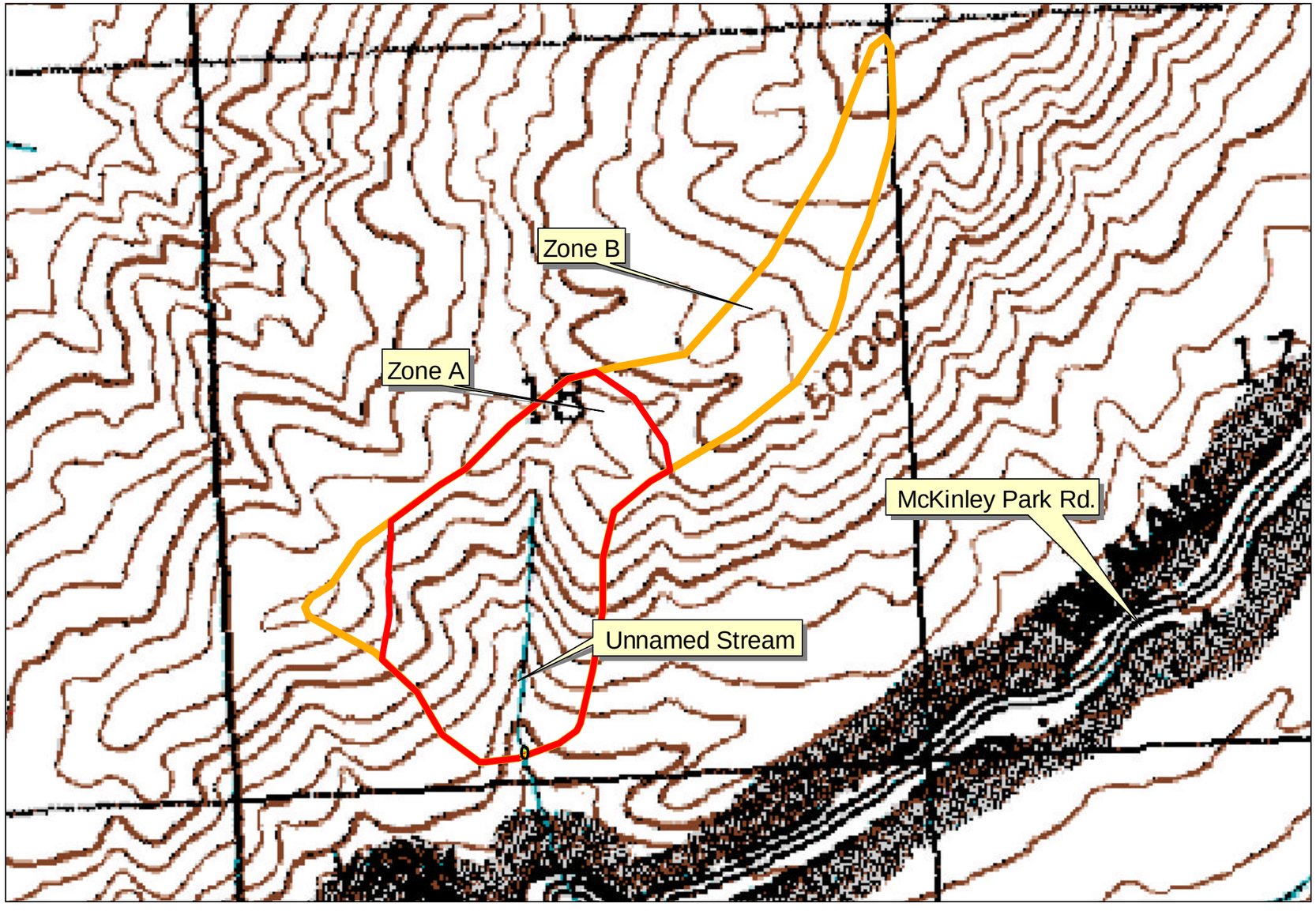
Gilbert, W.G., 1979, *A Geologic Guide to Mount McKinley National Park*, Alaska Natural History Association, Anchorage, Alaska.

Wang, B., Strelakos, P.M., and Jokela, B., 2000, Nitrate Source Indicators In Groundwater of the Scimitar Subdivision, Peters Creek Area, Anchorage Alaska: U.S. Geological Survey Water-Resources Investigations Report 00-4137, 25p.

APPENDIX A

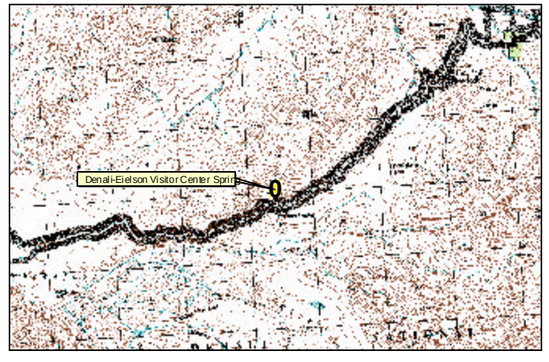
Denali - Eielson Visitor Center
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Area for Denali-Eielson Visitors Center



0 Denali- Eielson Visitor Center Intake
Zone A (1000' from Surface Water Body)
Zone B (1 Mile from Surface Water Body)

N
W E
S



0 1 Miles

PWSID 390609.001

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Denali - Eielson Visitor Center (Tables 1-4)

Not Applicable – No Contaminant Sources Identified

APPENDIX C

Denali - Eielson Visitor Center
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Not Applicable – No Contaminant Sources Identified

APPENDIX D

Vulnerability Analysis for Denali - Eielson Visitor Center Public Drinking Water Source

(Charts 1-7)

Chart 1. Susceptibility of the surface water source - Denali- Eielson Visitor Center

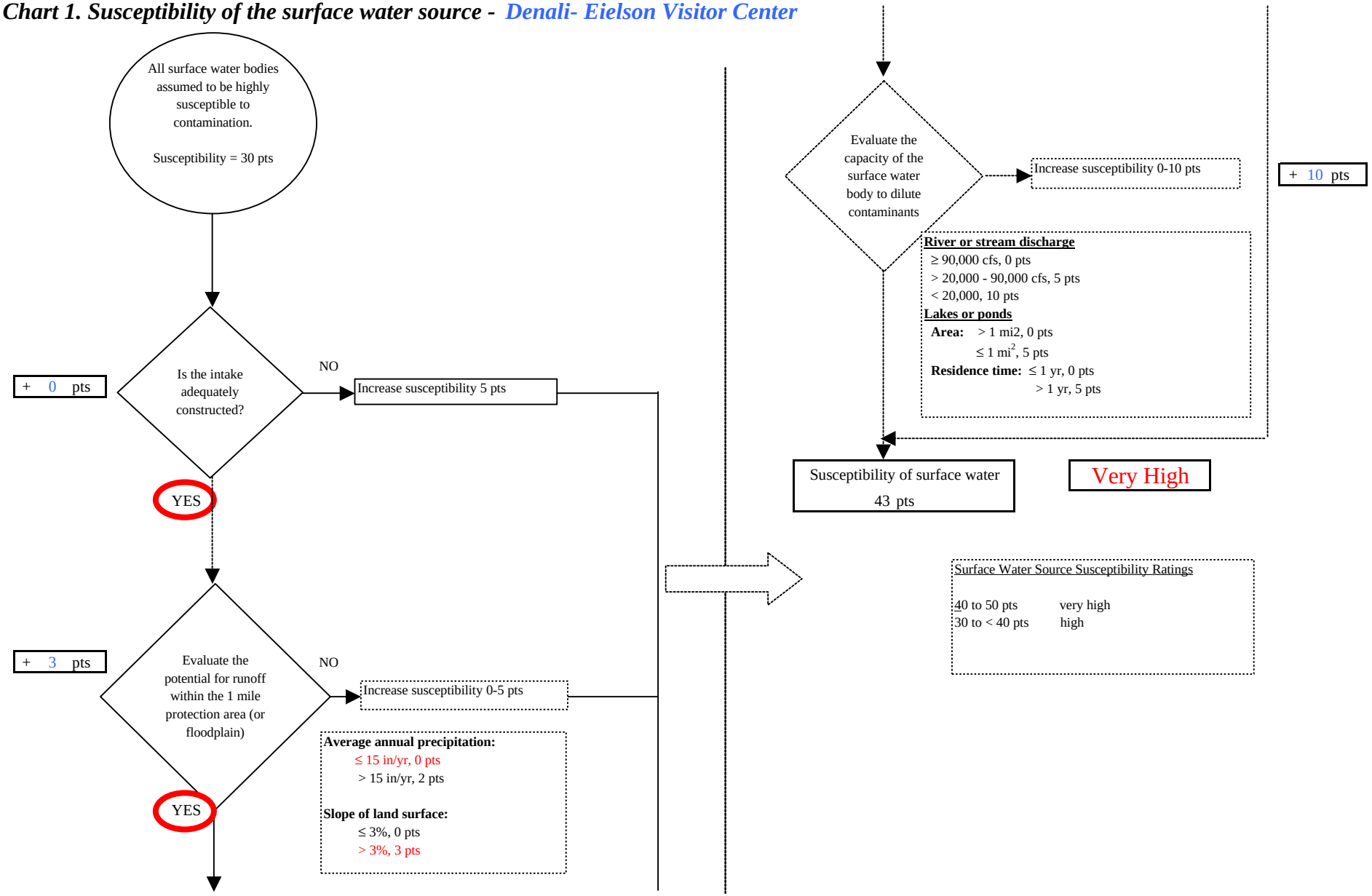
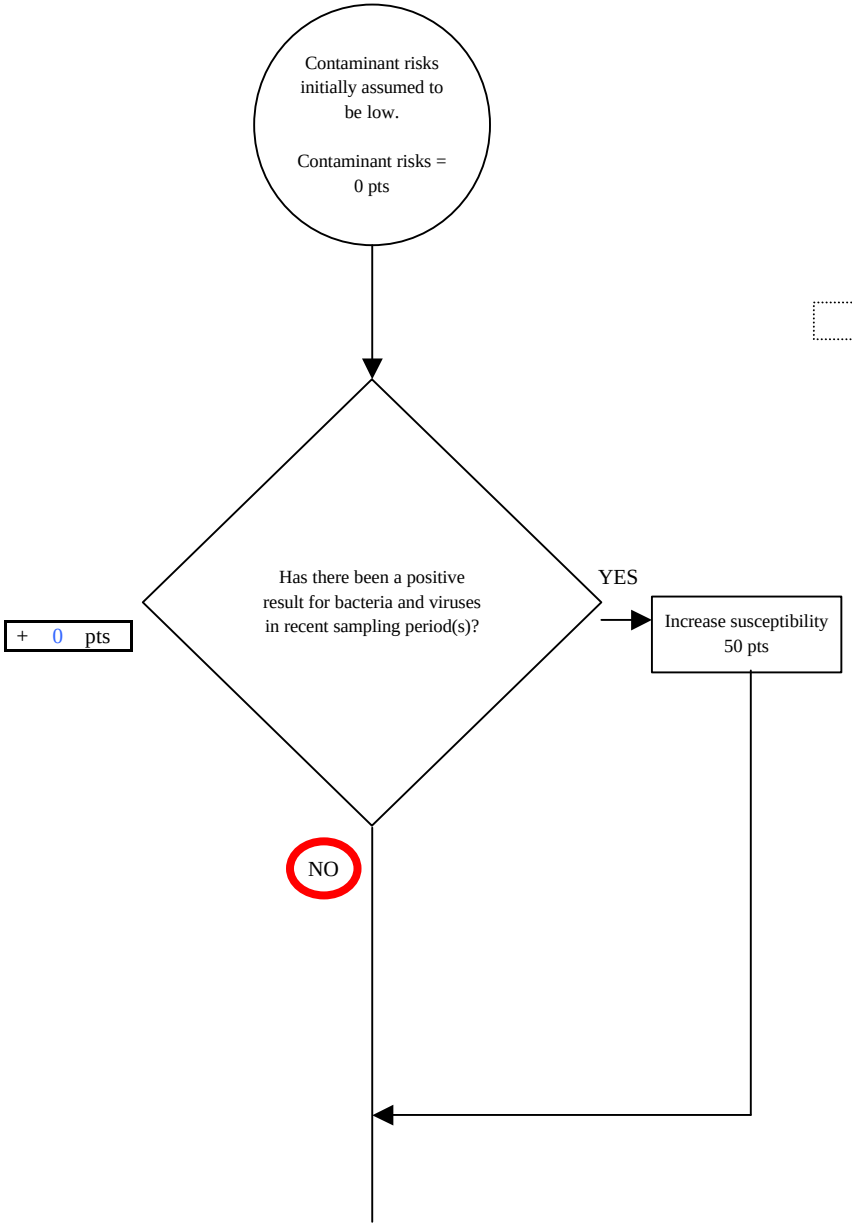
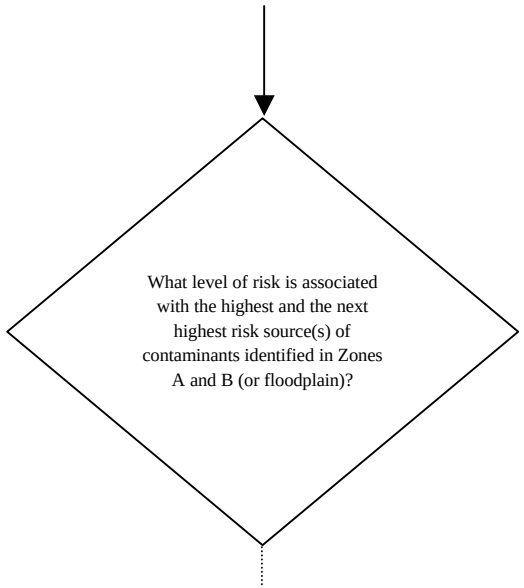


Chart 2. Contaminant risks for Denali- Eielson Visitor Center - Bacteria & Viruses





+ 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	[3] 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 Denali- Eielson Visitor Center - Bacteria & Viruses

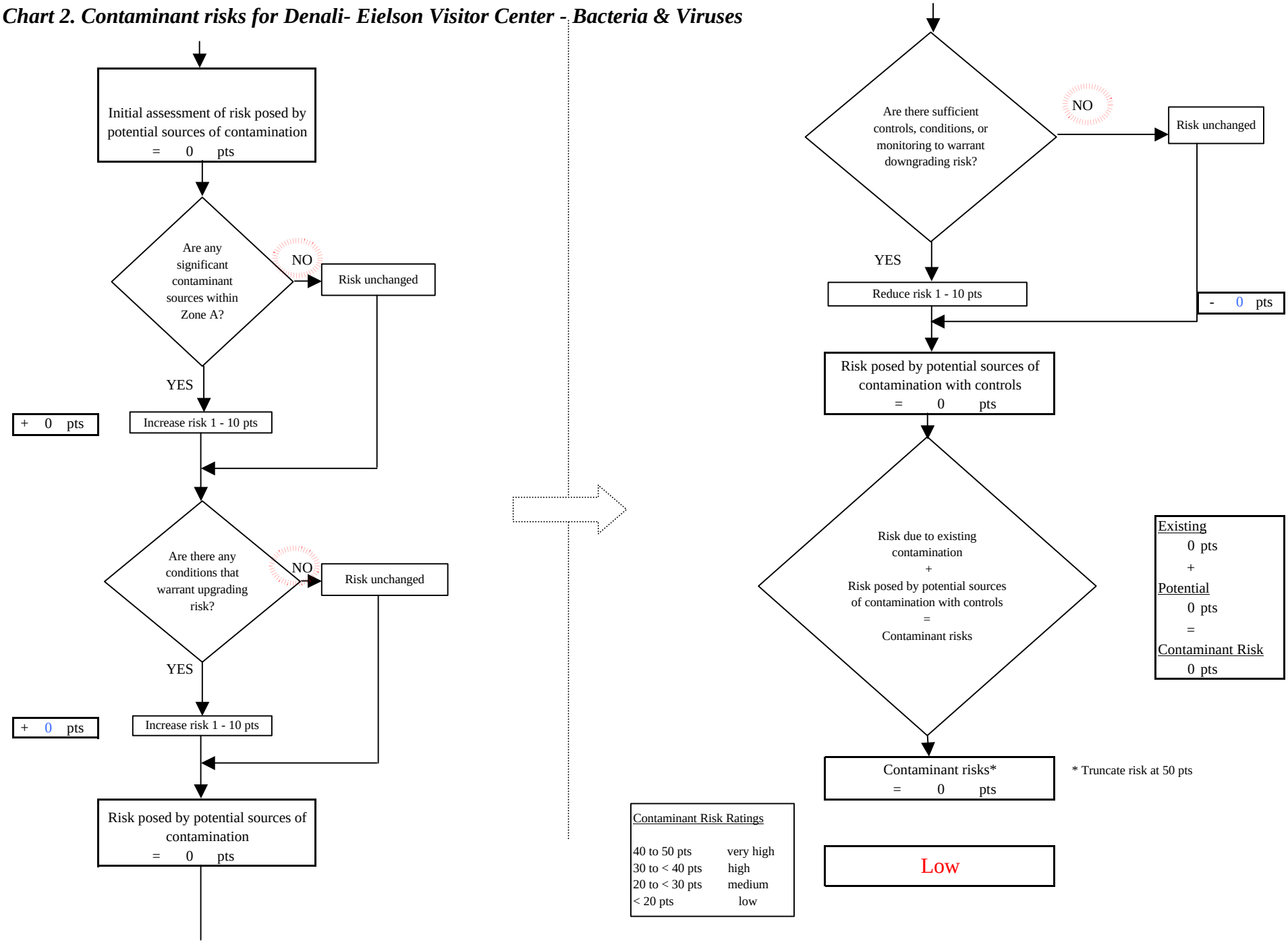


Chart 3. Vulnerability analysis for Denali- Eielson Visitor Center - Bacteria & Viruses

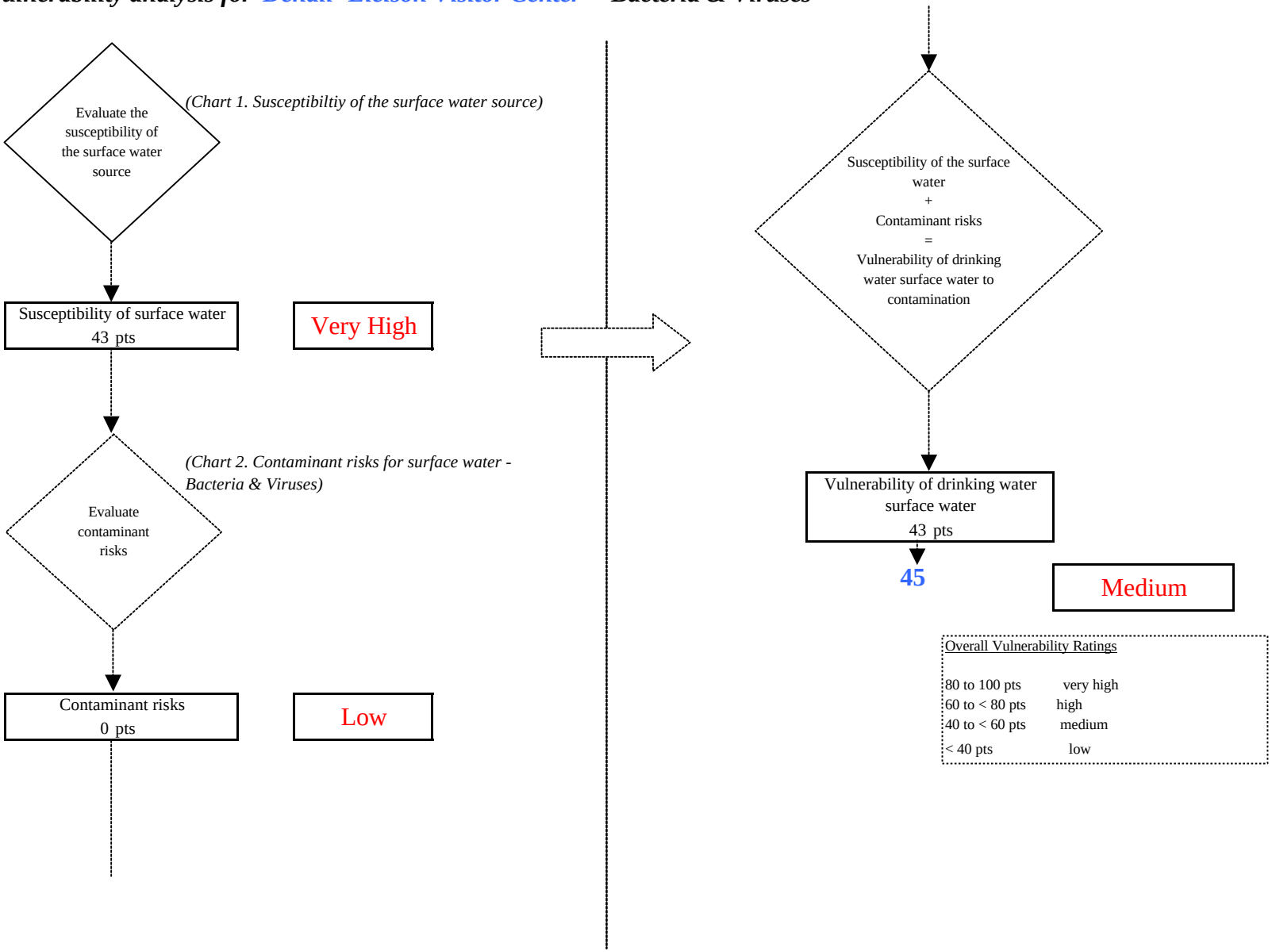


Chart 4. Contaminant risks for Denali- Eielson Visitor Center - Nitrates and Nitrites

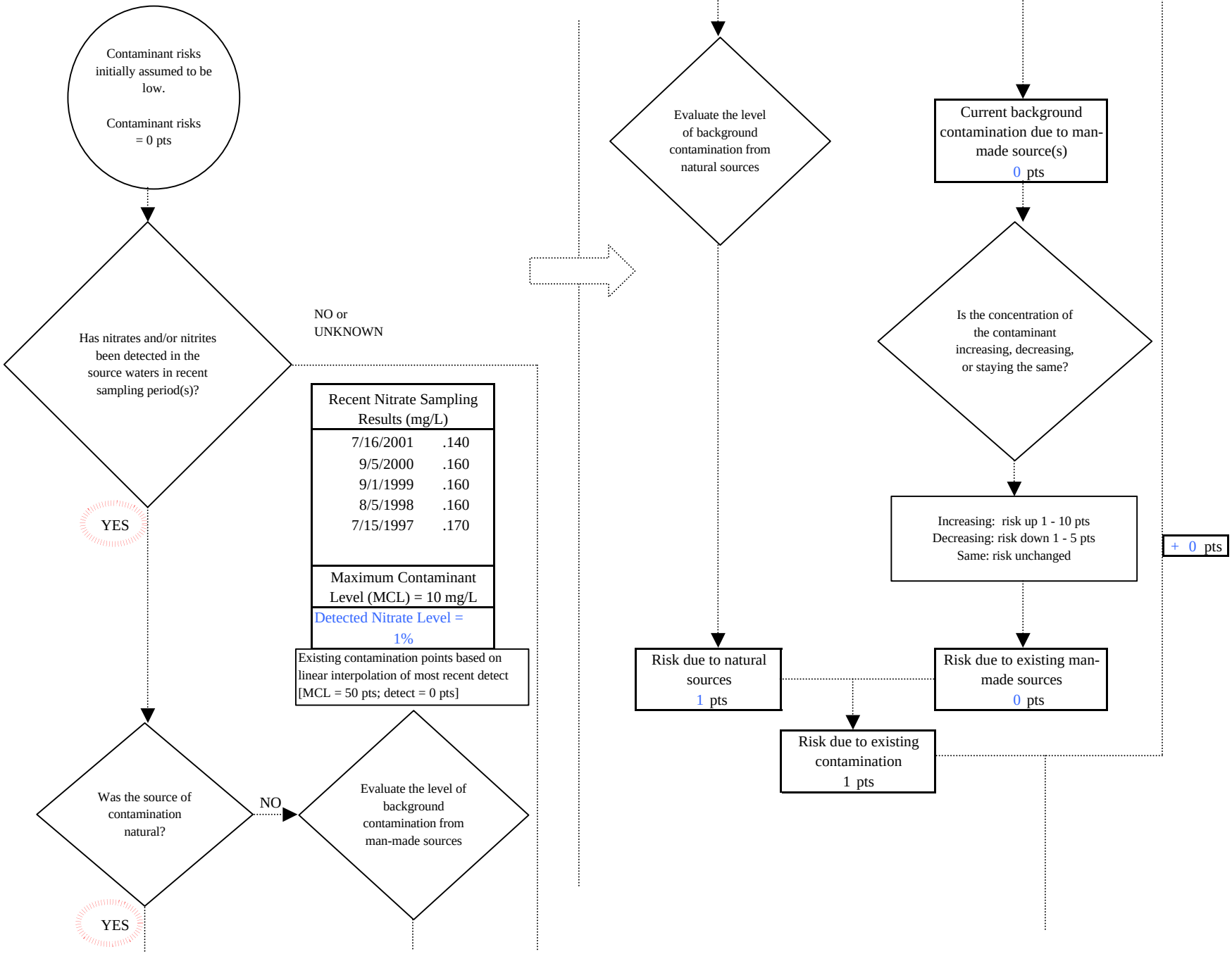


Chart 4. Contaminant risks for Denali- Eielson Visitor Center - Nitrates and Nitrites

+ 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	[3] 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

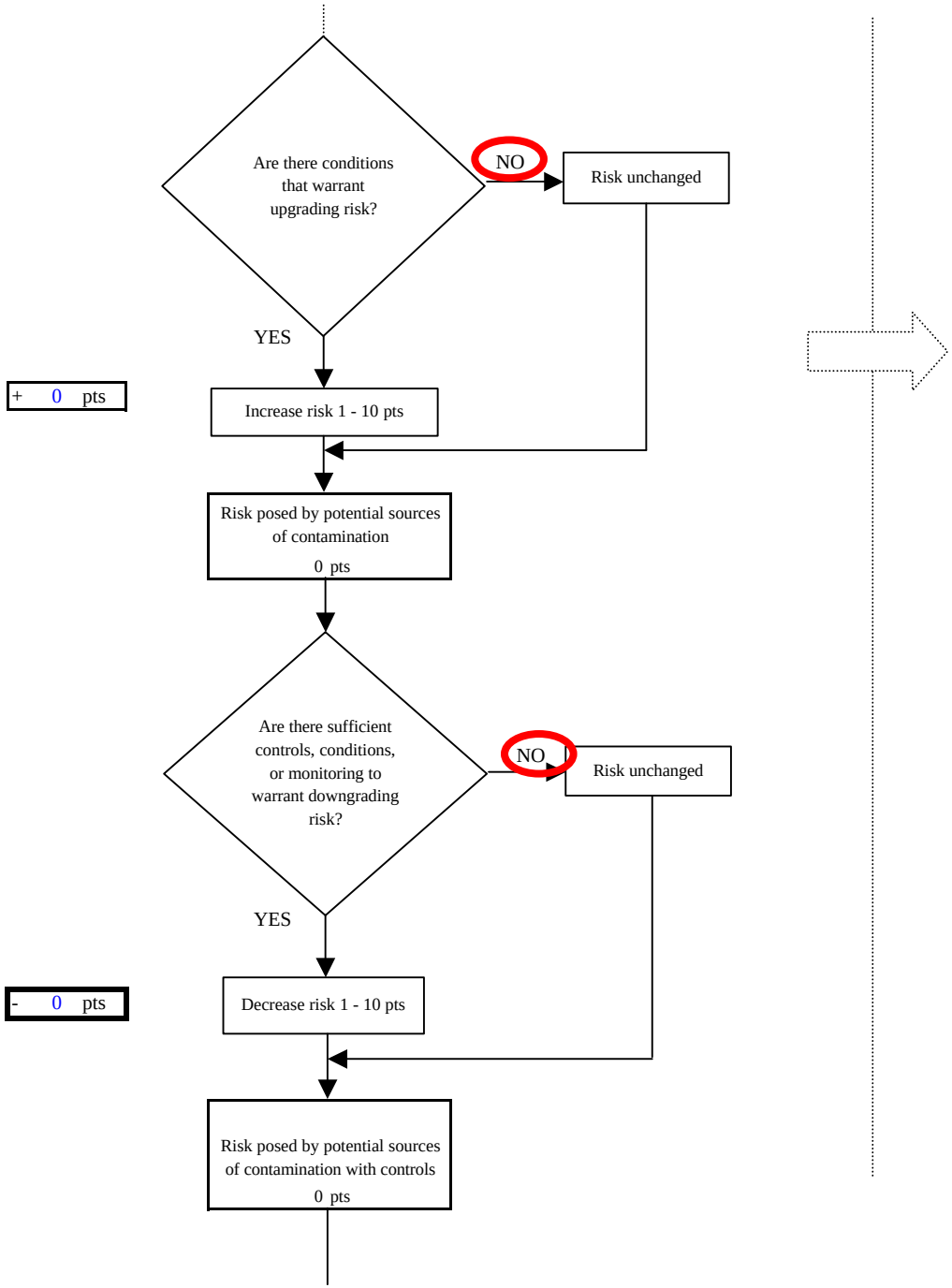
Risk unchanged

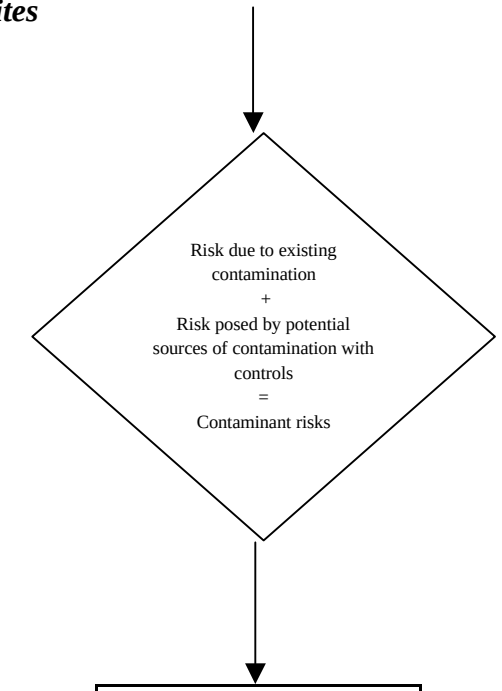
YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 4. Contaminant risks for Denali- Eielson Visitor Center - Nitrates and Nitrites





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

Contaminant risks*
= 1 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 5. Vulnerability analysis for Denali- Eielson Visitor Center - Nitrates and Nitrites

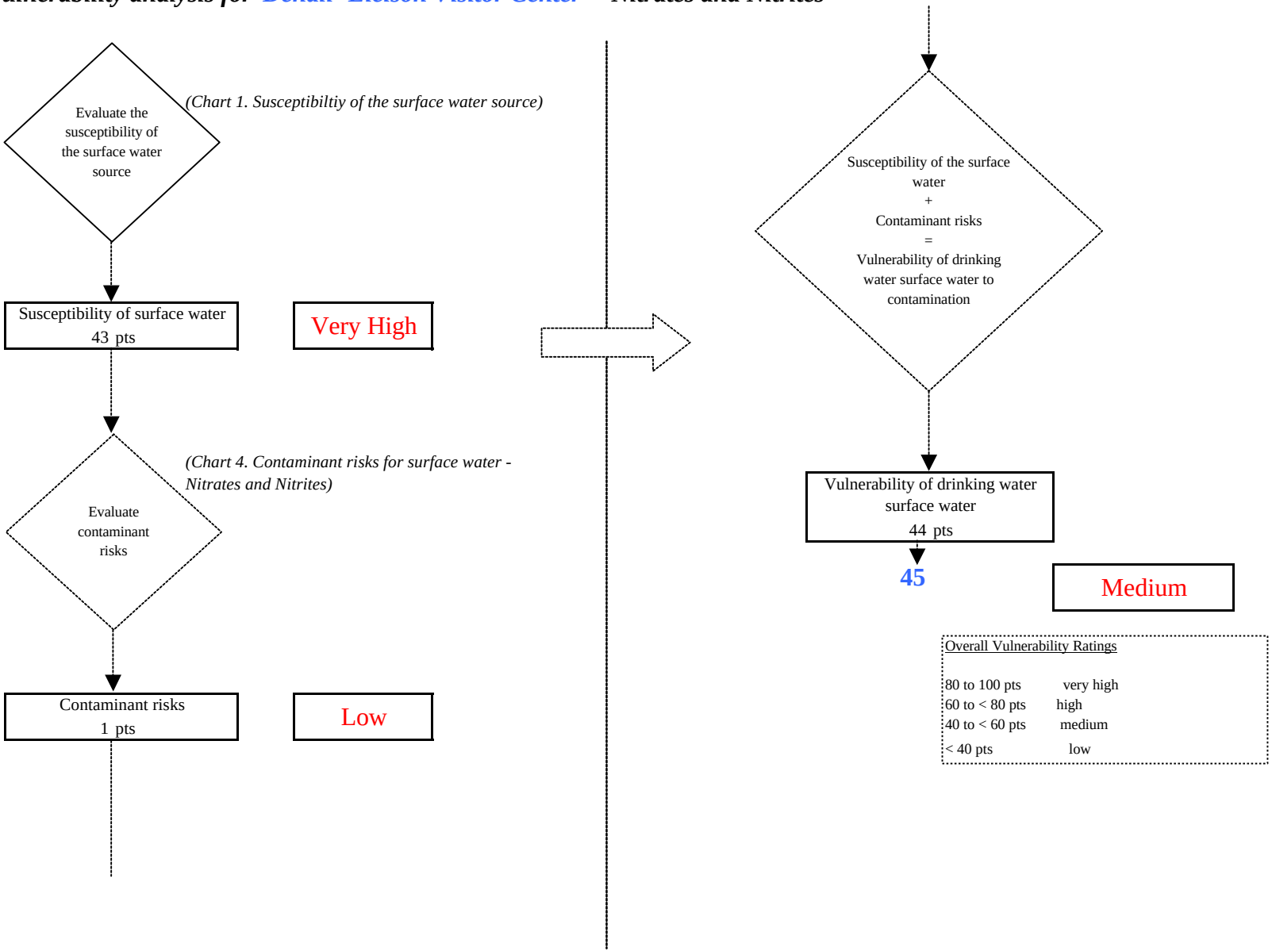


Chart 6. Contaminant risks for Denali- Eielson Visitor Center - Volatile Organic Chemicals

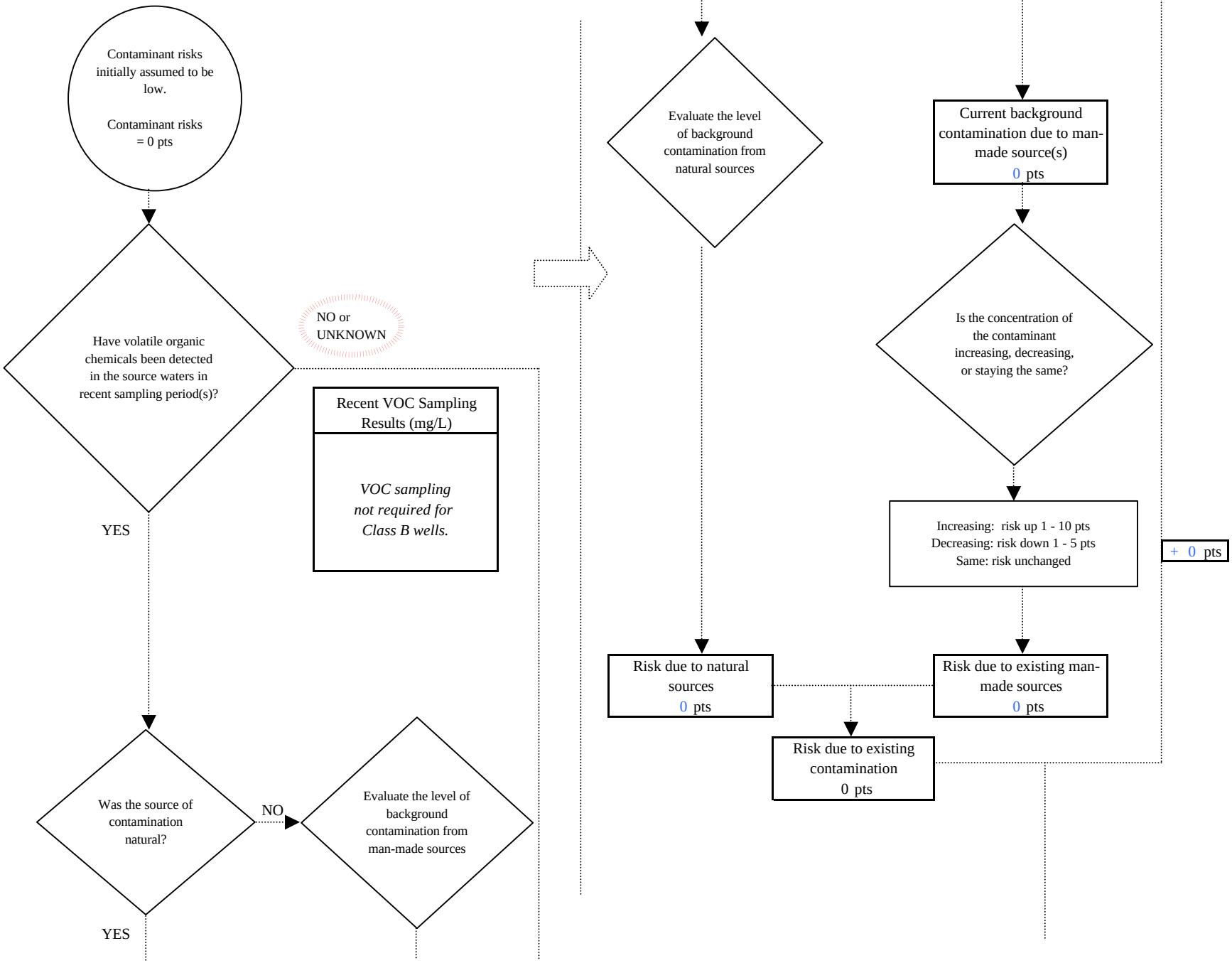
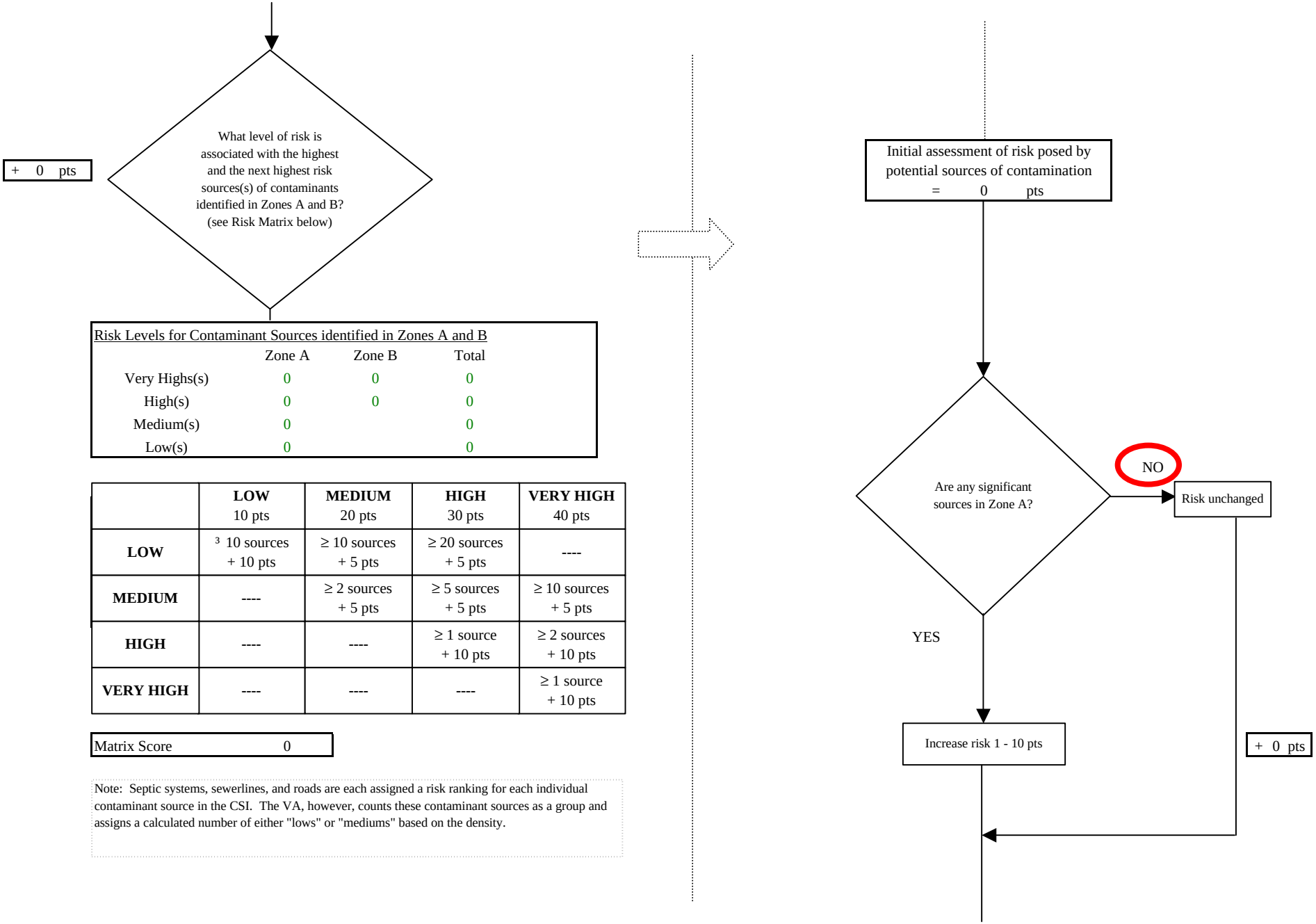


Chart 6. Contaminant risks for Denali- Eielson Visitor Center - Volatile Organic Chemicals



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	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
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Matrix Score 0

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Chart 6. Contaminant risks for Denali- Eielson Visitor Center - Volatile Organic Chemicals

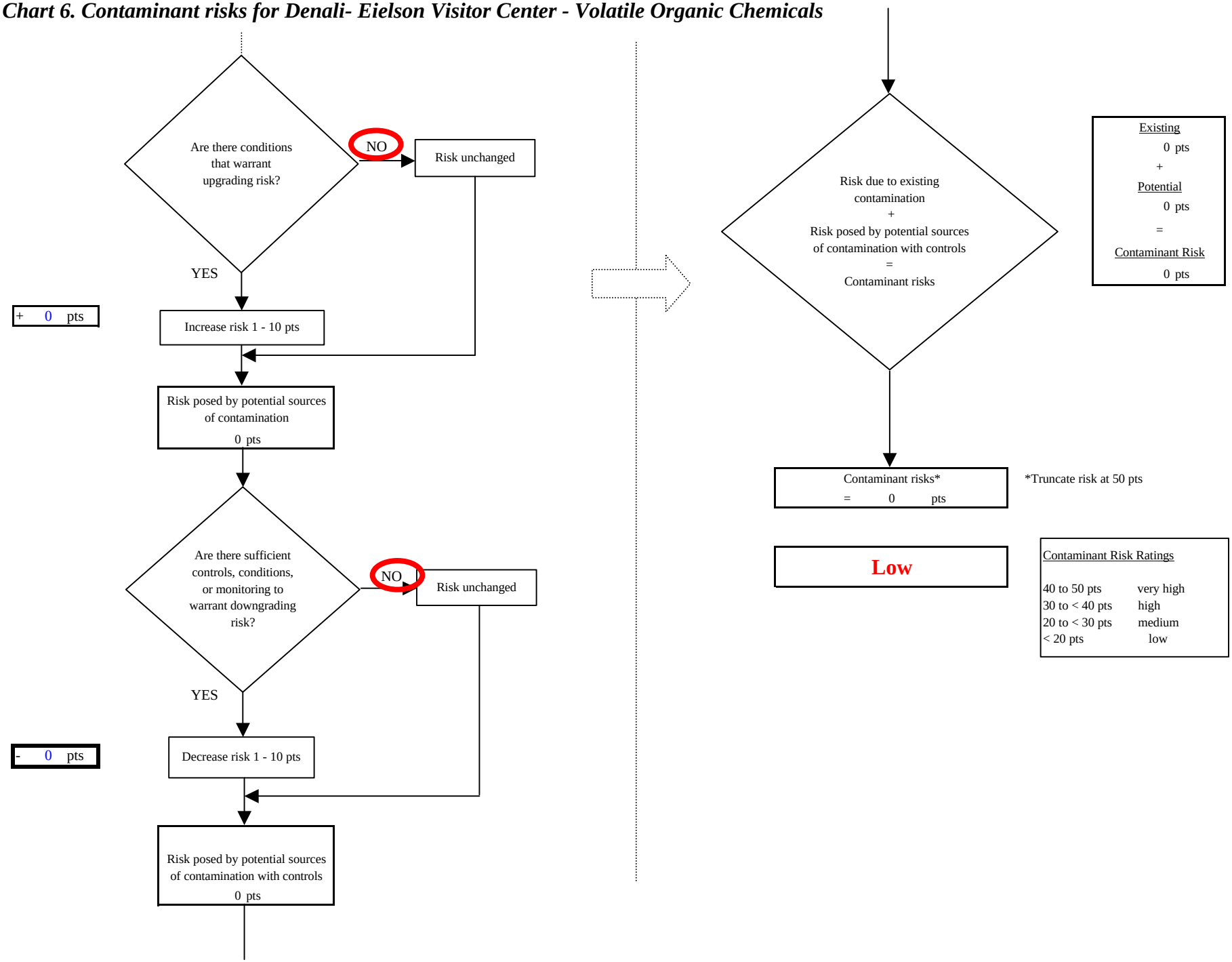

Chart 7. Vulnerability analysis for Denali- Eielson Visitor Center - Volatile Organic Chemicals