Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for North Face Lodge Drinking Water System, Denali National Park, Alaska PWSID # 390324

DRINKING WATER PROTECTION PROGRAM REPORT # 288
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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Source Water Assessment for North Face Lodge Source of Public Drinking Water, Denali National Park, Alaska

By Ecology & Environment, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

North Face Lodge is a Class B (transient/non-community) water system consisting of one spring in Denali National Park, Alaska. Identified potential and current sources of contaminants for North Face Lodge's public drinking water source include: a gravel road, septic systems, aboveground diesel and heating oil tanks, placer mines and underground mines. 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 North Face Lodge received a vulnerability rating of **Low** for bacteria and viruses, **Low** and 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)

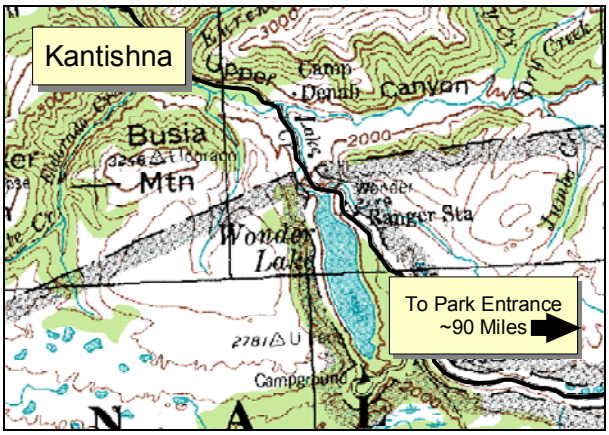


Figure 1

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).

NORTH FACE LODGE PUBLIC DRINKING WATER SYSTEM

North Face Lodge is a Class B (transient/non-community) water system. The system consists of one spring near Lake Creek at mile 88.5 of the McKinley Park Road in the Kantishna area.

The system's intake is a spring at the base of mountainous terrain. The most recent Sanitary Survey (6/29/99) indicates the spring intake is adequately constructed. The spring is protected in a spring house with a concrete foundation to protect against flooding and contamination by wildlife.

This system operates June 5 to September 10 and serves 13 residents and more than 37 non-residents.

NORTH FACE LODGE 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 spring than others.

The most probable area for contamination to reach the drinking water spring is the area that contributes water to the spring. 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 spring, this area will serve as the focus for voluntary protection efforts.

The Drinking Water Protection Areas established for springs by the Alaska Department of Environmental Conservation (ADEC) are separated into zones. The Drinking Water Protection Areas for the North Face Lodge source contains three zones, Zone A through Zone C (See Map 1 in Appendix A). Zone A corresponds to an area within 1000 feet of the spring intake. Zone B identifies the area within one mile, and Zone C encompasses the entire watershed upslope of the spring. (Please refer to the Guidance Manual for Class B Water Systems for additional information).

The following is a summary of the four DWPA zones:

Table 1. Definition of Zones

Zone	Definition
A	1000 Feet from Spring
B	1 Mile from Spring
C	Entire Watershed of Spring

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 North Face Lodge 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 Zones A through Zone C were associated with mining and commercial lodging activities. Map 2 in Appendix C of this report depicts the contaminant source inventory for North Face Lodge. The sources are summarized in the tables in Appendix B of the Guidance Manual.

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 spring.

VULNERABILITY OF NORTH FACE LODGE 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 susceptiblity of the spring outlet and intake to flooding, the construction of the outlet and intake, potential for runoff. Table 2 shows the overall susceptibility score and rating for North Face Lodge.

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 Spring' to contamination by looking at the construction of the spring outlet and intake 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 spring. 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.

Table 2. Natural Susceptibility - Susceptibility of the Spring and Aquifer to Contamination

	Score	Rating
Susceptibility of the Spring	5	Low
Susceptibility of the Aquifer	15	High
Natural Susceptibility	20	Medium

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 3, 5, and 7).

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	13	Low
Volatile Organic Chemicals	25	Medium

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 4, 6, and 8).

Table 4. Overall Vulnerability of North Face Lodge to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	30	Low
Nitrates and Nitrites	35	Low
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 North Face Lodge, the result is a maximum score on Chart 3 in Appendix D.

The sampling history for North Face Lodge spring 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 North Face Lodge spring 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 North Face Lodge. The overall vulnerability of this source to contamination is **Low** for bacteria and viruses, **Low** 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 North Face Lodge 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 North Face Lodge 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

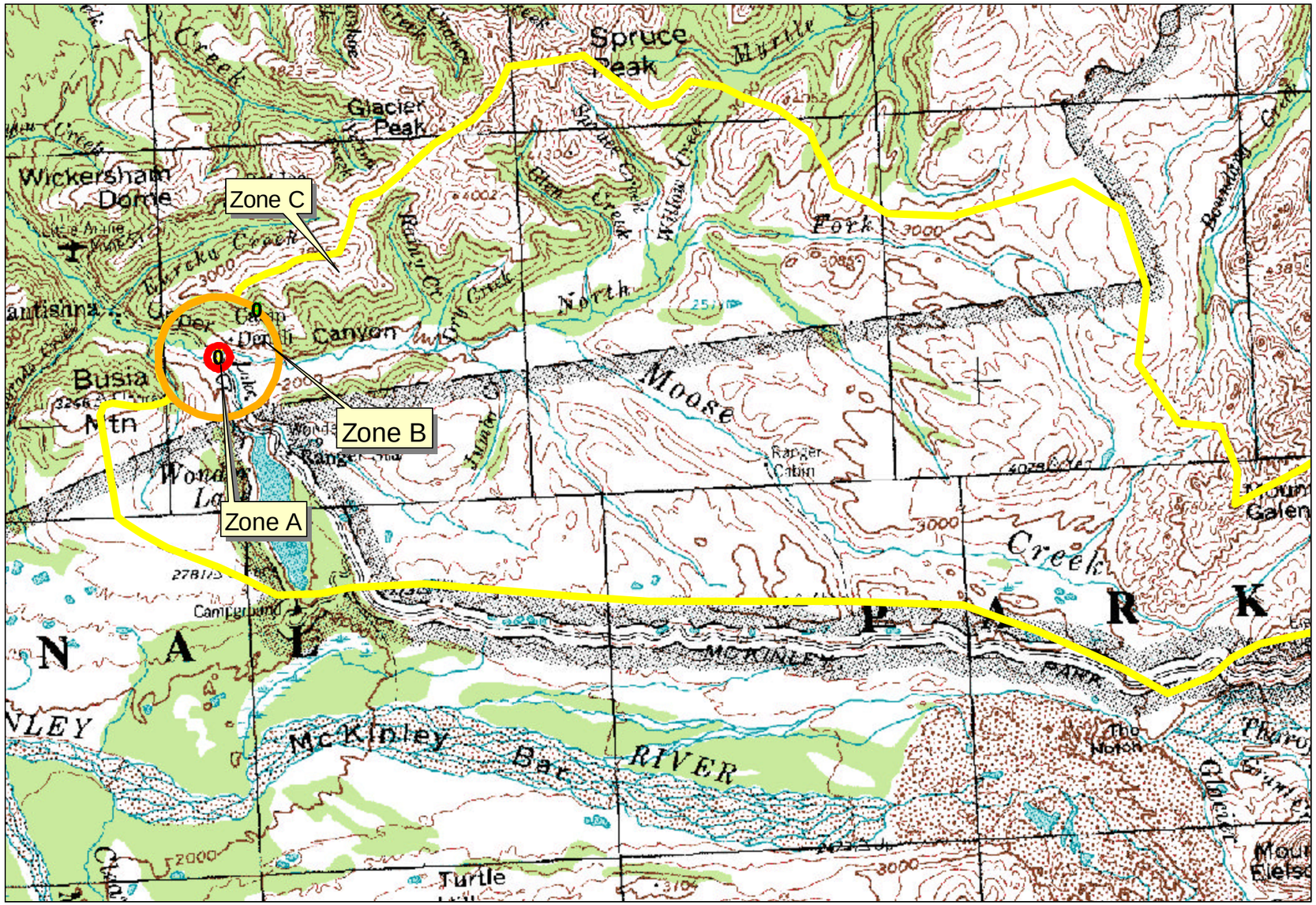
Gilbert, W.G., 1979, *A Geologic Guide to Mount McKinley National Park*, Alaska Natural History Association, Anchorage, Alaska.

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

North Face Lodge
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Area for North Face Lodge



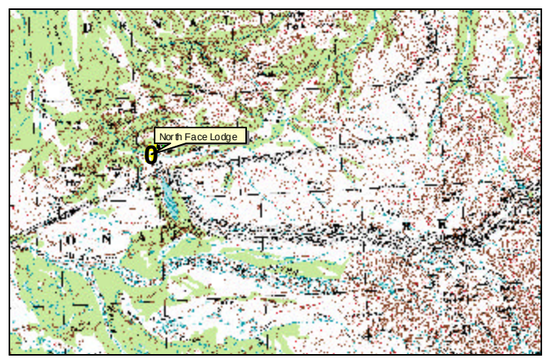
Water Sources
- North Face Lodge Spring
- Public Water Well

Zone A Protection Area
- 1000' Feet From Spring Intake

Zone B Protection Area
- 1 Mile From Spring Intake

Zone C Protection Area
- Entire Watershed(s)

N
W E
S



6 0 6 12 Miles

PWSID 390324.001

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for North Face Lodge (Tables 1-4)

Table 1

Contaminant Source Inventory for ***North Face Lodge***

PWSID 390324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-1	A		2	
Septic systems (serves one single-family home)	R02	R2-2	A		2	
Septic systems (serves one single-family home)	R02	R2-3	A		2	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	INFERRED FROM PAPER FILE	2	
Tanks, diesel (above ground)	T06	T6-1	A		2	
Tanks, diesel (above ground)	T06	T6-2	A	INFERRED FROM PAPER FILE	2	
Highways and roads, dirt/gravel	X24	X24-1	A	MCKINLEY PARK ROAD	2	

Table 2

Contaminant Source Inventory and Risk Ranking for North Face Lodge Sources of Bacteria and Viruses

PWSID 390324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-1	A	Low		2	
Septic systems (serves one single-family home)	R02	R2-2	A	Low		2	
Septic systems (serves one single-family home)	R02	R2-3	A	Low		2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	MCKINLEY PARK ROAD	2	

Table 3

Contaminant Source Inventory and Risk Ranking for North Face Lodge Sources of Nitrates/Nitrites

PWSID 390324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-1	A	Low		2	
Septic systems (serves one single-family home)	R02	R2-2	A	Low		2	
Septic systems (serves one single-family home)	R02	R2-3	A	Low		2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	MCKINLEY PARK ROAD	2	

Table 4

Contaminant Source Inventory and Risk Ranking for North Face Lodge
Sources of Volatile Organic Chemicals

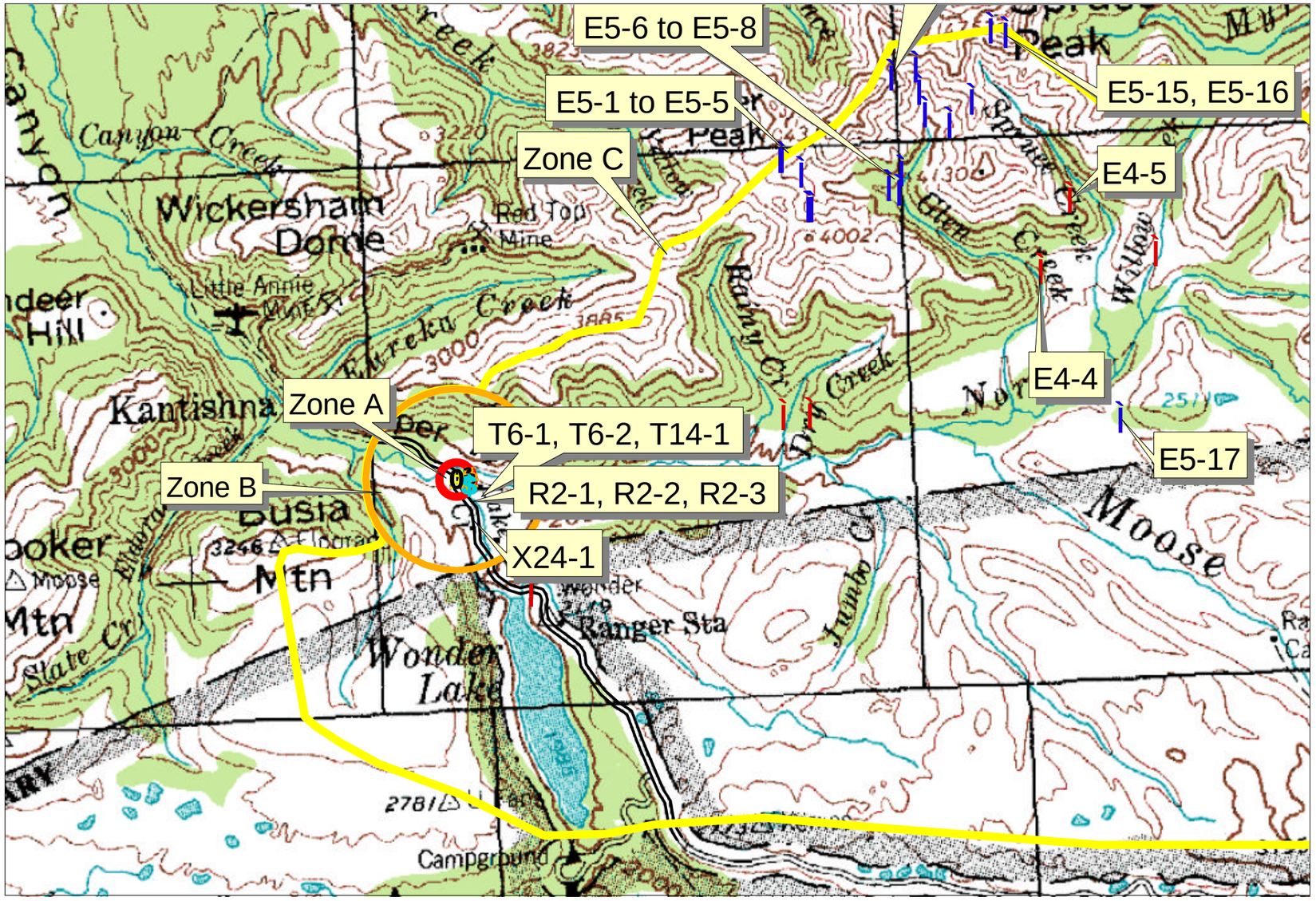
PWSID 390324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-1	A	Low		2	
Septic systems (serves one single-family home)	R02	R2-2	A	Low		2	
Septic systems (serves one single-family home)	R02	R2-3	A	Low		2	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	INFERRED FROM PAPER FILE	2	
Tanks, diesel (above ground)	T06	T6-1	A	Medium		2	
Tanks, diesel (above ground)	T06	T6-2	A	Medium	INFERRED FROM PAPER FILE	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	MCKINLEY PARK ROAD	2	

APPENDIX C

North Face Lodge
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Drinking Water Protection Area for North Face Lodge and Potential and Existing Sources of Contamination



Water Sources
- North Face Lodge Spring

Mines
- Placer-E4
- Underground-E5
- Septic systems-R2
- Fuel Oil Tanks (Above Ground)-T6

Zone A Protection Area
- 1000' Feet From Spring Intake

Zone B Protection Area
- 1 Mile From Spring Intake

Zone C Protection Area
- Entire Watershed(s)

Road-X24

N W E S

2 0 2 4 6 8 Miles

PWSID 390324.001

Map 2

APPENDIX D

Vulnerability Analysis for North Face Lodge Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the spring outlet/intake - North Face Lodge

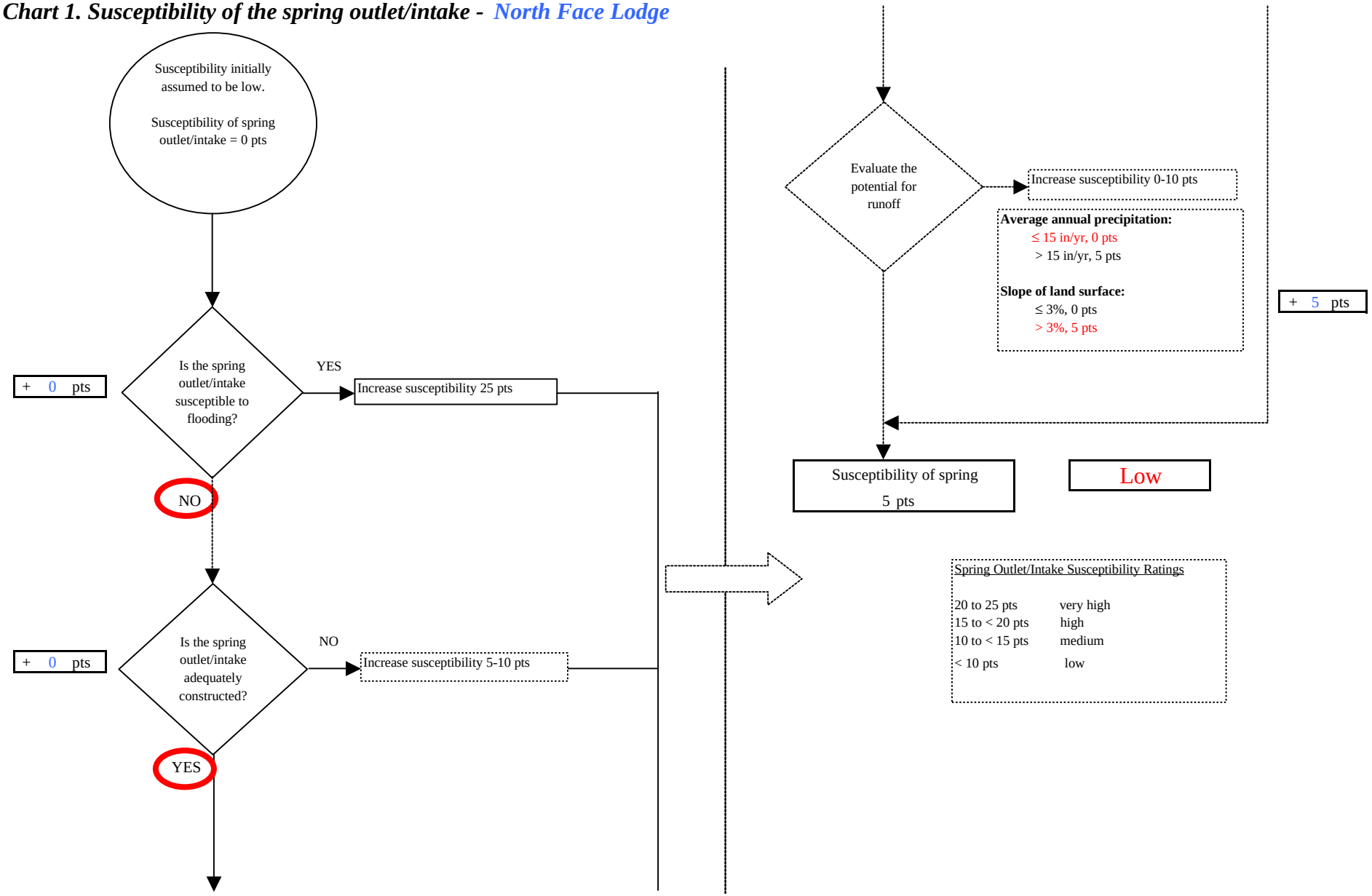


Chart 2. Susceptibility of the aquifer - North Face Lodge

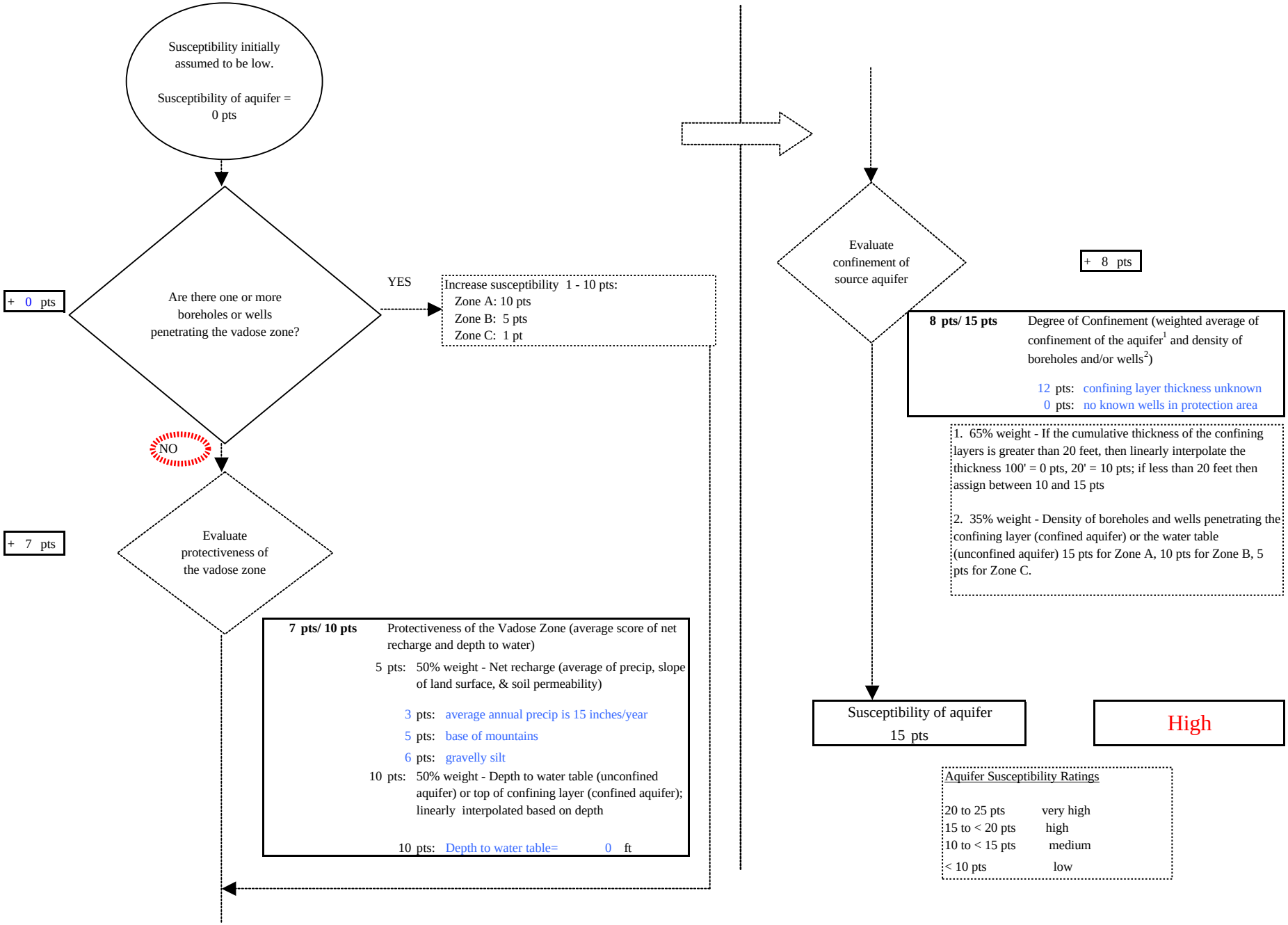
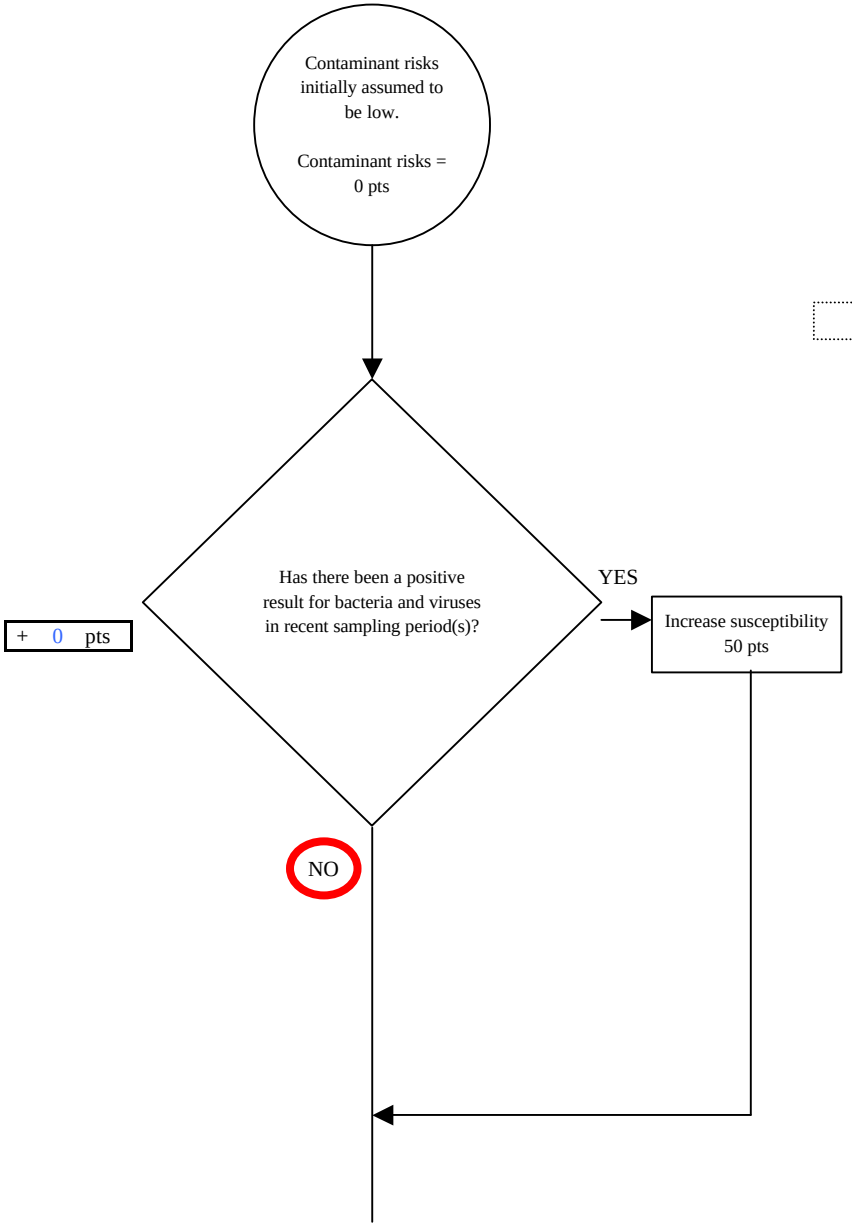
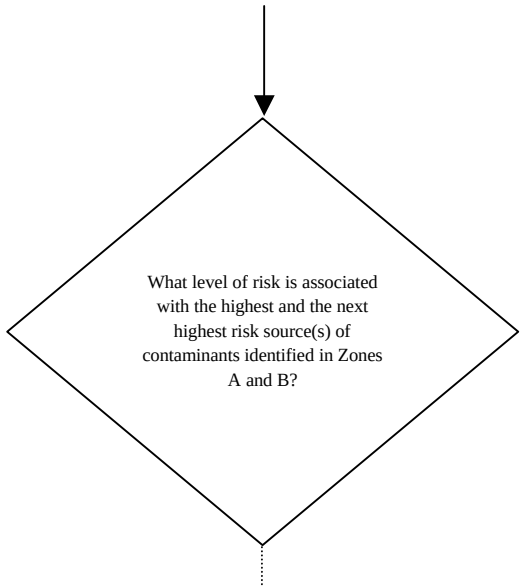


Chart 3. Contaminant risks for North Face Lodge - Bacteria & Viruses





+ 10 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	0
Low(s)	4	0	4

	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 10

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 North Face Lodge - Bacteria & Viruses

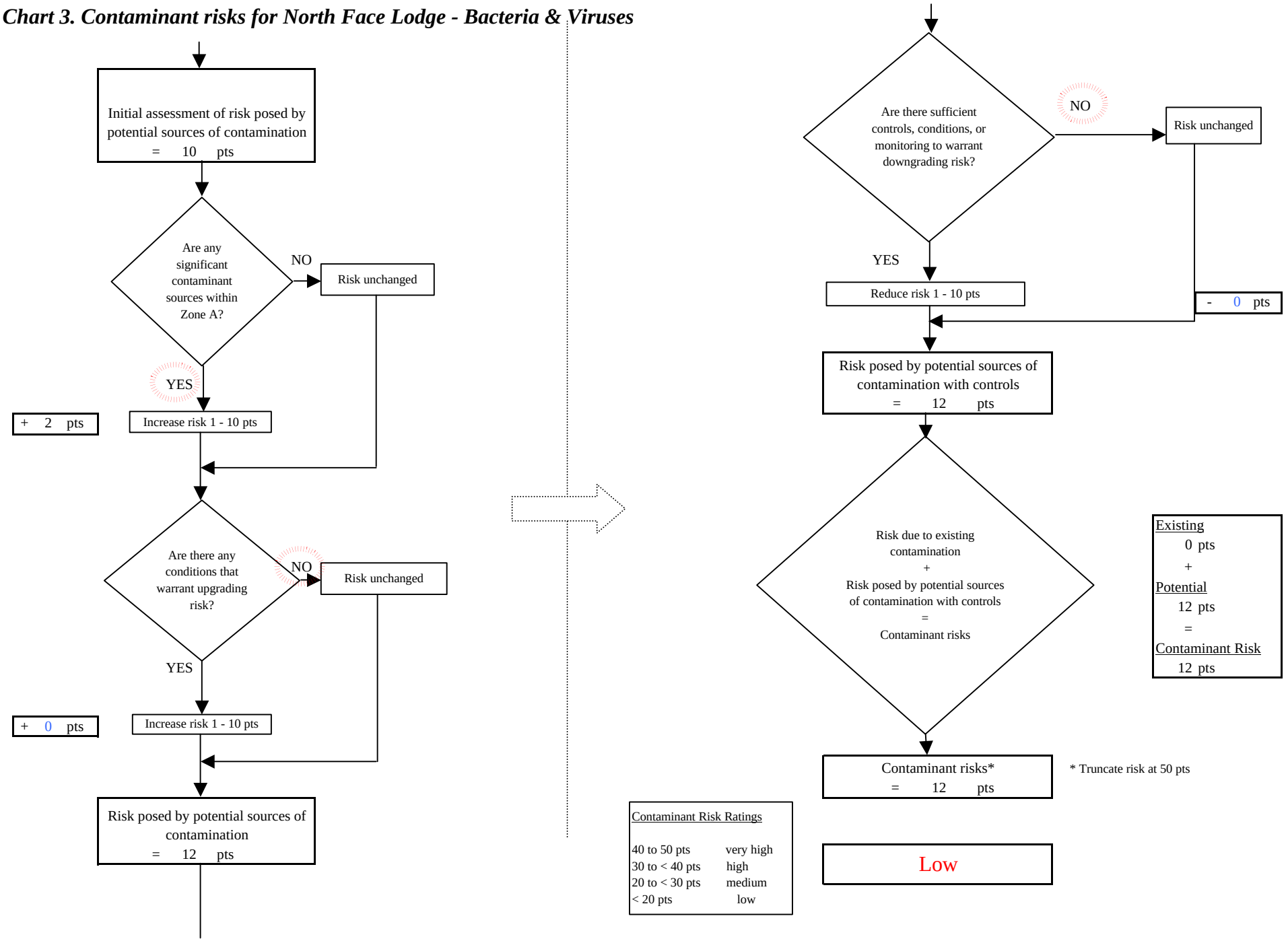


Chart 4. Vulnerability analysis for North Face Lodge - Bacteria & Viruses

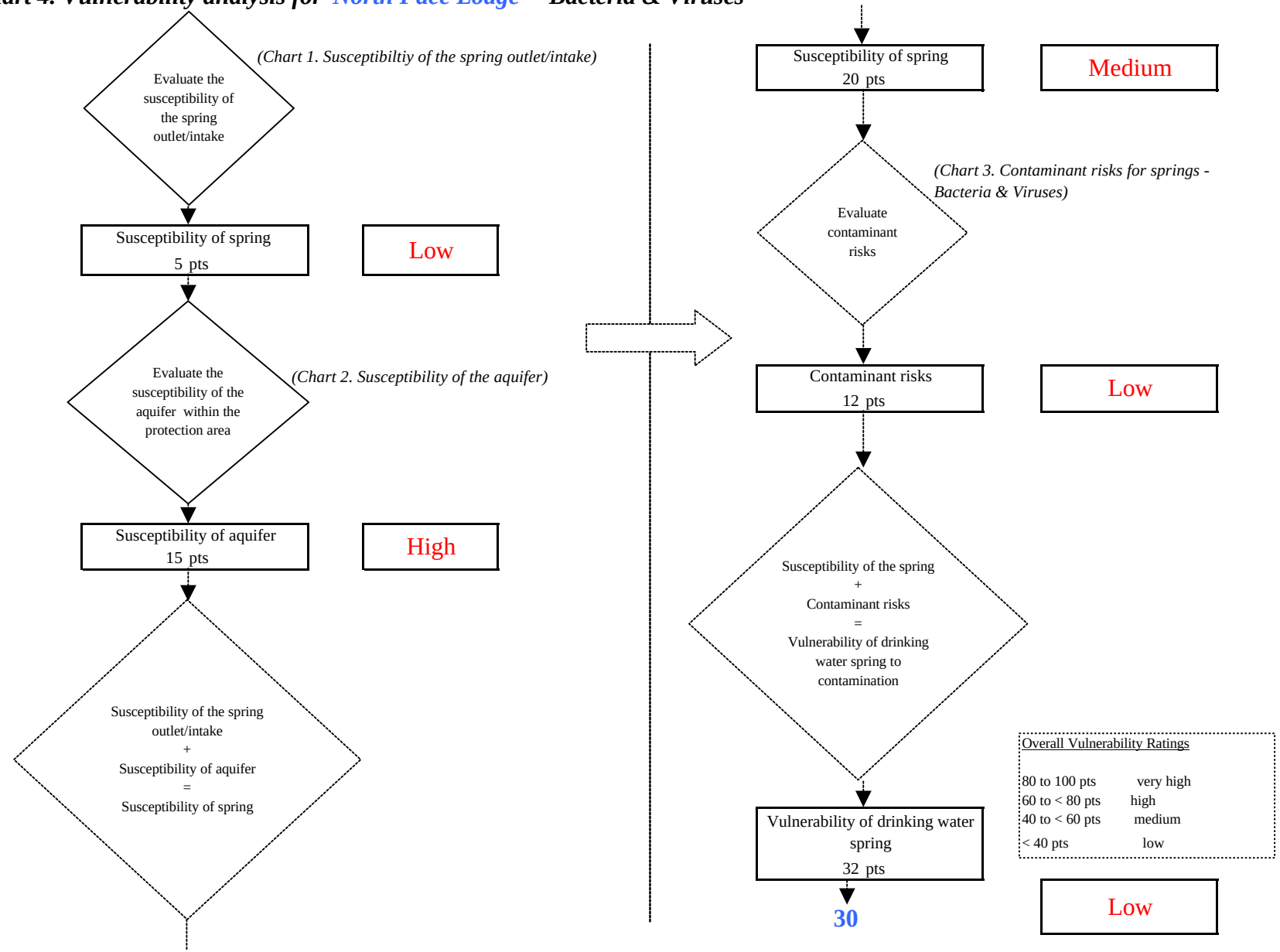


Chart 5. Contaminant risks for North Face Lodge - Nitrates and Nitrites

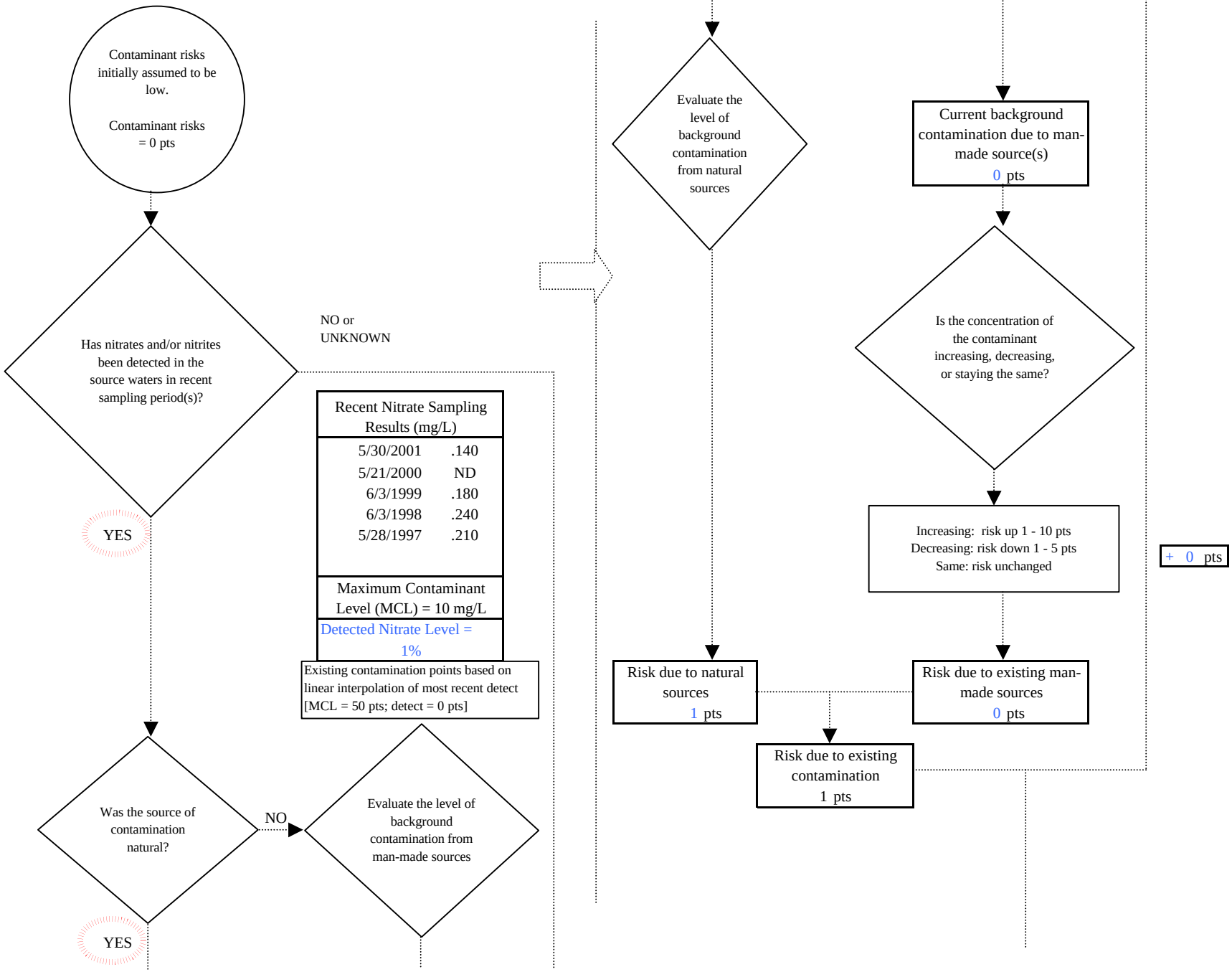


Chart 5. Contaminant risks for North Face Lodge - Nitrates and Nitrites

+ 10 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)

Initial assessment of risk posed by potential sources of contamination = 10 pts

Are any significant sources in Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 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	0
Low(s)	4	0	4

	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 10

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 5. Contaminant risks for North Face Lodge - Nitrates and Nitrites

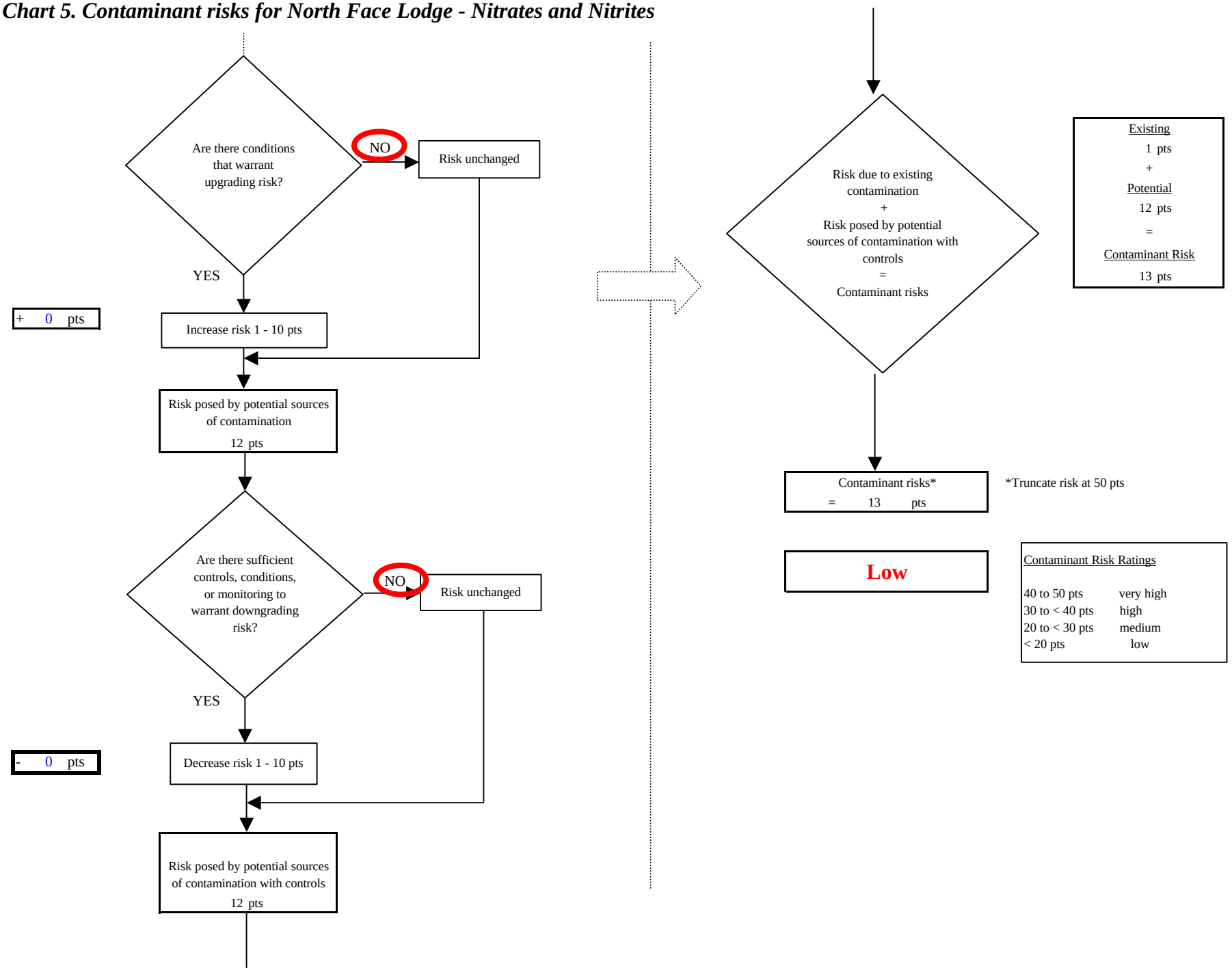


Chart 6. Vulnerability analysis for North Face Lodge - Nitrates and Nitrites

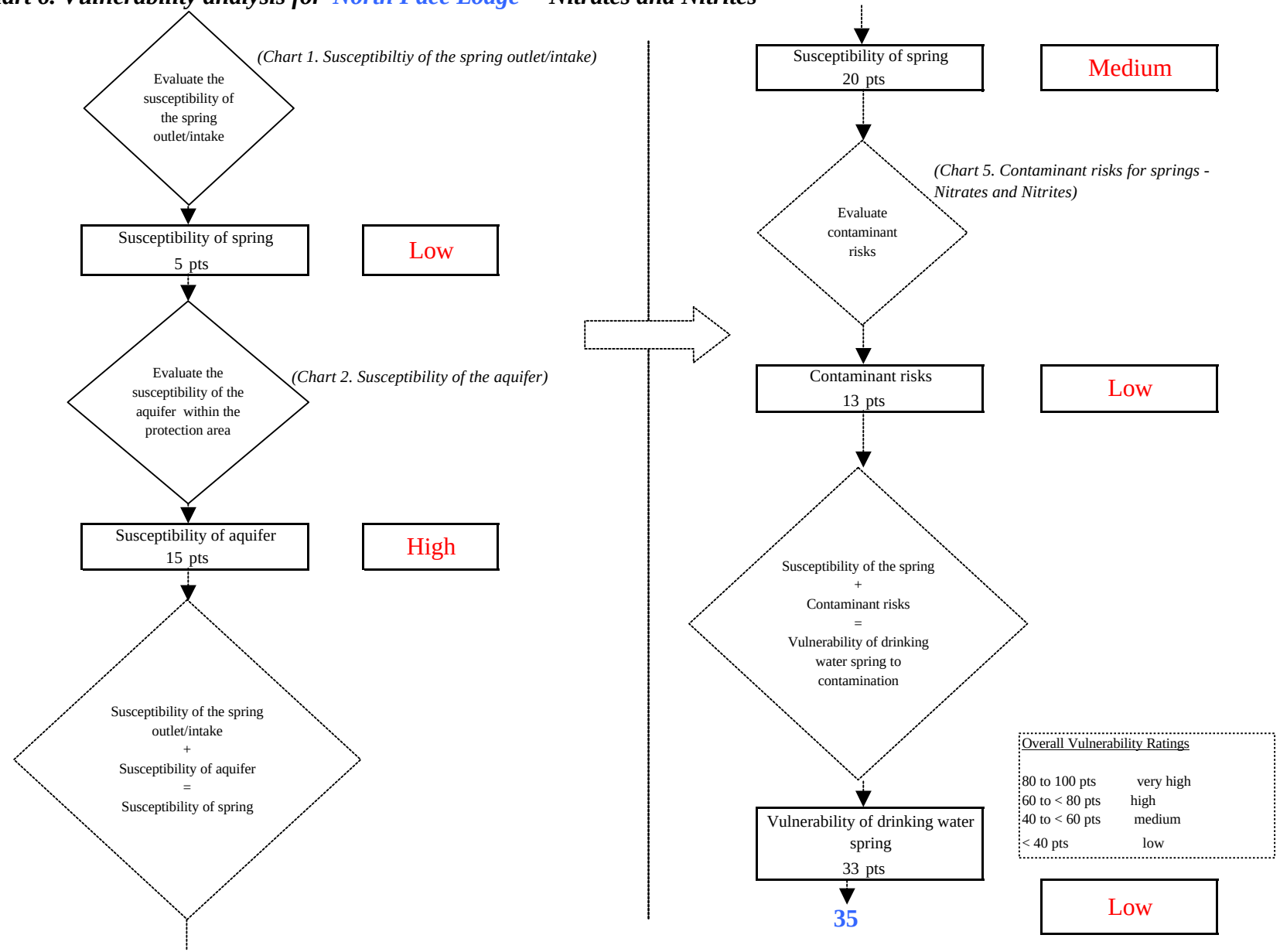


Chart 7. Contaminant risks for North Face Lodge - Volatile Organic Chemicals

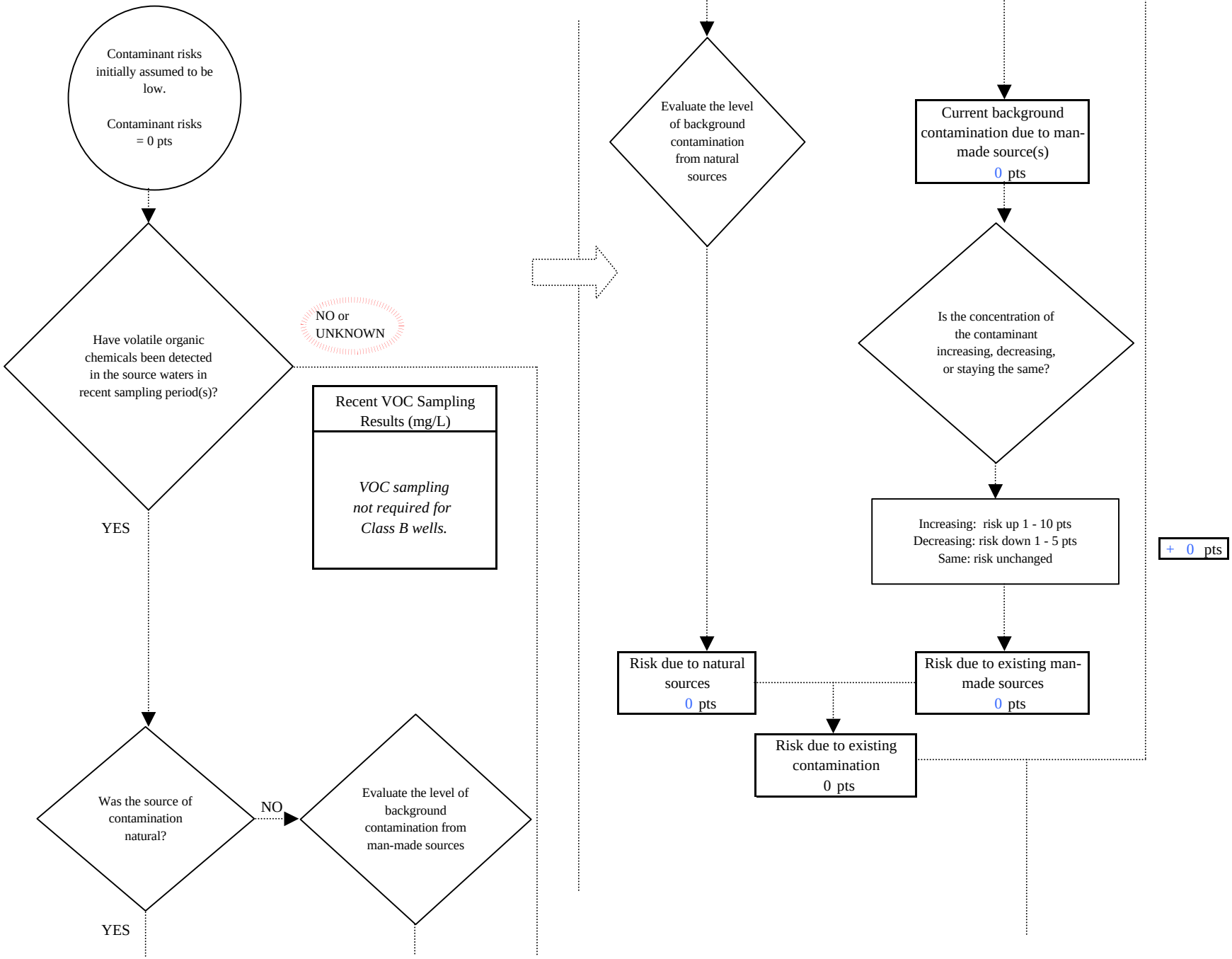
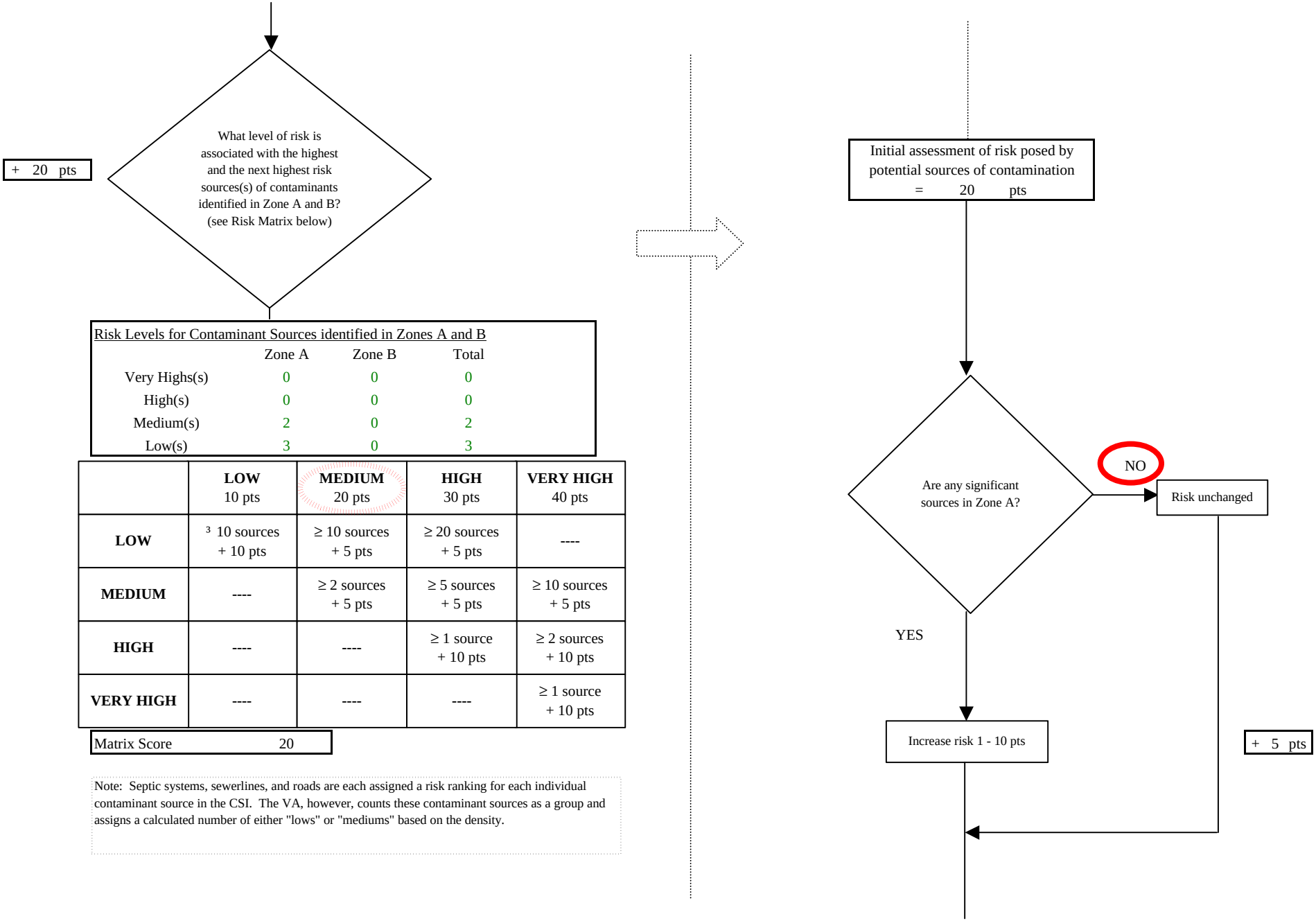


Chart 7. Contaminant risks for North Face Lodge - Volatile Organic Chemicals



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)	2	0	2
Low(s)	3	0	3

	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 20

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 7. Contaminant risks for North Face Lodge - Volatile Organic Chemicals

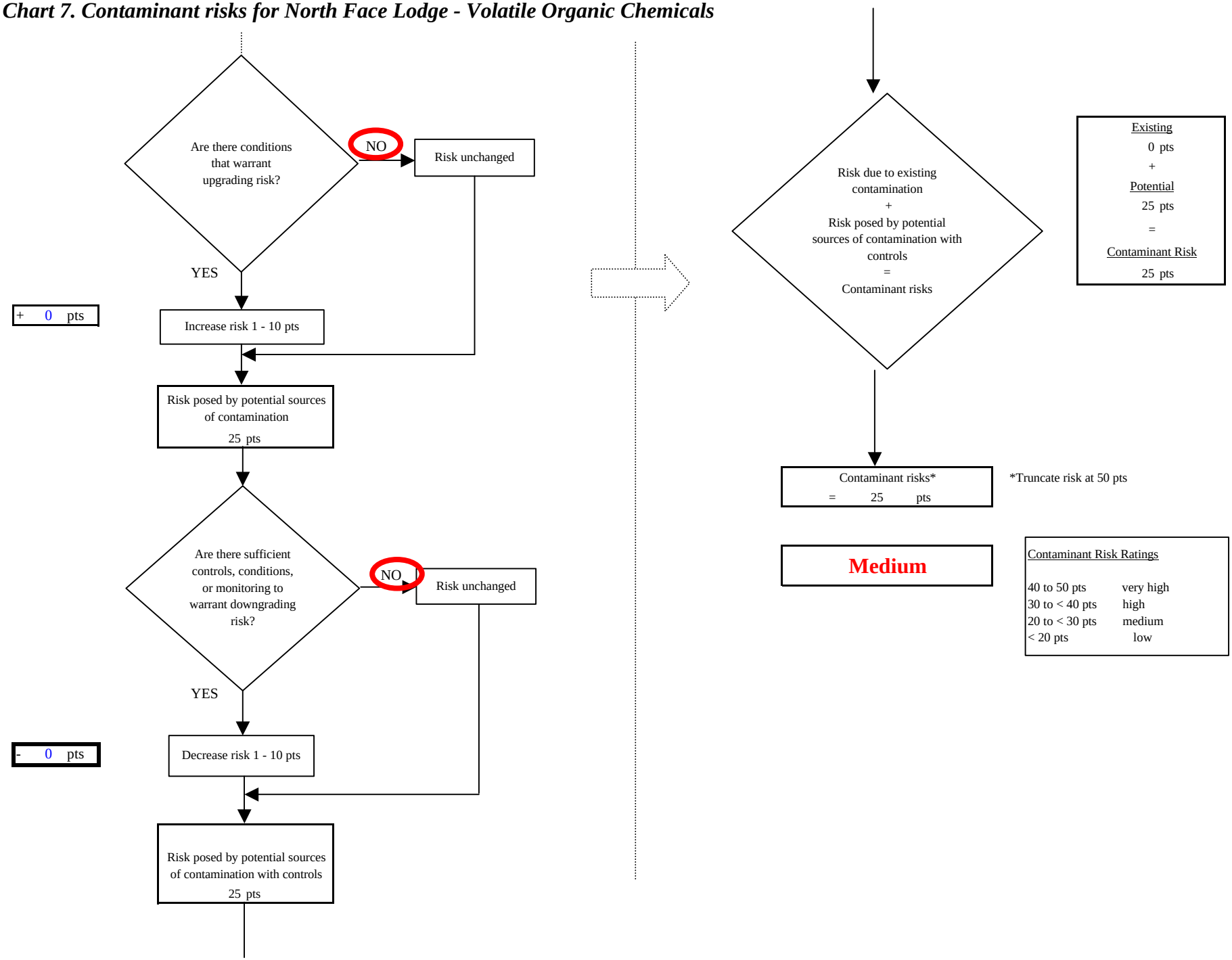


Chart 8. Vulnerability analysis for North Face Lodge - Volatile Organic Chemicals