Source Water Assessment for
Hatcher Pass Lodge
Hatcher Pass Area, Alaska

A Hydrogeologic Susceptibility and Vulnerability Assessment

DRINKING WATER PROTECTION PROGRAM REPORT 198
PWSID 226779

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Public Water System for Hatcher Pass Lodge is a Class B (transient/non-community) water system consisting of two wells north of Wasilla and Palmer, Alaska. Identified potential and current sources of contaminants for Hatcher Pass Lodge public drinking water source include: underground mines, a pit toilet, a closed leaking underground storage tank (LUST) site, an underground diesel storage tank, and a gravel road. 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 Hatcher Pass Lodge received a vulnerability rating of **Medium** for bacteria and viruses and nitrates and nitrites, and **Very High** for volatile organic chemicals.

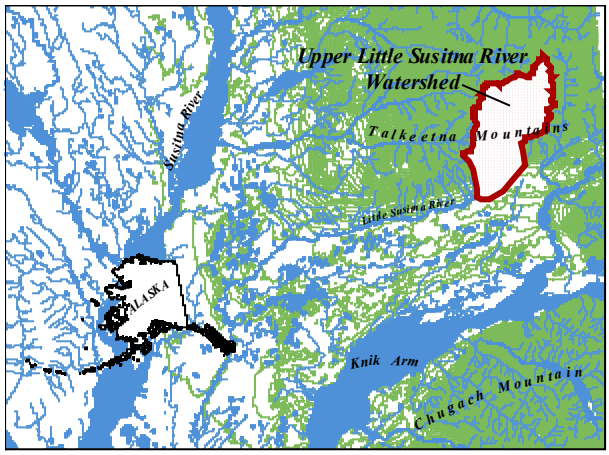

Figure 1. Index map showing Matanuska-Susitna Valley and the Upper Little Susitna River Watershed.

INTRODUCTION

The purpose of this environmental assessment is to provide public water system owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. This assessment was completed for the source of public drinking water serving Hatcher Pass Lodge. This water system consists of two wells north of Palmer and Wasilla, Alaska near the intersection of Willow-Fishhook Road and Gold Chord Road. This assessment, known under the Alaska Drinking Water Protection Program as the *Source Water Assessment*, has combined a review of the natural hydrogeologic sensitivity with potential and existing contaminant risks to arrive at an overall vulnerability of the drinking water source to contamination. This assessment has been completed as a basis for local voluntary protection efforts and to assist agencies in their efforts to reduce risk to this public drinking water supply.

DESCRIPTION OF THE UPPER LITTLE SUSITNA WATERSHED, ALASKA

Location

The Upper Little Susitna River watershed is located within the Matanuska-Susitna Borough in southcentral Alaska. The Borough encompasses a total of 24,694 square miles supporting a population of approximately 60,000. It is contained within the watersheds of the Matanuska and Susitna Rivers which flow from the glacier melt waters in the Alaska Range, Talkeetna Mountains, and the Chugach Mountains to tidewater in the Knik Arm of Upper Cook Inlet *(Jokela, Munter and Evans, 1991)*. This area between the Matanuska and Susitna Valleys is commonly referred to as the Mat-Su Valley. The Little Susitna River originates in the Talkeetna Mountains north of Palmer and Wasilla and flows into Cook Inlet between Knik Arm and the outlet for Susitna River (see Figure 1). The Upper Little Susitna River watershed extends from the headwaters of the Little Susitna River down through the foothills of the Talkeetna Mountains.

Climate

The climate in the Mat-Su Valley is considered transitional between the extreme temperature fluctuations of Interior Alaska and the wet conditions of the coastal areas.

The Upper Little Susitna River watershed is less than 15 miles from Knik Arm and less than 75 miles from Prince William Sound. Summer temperatures are more moderate than those in the Interior due to the proximity to the coast. The Chugach and Talkeetna Mountains and the Alaska Range also protect the area from the frigid cold of the Interior Alaska winter and act to break up strong storm fronts *(Brabets, 1997), (Western Regional Climate Center, 2000)*.

The Mat-Su Valley area averages about 18 inches of precipitation per year, including about 59 inches of snowfall. Winter thaws can decrease snow cover to a few inches. Mean monthly high temperatures range from about 22 degrees Farenheight in December and January to 69 degrees in July. The frost-free period in spring and summer averages 115 days, with the first frost usually arriving by September 1.

The record low for Wasilla was –50 degrees in January 1947. The highest recorded temperature was 90 degrees in 1969 *(Wickersham Alaska Corporation, 1986)*.

Physiography and Groundwater Conditions

Glacial forces during the end of the last ice age shaped the Mat-Su Valley. Several glacial advances and retreats left a complex system of hills, ridges, lakes, and lowlands that define the topography of today. Surface elevations in the Mat-Su Valley range from sea level where the Knik and Matanuska Rivers enter the Cook Inlet to well over 6,000 feet in the peaks that bound the area. Landforms in the area consist of undulating ridges of glacial till and flat benches of sand and gravel outwash *(Matanuska-Susitna Borough)*. The Upper Little Susitna River watershed lies in the foothills of the Talkeetna Mountains.

The regional geology and ground water conditions of the Mat-Su Valley vary greatly by location. Glacial advances and retreats also formed a fluctuating subsurface system of unconsolidated layers comprised of fine- to coarse-grained particles (clay to boulders) and consolidated confining layers. The majority of wells in the Mat-Su Valley are located in unconsolidated layers consisting of relatively well-sorted sands and gravels. These unconsolidated layers vary substantially in size and distribution throughout the Valley. In general, the unconsolidated layers increase in thickness moving towards Cook Inlet *(Jokela, Munter and Evans, 1991)*. The numerous confining layers in the area, ranging in thickness from

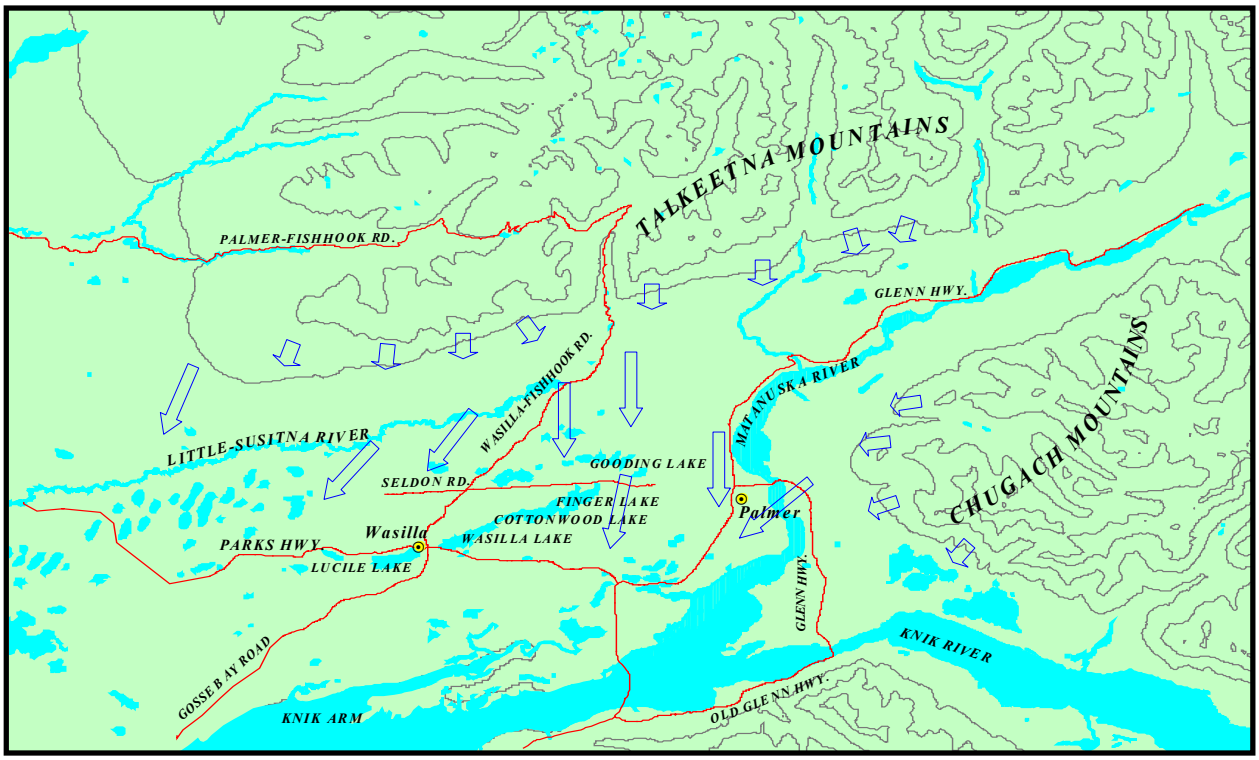

Figure 2. Map showing groundwater flow in the Matanuska-Susitna Valley (Jokela, Munter and Evans, 1991).

less than 1 foot to 60 feet, divide the unconsolidated layers.

Groundwater flow in the deeper confined aquifers of the Mat-Su Valley is generally north to south in the central region of the valley flowing toward the Matanuska River and gradually becoming more northeast to southwest in the western region. The direction of groundwater flow in the upper unconfined aquifers are more variable due to the influence from surficial topography as well as its close connection with surface water bodies *(Jokela, Munter and Evans, 1991)* (Figure 2). The groundwater flow direction of the Upper Little Susitna River watershed was generally found to be north to south in both the unconfined and confined aquifers.

In the Mat-Su Valley, groundwater is primarily recharged by snowmelt and precipitation infiltrating both directly and also from the infiltration into the foothill slopes of the Talkeetna and Chugach Mountains.

HATCHER PASS LODGE PUBLIC DRINKING WATER SYSTEM

Hatcher Pass Lodge public water system is a Class B (transient/non-community) water system. The system consists of two wells near the intersection of Willow-Fishhook Road and Gold Chord Road (T20N, R1E, Section 33). This area is at an elevation of approximately 10,000 feet above sea level.

According to a letter describing the water system upgrade dated July 30, 1999, well number 2 is being used as the primary well. Well number 1 is connected to the system for possible future use but is not currently being pumped. The well log completed for well number 1 indicates installation occurred on September 20, 1992 to a total depth of approximately 84 feet below ground surface and was completed in 6-inch well casing. A well log for well number 2 is unavailable. The most recent Sanitary Survey (9/17/91, assumed to have been completed for well #1) indicates the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The land surface is not adequately sloped away from the well. Sloping of the land surface provides drainage preventing surface water and contaminants from accumulating at the well. The well log for well number 2 indicates the well was grouted according to ADEC regulations. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters.

This system operates primarily in the summer and serves between 25 to 200 non-residents through one service connection.

ASSESSMENT AND PROTECTION AREA FOR HATCHER PASS LODGE DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for Hatcher Pass Lodge source of drinking water is the area that is most sensitive to contamination. This area has served as a basis for assessing the risk of the drinking water source to contamination. The zones around the drinking water source outline the most critical area for the preservation of the quality of the drinking water for this system. For simplicity, this area will be known as your Drinking Water Protection Area and will serve as the focus for voluntary protection efforts.

Conceptually, groundwater enters the aquifer systems through infiltration of direct precipitation within the area and also from the infiltration into the foothill slopes of the Talkeetna Mountains. An analytical calculation was used to determine the size and shape of the area that contributes water to the well. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*). This analytical calculation was used as a guide as the first step in establishing the protection area for each public drinking water source. Additional methods were further employed to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at meaningful and conservative protection areas with respect to public health (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The Drinking Water Protection Areas established for wells by the Alaska Department of Environmental Conservation are separated into zones. These zones correspond to a time-of-travel. Time-of-travel is the time required for water to move in the saturated zone of the ground from a specific point to the well. The Drinking Water Protection Area for Hatcher Pass Lodge contains one zone labeled Zone A (See Map 1 in Appendix A). Zone A encompasses the entire immediate watershed and corresponds to the area between the well and the distance equal to ¼ of the distance of the 2-year time-of-travel. Depending on where a contaminant source is located within Zone A, travel time for a contaminant to the wells may be several hours to several days. Zone A also extends downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the wells.

The Drinking Water Protection Areas established for wells normally include four zones, A, B, C and D corresponding to ¼ of the distance of the 2-year time-of-travel, the 2-year time-of travel, the 5-year time-of-travel, and the 10-year time-of-travel. The protection area for Hatcher Pass Lodge is limited by the extent of its immediate watershed and therefore includes only Zone 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 Drinking Water Protection Area for Hatcher Pass Lodge. This survey was completed through a search of agency records and other publicly available information. Potential sources of contamination to drinking water supplies cover 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 this assessment and 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

Map 2 in Appendix C depicts the Contaminant Source Inventory for Hatcher Pass Lodge. Table 1 in Appendix B lists the inventoried potential sources of contamination within Zones A through B. Below is a summary of the contaminant sources inventoried within the Drinking Water Protection Area for Hatcher Pass Lodge:

- Underground mines;
- a leaking underground storage tank (LUST) site;
- an underground diesel storage tank;
- a pit toilet; and
- a gravel road.

These potential and existing contaminant sources present risk for all three categories of drinking water contaminants for Hatcher Pass Lodge source of public drinking water.

RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been identified, 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. Contaminant risks are further a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the public drinking water wells.

VULNERABILITY OF HATCHER PASS 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 have been analyzed and an overall vulnerability score of 0 to 100 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 is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
+
Susceptibility of the Aquifer (0 – 25 Points)

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

The well serving Hatcher Pass Lodge was completed in an unconfined aquifer. The depth to the water table is very near the land surface. The saturated thickness of the aquifer in which the well is screened in is approximately 60 feet and composed of silty gravel, cobbles and boulders. The absence of a confining layer allows contaminants that enter the subsurface within the vicinity of the well and Drinking Water Protection Area to migrate to the screened portion of the well uninhibited.

Combining the susceptibility of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility of the well to contamination (See Appendix D). Table 1 lists the overall Susceptibility score and rating for the sources of public drinking water serving Hatcher Pass Lodge.

Table 1. Natural Susceptibility - Susceptibility of the Wellheads and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellheads	15	High
Susceptibility of the Aquifer	24	Very High
Natural Susceptibility	39	High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (See Appendix B - Table 1 – Table 4). This portion of the analysis examines recent existing or historical contamination that has been detected at the drinking water sources through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the either well. Table 2 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 2. Contaminant Risks of Hatcher Pass Lodge Public Drinking Water Source to Contamination by Category

Contaminant Risks	Score	Rating
Bacteria and Viruses	11	Low
Nitrates and/or Nitrites	12	Low
Volatile Organic Chemicals	45	Very High

Appendix D contains eight charts, which together form the 'Vulnerability Analysis' for a Class B public drinking water system. 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 Analysis for nitrates and nitrites and volatile organic chemicals.

Vulnerability of drinking water sources to contamination is the combination of susceptibility of the aquifer and the well with contaminant risks. Table 3 contains the overall vulnerability scores (0 – 100) and ratings for each of the three categories of drinking water contaminants (See Appendix D). Note: scores are rounded off to the nearest five.

Table 3. Overall Vulnerability of Hatcher Pass Lodge Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	50	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	85	Very High

Tables 2 through 5 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.

The pit toilet and gravel road create a risk increase for the bacteria and viruses, and nitrates and nitrites contaminant categories

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 Hatcher Pass Lodge.

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].

Sampling history for Hatcher Pass Lodge well indicates that very low concentrations of nitrate have been detected (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing nitrate concentration is approximately 0.2 mg/L or 2% 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 very safe levels with respect to human health.

The risk for volatile organic chemicals is driven by the underground diesel storage tank and the eight hardrock underground mines located in the protection area. Underground mines also pose a large risk to the water source for heavy metals contamination. Water flowing over and through the metal-rich rock exposed by mining activities can contaminate the surface and ground waters. This occurrence is called acid mine drainage, and is often generated from waste rock piles or other mining wastes. Acid mine drainage can occur at an active or inactive mine and continue long after mining ends.

The closed LUST site (RecKey 1989220100401) found in the protection area is located at the Independence Mine Historical Site. In 1979, approximately 200-300 gallons of diesel were spilled onto the ground. An additional 200-300 gallons of fuel were spilled on January 7, 1989. Monitoring and cleanup of the site began on January 13, 1989. It was determined that no further cleanup nor monitoring was needed on November 17, 1995 and the site was closed.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Hatcher Pass Lodge. The overall vulnerability of this source to contamination is **Medium** for bacteria and viruses, and nitrates and nitrites, and **Very High** 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 Hatcher Pass 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 Hatcher Pass Lodge public drinking water source.

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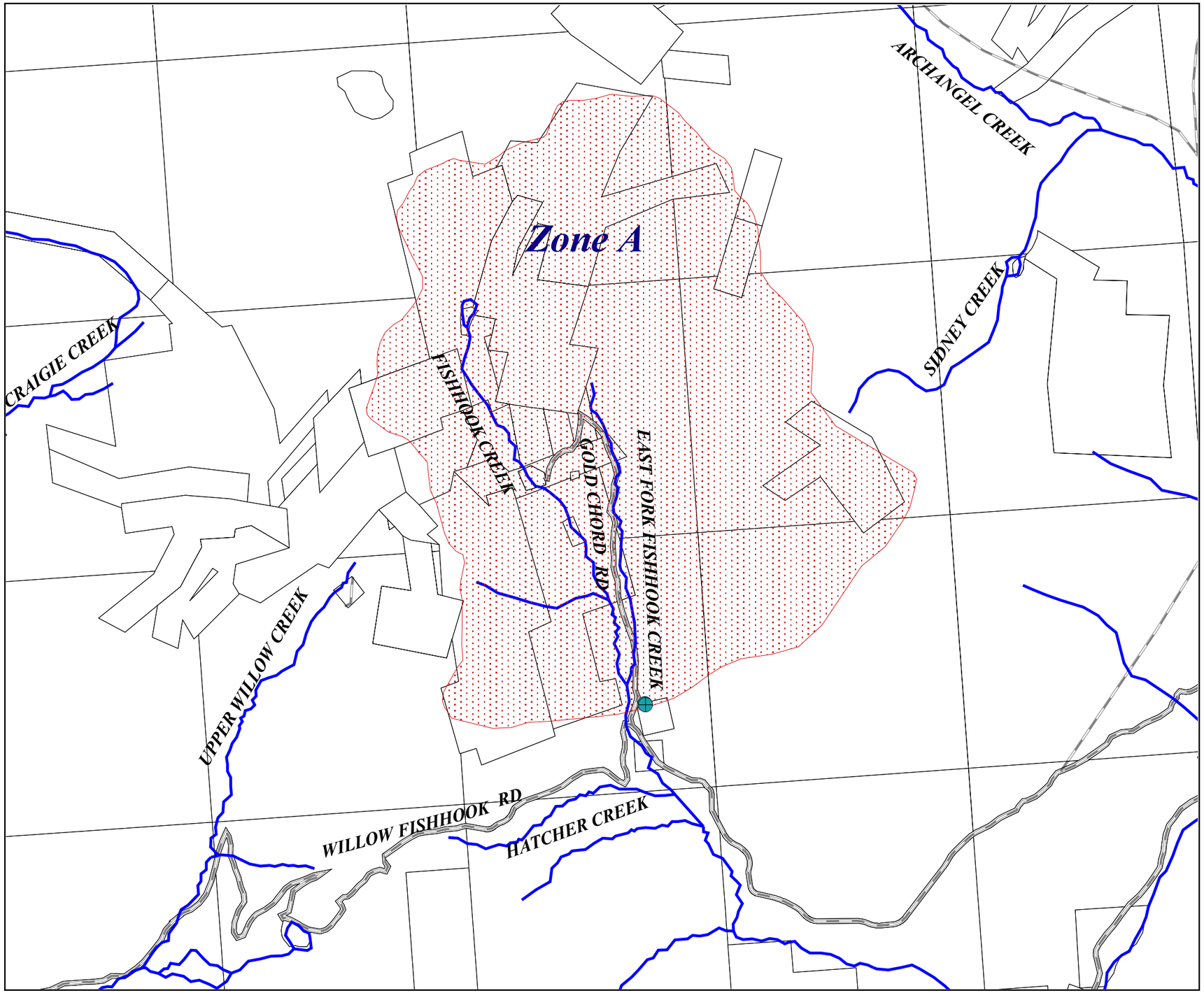
APPENDIX A

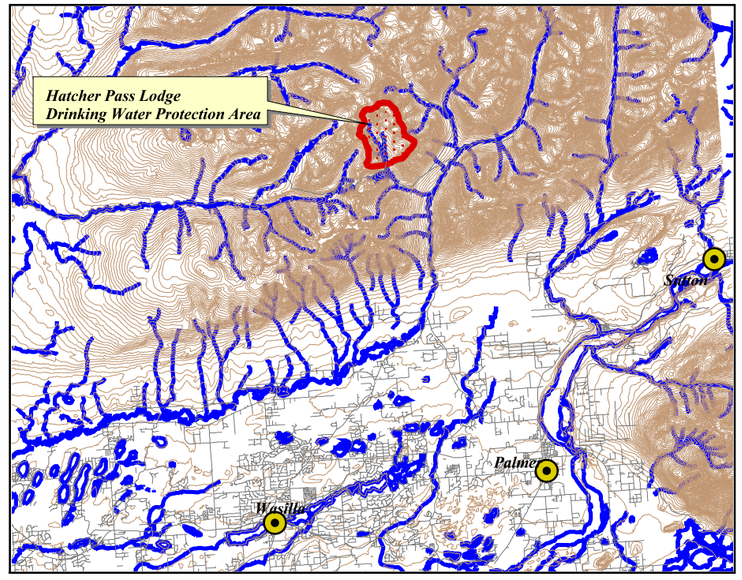
Hatcher Pass Lodge
Drinking Water Protection Area

Hatcher Pass Lodge Drinking Water Protection Area



Legend

- Hatcher Pass Public Water System Wells
- Zone A Protection Area
- Several Months Travel Time
- Rivers and Streams
- Parcels
- Roads



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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Hatcher Pass Lodge

Table 1

Contaminant Source Inventory for

Hatcher Pass Lodge

PWSID 226779.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-1	A	Gold Chord Rd	2	
Metals mining, underground (active or inactive?)	E05	E05-1	A	Eldorado Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-2	A	Martin Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-3	A	unnamed	2	
Metals mining, underground (active or inactive?)	E05	E05-4	A	Independence Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-5	A	Rae Wallace Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-6	A	Gold Chord Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-7	A	Gold Chord Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-8	A	High Grade Mine	2	
Tanks, diesel (underground)	T08	T08-1	A	Gold Chord Rd	2	
Closed Leaking Underground Fuel Storage Tank (LUST) (lubicants or other petroleum products)	U08	U08-1	A	Gold Chord Rd	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Gold Chord Rd	2	

Table 2

Contaminant Source Inventory and Risk Ranking for Hatcher Pass Lodge Sources of Bacteria and Viruses

PWSID 226779.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-1	A	Low	1	Gold Chord Rd	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Gold Chord Rd	2	

Table 3

Contaminant Source Inventory and Risk Ranking for Hatcher Pass Lodge Sources of Nitrates/Nitrites

PWSID 226779.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-1	A	Low	1	Gold Chord Rd	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Gold Chord Rd	2	

Table 4

Contaminant Source Inventory and Risk Ranking for Hatcher Pass Lodge
Sources of Volatile Organic Chemicals

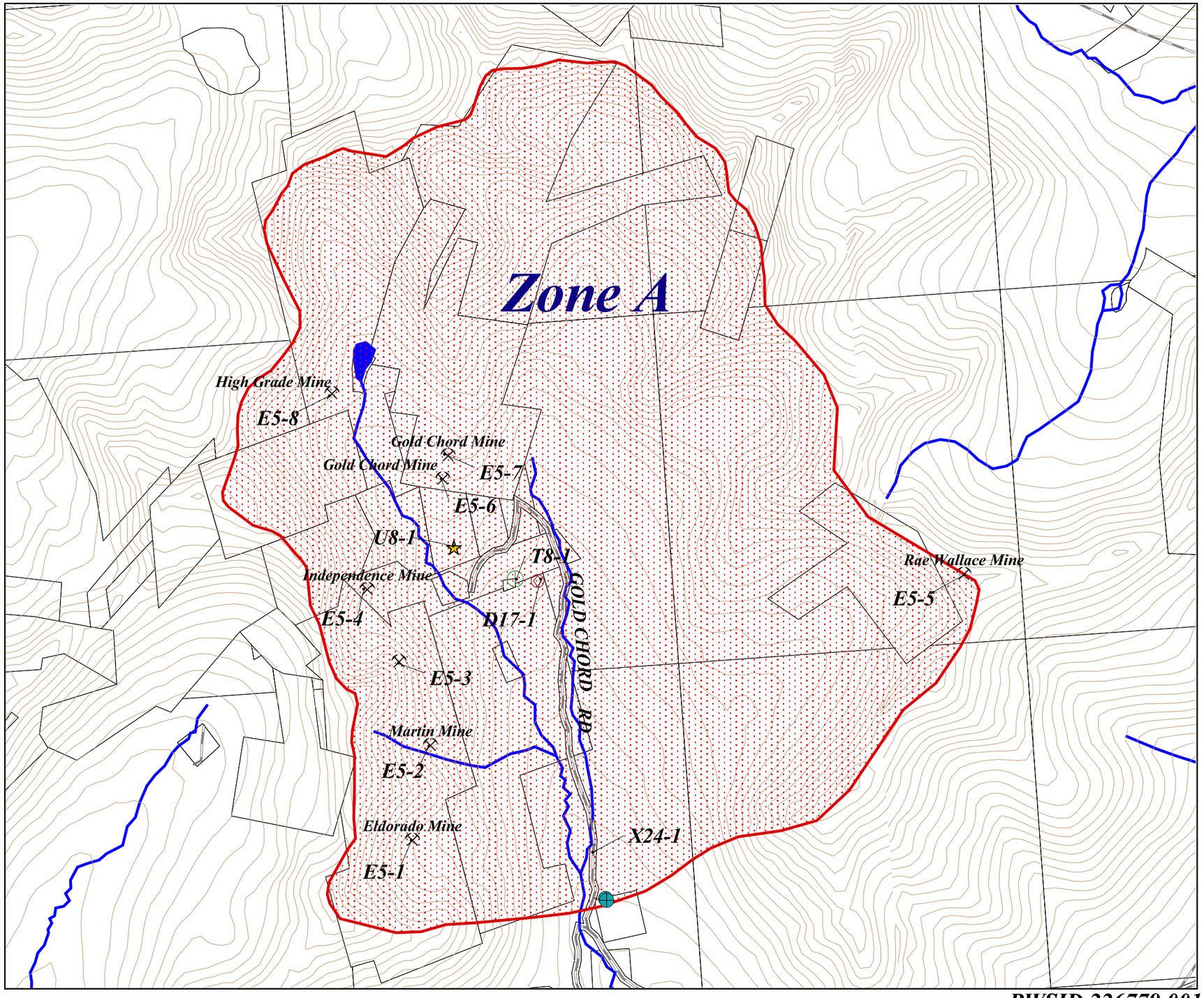
PWSID 226779.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Tanks, diesel (underground)	T08	T08-1	A	High	1	Gold Chord Rd	2	
Metals mining, underground (active or inactive?)	E05	E05-1	A	Medium	2	Eldorado Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-2	A	Medium	3	Martin Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-3	A	Medium	4	unnamed	2	
Metals mining, underground (active or inactive?)	E05	E05-4	A	Medium	5	Independence Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-5	A	Medium	6	Rae Wallace Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-6	A	Medium	7	Gold Chord Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-7	A	Medium	8	Gold Chord Mine	2	
Metals mining, underground (active or inactive?)	E05	E05-8	A	Medium	9	High Grade Mine	2	
Closed Leaking Underground Fuel Storage Tank (LUST) (lubicants or other petroleum products)	U08	U08-1	A	Low	10	Gold Chord Rd	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low		Gold Chord Rd	2	

APPENDIX C

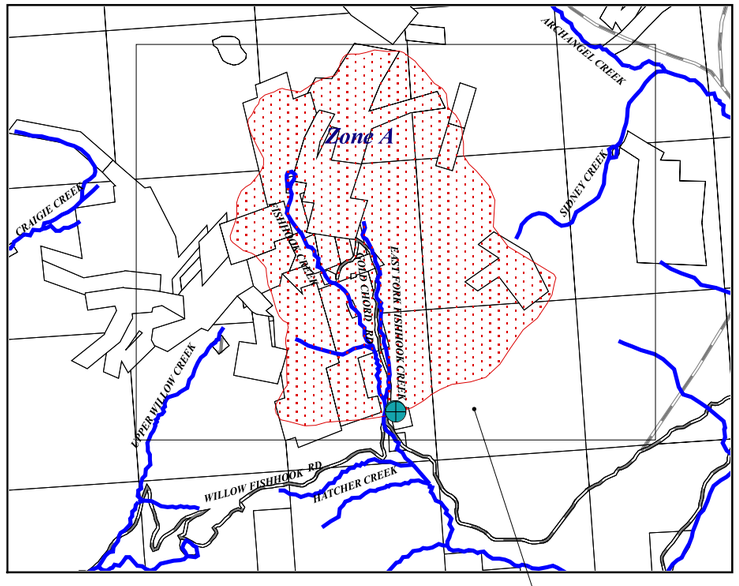
Hatcher Pass Lodge
Drinking Water Protection Area
and Potential and Existing Contaminant Sources

Hatcher Pass Drinking Water Protection Area with Potential and Existing Contaminant Sources



Legend

- Hatcher Pass Public Water System Wells
- Zone A Protection Area
- Several Months Travel Time
- Contaminant Source Inventory
- Vaulted Pit Toilet (D17)
- Underground Diesel Tank (T8)
- Closed Leaking Underground Fuel Storage Tank (LUST) (U8)
- Underground Mines (E5)
- Roads (X24)
- Elevation Contours
- Rivers and Streams
- Lakes
- Parcels



area of map

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Map 2

APPENDIX D

Vulnerability Analysis for Hatcher Pass Lodge Public Drinking Water Source

Chart 1. Susceptibility of the wellhead - Hatcher Pass Lodge

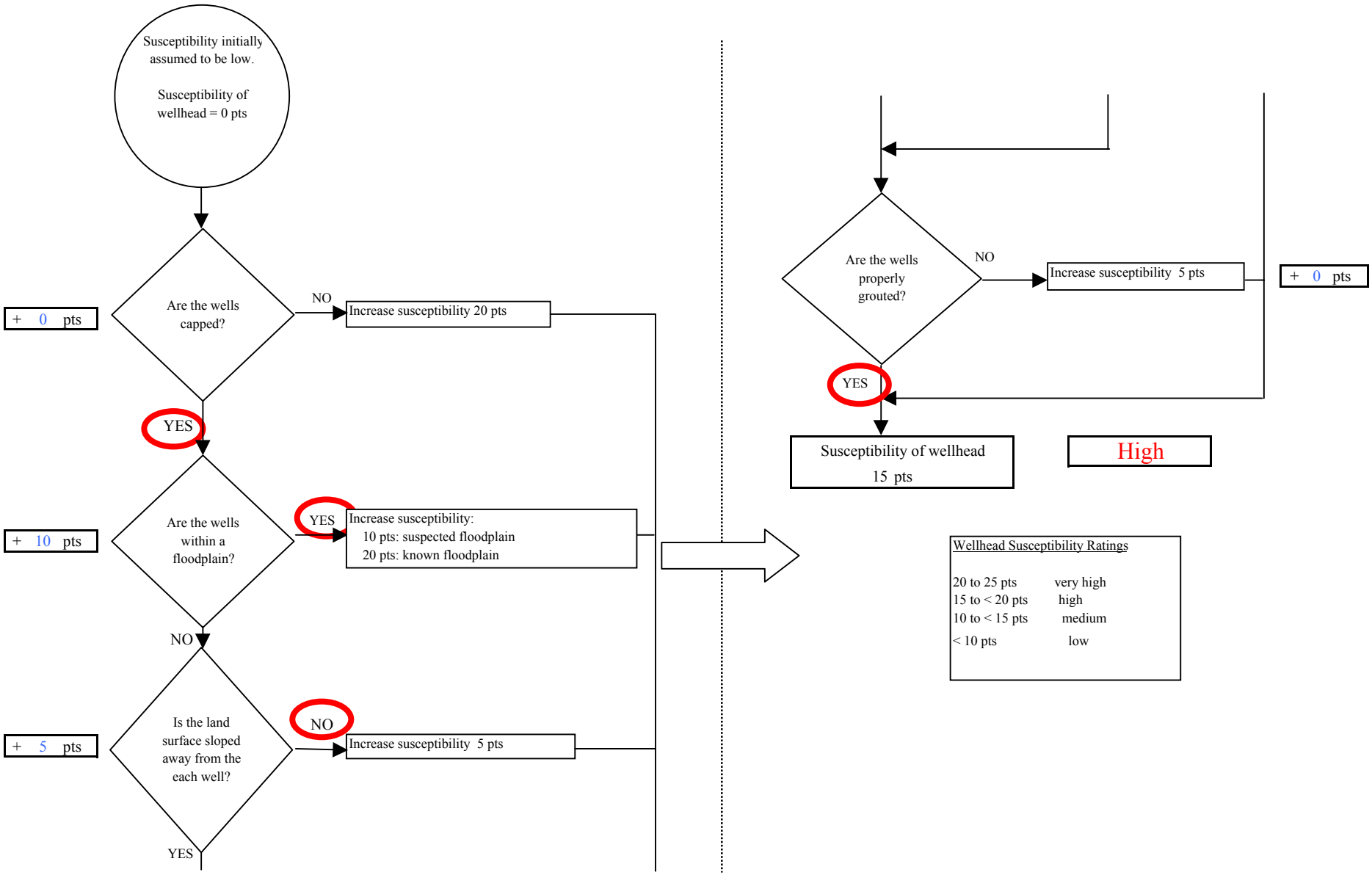


Chart 2. Susceptibility of the aquifer - Hatcher Pass Lodge

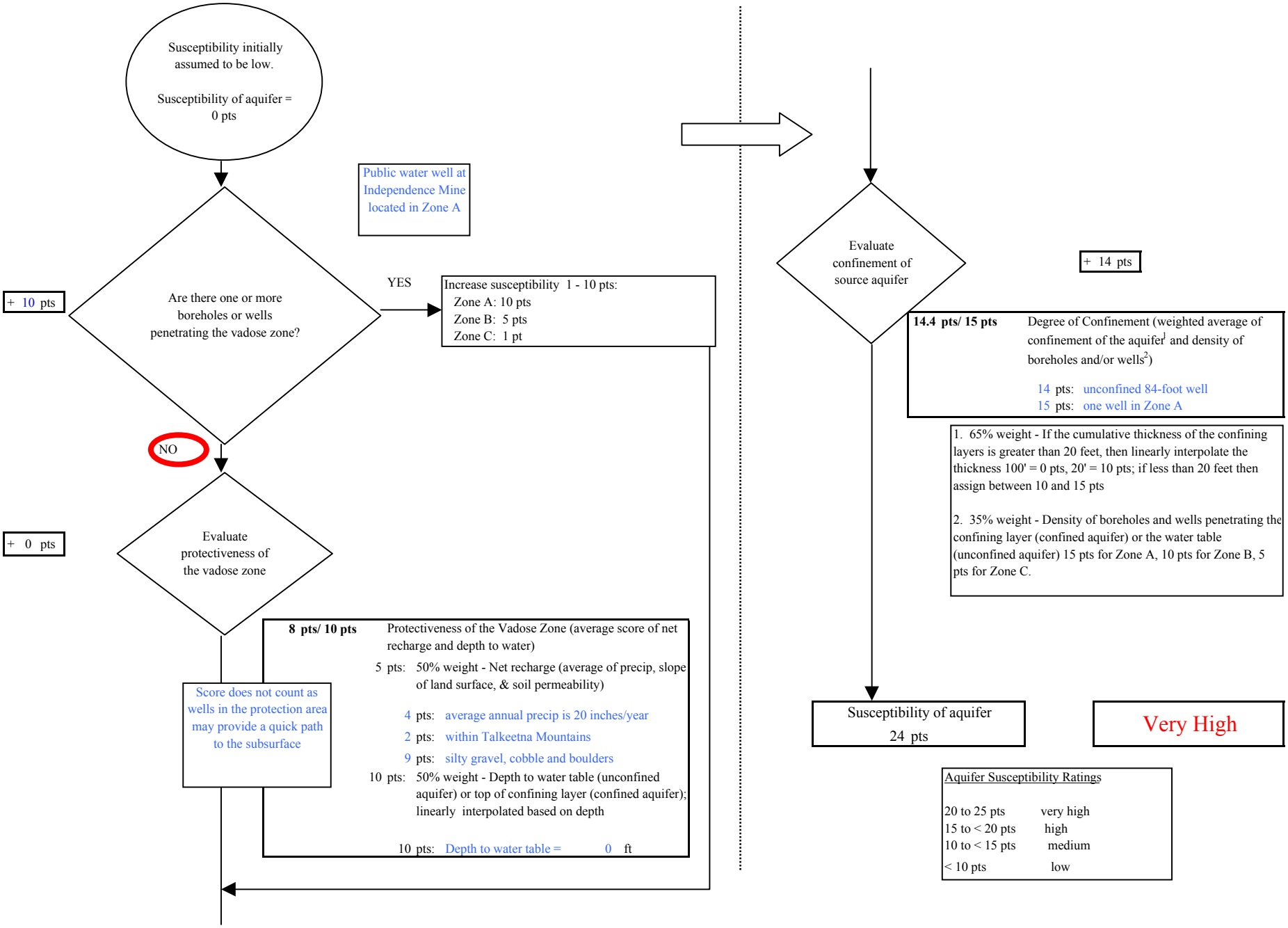
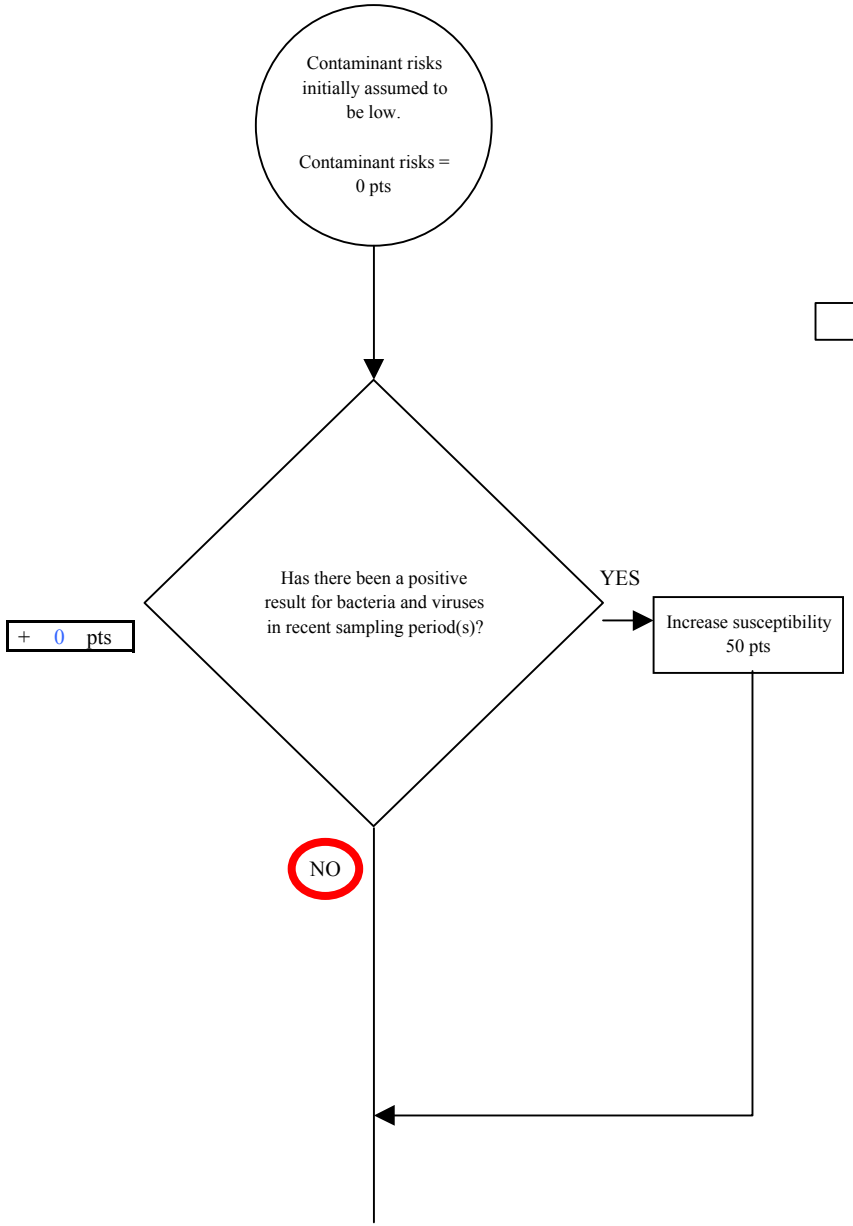
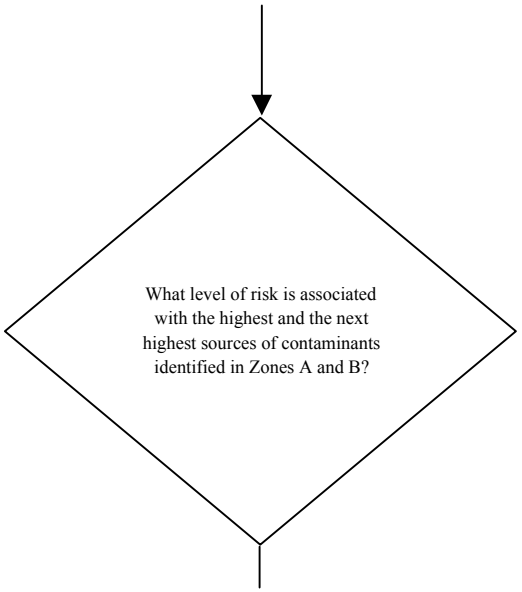


Chart 3. Contaminant risks for Hatcher Pass Lodge - Bacteria & Viruses





+ 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)	2	0	2

	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, 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 Hatcher Pass Lodge - Bacteria & Viruses

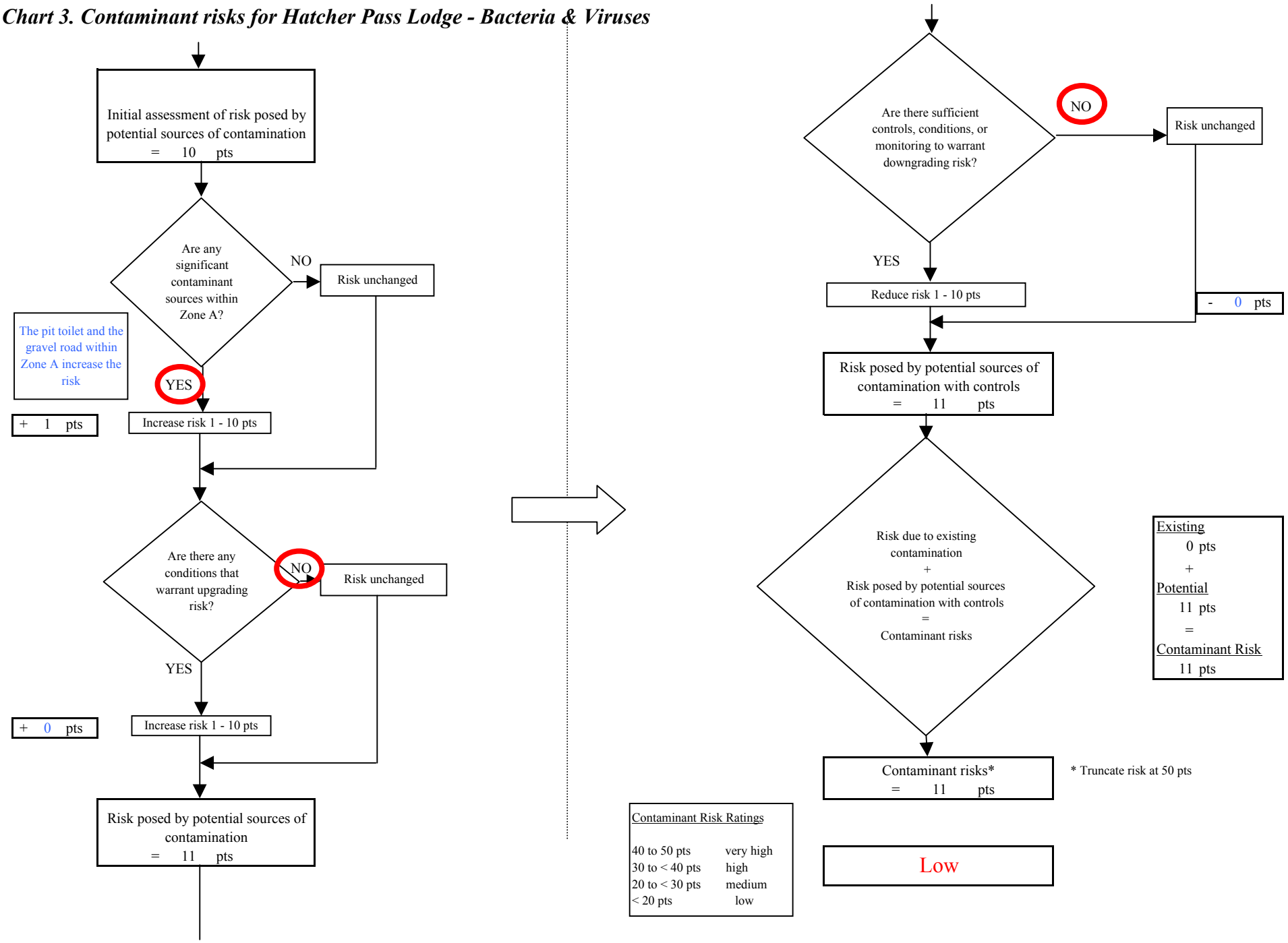


Chart 4. Vulnerability analysis for Hatcher Pass Lodge - Bacteria & Viruses

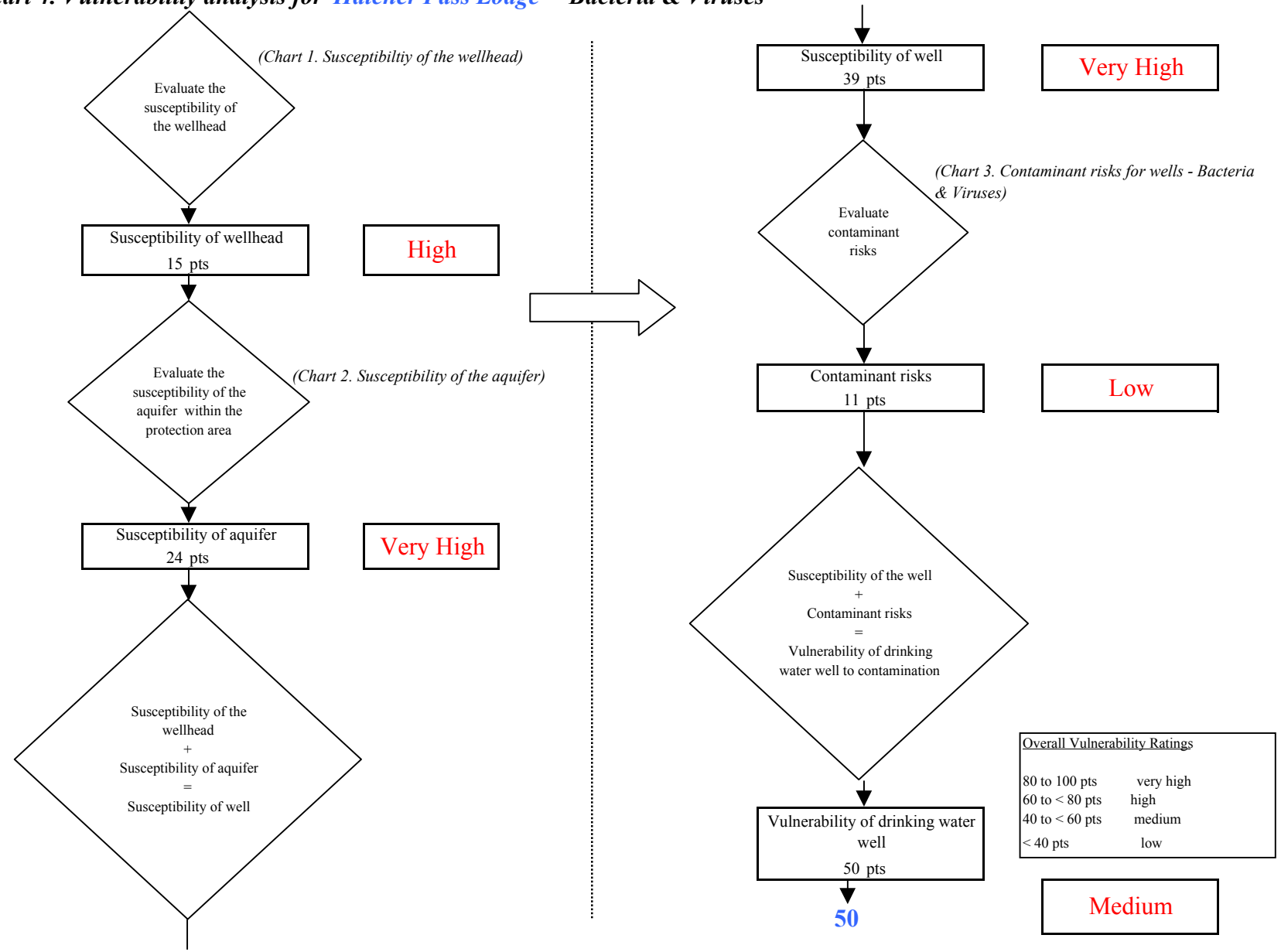


Chart 5. Contaminant risks for Hatcher Pass Lodge - Nitrates and Nitrites

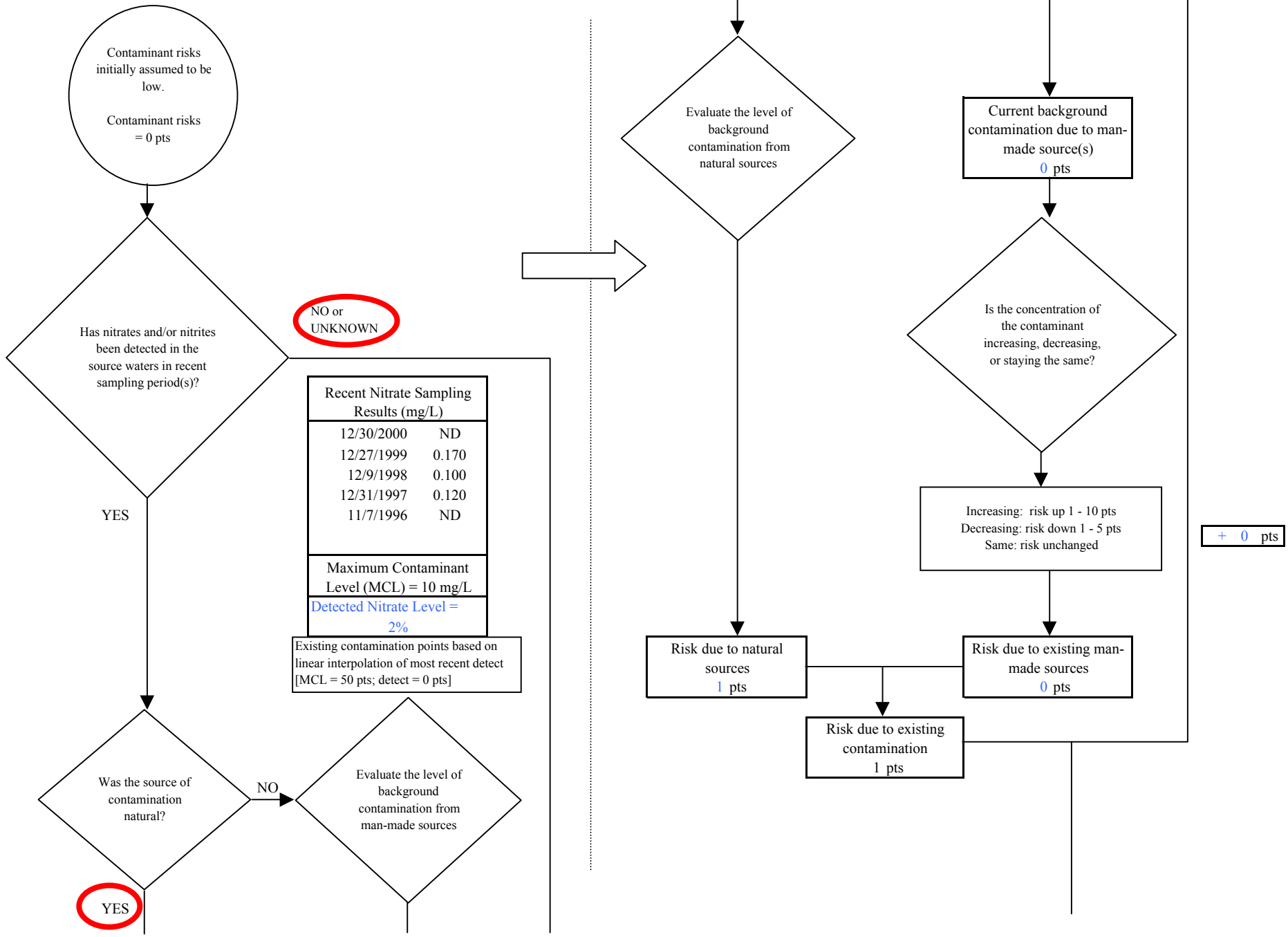


Chart 5. Contaminant risks for Hatcher Pass Lodge - Nitrates and Nitrites

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

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)	2	0	2

	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, 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 = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

The pit toilet and the gravel road within Zone A increase the risk

YES

Increase risk 1 - 10 pts

+ 1 pts

Chart 5. Contaminant risks for Hatcher Pass Lodge - Nitrates and Nitrites

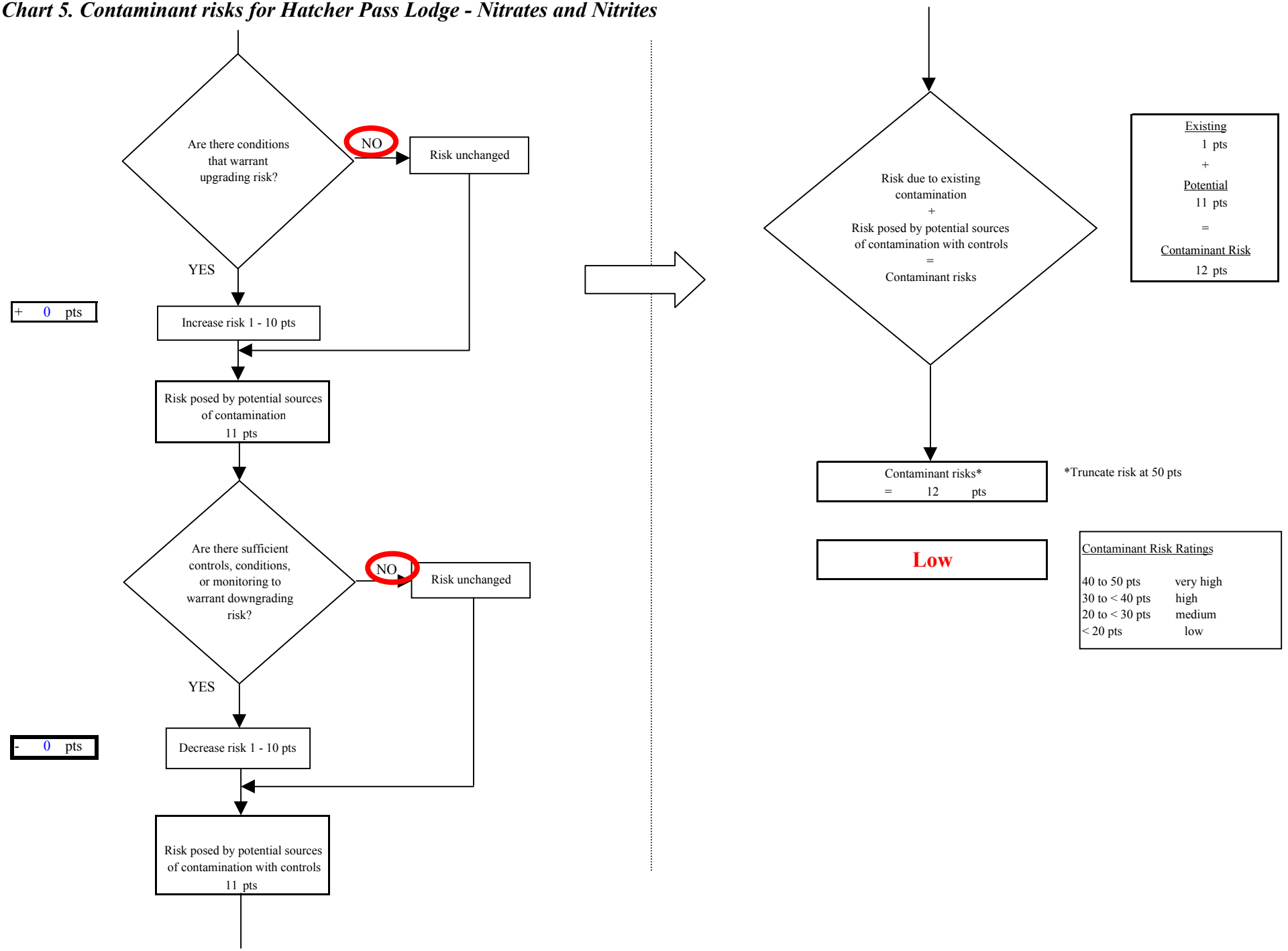


Chart 6. Vulnerability analysis for Hatcher Pass Lodge - Nitrates and Nitrites

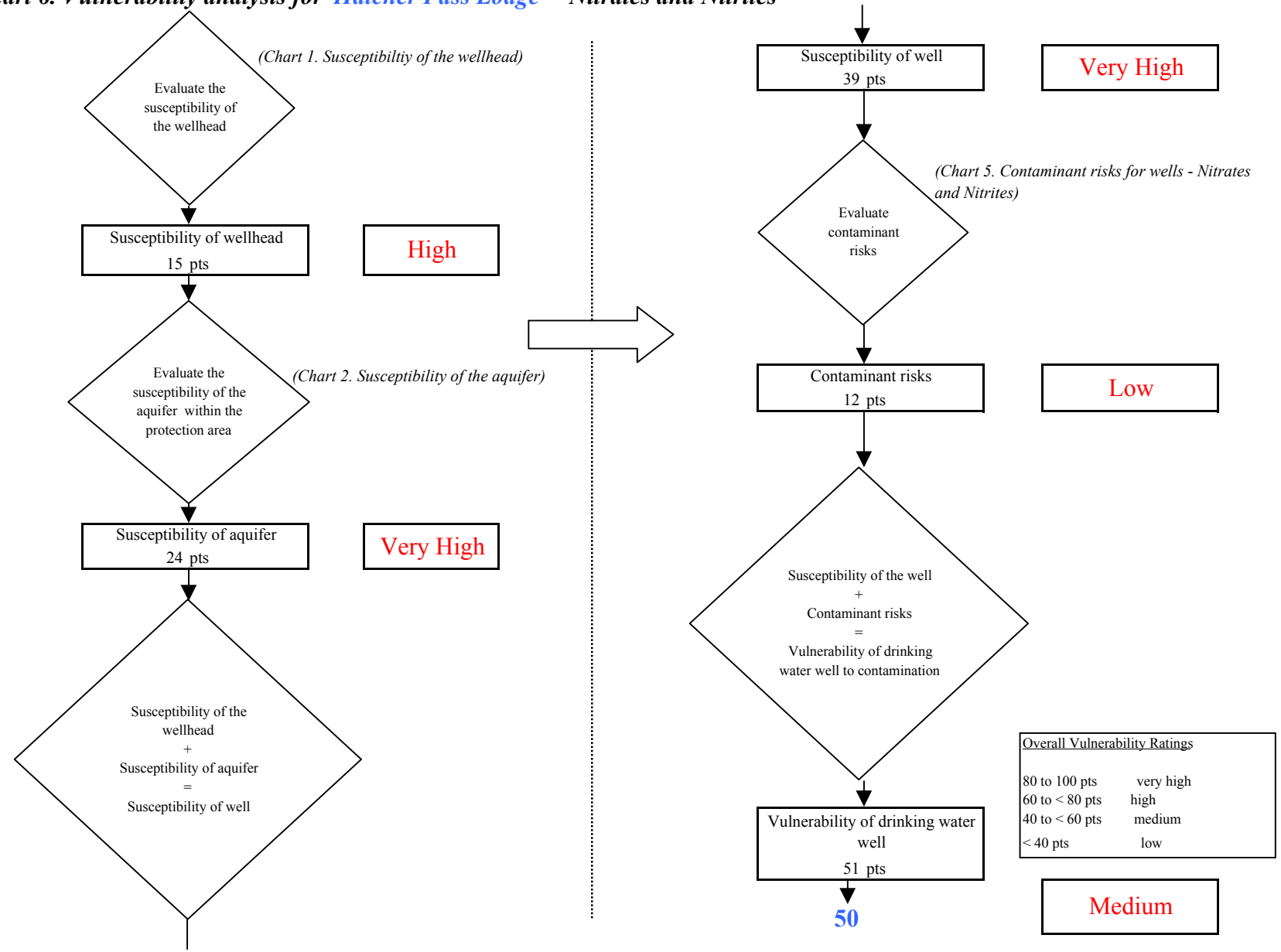


Chart 7. Contaminant risks for Motherlode Lodge - Volatile Organic Chemicals

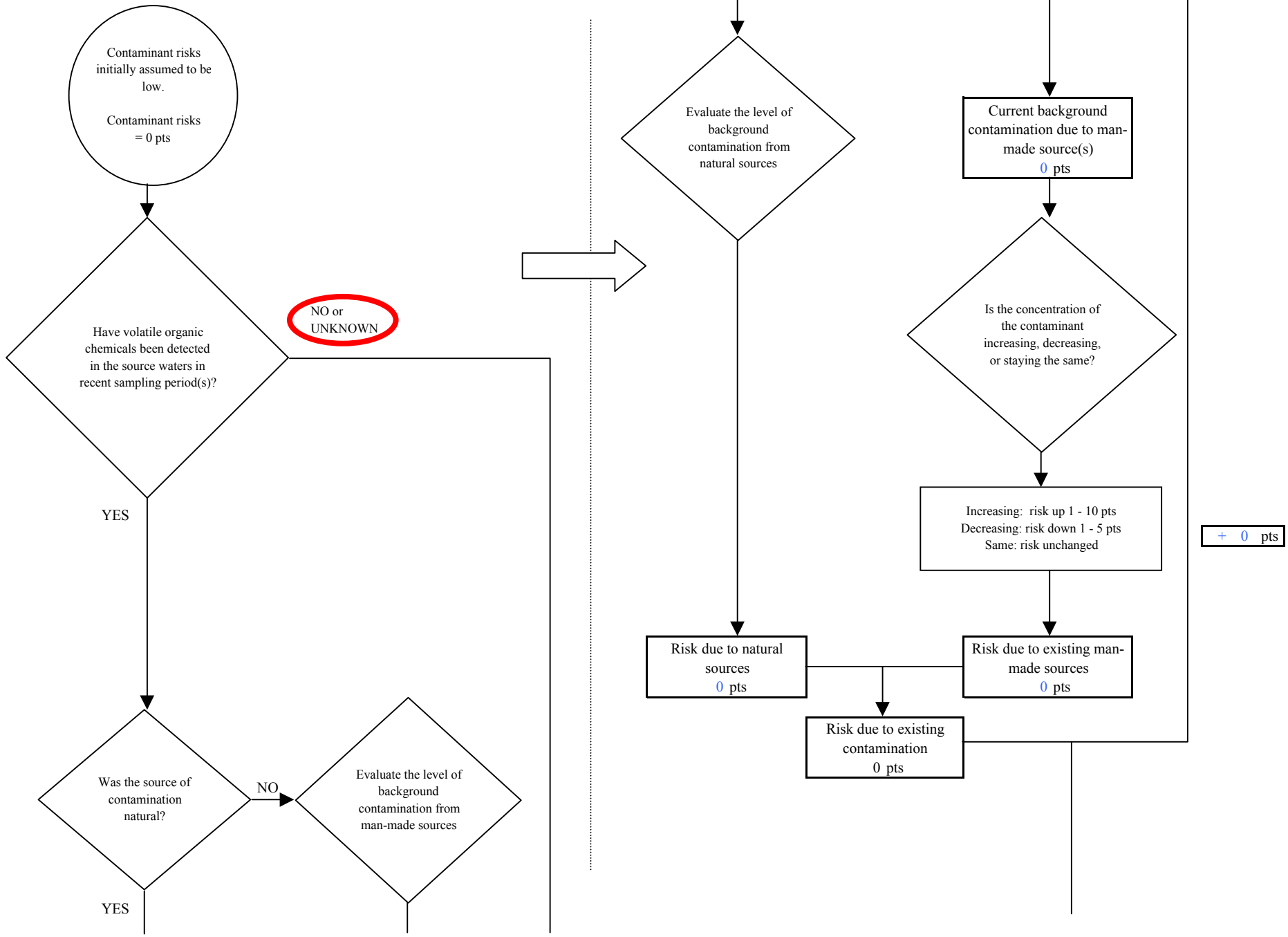


Chart 7. Contaminant risks for Motherlode Lodge - Volatile Organic Chemicals

+ 35 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

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)	1	0	1
Medium(s)	8	0	8
Low(s)	2	0	2

	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 35

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 = 35 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

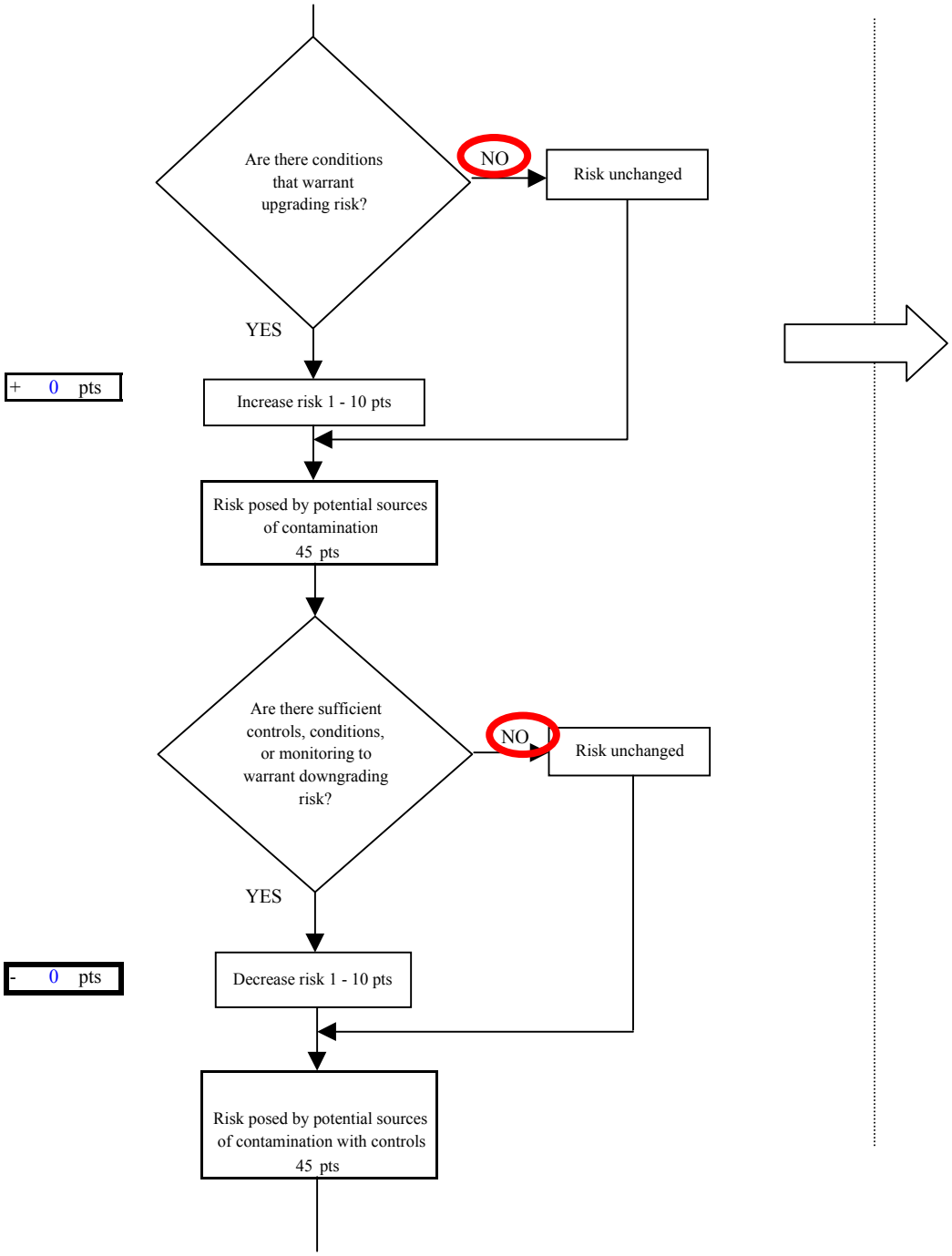
The underground diesel storage tank and the 8 underground mines within Zone A increase the risk

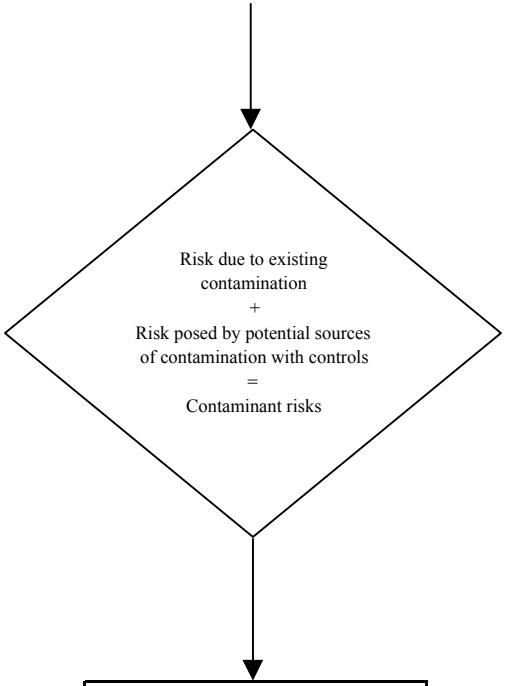
YES

Increase risk 1 - 10 pts

+ 10 pts

Chart 7. Contaminant risks for Motherlode Lodge - Volatile Organic Chemicals





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

Contaminant risks*
= 45 pts

*Truncate risk at 50 pts

Very High

Contaminant Risk Ratings

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

Chart 8. Vulnerability analysis for Motherlode Lodge - Volatile Organic Chemicals