Source Water Assessment for Hatcher Pass Gateway Center Hatcher Pass Area, Alaska

A Hydrogeologic Susceptibility and Vulnerability Assessment

DRINKING WATER PROTECTION PROGRAM REPORT 430
PWSID 227343

May 2002

Source Water Assessment for Hatcher Pass Gateway Center Hatcher Pass Area, Alaska

By SARAH A BENDEWALD

DRINKING WATER PROTECTION PROGRAM REPORT 430

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

CONTENTS

TABLES

ILLUSTRATIONS

APPENDICES

Source Water Assessment for Hatcher Pass Gateway Center Source of Public Drinking Water,
Hatcher Pass Area, Alaska

By Sarah A. Bendewald

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Public Water System for Hatcher Pass Gateway Center is a Class B (transient/non-community) water system consisting of one well north of Wasilla and Palmer, Alaska. Identified potential and current sources of contaminants for Hatcher Pass Gateway Center public drinking water source include: residential and large capacity septic systems, roads, a horse stable, and residential areas. 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 Gateway Center received a vulnerability rating of **Very High** for bacteria and viruses, nitrates and nitrites, and volatile organic chemicals.

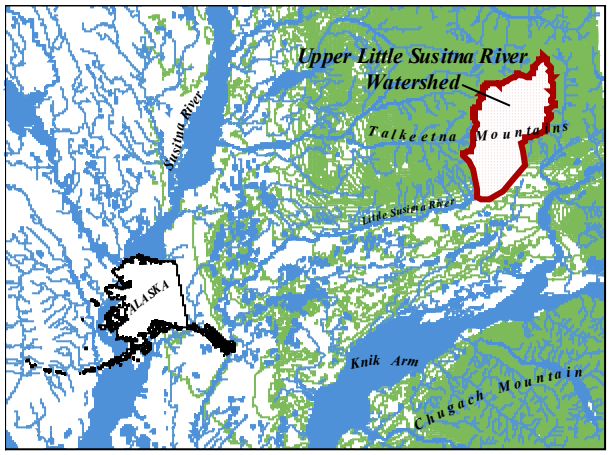


Figure 1. Index map showing Matanuska-Susitna Valley and the Upper Little Susitna River Watershed.

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 Gateway Center. This water system consists of one well north of Palmer and Wasilla, Alaska along Palmer-Fishhook Road near Wasilla-Fishhook 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 less than 1 foot to 60 feet, divide the unconsolidated layers.

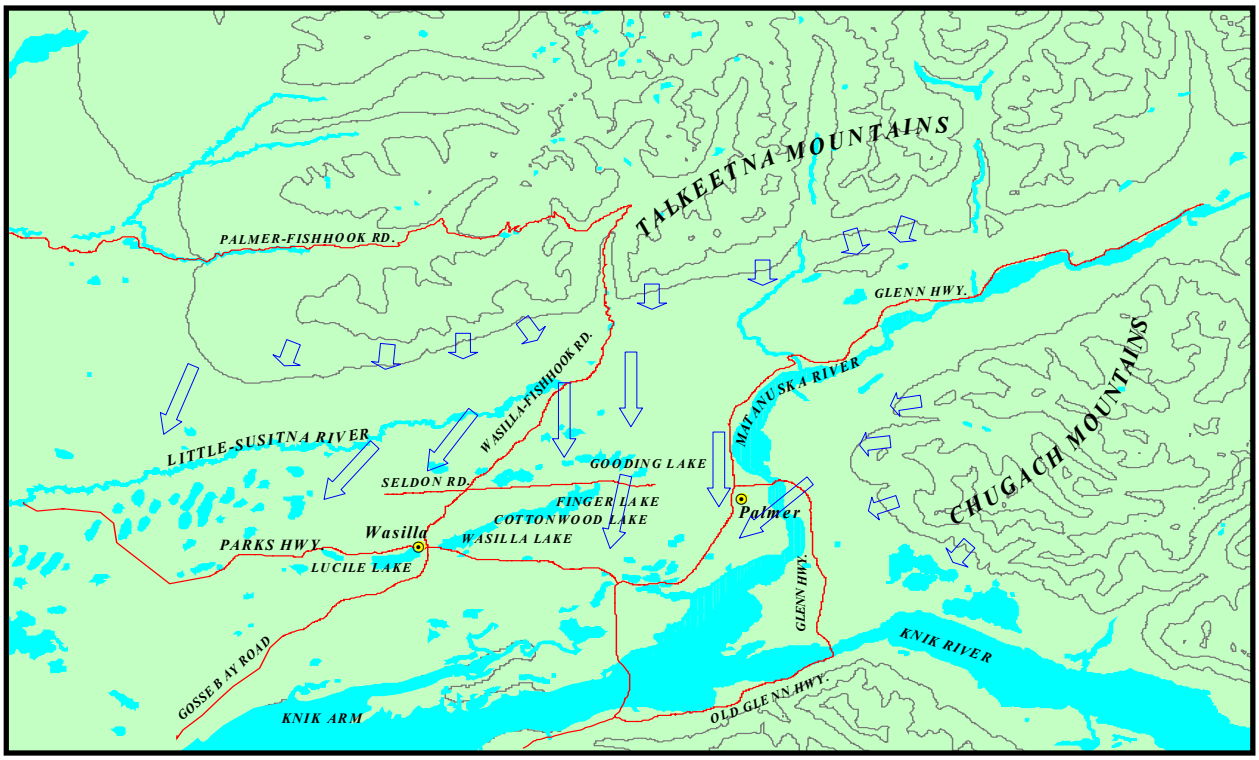


Figure 2. Map showing groundwater flow in the Matanuska-Susitna Valley (Jokela, Munter and Evans, 1991).

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 GATEWAY CENTER PUBLIC DRINKING WATER SYSTEM

Hatcher Pass Gateway Center public water system is a Class B (transient/non-community) water system. The system consists of one well along Palmer-Fishhook Road near its intersection with Wasilla-Fishhook Road (T19N, R1E, Section 3). This area is at an elevation of approximately 750 feet above sea level.

According to the most recent Sanitary Survey (3/15/00) the well was installed in 1983 to a total depth of approximately 57 feet below ground surface and was completed in 6-inch well casing. The Sanitary Survey also 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 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 was not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters.

This system operates year-round and serves more than a variable number of non-residents through one service connection.

ASSESSMENT AND PROTECTION AREA FOR HATCHER PASS GATEWAY CENTER DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for Hatcher Pass Gateway Center 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 Hatcher Pass Gateway Center contains three zones, Zone A through Zone C (See Map 1 in Appendix A). Zone A 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 wells to take into account the area of the aquifer that is influenced by pumping of the wells.

Zone B corresponds to a time-of-travel of less than two years, and Zone C corresponds to the area of less than 5 years time-of-travel.

The Drinking Water Protection Areas established for a well normally includes four zones. Zone D corresponds to a time-of-travel of less than ten years. The protection area for Hatcher Pass Gateway Center is limited by the extent of its immediate watershed and therefore includes only Zones A, B, and C.

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 Gateway Center. 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

Maps 2 and 3 in Appendix C depict the Contaminant Source Inventory for Hatcher Pass Gateway Center. Table 1 in Appendix B lists the inventoried potential sources of contamination within Zones A through C. Below is a summary of the contaminant sources inventoried within the Drinking Water Protection Area for Hatcher Pass Gateway Center:

- A gasoline station;
- underground gasoline storage tanks;
- a residential heating oil tank;
- a horse stable;
- a closed Leaking Underground Fuel Storage Tank (LUST) site;
- large capacity and residential septic systems;
- paved roads; and
- residential areas.

These potential and existing contaminant sources present risk for all three categories of drinking water contaminants for Hatcher Pass Gateway Center 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 GATEWAY 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 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 Gateway Center was completed in an unconfined aquifer. The depth to the water table is approximately 32 feet below the ground surface. The saturated thickness of the aquifer in which the well is screened in is approximately 30 feet and composed of sand and gravel. 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 Gateway Center.

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

	Score	Rating
Susceptibility of the Wellheads	5	Low
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	30	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 Gateway Center Public Drinking Water Source to Contamination by Category

Contaminant Risks	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	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 Gateway Center Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	80	Very High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	80	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 septic systems located throughout the protection area are the most significant sources of risk for both bacteria and viruses and nitrates and nitrites. The large capacity septic systems found in zones A and C significantly increase the risk for bacteria and viruses, and nitrates and nitrites. Large capacity septic systems are classified by the Environmental Protection Agency (EPA) as a type of Class V Injection well, and differ from residential septic systems in that they serve multiple dwellings, businesses, or communities. Septic systems are designed to leach domestic wastewater in the subsurface. If engineered and operating properly, leach fields for septic systems should filter and stop the migration of microorganisms in the subsurface. However, failure of a septic system can result in the migration of contaminants away from the leach field, sometimes to great distances, especially in highly transmissive soils.

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 Gateway Center.

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 Gateway Center 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 0.87 mg/L or 8.7% 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 gasoline station and fuel storage tanks located in Zone A represent the greatest risk for volatile organic chemicals. Alaska Department of Environmental Conservation (ADEC) records indicate there are two underground fuel storage tanks at the gasoline station at Hatcher Pass Gateway Center, one regulated and the other non-regulated. The regulated tank, installed on August 1, 1994, is constructed of double-walled cathodically protected steel and has a 20,000-gallon capacity. No information is known about the non-regulated tank.

On December 15, 1993, gasoline contaminated soil were encountered during the replacement of fuel tank piping and dispensers at Hatcher Pass Gateway Center (LUST site #93220034901). . The site has been remediated to ADEC standards and is considered closed as of November 8, 1984. Currently the site represents only a low risk of contamination to the Hatcher Pass Gateway Center public water supply.

SUMMARY

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

REFERENCES CITED

Alaska Department of Community and Economic Development, 2001 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

Alaska Department of Labor, State of Alaska 2001 [WWW document]. URL http://146.63.75.45/census2000/.

Brabets, T., 1997, Precipitation map of Alaska, Web extension to the U.S. Geological Survey Water Resources for Alaska GIS datasets. <URL:http://agdc.usgs.gov/data/usgs/water> .

Jokela, J.B., Munter, J.A., and Evans, J.G., 1991, Ground-water resources of the Plamer-Big Lake area, Alaska: a conceptual model. Division of Geological &Geophysical Surveys Reports of Investigations 90-4, State of Alaska Department of Natural Resources, Fairbanks, AK.

Matanuska-Susitna Borough, 1985, Knik-Matanuska-Sisitna: A Visual History of the Valleys, Wasilla, AK.

Patrick, L.D., Brabets, T.P., and Glass, R.L., 1989, Simulation of ground-water flow at Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 88-4139, 41p.

Western Regional Climate Center, 2000, August 24, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?akmatv

Wickersham Alaska Corporation, 1986, Wasilla Comprehensive Plan, Anchorage, AK.

APPENDIX A

Hatcher Pass Gateway Center
Drinking Water Protection Area

Hatcher Pass Gateway Center Drinking Water Protection Area

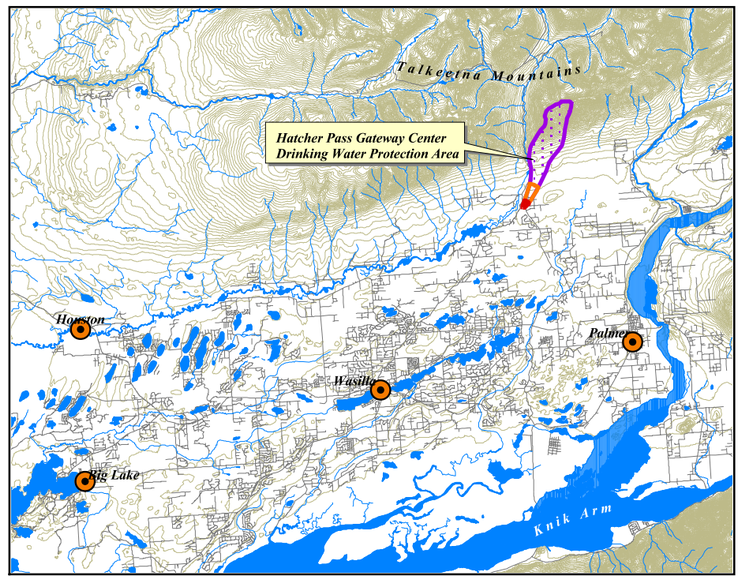
LITTLE SUSITNA RIVER
PALMER-FISHHOOK RD
GOVERNMENT CREEK
Zone C
Zone B
Zone A
EDGERTON PARKS RD
BYRON'S DR
WASILLA-FISHHOOK RD
WENDT RD
PALMER-FISHHOOK RD
WASILLA CREEK
WILDERNESS LN
MIKES LN
YARROW RD
HERMANN AVE

2 0 2 Miles

PWSID 227343.001

Legend

- Hatcher Pass Gateway Well
- Zone A Protection Area
- Several Months Travel Time
- Zone B Protection Area
- Less Than 2 Years Travel Time
- Zone C Protection Area
- Less Than 5 Years Travel Time
- Lakes
- Rivers and Streams
- Parcels
- Roads



N
W E
S

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Hatcher Pass Gateway Center

Table 1

Contaminant Source Inventory for ***Hatcher Pass Gateway Center***

PWSID 227343.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Gasoline stations (without repair shop)	C15	C15-1	A	Hatcher Pass Gateway Center	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Hatcher Pass Gateway Center	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	Along Doro Drive	2	
Residential Areas	R01	R01-1	A	Between Palmer-Fishhook Road and Doro Drive	2	Approximately 14 acres of residential area within Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Corner of Doro Drive and Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-02	A	North side of Doro Drive	2	
Septic systems (serves one single-family home)	R02	R02-03	A	East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-04	A	East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-05	A	West side of Doro Drive	2	
Tanks, heating oil, residential (above ground)	R08	R08-1	A	Hatcher Pass Gateway Center	2	500 gallon tank
Tanks, gasoline (underground)	T12	T12-1	A	Hatcher Pass Gateway Center	2	unregulated tank
Tanks, gasoline (underground)	T12	T12-2	A	Hatcher Pass Gateway Center	2	20,000 gallon tank; regulated; cathodically protected steel; double-walled
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-1	A	Hatcher Pass Gateway Center	2	Gasoline soils encountered during piping and dispenser replacement on 12/15/93; site cleanup complete and LUST site closed on 11/8/94.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Doro Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Palmer-Fishhook Road	2	
Residential Areas	R01	R01-2	B	Along Doro Road, Blue Mountain, and Sun Valley Road	3	Approximately 40 acres of Residential Area within Zone B
Septic systems (serves one single-family home)	R02	R02-06	B	West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Corner of Blue Mountain and Doro Drive	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R02-09	B	West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-10	B	South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-11	B	South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-12	B	West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-13	B	East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-14	B	North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-15	B	North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-16	B	End of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-17	B	West sid of Sun Valley Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Blue Mountain	3	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Sun Valley Rd	3	
Livestock stables/corrals	A09	A09-1	C	Palmer-Fishhook Rd	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-18	C	Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-19	C	Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-20	C	Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-21	C	Palmer-Fishhook Rd	3	

Table 2

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

PWSID 227343.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	Hatcher Pass Gateway Center	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	Along Doro Drive	2	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	3	Corner of Doro Drive and Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	4	North side of Doro Drive	2	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	5	East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	6	East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-05	A	Low	7	West side of Doro Drive	2	
Residential Areas	R01	R01-1	A	Low	8	Between Palmer-Fishhook Road and Doro Drive	2	Approximately 14 acres of residential area within Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	9	Doro Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	10	Palmer-Fishhook Road	2	
Residential Areas	R01	R01-2	B	Low		Along Doro Road, Blue Mountain, and Sun Valley Road	3	Approximately 40 acres of Residential Area within Zone B
Septic systems (serves one single-family home)	R02	R02-06	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low		East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low		Corner of Blue Mountain and Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low		South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low		South side of Blue Mountain	3	

Table 2 (continued)

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

PWSID 227343.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R02-12	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-13	B	Low		East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-14	B	Low		North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-15	B	Low		North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-16	B	Low		End of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-17	B	Low		West sid of Sun Valley Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Blue Mountain	3	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Sun Valley Rd	3	

Table 3

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

PWSID 227343.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	Hatcher Pass Gateway Center	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High	2	Along Doro Drive	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	High	3	Palmer-Fishhook Rd	3	
Livestock stables/corrals	A09	A09-1	C	Medium	4	Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	5	Corner of Doro Drive and Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	6	North side of Doro Drive	2	
Septic systems (serves one single-family home)	R02	R02-03	A	Low	7	East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-04	A	Low	8	East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-05	A	Low	9	West side of Doro Drive	2	
Residential Areas	R01	R01-1	A	Low	10	Between Palmer-Fishhook Road and Doro Drive	2	Approximately 14 acres of residential area within Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Doro Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Palmer-Fishhook Road	2	
Residential Areas	R01	R01-2	B	Low		Along Doro Road, Blue Mountain, and Sun Valley Road	3	Approximately 40 acres of Residential Area within Zone B
Septic systems (serves one single-family home)	R02	R02-06	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low		East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low		Corner of Blue Mountain and Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low		West side of Doro Drive	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R02-10	B	Low		South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low		South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-12	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-13	B	Low		East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-14	B	Low		North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-15	B	Low		North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-16	B	Low		End of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-17	B	Low		West sid of Sun Valley Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Blue Mountain	3	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Sun Valley Rd	3	
Septic systems (serves one single-family home)	R02	R02-18	C	Low		Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-19	C	Low		Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-20	C	Low		Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-21	C	Low		Palmer-Fishhook Rd	3	

Table 4

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

PWSID 227343.001

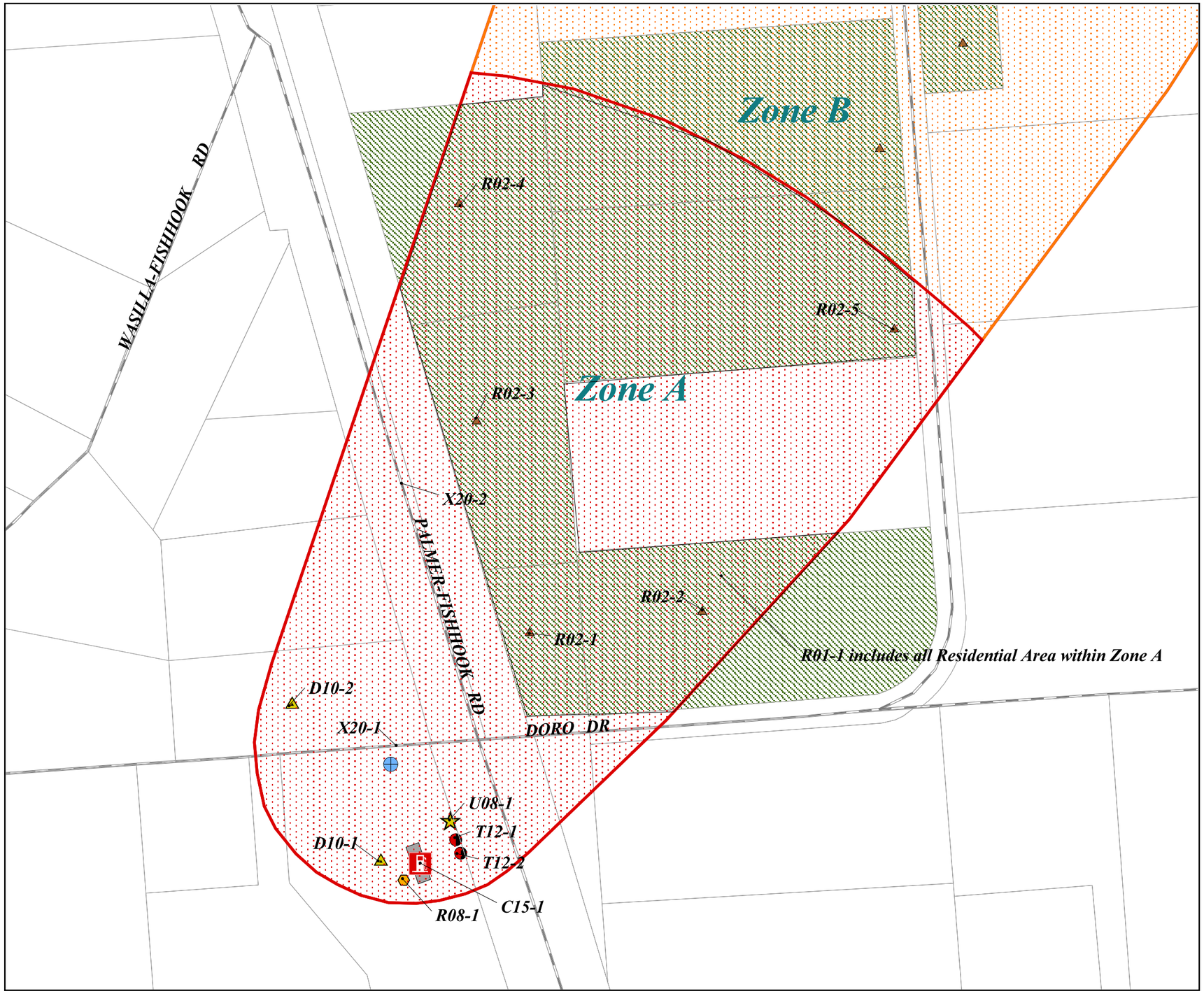
Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Gasoline stations (without repair shop)	C15	C15-1	A	High	1	Hatcher Pass Gateway Center	3	
Tanks, gasoline (underground)	T12	T12-1	A	High	2	Hatcher Pass Gateway Center	2	unregulated tank
Tanks, gasoline (underground)	T12	T12-2	A	High	3	Hatcher Pass Gateway Center	2	20,000 gallon tank; regulated; cathodically protected steel; double-walled
Tanks, heating oil, residential (above ground)	R08	R08-1	A	Medium	4	Hatcher Pass Gateway Center	2	500 gallon tank
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-1	A	Low	5	Hatcher Pass Gateway Center	2	Gasoline soils encountered during piping and dispenser replacement on 12/15/93; site cleanup complete and LUST site closed on 11/8/94.
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	6	Hatcher Pass Gateway Center	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	Low	7	Along Doro Drive	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	Low	8	Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	9	Corner of Doro Drive and Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-02	A	Low	10	North side of Doro Drive	2	
Residential Areas	R01	R01-1	A	Low		Between Palmer-Fishhook Road and Doro Drive	2	Approximately 14 acres of residential area within Zone A
Septic systems (serves one single-family home)	R02	R02-03	A	Low		East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-04	A	Low		East side of Palmer-Fishhook Road	2	
Septic systems (serves one single-family home)	R02	R02-05	A	Low		West side of Doro Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Doro Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Palmer-Fishhook Road	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R01-2	B	Low		Along Doro Road, Blue Mountain, and Sun Valley Road	3	Approximately 40 acres of Residential Area within Zone B
Septic systems (serves one single-family home)	R02	R02-06	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-07	B	Low		East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-08	B	Low		Corner of Blue Mountain and Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-09	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-10	B	Low		South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-11	B	Low		South side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-12	B	Low		West side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-13	B	Low		East side of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-14	B	Low		North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-15	B	Low		North side of Blue Mountain	3	
Septic systems (serves one single-family home)	R02	R02-16	B	Low		End of Doro Drive	3	
Septic systems (serves one single-family home)	R02	R02-17	B	Low		West sid of Sun Valley Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Blue Mountain	3	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Sun Valley Rd	3	
Septic systems (serves one single-family home)	R02	R02-18	C	Low		Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-19	C	Low		Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-20	C	Low		Palmer-Fishhook Rd	3	
Septic systems (serves one single-family home)	R02	R02-21	C	Low		Palmer-Fishhook Rd	3	

APPENDIX C

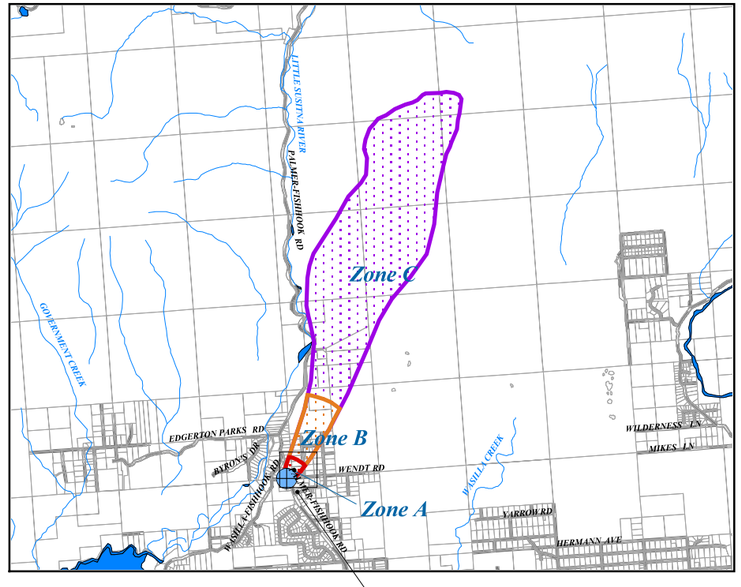
Hatcher Pass Gateway Center
Drinking Water Protection Area
and Potential and Existing Contaminant Sources

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



Legend

- Hatcher Pass Gateway Center Well
- Zone A Protection Area
  - Several Months Travel Time
- Zone B Protection Area
  - Less Than 2 Years Travel Time
- Zone C Protection Area
  - Less Than 5 Years Travel Time
- Rivers and Streams
- Parcels
- Potential Contaminant Sources
  - Gasoline Station (C15)
  - Underground Gasoline Tank (T12)
  - Closed Leaking Underground Storage Tank Site (U8)
  - Residential Above Ground Heating Oil Tank (R8)
  - Roads (X20 or X24)
- Septic Systems
  - Large Capacity Septic Systems (D10)
  - Residential Septic Systems (R2)
- Residential Areas (R1)
- Building

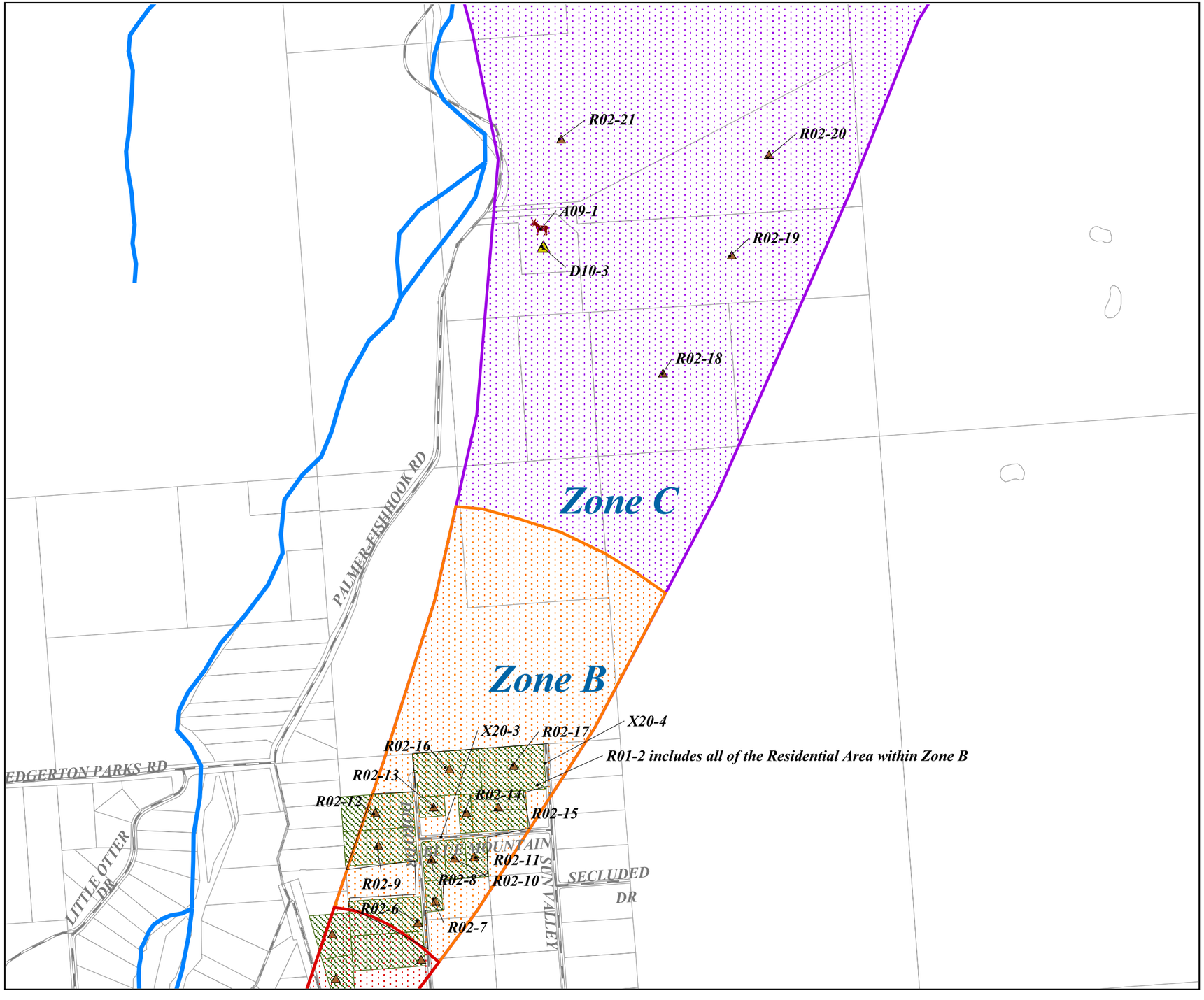


N W E S

PWSID 227343.001

Map 2

Hatcher Pass Gateway Center Drinking Water Protection Area with Potential & Existing Contaminant Sources



Legend

- Hatcher Pass Gateway Center Well

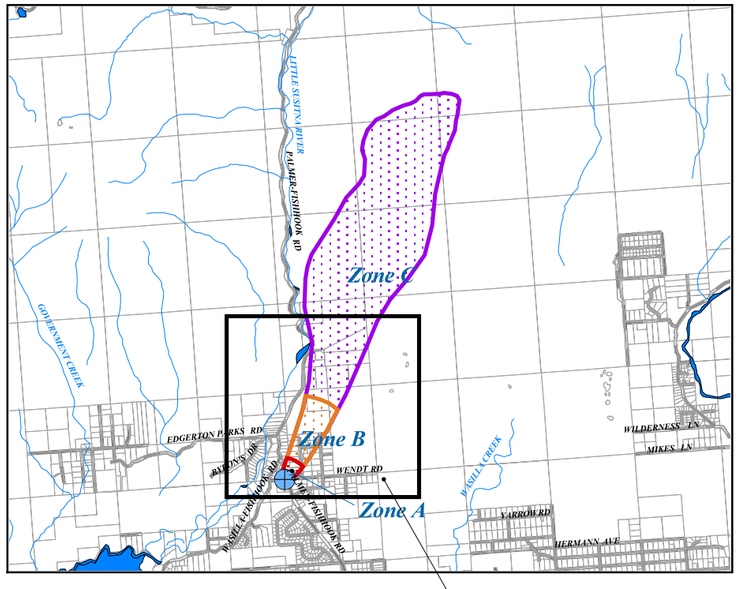
Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Potential Contaminant Sources
- Gasoline Station (C15)
- Underground Gasoline Tank (T12)
- Closed Leaking Underground Storage Tank Site (U8)
- Residential Above Ground Heating Oil Tank (R8)
- Horse Stable (A09)

Septic Systems
- Large Capacity Septic Systems (D10)
- Residential Septic Systems (R2)
- Residential Areas (R1)
- Rivers and Streams
- Parcels
- Roads



N
W E
S

PWSID 227343.001

Map 3

APPENDIX D

Vulnerability Analysis for Hatcher Pass Gateway Center Public Drinking Water Source

Chart 1. Susceptibility of the wellhead - Hatcher Pass Gateway Center

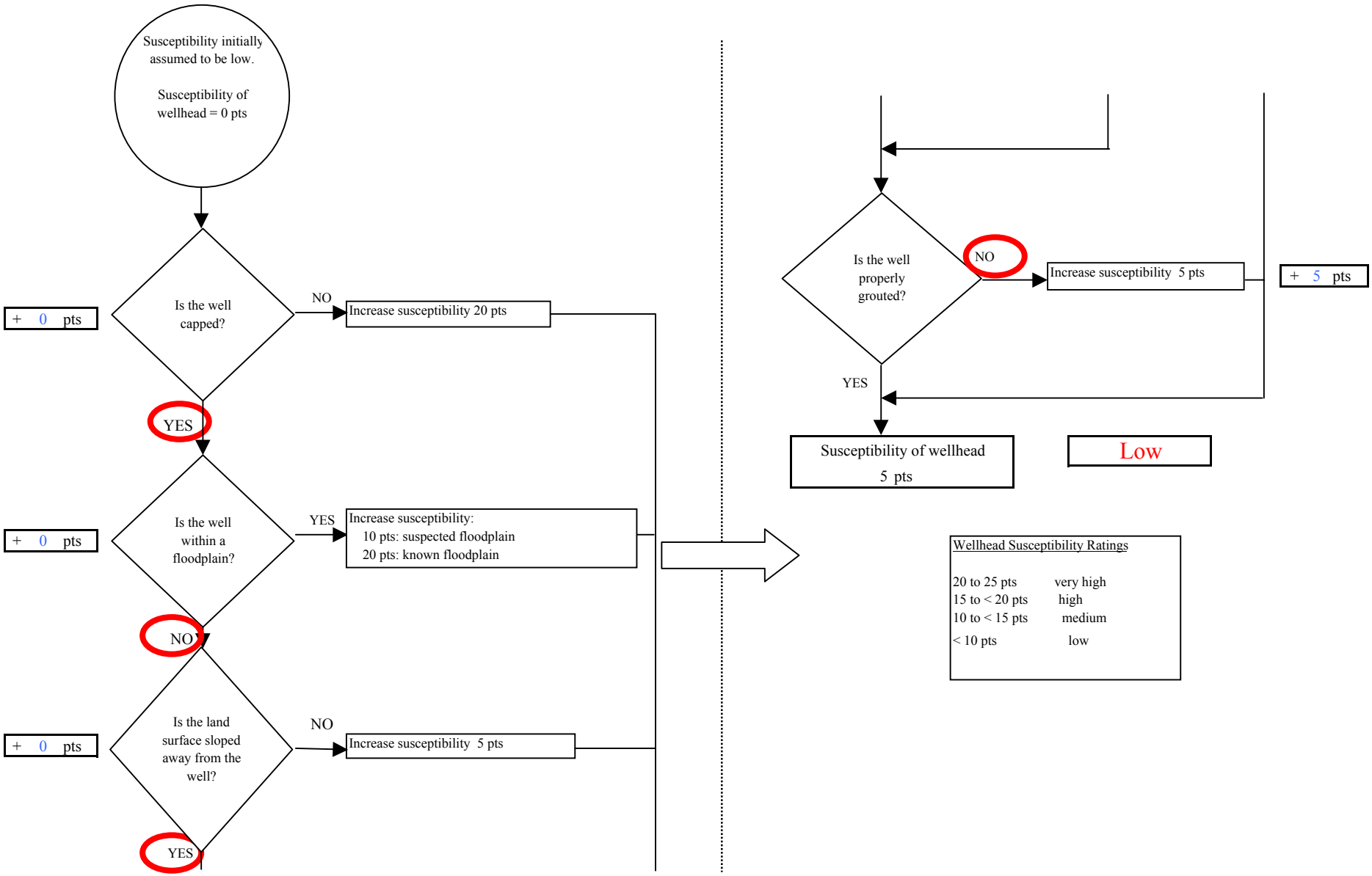


Chart 2. Susceptibility of the aquifer - Hatcher Pass Gateway Center

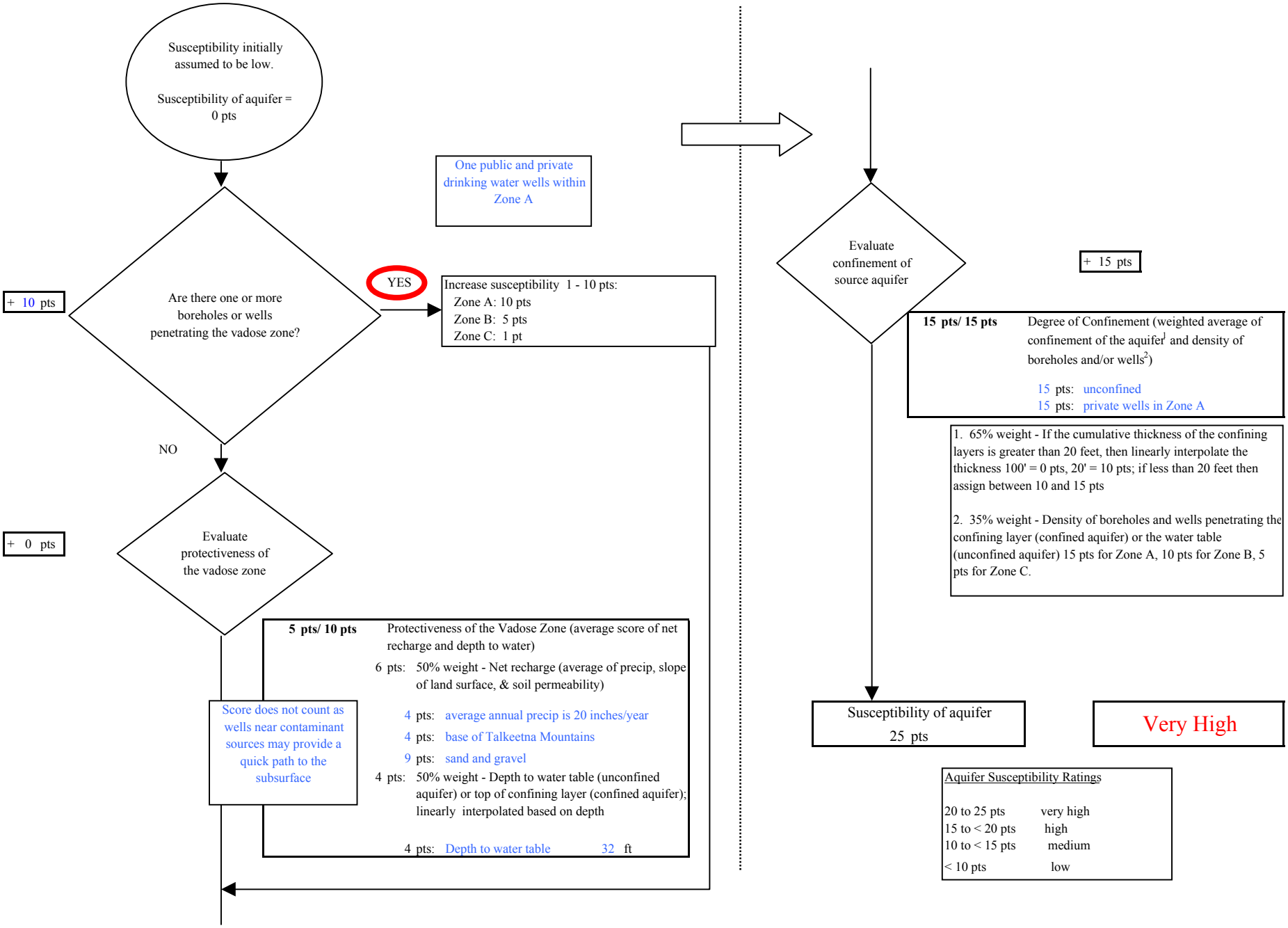
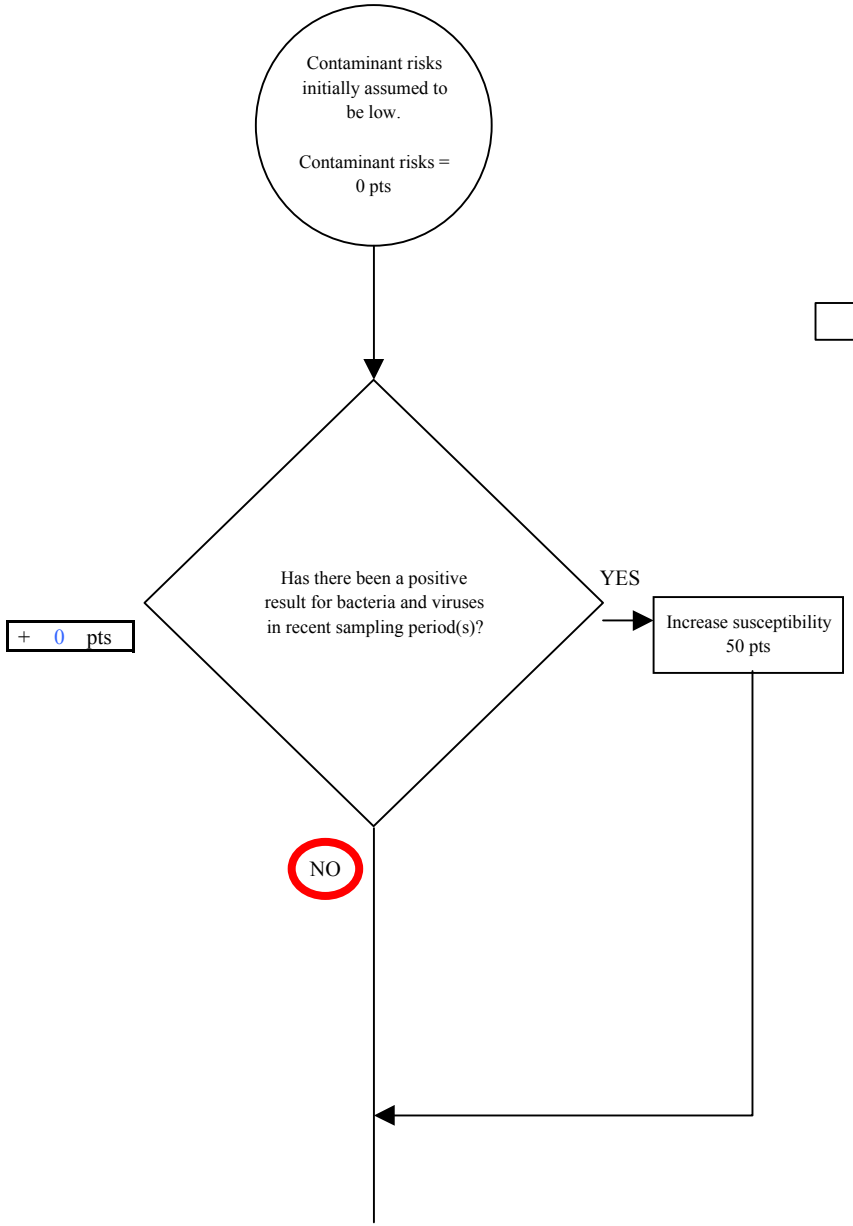
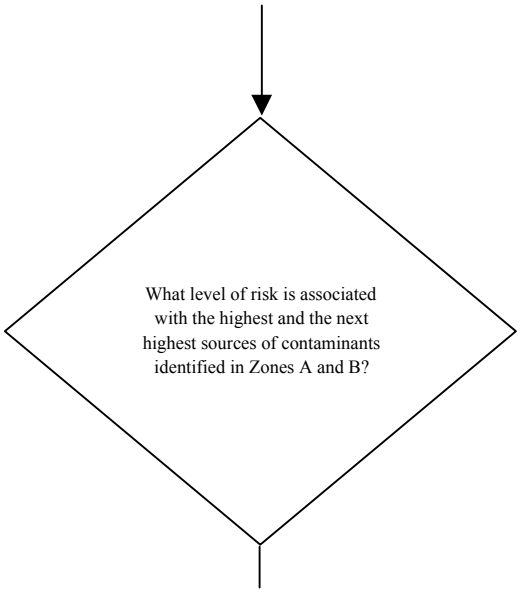


Chart 3. Contaminant risks for Hatcher Pass Gateway Center - Bacteria & Viruses





+ 40 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)	2	0	2
Medium(s)	0	0	0
Low(s)	7	4	11

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

Matrix Score 40

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

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

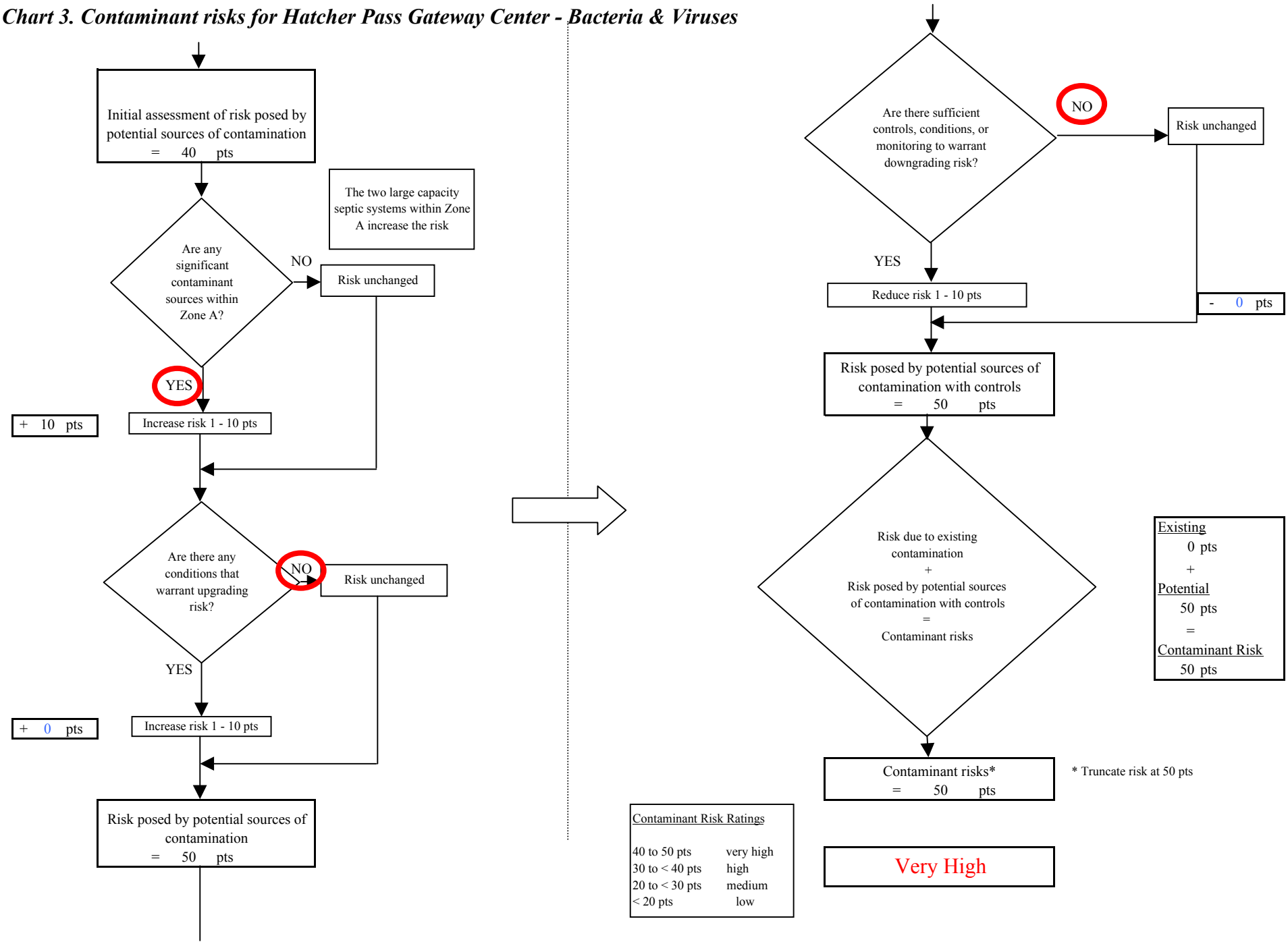


Chart 4. Vulnerability analysis for Hatcher Pass Gateway Center - Bacteria & Viruses

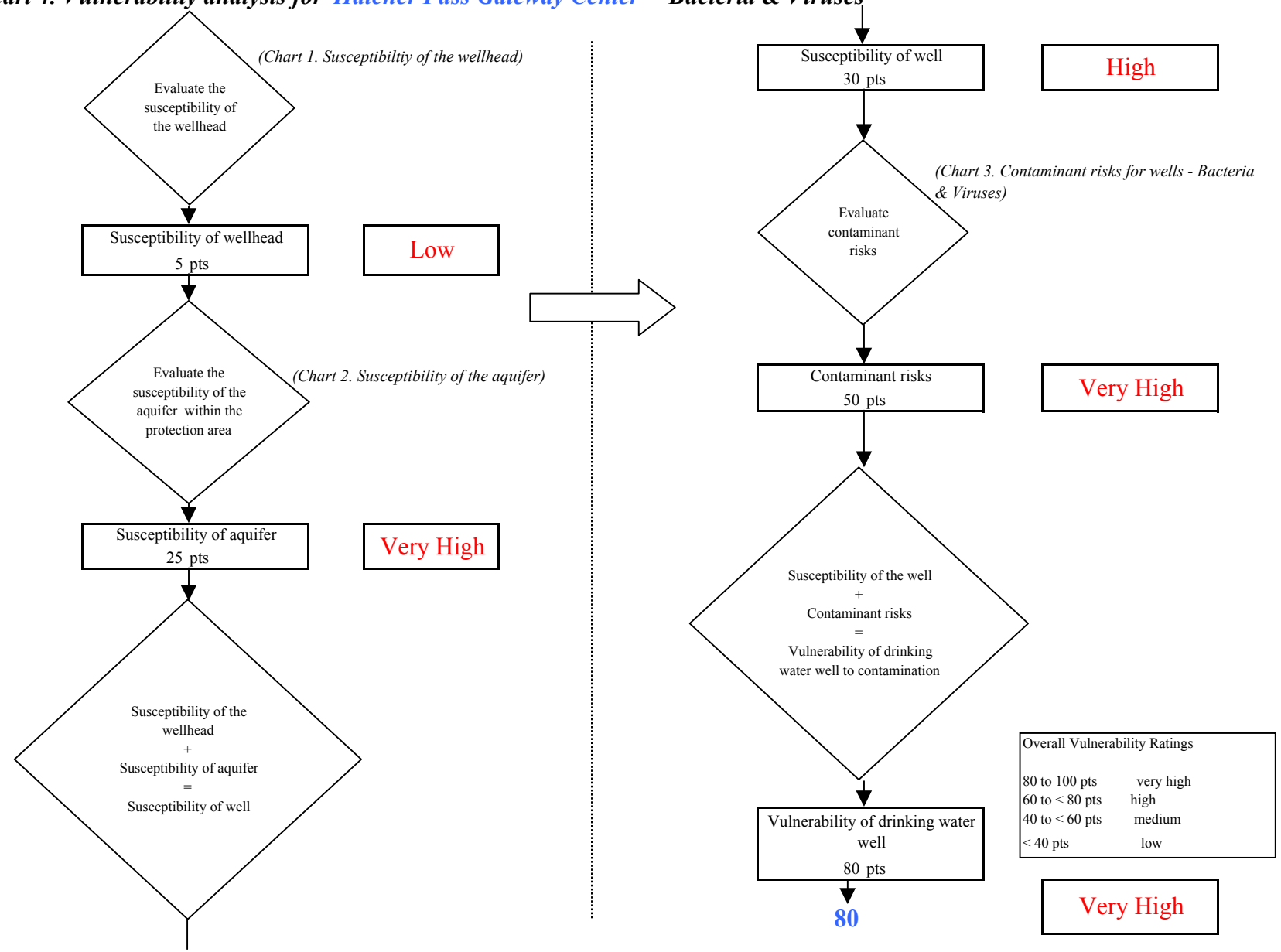


Chart 5. Contaminant risks for Hatcher Pass Gateway Center - Nitrates and Nitrites

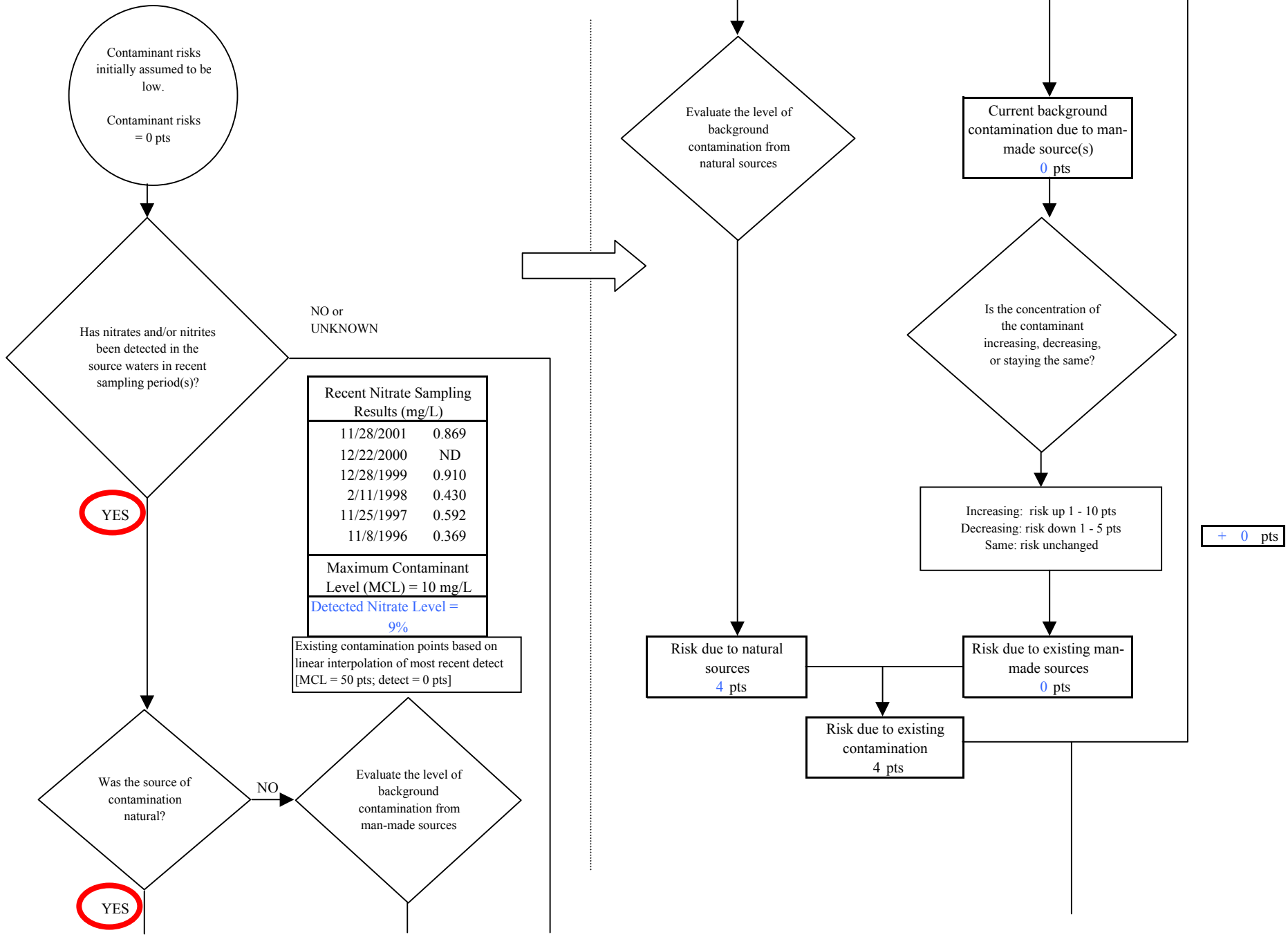
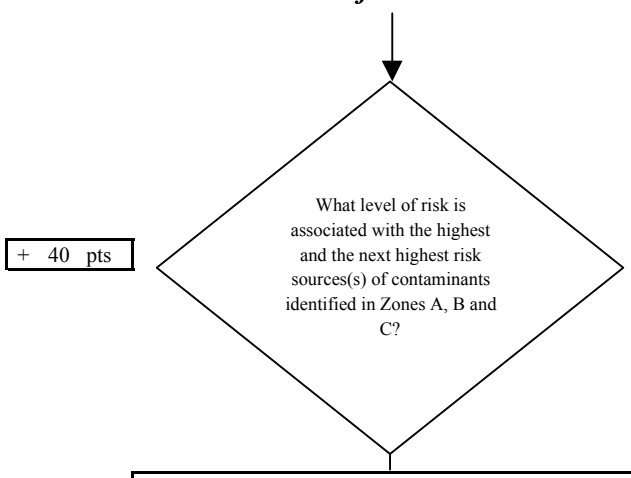


Chart 5. Contaminant risks for Hatcher Pass Gateway Center - Nitrates and Nitrites



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)	2	1	3
Medium(s)	0	1	1
Low(s)	7	4	11

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

Matrix Score 40

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

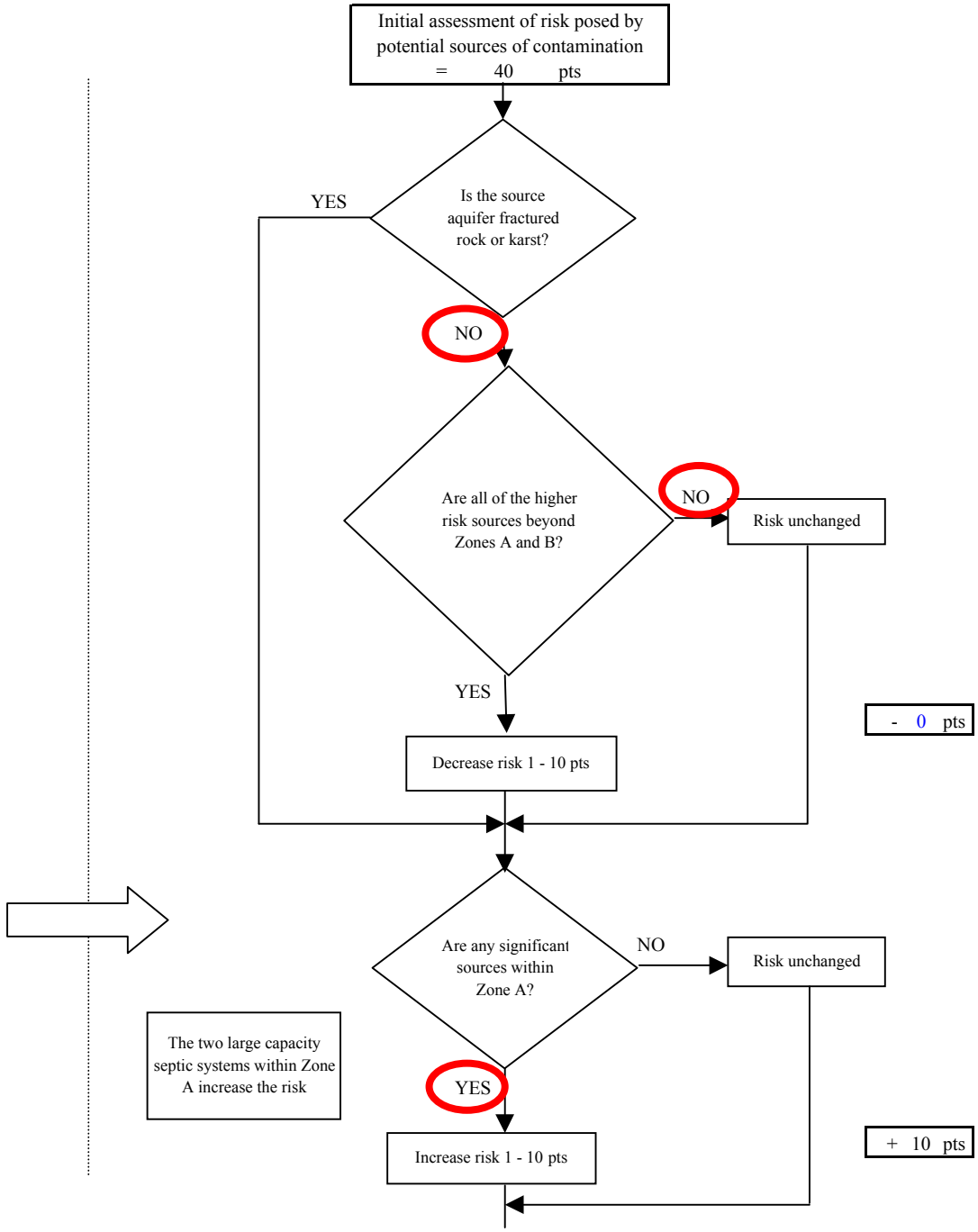


Chart 5. Contaminant risks for Hatcher Pass Gateway Center - Nitrates and Nitrites

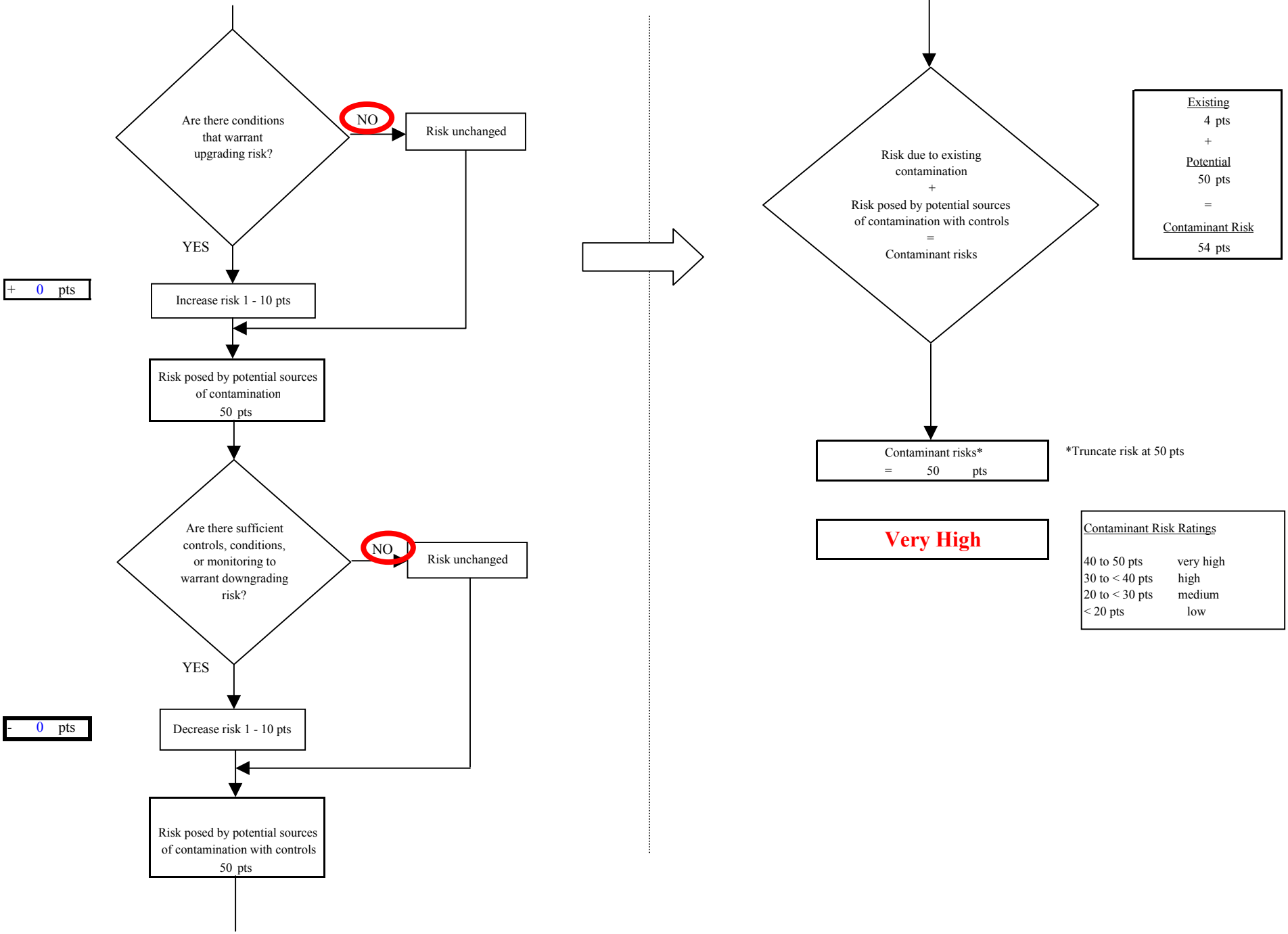


Chart 6. Vulnerability analysis for Hatcher Pass Gateway Center - Nitrates and Nitrites

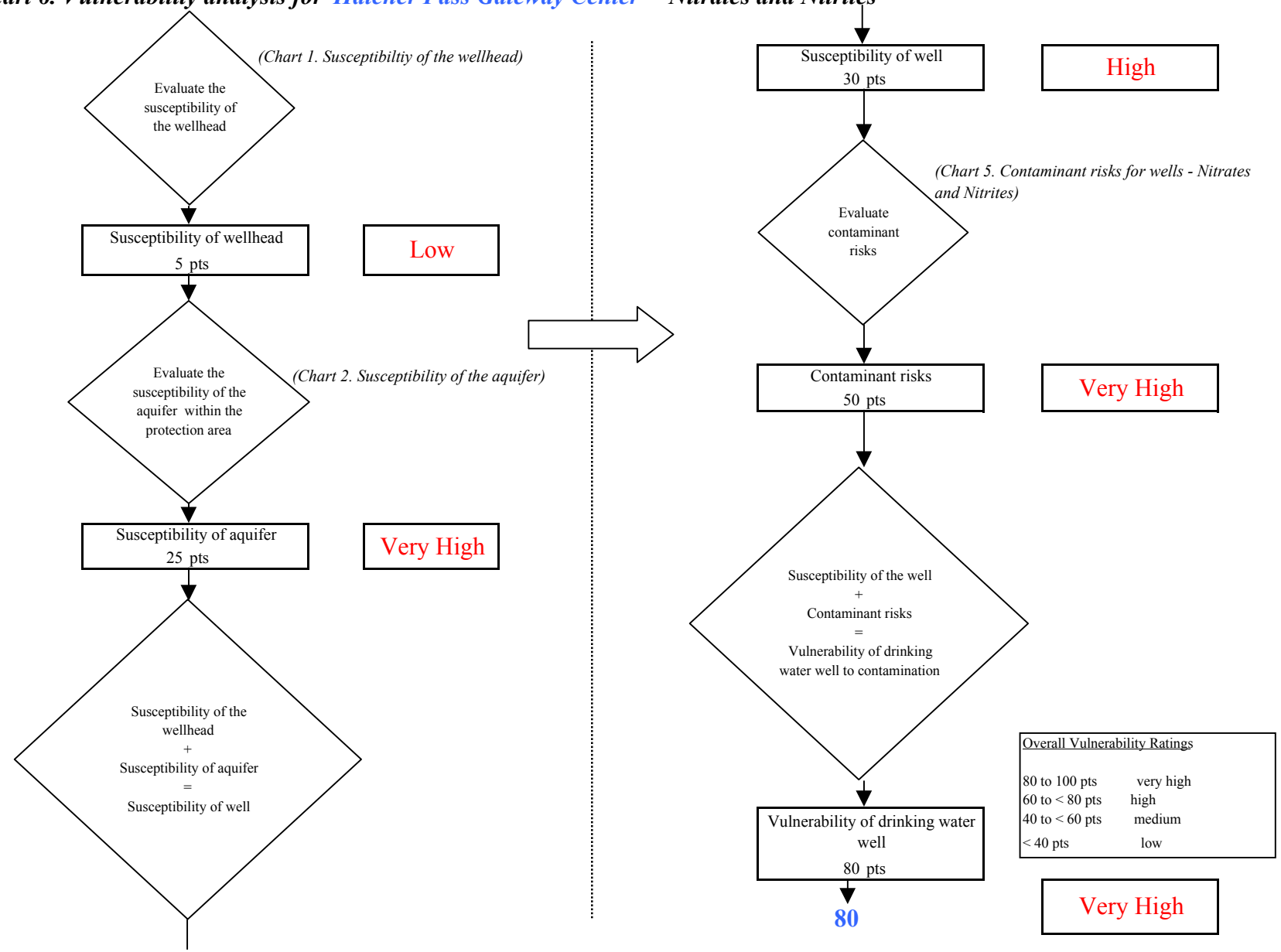


Chart 7. Contaminant risks for Hatcher Pass Gateway Center - Volatile Organic Chemicals

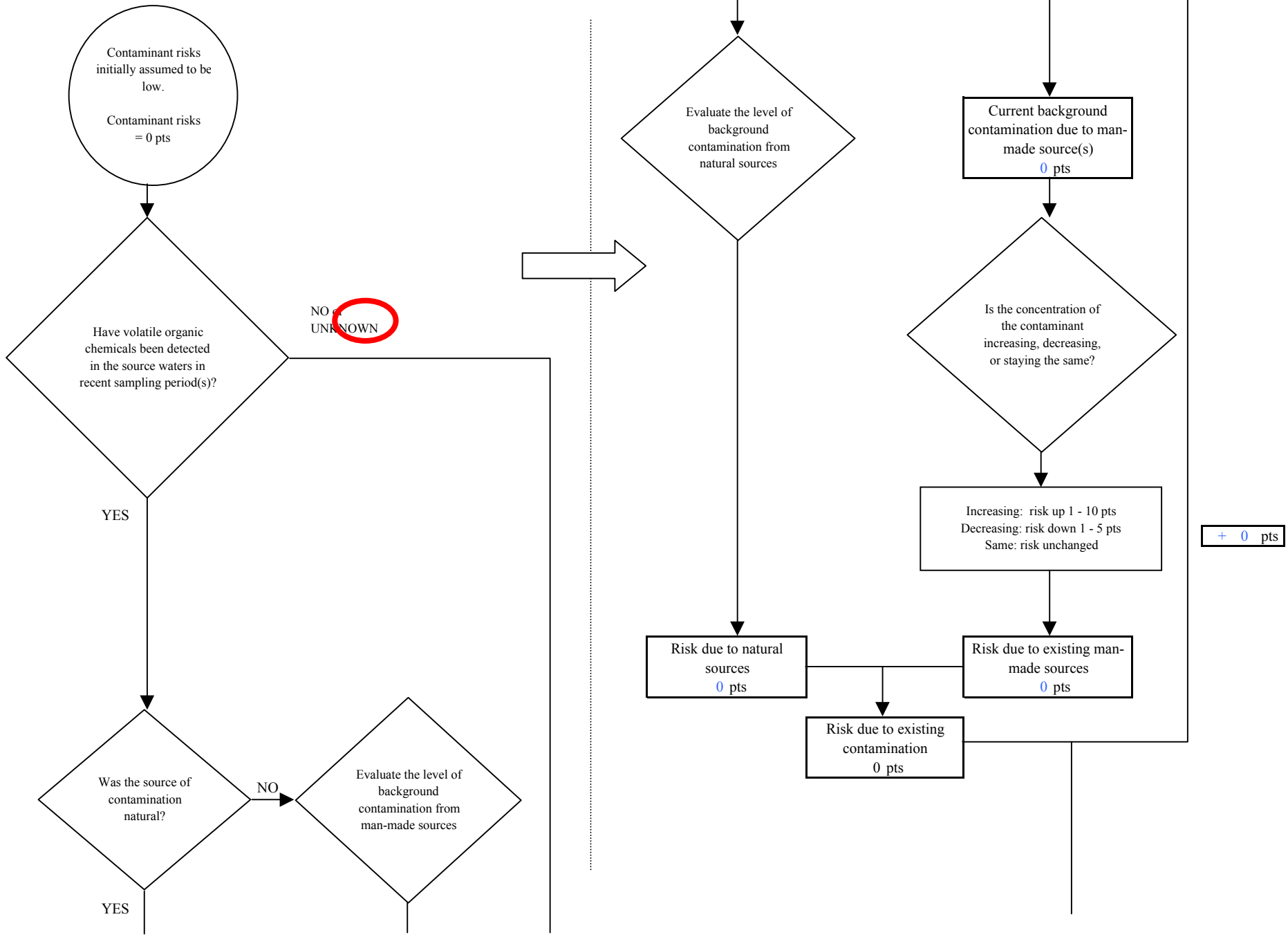


Chart 7. Contaminant risks for Hatcher Pass Gateway Center - Volatile Organic Chemicals

+ 40 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)	3	0	3
Medium(s)	2	0	2
Low(s)	5	4	9

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

Matrix Score 40

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

Initial assessment of risk posed by potential sources of contamination = 40 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

YES

Increase risk 1 - 10 pts

+ 10 pts

The gasoline station and the two underground gasoline storage tanks within Zone A increase the risk

Chart 7. Contaminant risks for Hatcher Pass Gateway Center - Volatile Organic Chemicals

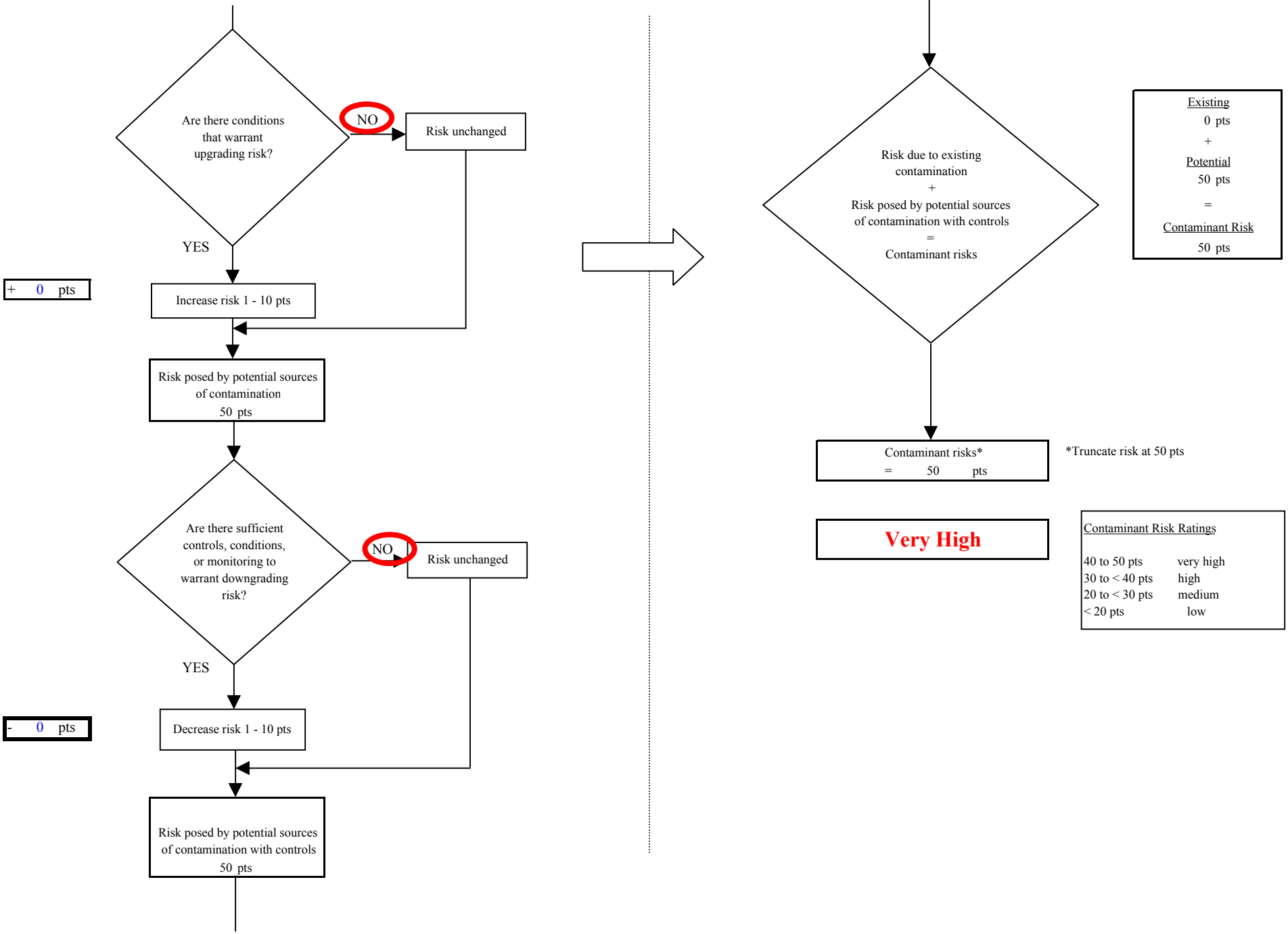


Chart 8. Vulnerability analysis for Hatcher Pass Gateway Center - Volatile Organic Chemicals