Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
McNeil Canyon School
Fritz Creek, Alaska
PWSID 242929

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1553
Alaska Department of Environmental Conservation

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The Drinking Water Protection Program (DWPP) is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

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Source Water Assessment for McNeil Canyon School
Fritz Creek, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability to potential contamination of the public water system serving McNeil Canyon School. This Class A (non-transient non-community) water system consists of two wells located along East End Road near its intersection with McNeil Creek in the community of Fritz Creek, Alaska. The well received a natural susceptibility rating of **Low**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **Low** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the McNeil Canyon School public water system include: septic systems, residential areas, roads, a logging area, and a DEC-recognized contaminated site. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals. Combining the natural susceptibility of the well with the contaminant risk, the public water system for McNeil Canyon School received an overall vulnerability rating of **Medium** for bacteria and viruses, and nitrates and/or nitrites, and a **Low** for volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

MCNEIL CANYON SCHOOL PUBLIC DRINKING WATER SYSTEM

The McNeil Canyon School public water system is a Class A (non-transient non-community) water system. Its two wells are located along the Sterling Highway near its intersection with Ester Road in Anchor Point, Alaska (T4S, R15W, Section 34) (See Map 1 of Appendix A). Anchor Point is located 14 miles northwest of Homer, Alaska. It is within the Kenai Peninsula Borough which is located in south-central Alaska (Please see the inset of Map 1 in Appendix A for location). The Kenai Peninsula Borough is comprised of the Kenai Peninsula, Cook Inlet and a large unpopulated area northeast of the Alaska Peninsula The Borough's current population is almost 50,000 (ADCED, 2002). Communities located within the Borough include: Anchor Point, Grouse Creek Group, Beluga, Clam Gulch, Cohoe, Cooper Landing, Crown Point, Diamond Ridge, Fox River, Fritz Creek, Funny River, Halibut Cove, Happy Valley, Homer, Hope, Kachemak, Kalifornsky, Kasilof, Kenai, Lowell Point, Miller Landing, Moose Pass, Nanwalek, Nikiski, Nikolaevsk, Ninilchik, Port Graham, Primrose, Ridgeway, Salamatof, Seldovia, Seldovia Village, Seward, Soldotna, Sterling, Sunrise and Tyonek.

Most residents of Fritz Creek have water hauled or use individual water wells and use septic systems or outhouses (ADCED, 2002). Residents primarily use heating oil (typically stored in both above and below ground 275 to 500-gallon tanks), but also wood or bottled gas to heat homes and buildings (ADCED, 2002). A Borough refuse transfer facility is available at mile 157 of the Sterling Highway, or Homer sanitation facilities are used (ADCED, 2002).

The McNeil Canyon School well lies on the north shore of Kachemak Bay an elevation of approximately 1200 feet above sea level.

According to the well logs, the depths of the wells are 155 and 158 feet below the ground. Sediments in the area generally consist of a combination of sand, gravel, silt, and clay and were deposited by glacially-fed streams, abandoned-channel deposits, glacial moraines and alluvium from existing streams (Glass, 1996). There can be a significant variation in the composition of sediment layers over relatively small areas. Consequently, confinement of the aquifers in the area can vary over short distances (Glass, 1996). The aquifer in the area of the McNeil Canyon School well is confined by almost 100 feet of clay with some sands and silts.

The McNeil Canyon School public drinking water system serves approximately 136 residents through one service connection.

MCNEIL CANYON SCHOOL DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water wells is the area that contributes water to the well, the groundwater capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different ways of calculating the size of capture zones. This assessment uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture zone calculated in this assessment is only a best guess using the information and resources available to us, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the area and were obtained from area well logs in the area and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

Only limited information is available for the aquifer McNeil Canyon School's public water system well draws its water from. The orientation of the capture zone was drawn based on the assumption that groundwater flow direction is generally the same direction as the topography.

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into four zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the four zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than 2 years time-of-travel
C	Less than 5 years time-of-travel
D	Less than 10 years time-of-travel

The time of travel for *contaminants* within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the McNeil Canyon School on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program (DWPP) has completed an inventory of potential and existing sources of contamination within the McNeil Canyon School protection area. This inventory was completed through a search of agency records and other publicly available information. 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 A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile organic chemicals;
- Heavy metals, cyanide, and other inorganic chemicals;
- Synthetic organic chemicals; and
- Other inorganic chemicals.

The sources are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are each assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a combination of toxicity and volume associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

Tables 2 through 7 in Appendix B contain the ranking of inventoried potential and existing sources of contamination with respect to the six contaminant categories.

VULNERABILITY OF MCNEIL CANYON SCHOOL DRINKING WATER SYSTEM

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

- Natural susceptibility; and
- Contaminant risks.

Appendix D contains fourteen 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 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 properties of the aquifer and the presence of other wells or boreholes in the area. 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 the water system's contaminant sample results. Lastly, Chart 4 combines the results of the first three charts to produce the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

A score for the Natural Susceptibility is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
(Chart 2 of Appendix D)

=

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

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

Natural Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

The wellhead for the McNeil Canyon School received a Low Susceptibility rating. The 4/12/01 Sanitary Survey indicates the well is capped with a sanitary seal, the land surface is sloped away from the well; and the well is grouted. A sanitary seal prevents potential contaminants from entering the well from the inside while sloping the land surface away from the well and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer the McNeil Canyon School well is completed in received a Low Susceptibility rating. The aquifer in this area is confined with over 100 feet of low-permeability clay. This clay layer inhibits surface contaminants from migrating down to the aquifer. Although none were identified, private residential wells in the area can provide a quick pathway for contaminants to travel down into the aquifer if they are not grouted correctly. Table 2 summarizes the Susceptibility scores and ratings for McNeil Canyon School.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	3	Low
Natural Susceptibility	3	Low

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	10	Low
Nitrates and/or Nitrites	13	Low
Volatile Organic Chemicals	10	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	50	Very High
Synthetic Organic Chemicals	10	Low
Other Organic Chemicals	10	Low

Finally, an overall vulnerability score is assigned for each water system by combining each of the contaminant risk scores with the natural susceptibility score:

Natural Susceptibility (0 – 50 points)
+
Contaminant Risks (0 – 50 points)
=
Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80 to 100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	15	Low
Nitrates and/or Nitrites	15	Low
Volatile Organic Chemicals	15	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	55	Medium
Synthetic Organic Chemicals	15	Low
Other Organic Chemicals	15	Low

Bacteria and Viruses

The septic systems represents the greatest risk of Bacteria and Viruses to this water system.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, it is an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli which only come from human and animal fecal waste (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Routine sampling has not recently detected coliforms in the water.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Nitrates and Nitrites

The septic systems also represent the greatest risk of nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have not been detected in significant concentrations in recent sampling history for the McNeil Canyon School well.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Volatile Organic Chemicals

The septic systems, residential areas, and roads represent the identified risk for volatile organic chemical contamination to the well.

Volatile Organic Chemicals have not been detected during routine sampling of this water system. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The septic systems, residential areas, and roads represent the identified risk to heavy metals for this source of public drinking water.

Arsenic has consistently been detected in this water system, most recently (11/7/02) at a concentration of 0.00.047mg/L, or 94% with respect to its current Maximum Contaminant Level (MCL) of 0.05 mg/L. An MCL is the highest concentration of a contaminant allowed in drinking water by the Environmental Protection Agency (EPA). In concentrations above the MCL, prolonged ingestion of arsenic is known to cause skin damage, problems with circulatory systems, and may create an increased risk of developing cancer (EPA, 2002). Fluoride was also detected in one sample but in an extremely low concentration with respect to its MCL. No other heavy metals were detected during routine sampling.

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is medium.

Synthetic Organic Chemicals

The residential area and septic systems combine to represent the risk of synthetic organic chemicals for this source of public drinking water.

Synthetic Organic Chemicals have not recently been sampled for in this well.

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Other Organic Chemicals

The residential septic systems, roads, and residential area combine to represent the risk of other organic chemicals for this source of public drinking water.

Other Organic Chemicals have not recently been sampled for in this water system.

After combining the contaminant risk for other organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

REFERENCES

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

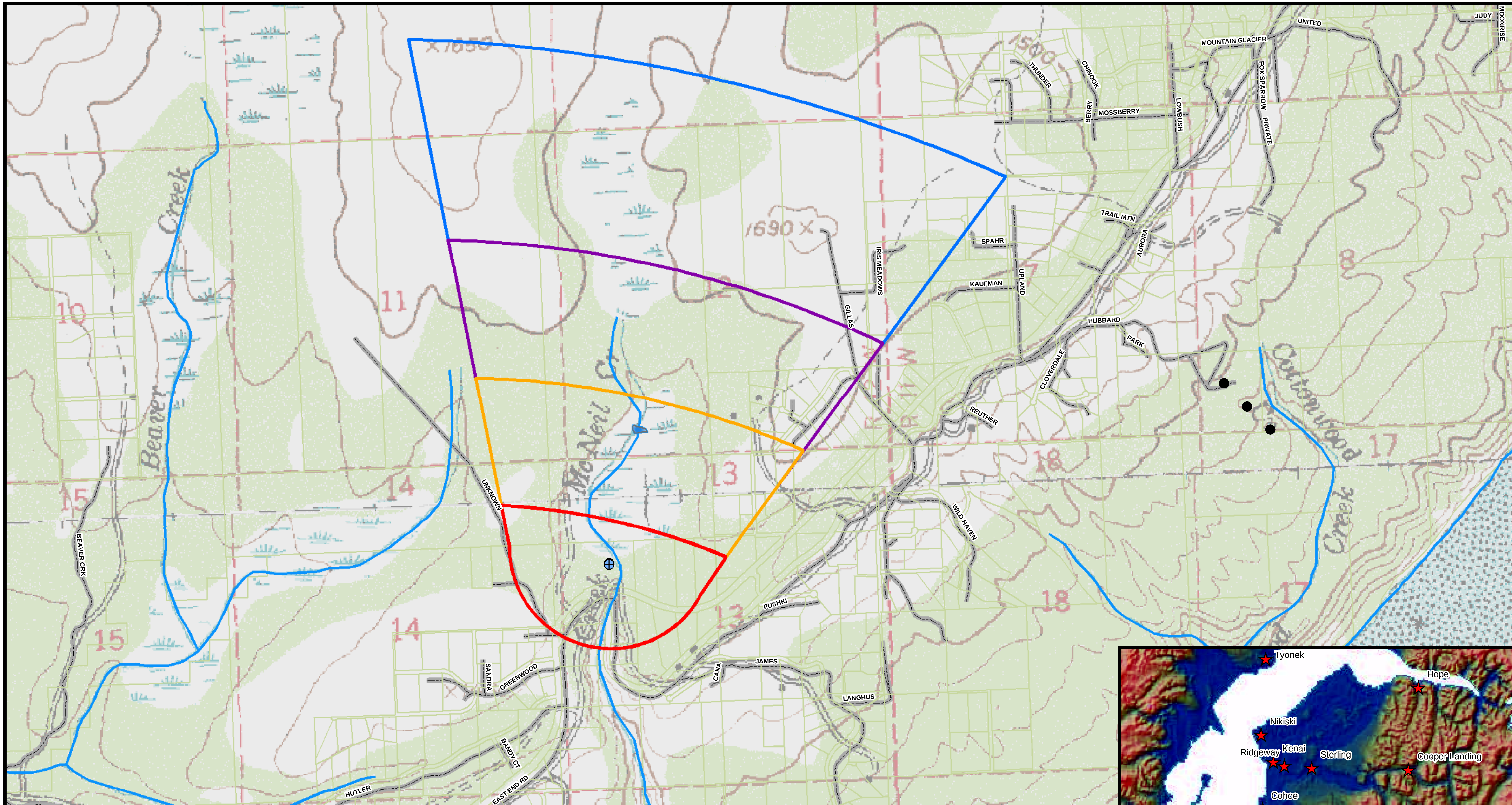
Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

Glass, R.L., 1996, Ground-water conditions and quality in the western part of Kenai Peninsula, southcentral Alaska, Prepared in cooperation with the Alaska Department of Natural Resources, Kenai Peninsula Borough, Kenai Soil and Water Conservation District, U.S. Geological Survey, Anchorage, AK, and Branch of Information Services, Denver, CO.

United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

McNeil Canyon School
Drinking Water Protection Area Location Map
(Map 1)



Map 1-KPBSD McNeil Canyon-Drinking Water Protection Area

PWSID: 242929.001 and 242929.002

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 500 1,000 2,000 Feet

1:17,900

Data Sources:
Kenai Borough: Roads and parcels
63,000 Topographic map:USGS
Potential Sources of Contamination: ADEC

Class A Public Water System
Zone A Protection Area
Zone B Protection Area
Zone C Protection Area
Zone D Protection Area
Roads
Rivers and Streams
Water

APPENDIX B

Contaminant Source Inventory and Risk Ranking for McNeil Canyon School (Tables 1-7)

Table 1

Contaminant Source Inventory for
KPBSD McNeil Canyon School

PWSID 242929.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Residential Areas	R01	R01-1	A	2	Zone A has 2 residential acres identified.
Highways and roads, paved (cement or asphalt)	X20	X20-1-5	A	2	Zone A has 2 roads identified.
Residential Areas	R01	R01-2	B	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	2	Zone C has 2 residential septic systems identfied.
Highways and roads, paved (cement or asphalt)	X20	X20-6-7	B	2	Zone B has 2 road identified.
Residential Areas	R01	R01-3	C	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	2	Zone C has 2 residential septic systems identified.
Highways and roads, paved (cement or asphalt)	X20	X20-8-9	C	2	Zone C has 2 roads identified.

Table 2

Contaminant Source Inventory and Risk Ranking for KPBSD McNeil Canyon School Sources of Bacteria and Viruses

PWSID 242929.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Residential Areas	R01	R01-1	A	Low	2	Zone A has 2 residential acres identified.
Highways and roads, paved (cement or asphalt)	X20	X20-1-5	A	Low	2	Zone A has 2 roads identified.
Residential Areas	R01	R01-2	B	Low	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	Low	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	Low	2	Zone C has 2 residential septic systems identfied.
Highways and roads, paved (cement or asphalt)	X20	X20-6-7	B	Low	2	Zone B has 2 road identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	Low	2	Zone C has 2 residential septic systems identified.
Highways and roads, paved (cement or asphalt)	X20	X20-8-9	C	Low	2	Zone C has 2 roads identified.

Table 3

Contaminant Source Inventory and Risk Ranking for KPBSD McNeil Canyon School Sources of Nitrates/Nitrites

PWSID 242929.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Residential Areas	R01	R01-1	A	Low	2	Zone A has 2 residential acres identified.
Highways and roads, paved (cement or asphalt)	X20	X20-1-5	A	Low	2	Zone A has 2 roads identified.
Residential Areas	R01	R01-2	B	Low	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	Low	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	Low	2	Zone C has 2 residential septic systems identfied.
Highways and roads, paved (cement or asphalt)	X20	X20-6-7	B	Low	2	Zone B has 2 road identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	Low	2	Zone C has 2 residential septic systems identified.
Highways and roads, paved (cement or asphalt)	X20	X20-8-9	C	Low	2	Zone C has 2 roads identified.

Table 4

Contaminant Source Inventory and Risk Ranking for KPBSD McNeil Canyon School Sources of Volatile Organic Chemicals

PWSID 242929.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Residential Areas	R01	R01-1	A	Low	2	Zone A has 2 residential acres identified.
Highways and roads, paved (cement or asphalt)	X20	X20-1-5	A	Low	2	Zone A has 2 roads identified.
Residential Areas	R01	R01-2	B	Low	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	Low	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	Low	2	Zone C has 2 residential septic systems identfied.
Highways and roads, paved (cement or asphalt)	X20	X20-6-7	B	Low	2	Zone B has 2 road identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	Low	2	Zone C has 2 residential septic systems identified.
Highways and roads, paved (cement or asphalt)	X20	X20-8-9	C	Low	2	Zone C has 2 roads identified.

Table 5

Contaminant Source Inventory and Risk Ranking for KPBSD McNeil Canyon School

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 242929.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Residential Areas	R01	R01-1	A	Low	2	Zone A has 2 residential acres identified.
Highways and roads, paved (cement or asphalt)	X20	X20-1-5	A	Low	2	Zone A has 2 roads identified.
Residential Areas	R01	R01-2	B	Low	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	Low	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	Low	2	Zone C has 2 residential septic systems identfied.
Highways and roads, paved (cement or asphalt)	X20	X20-6-7	B	Low	2	Zone B has 2 road identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	Low	2	Zone C has 2 residential septic systems identified.
Highways and roads, paved (cement or asphalt)	X20	X20-8-9	C	Low	2	Zone C has 2 roads identified.

Table 6

Contaminant Source Inventory and Risk Ranking for KPBSD McNeil Canyon School
Sources of Synthetic Organic Chemicals

PWSID 242929.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Residential Areas	R01	R01-1	A	Low	2	Zone A has 2 residential acres identified.
Residential Areas	R01	R01-2	B	Low	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	Low	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	Low	2	Zone C has 2 residential septic systems identfied.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	Low	2	Zone C has 2 residential septic systems identified.

Table 7

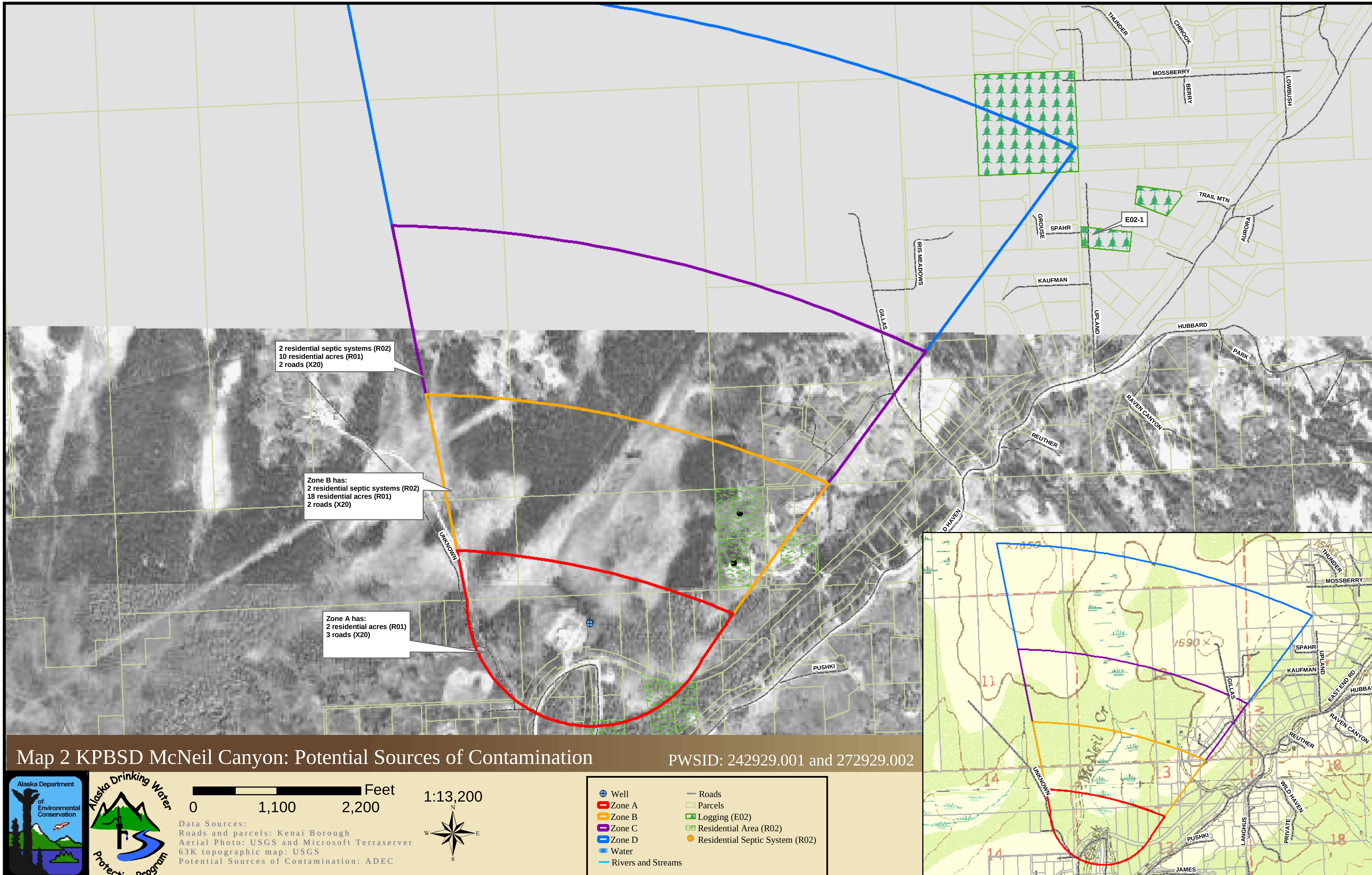
Contaminant Source Inventory and Risk Ranking for KPBSD McNeil Canyon School Sources of Other Organic Chemicals

PWSID 242929.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Residential Areas	R01	R01-1	A	Low	2	Zone A has 2 residential acres identified.
Highways and roads, paved (cement or asphalt)	X20	X20-1-5	A	Low	2	Zone A has 2 roads identified.
Residential Areas	R01	R01-2	B	Low	2	Zone B has 18 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-1-2	B	Low	2	Zone B has 2 residential septic systems identified.
Septic systems (serves one single-family home)	R02	R02-3-4	B	Low	2	Zone C has 2 residential septic systems identfied.
Highways and roads, paved (cement or asphalt)	X20	X20-6-7	B	Low	2	Zone B has 2 road identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 10 residential acres identified.
Septic systems (serves one single-family home)	R02	R02-5-6	C	Low	2	Zone C has 2 residential septic systems identified.
Highways and roads, paved (cement or asphalt)	X20	X20-8-9	C	Low	2	Zone C has 2 roads identified.

APPENDIX C

McNeil Canyon School
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)



Map 2 KPBSD McNeil Canyon: Potential Sources of Contamination

PWSID: 242929.001 and 272929.002

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,100 2,200 Feet

1:13,200

N W E S

Data Sources:
Roads and parcels: Kenai Borough
Aerial Photo: USGS and Microsoft Terraserver
63K topographic map: USGS
Potential Sources of Contamination: ADEC

- Well
- Zone A
- Zone B
- Zone C
- Zone D
- Water
- Rivers and Streams
- Roads
- Parcels
- Logging (E02)
- Residential Area (R02)
- Residential Septic System (R02)

APPENDIX D

Vulnerability Analysis for McNeil Canyon School Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - McNeil Canyon

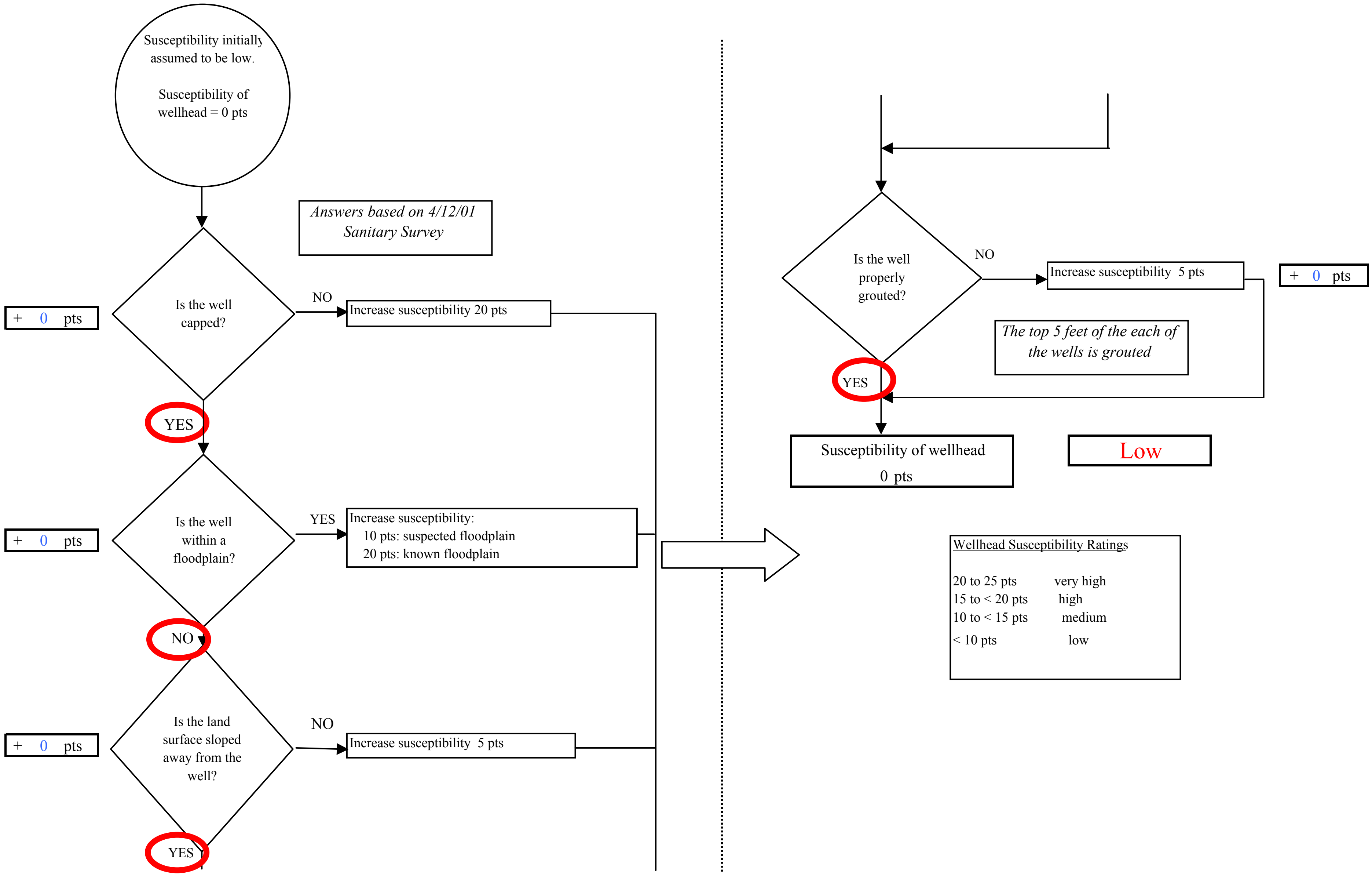


Chart 2. Susceptibility of the aquifer - McNeil Canyon

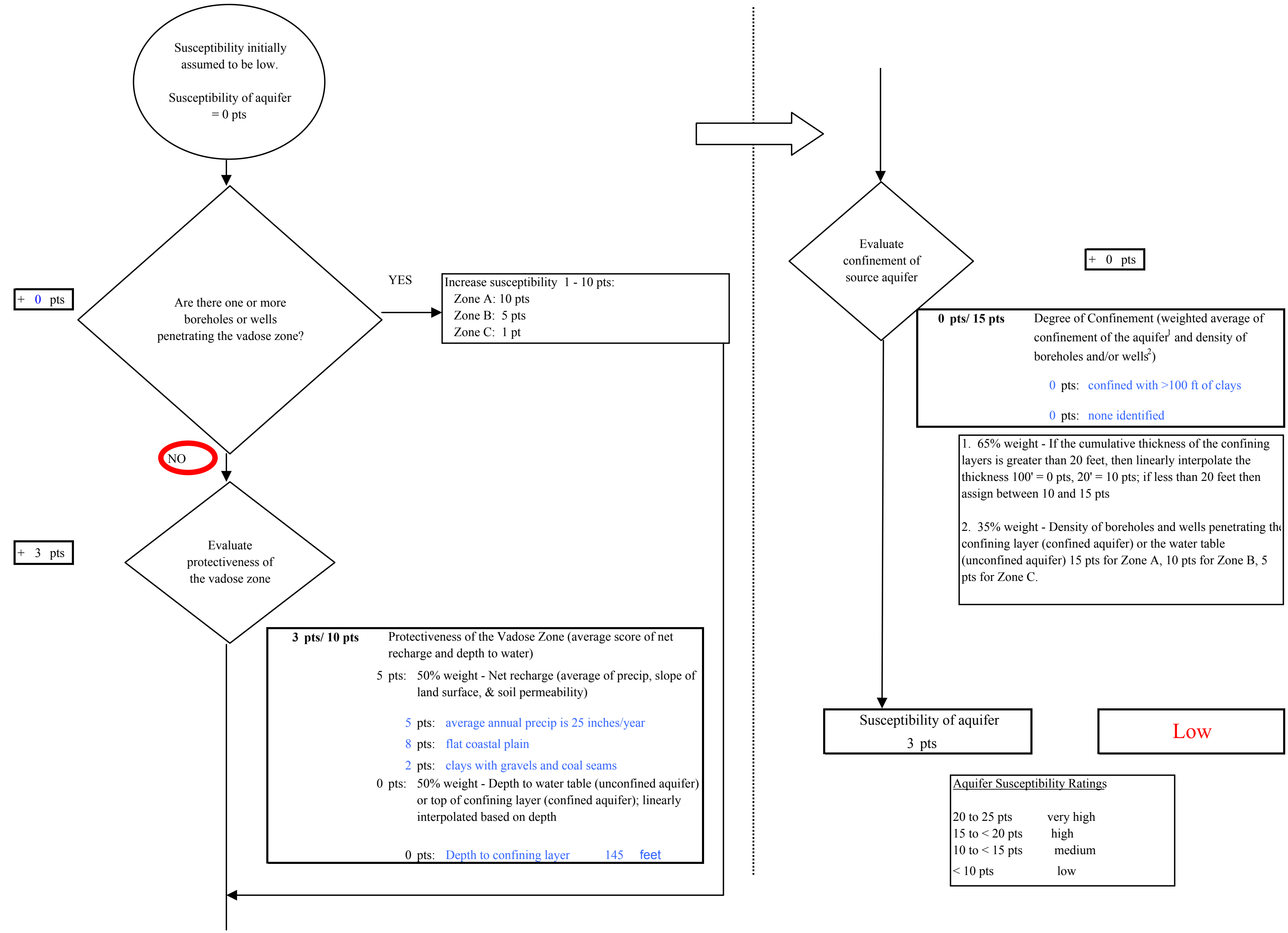
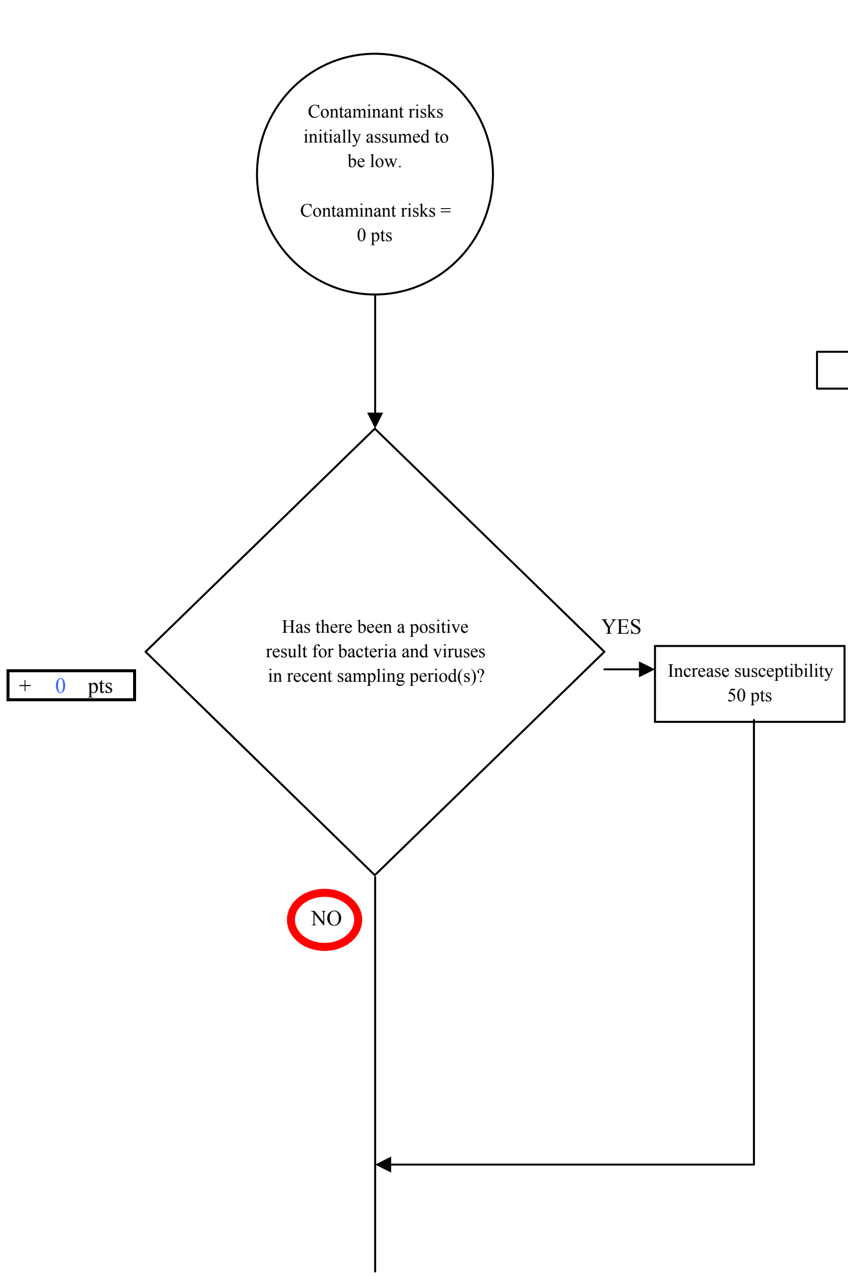
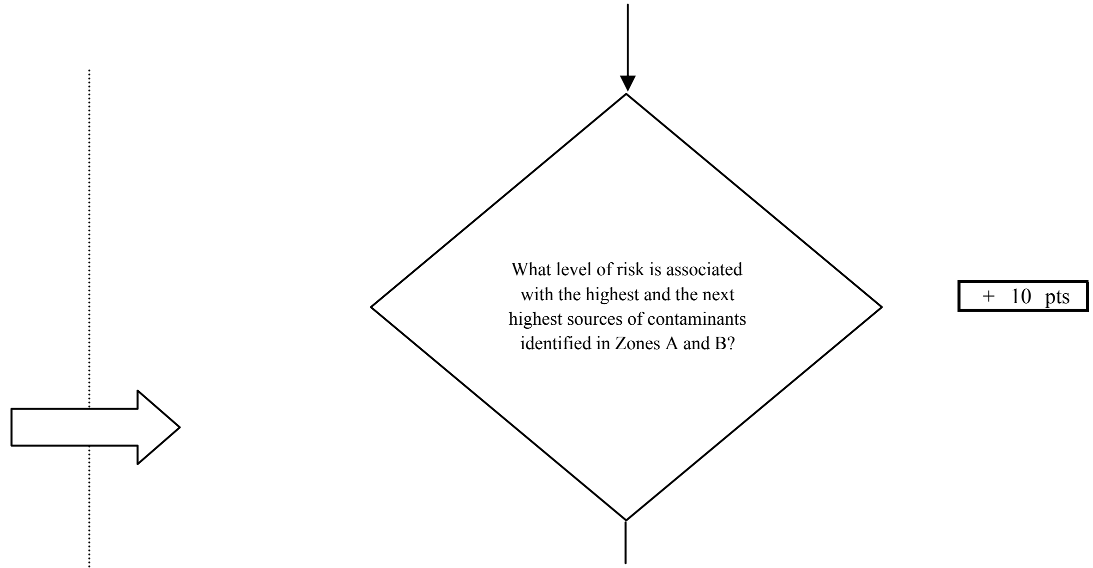


Chart 3. Contaminant risks for McNeil Canyon - Bacteria & Viruses





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)	3	3	6

	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 McNeil Canyon - Bacteria & Viruses

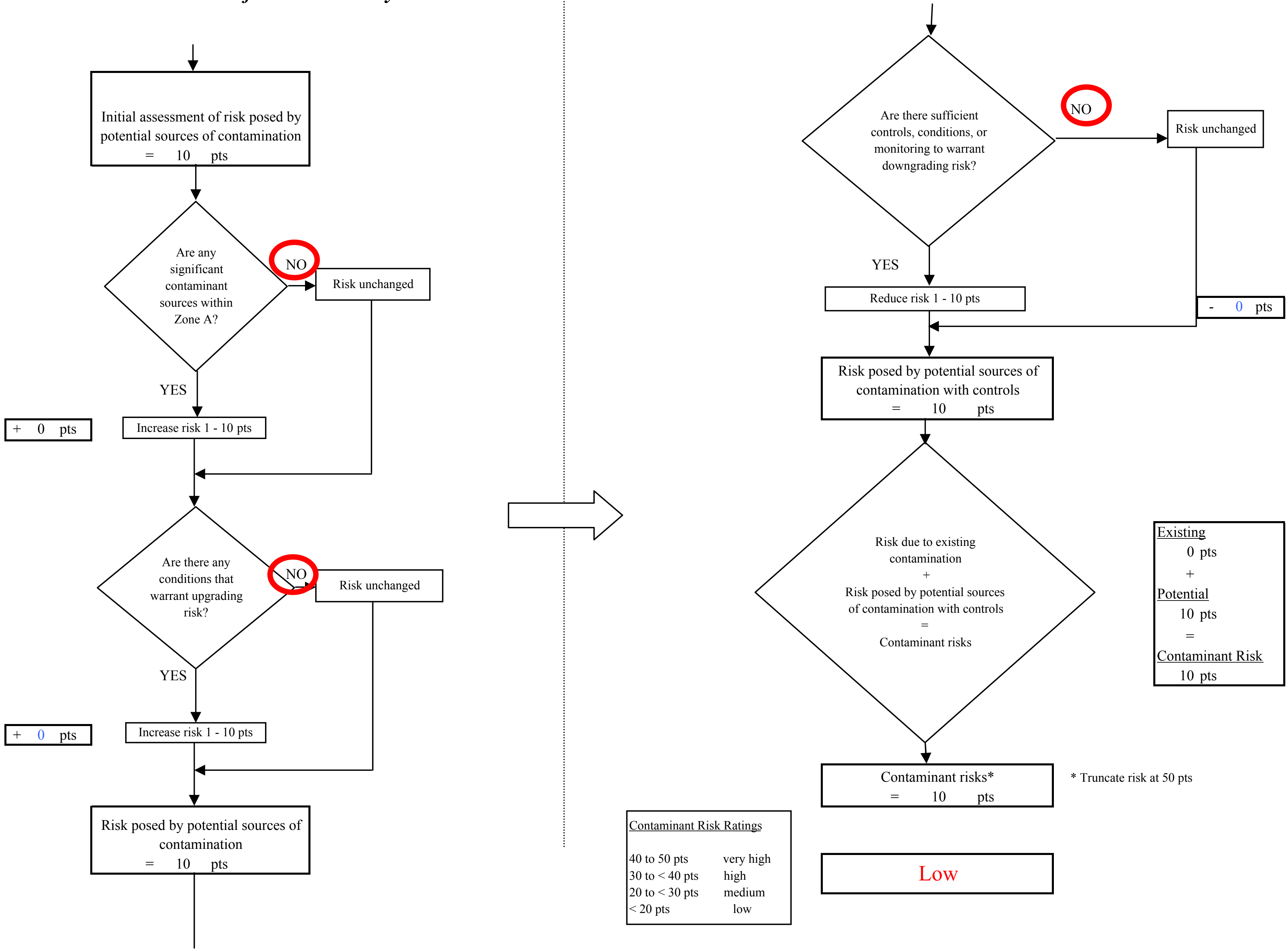


Chart 4. Vulnerability analysis for McNeil Canyon - Bacteria & Viruses

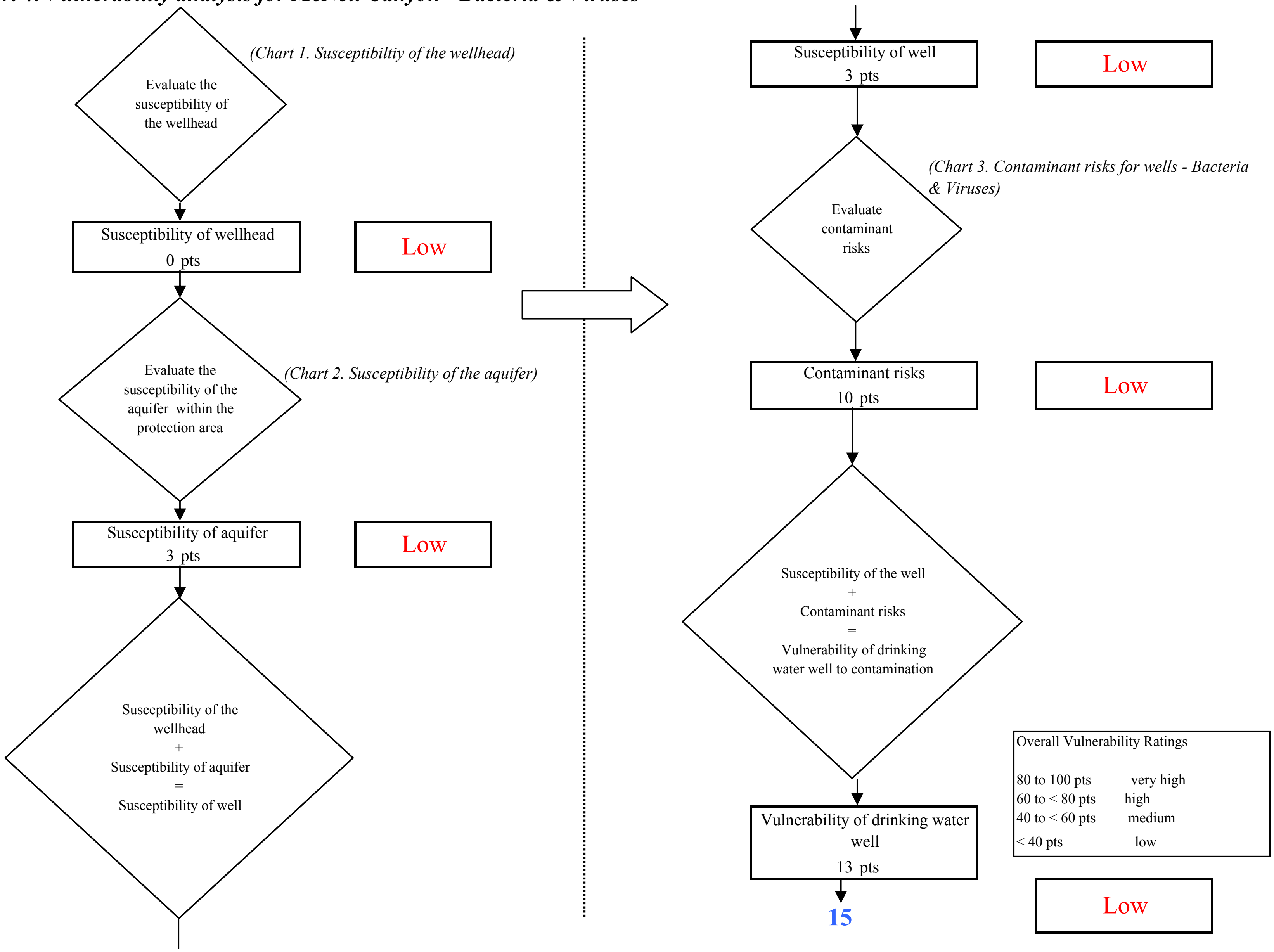


Chart 5. Contaminant risks for McNeil Canyon - Nitrates and Nitrites

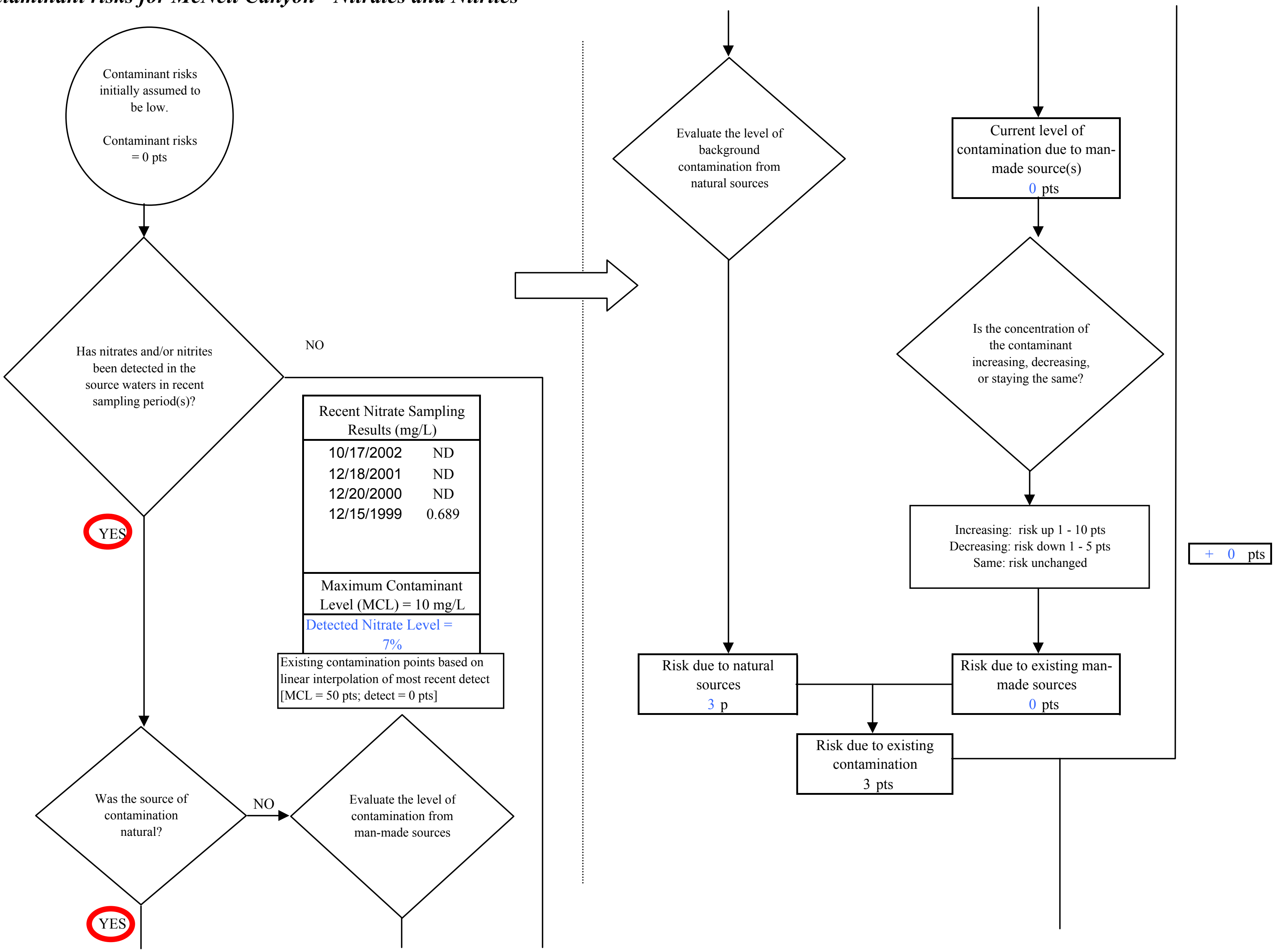
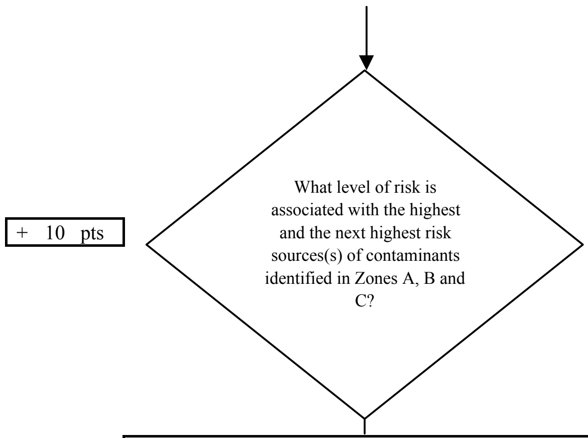


Chart 5. Contaminant risks for McNeil Canyon - Nitrates and Nitrites



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)	0	0	0
Medium(s)	0	0	0
Low(s)	3	4	7

	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.

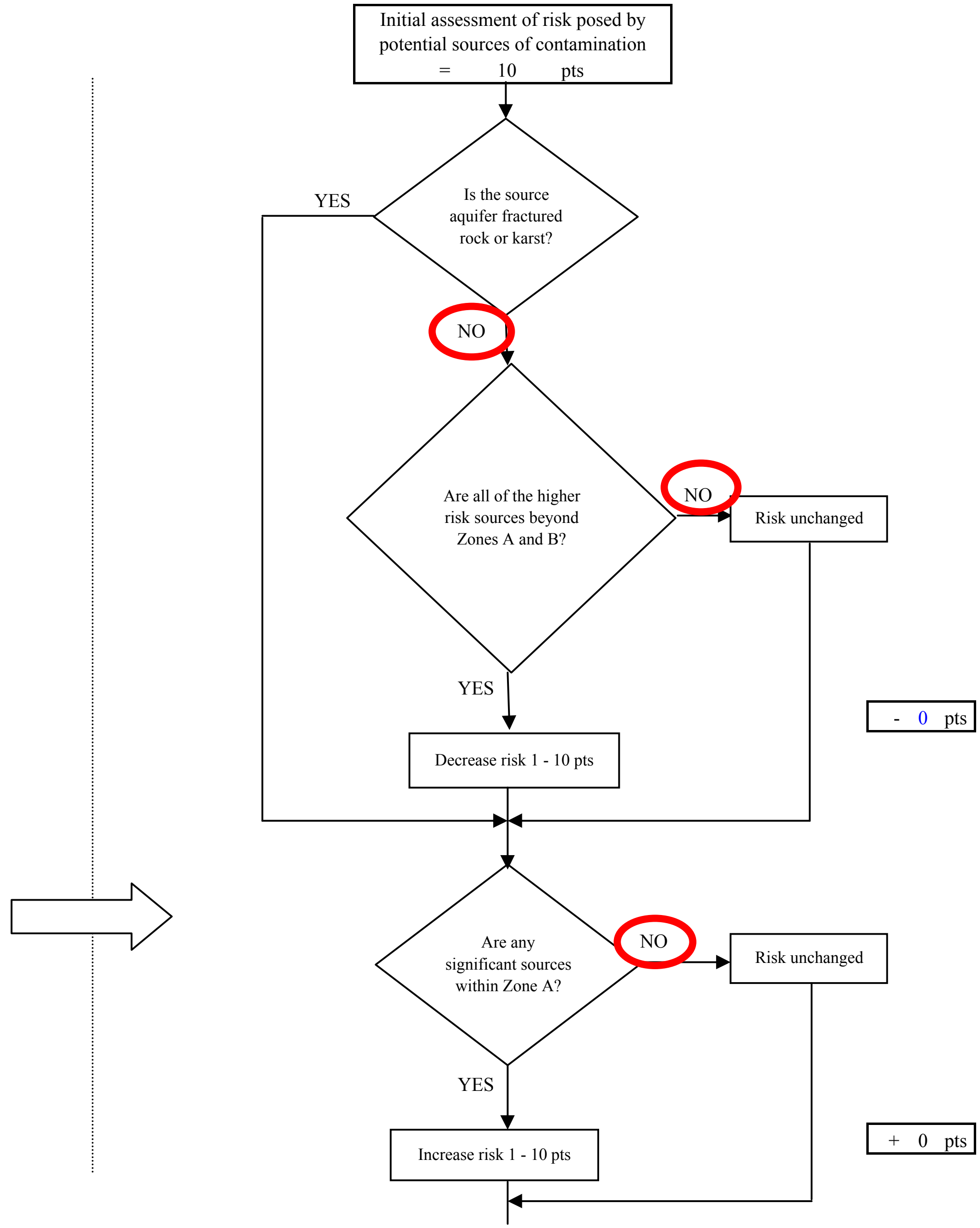


Chart 5. Contaminant risks for McNeil Canyon - Nitrates and Nitrites

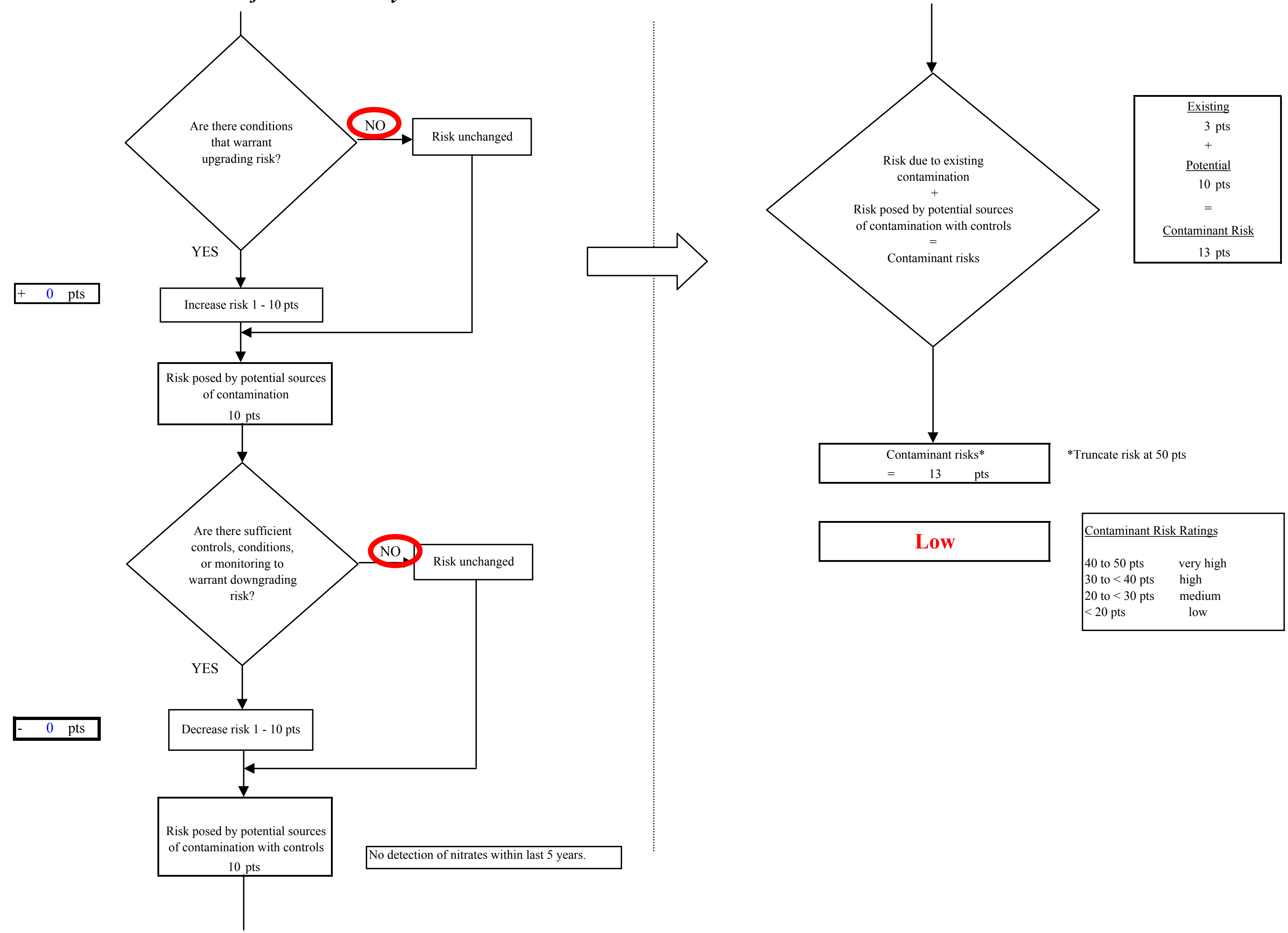


Chart 6. Vulnerability analysis for McNeil Canyon - Nitrates and Nitrites

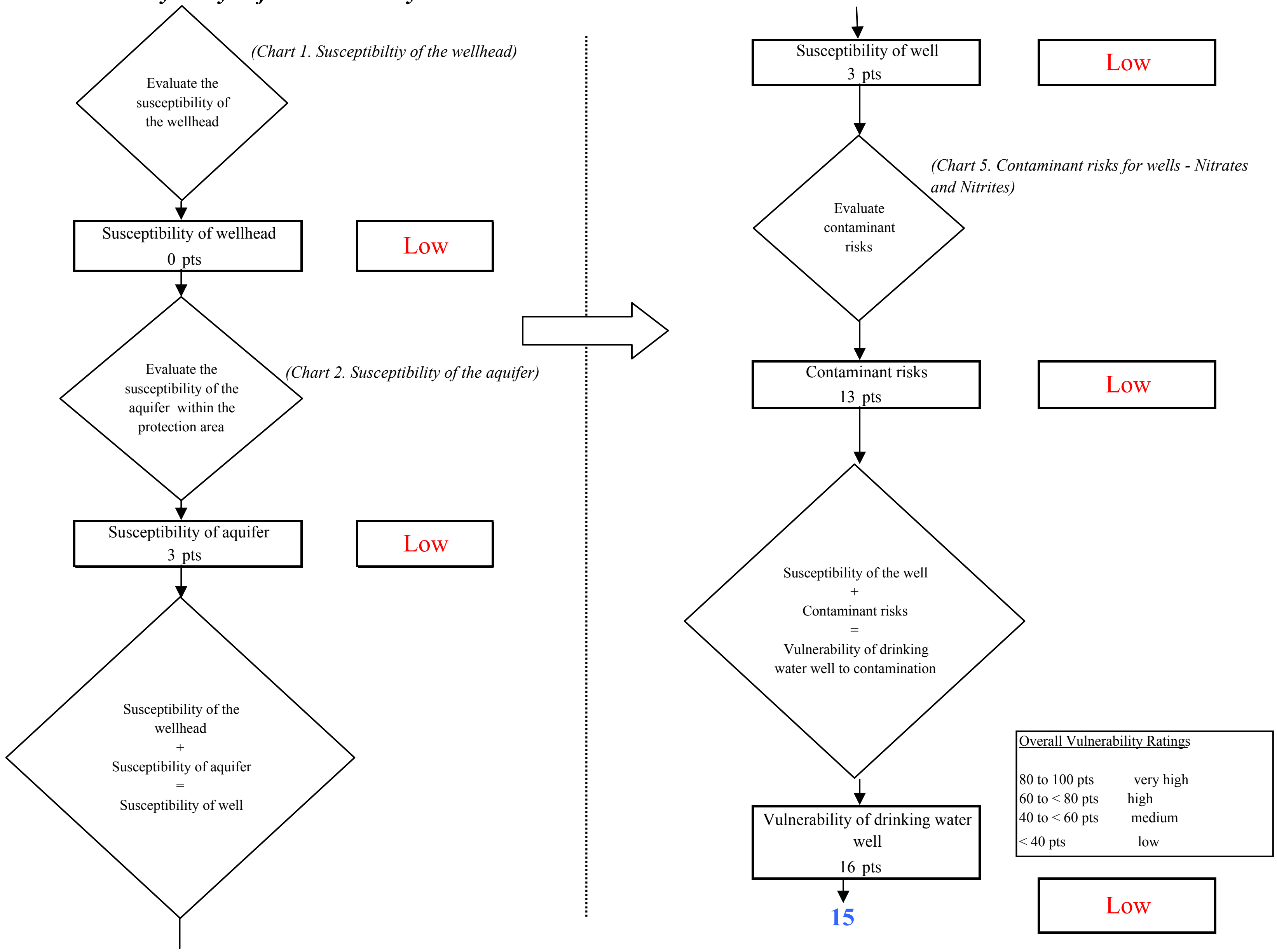


Chart 7. Contaminant risks for McNeil Canyon - Volatile Organic Chemicals

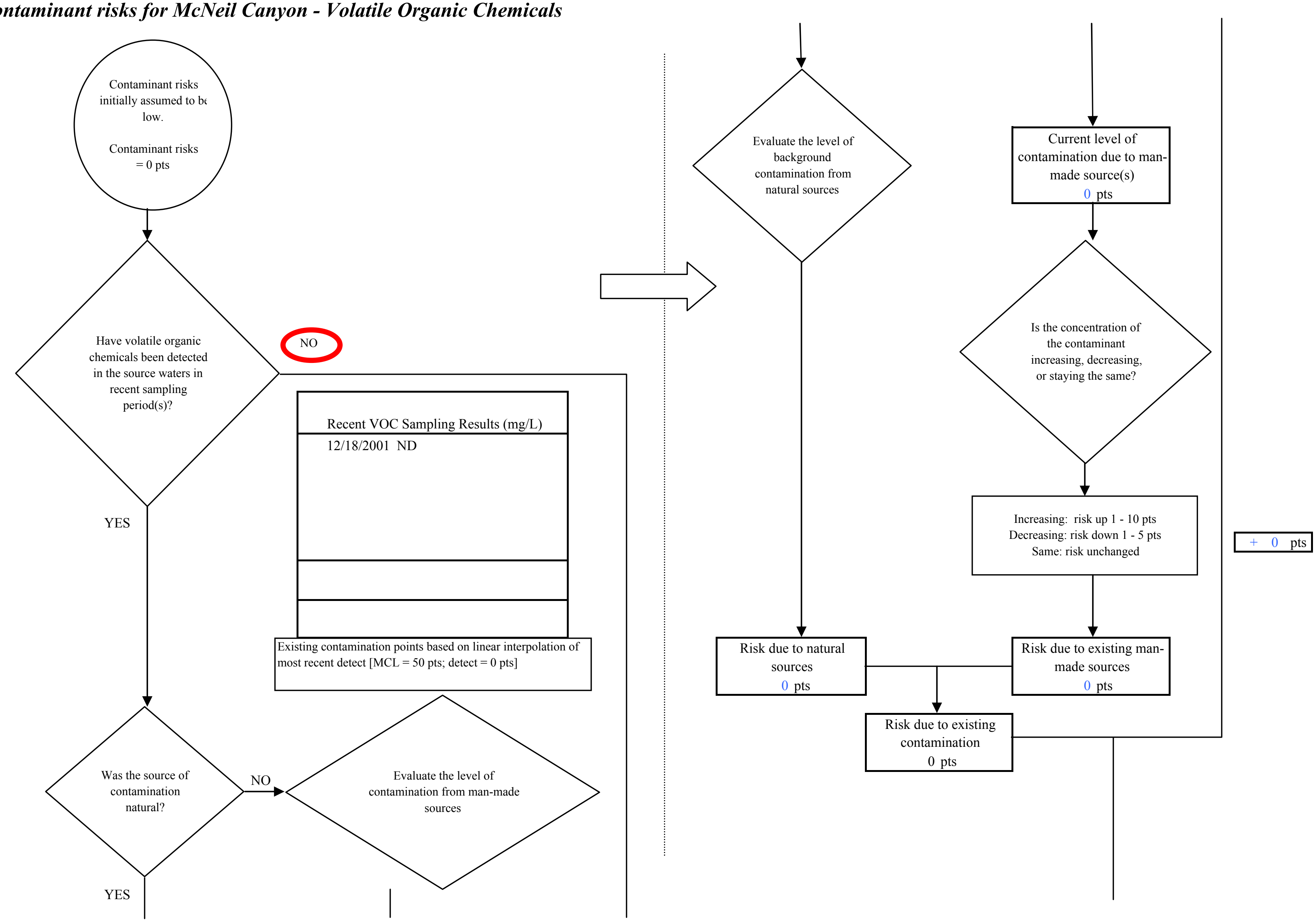
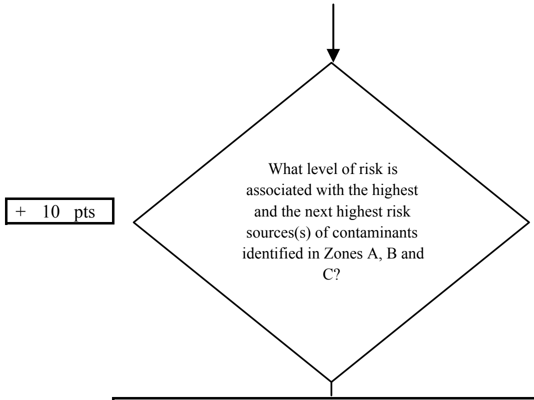


Chart 7. Contaminant risks for McNeil Canyon - Volatile Organic Chemicals



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)	3	4	7

	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 th 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.

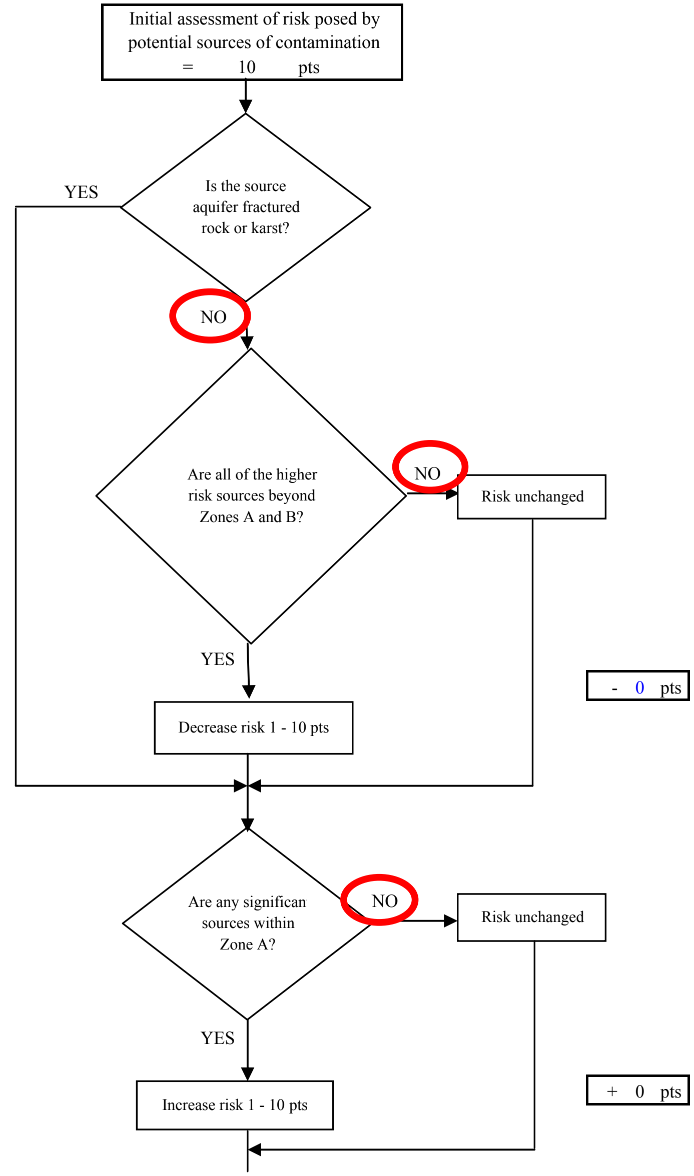


Chart 7. Contaminant risks for McNeil Canyon - Volatile Organic Chemicals

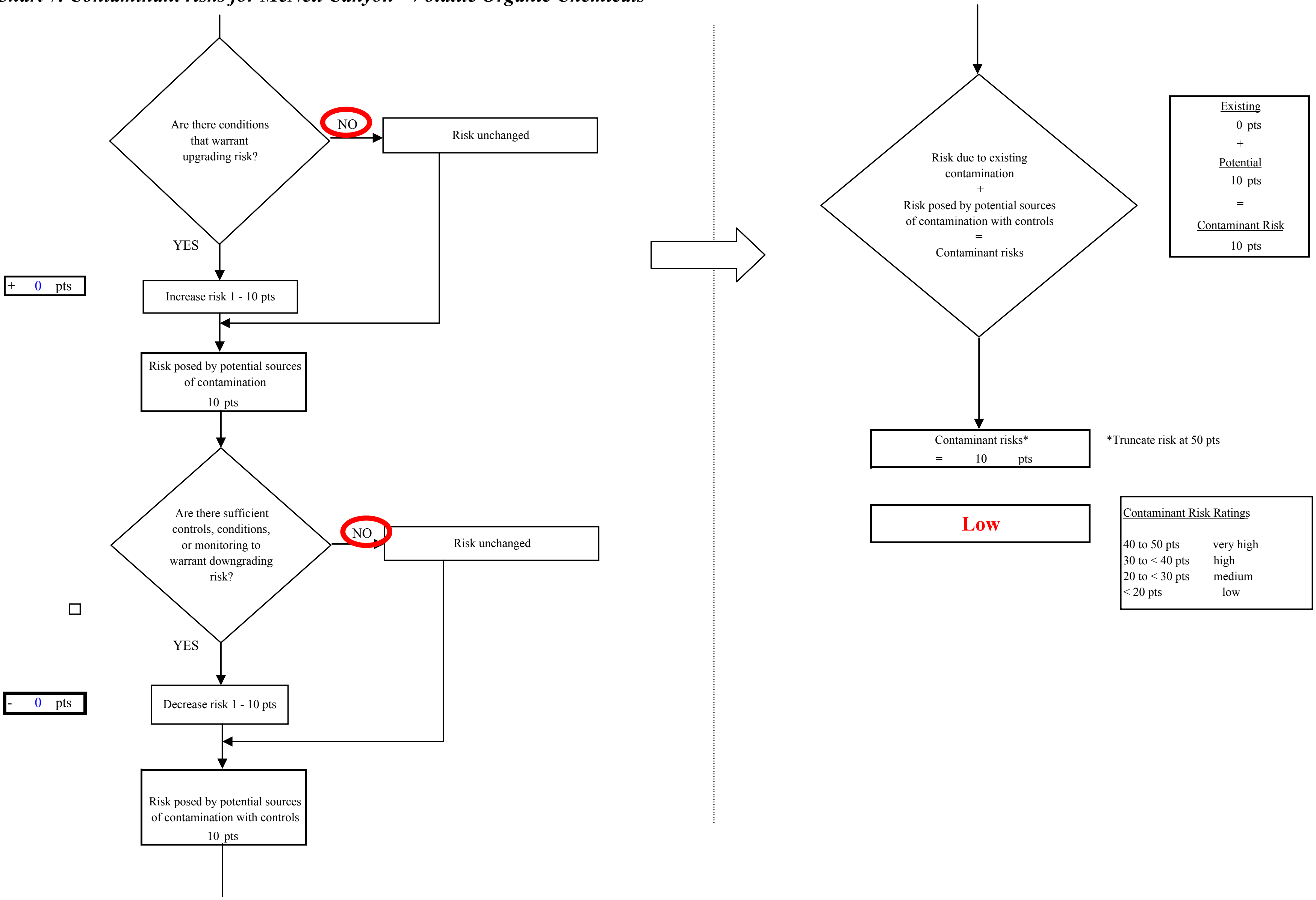


Chart 8. Vulnerability analysis for McNeil Canyon - Volatile Organic Chemicals

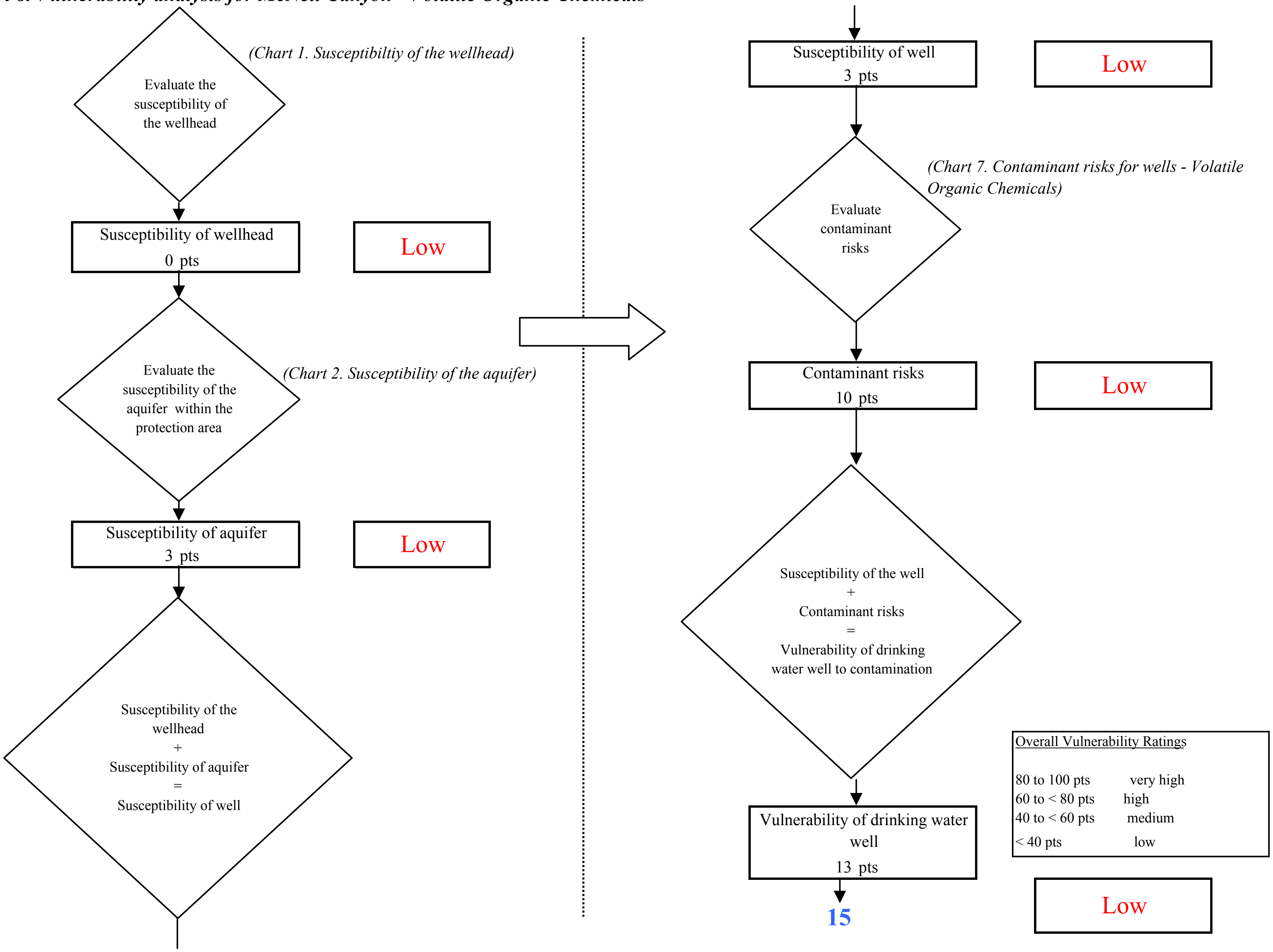


Chart 9. Contaminant risks for McNeil Canyon - Heavy Metals, Cyanide and Other Inorganic Chemicals

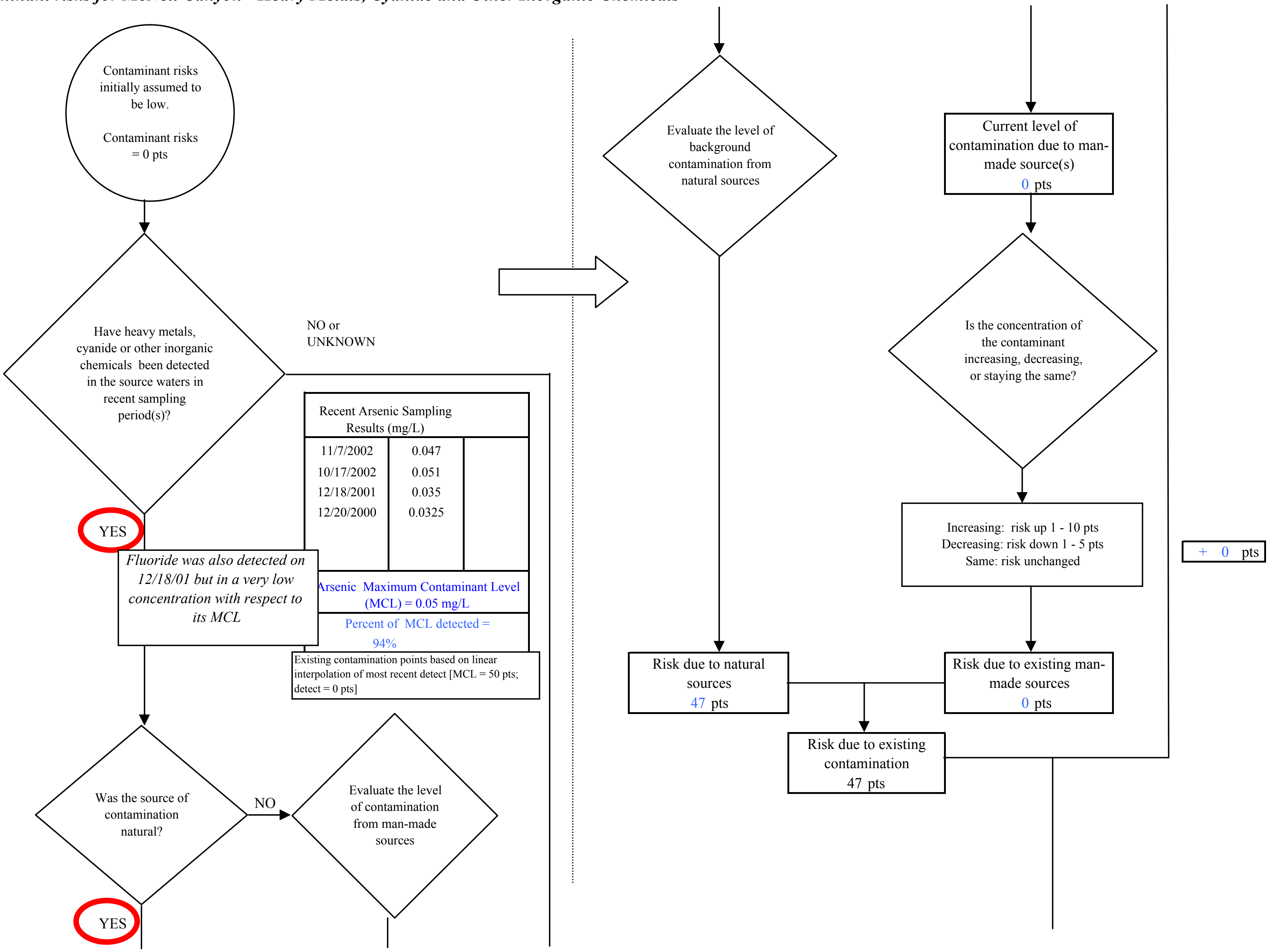
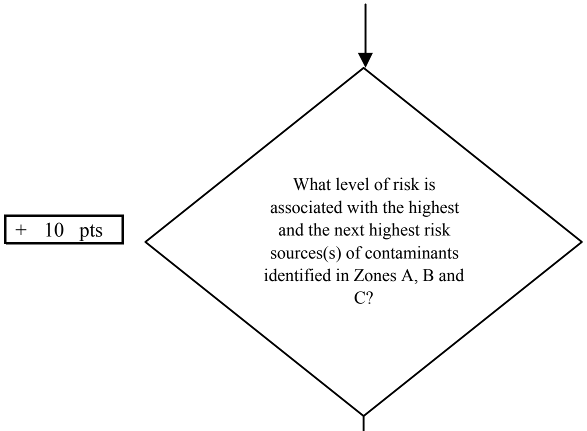


Chart 9. Contaminant risks for McNeil Canyon - Heavy Metals, Cyanide and Other Inorganic Chemicals



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)	3	4	7

	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.

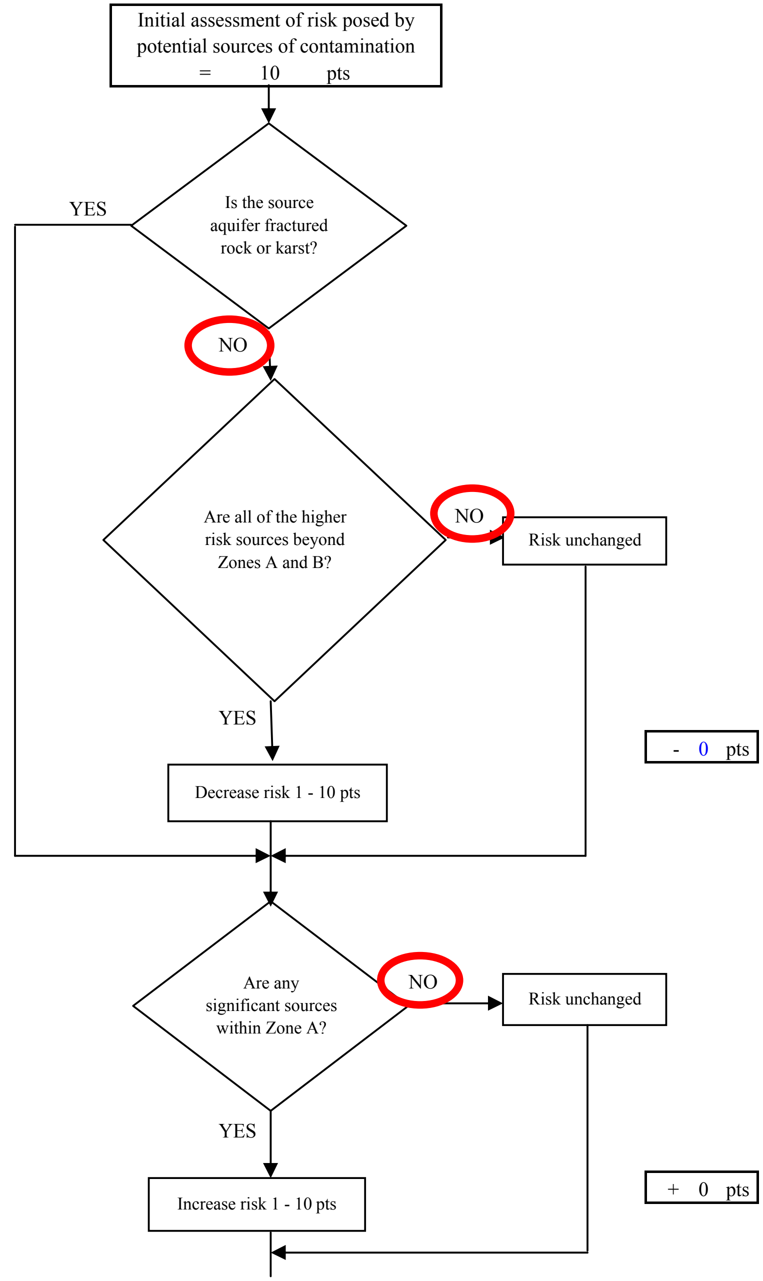


Chart 9. Contaminant risks for McNeil Canyon - Heavy Metals, Cyanide and Other Inorganic Chemicals

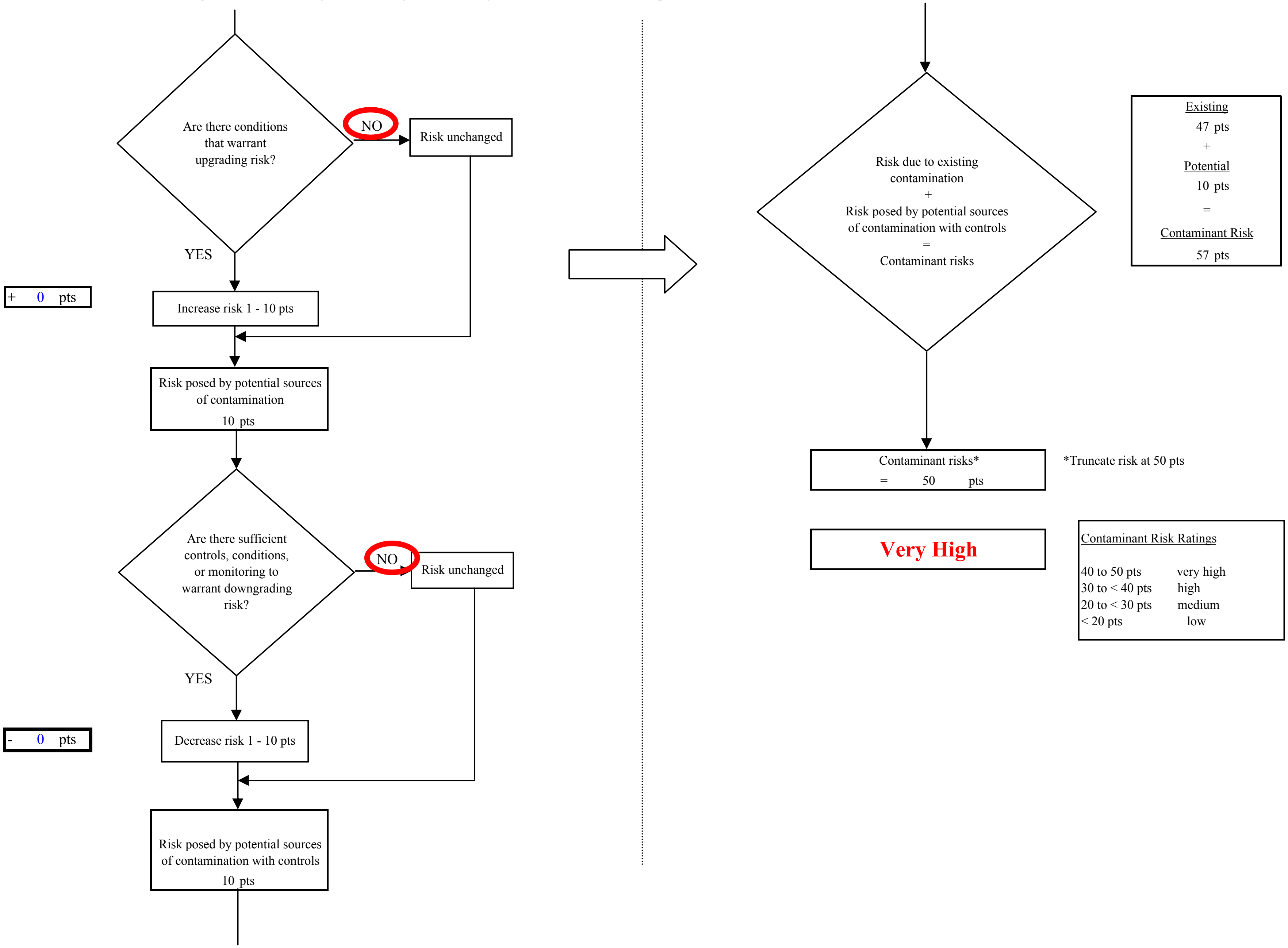


Chart 10. Vulnerability analysis for McNeil Canyon - Heavy Metals, Cyanide and Other Inorganic Chemicals

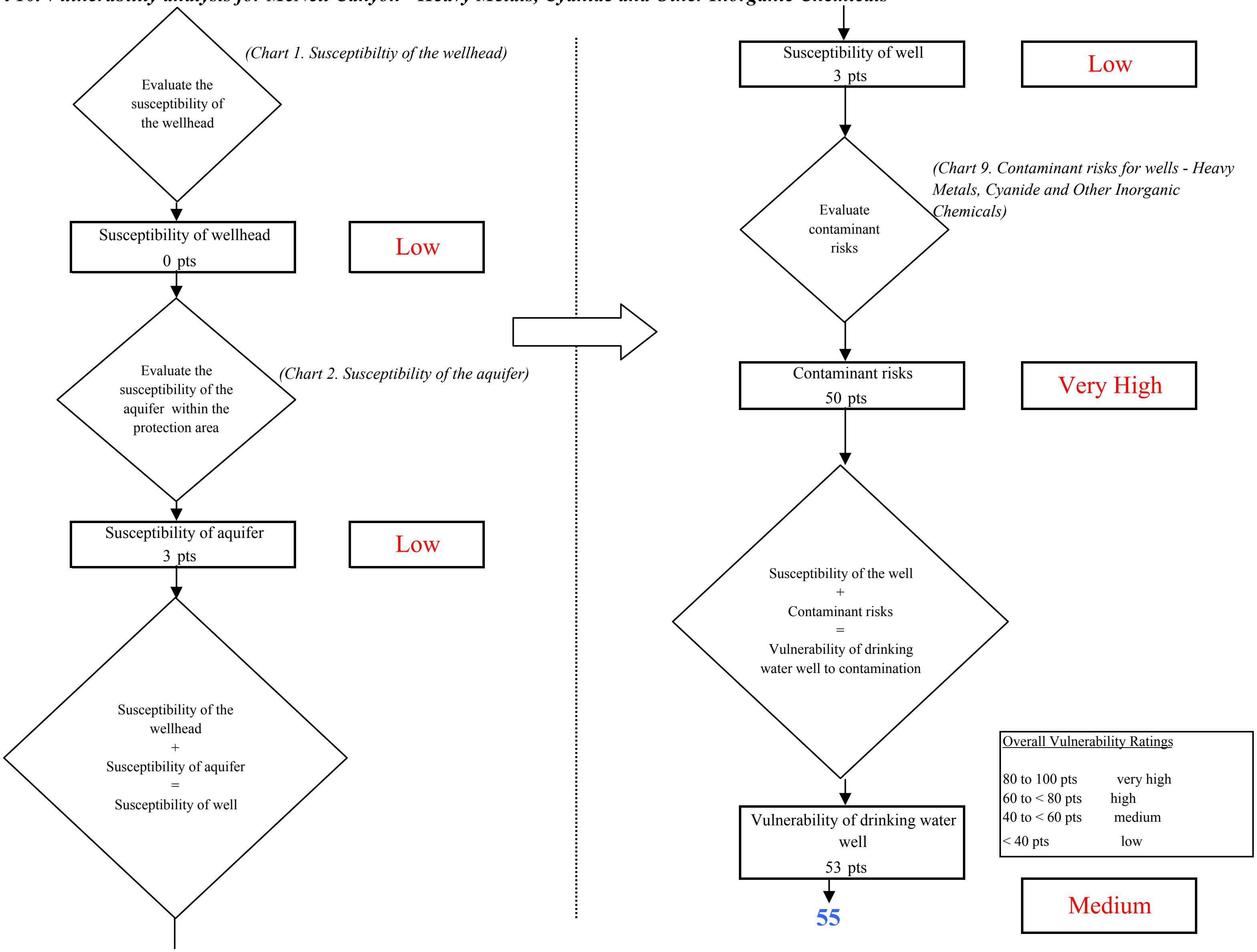


Chart 11. Contaminant risks for McNeil Canyon - Synthetic Organic Chemicals

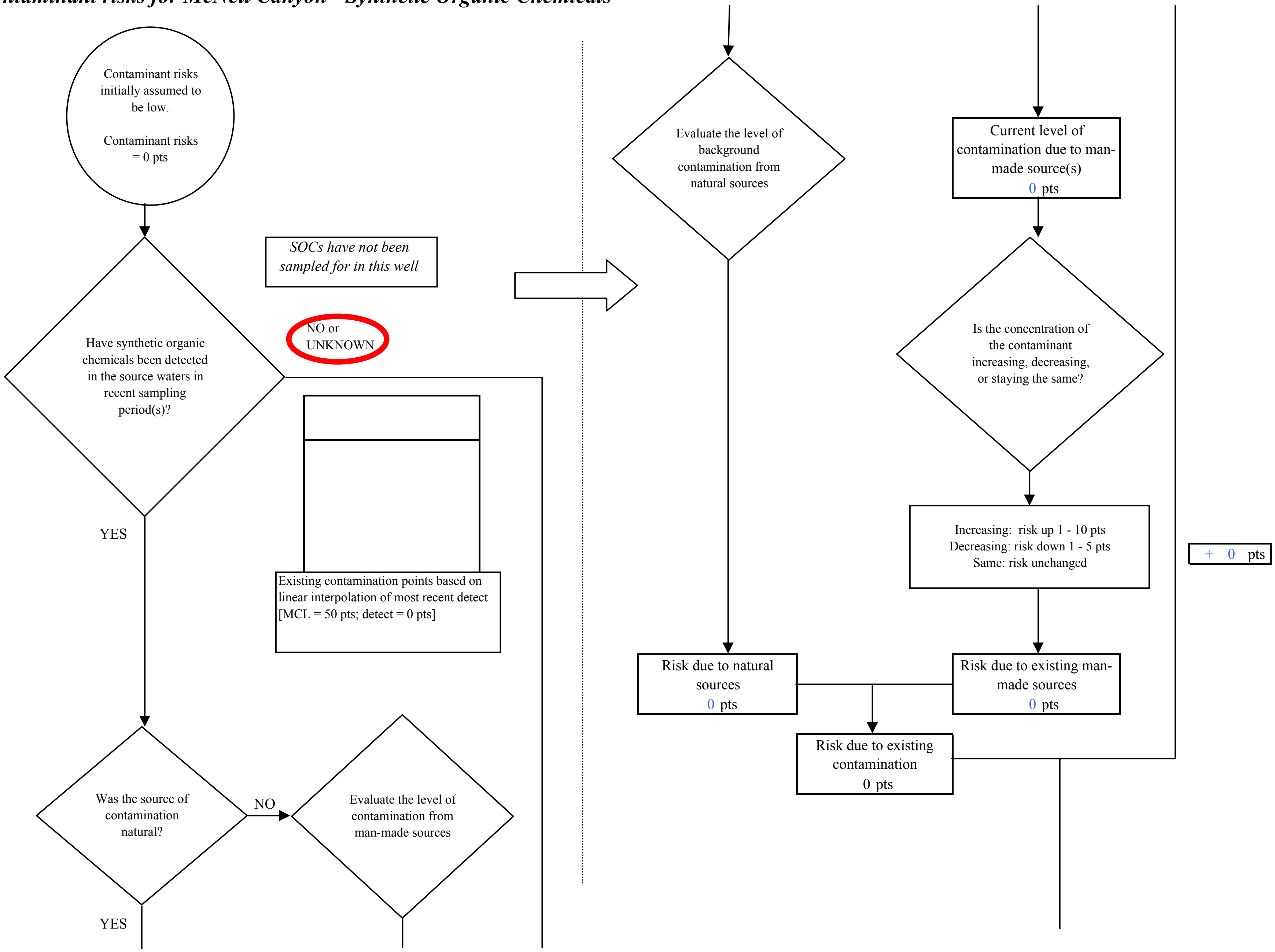
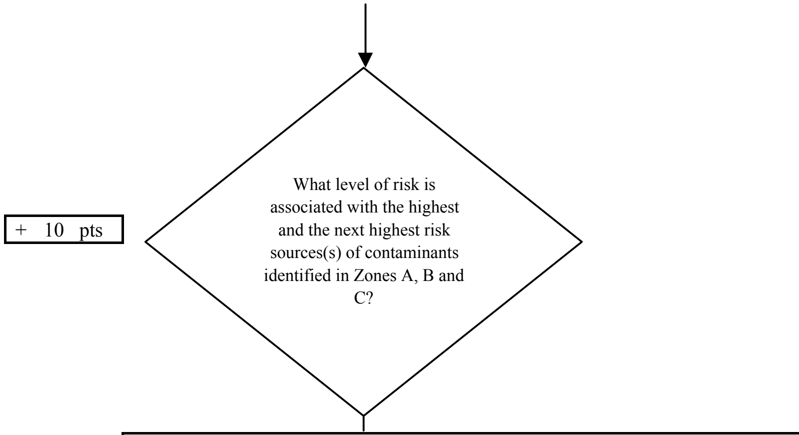


Chart 11. Contaminant risks for McNeil Canyon - Synthetic Organic Chemicals



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	3	5

	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.

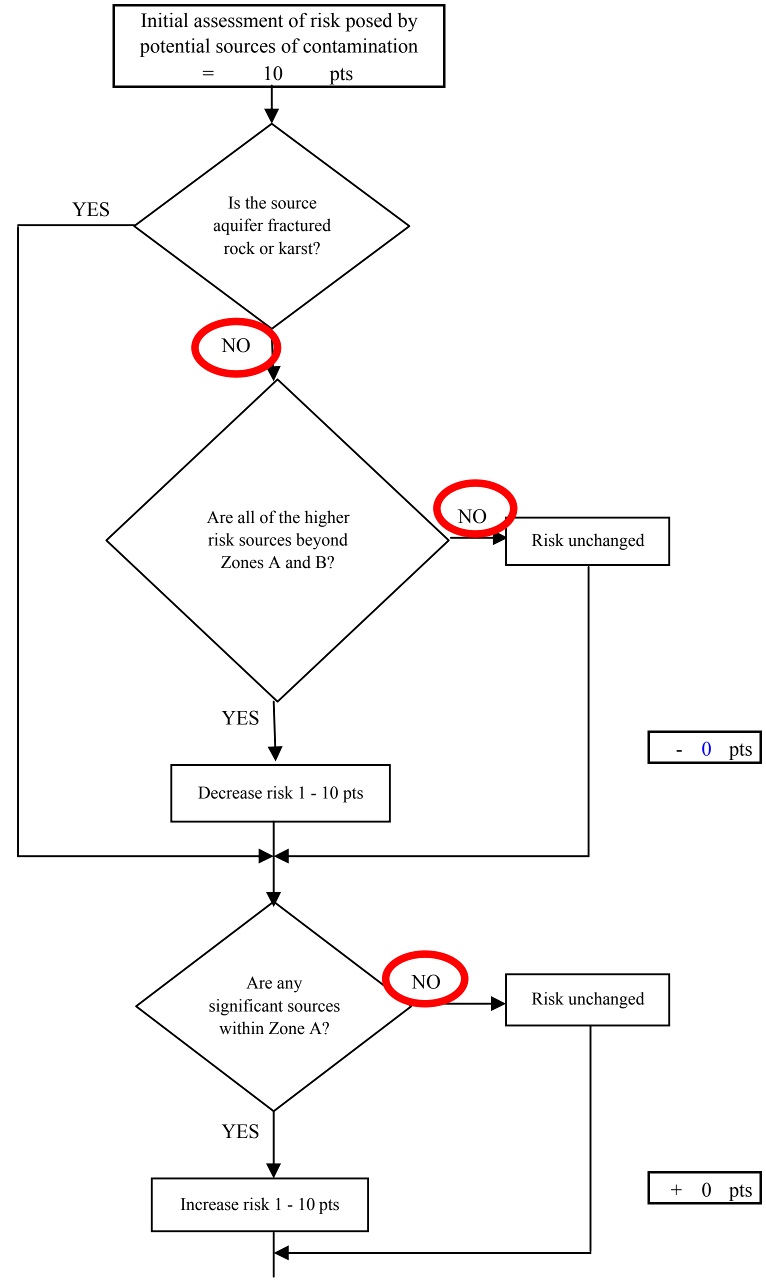


Chart 11. Contaminant risks for McNeil Canyon - Synthetic Organic Chemicals

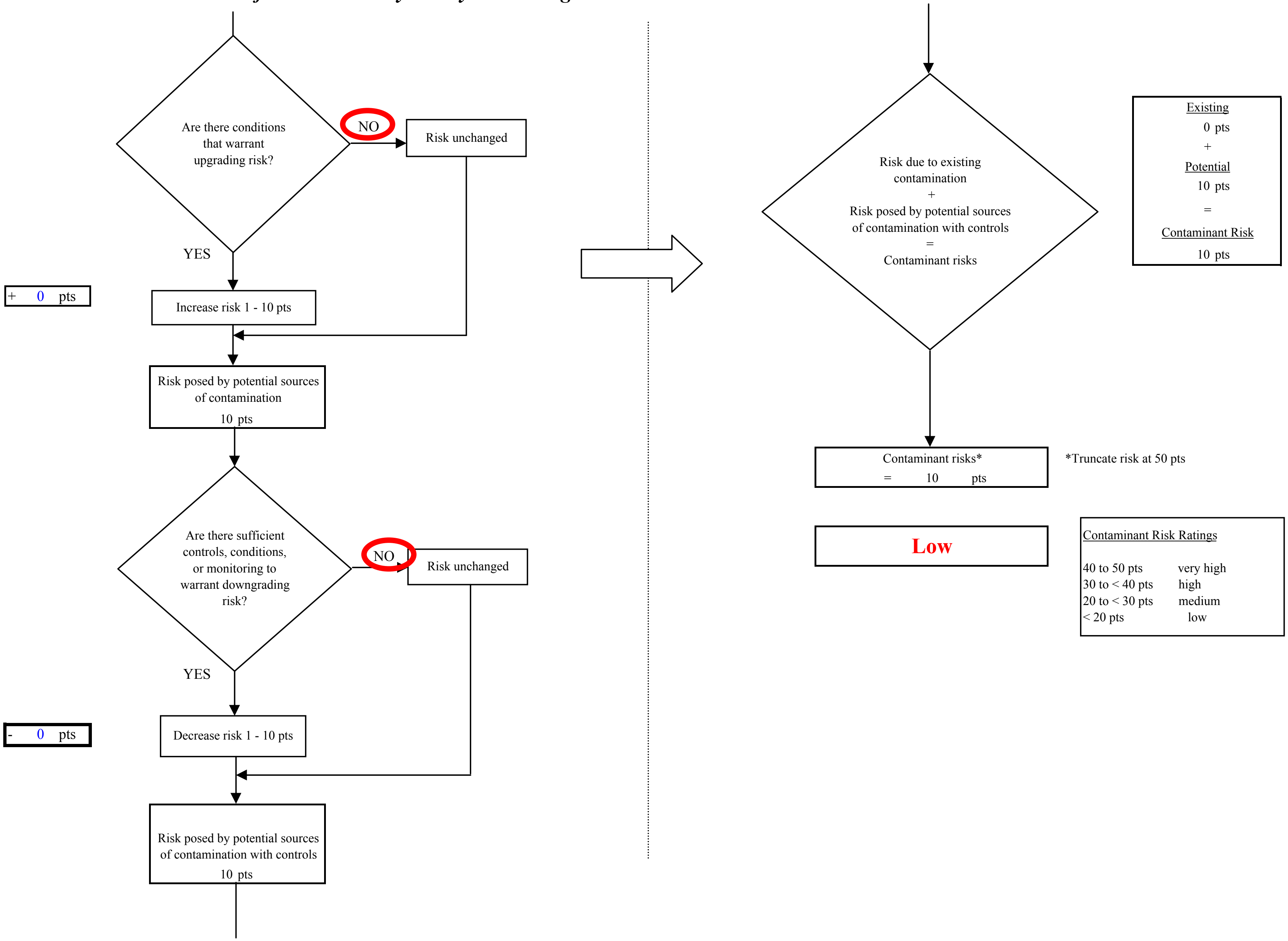


Chart 12. Vulnerability analysis for McNeil Canyon - Synthetic Organic Chemicals

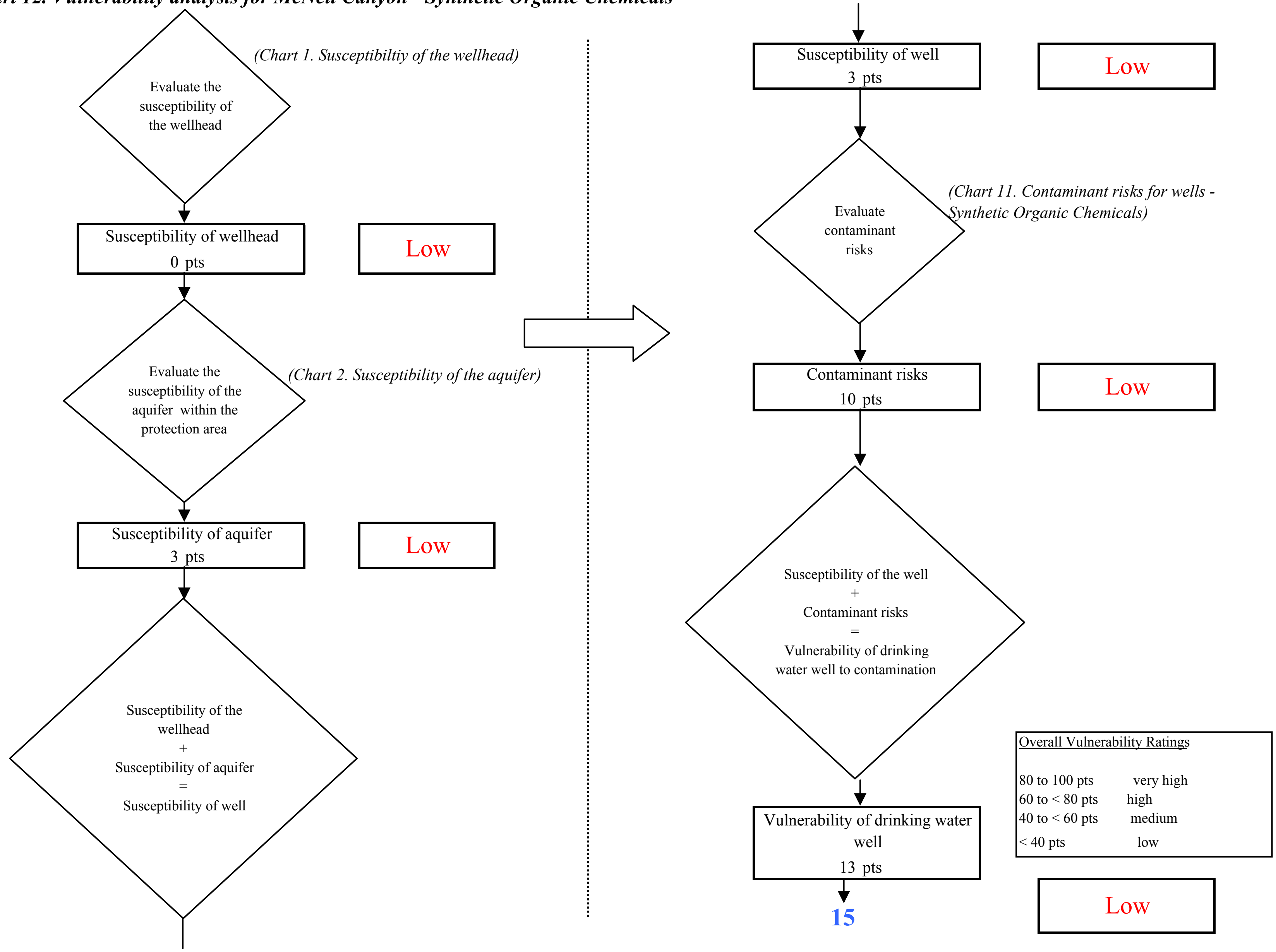


Chart 13. Contaminant risks for McNeil Canyon - Other Organic Chemicals

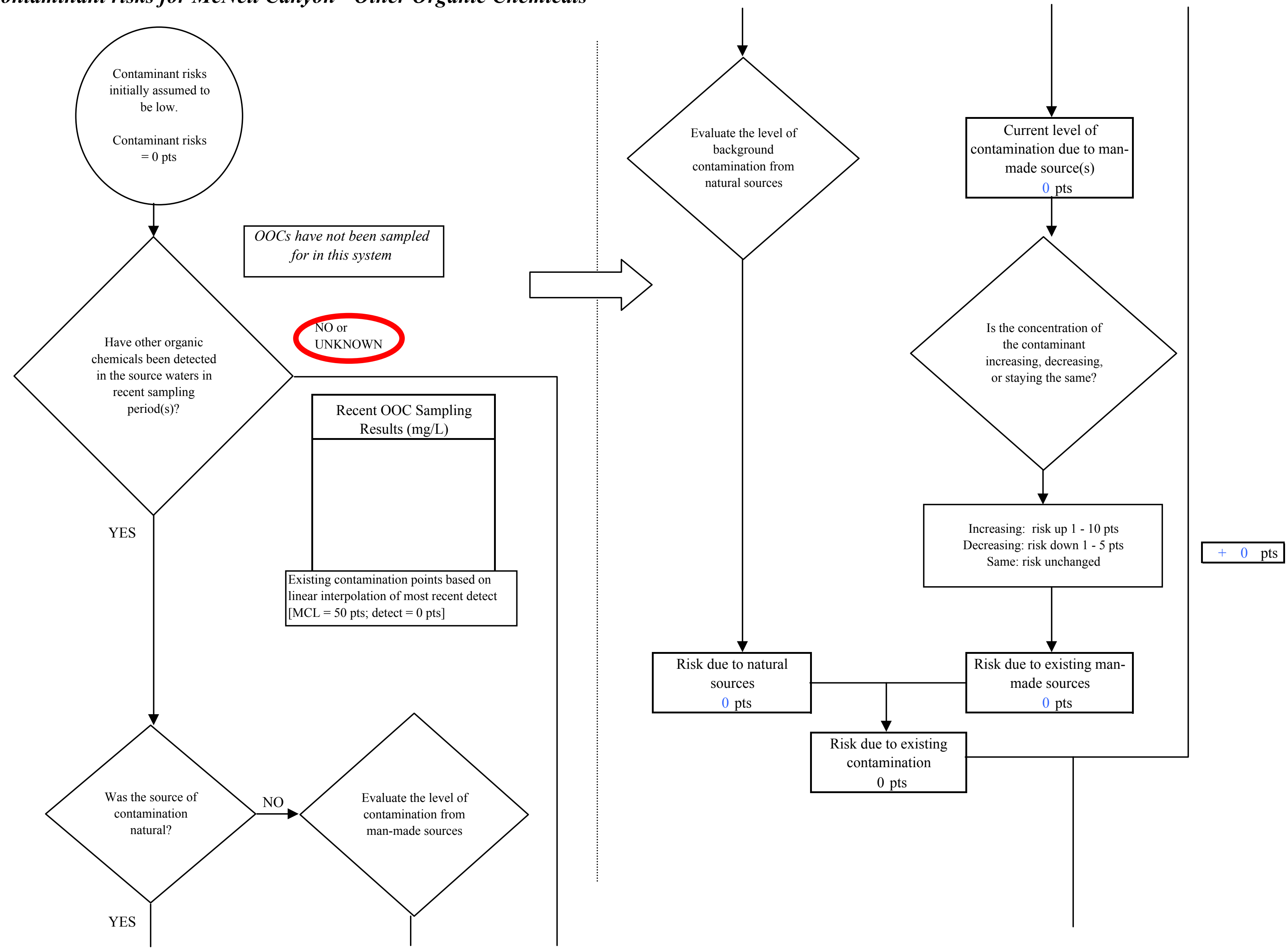
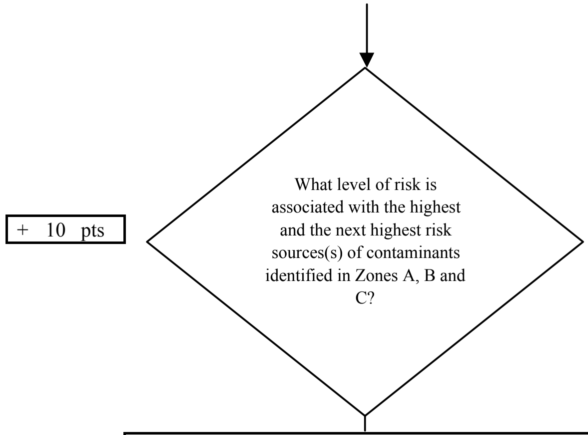


Chart 13. Contaminant risks for McNeil Canyon - Other Organic Chemicals



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)	3	4	7

	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.

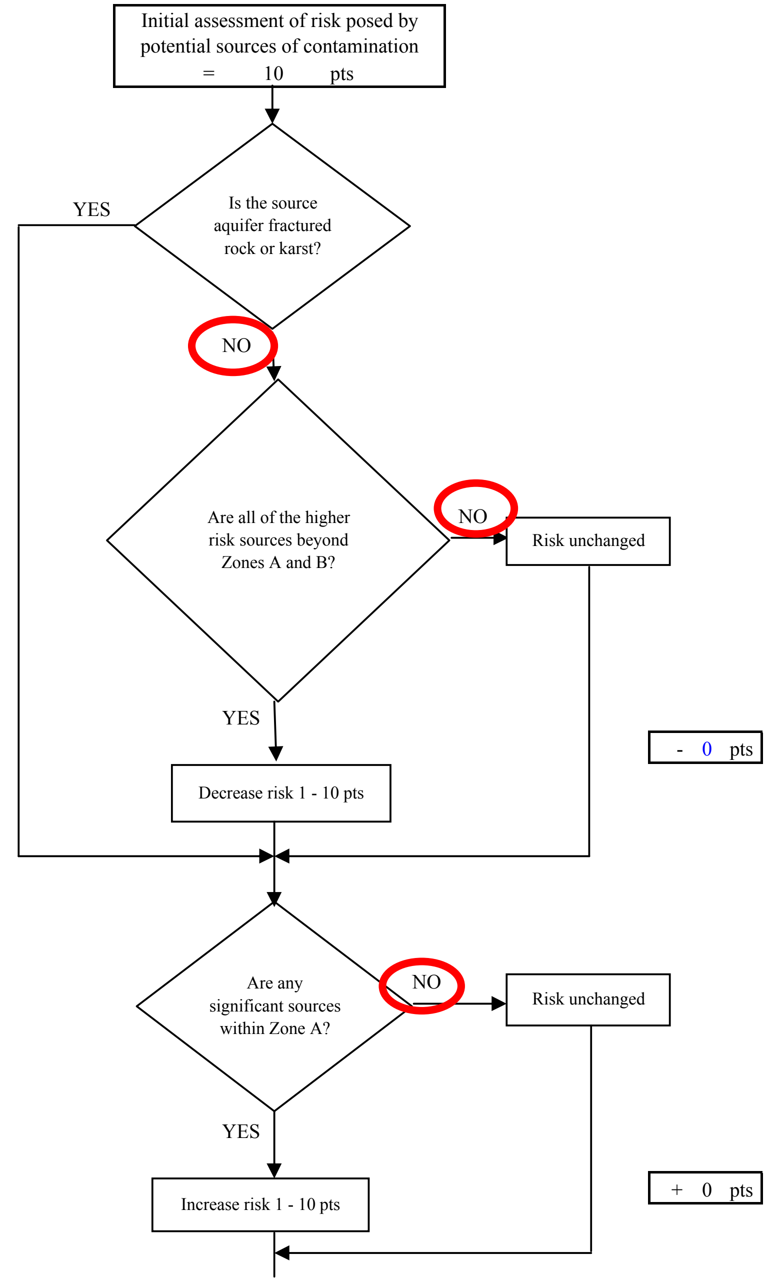


Chart 13. Contaminant risks for McNeil Canyon - Other Organic Chemicals

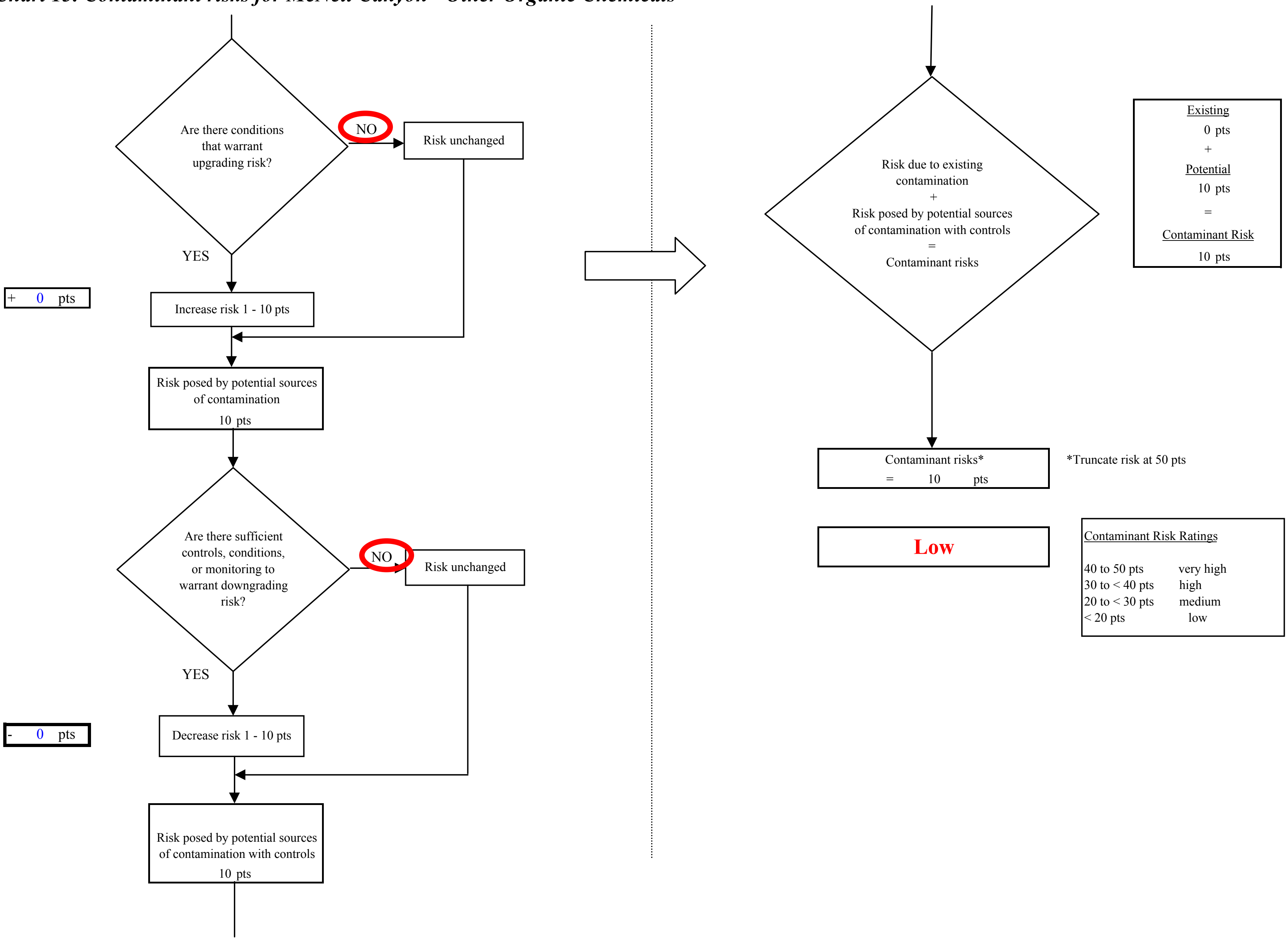


Chart 14. Vulnerability analysis for McNeil Canyon - Other Organic Chemicals