



Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the City of Petersburg , Alaska

(Cabin Creek)

PWSID # 130148.003

September 2003

Drinking Water Protection Program Report #847

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 the City of Petersburg – Cabin Creek, Public Water System

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The City of Petersburg water system is a Class A (community) water system that obtains water from Cabin Creek; with City Creek serving as a backup water source. The system's Cabin Creek intake is located approximately 5-miles southeast of Petersburg and is accessible via gravel road, which is gated and blocked at the reservoir. The overall Cabin Creek protection area is approximately 5.3 square miles in size and received a susceptibility rating of **"very high"**. *A rating of high to very high is typical for all systems with surface water catchment areas.* Potential and existing sources of the following contaminants were evaluated for this assessment: bacteria and viruses, nitrates and/or nitrites, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, and other organic chemicals. Sources of contaminants identified for the drinking water source include a blocked gravel road, which has been classified as a "foot trail". This evaluation included all available water sampling data submitted by the system operator. The samples may have been collected from either raw water or post-treatment water. Combining the susceptibility of the surface water source with the contaminant risk, this water system has received a vulnerability rating of **"medium"** for bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals synthetic organic chemicals, heavy metals, cyanide and other inorganic chemicals, and other organic chemicals.

DRINKING WATER SYSTEM AND AREA OVERVIEW

The City of Petersburg is located on the northwest end of Mitkof Island in the Southeast Panhandle of Alaska; midway between Juneau and Ketchikan (Sec. 27, T058S, R079E, Copper River Meridian) (Please see the inset of Map 1 in Appendix A for location). The current population is approximately 3,100 (ADCED, 2003). The City of Petersburg water system is a Class A (community) water system that operates year round. The system's primary intake is located on the south fork of Cabin Creek, approximately 5-miles southeast of Petersburg. The backup intake is located on City Creek, at the Petersburg Upper Dam (See Map 1 of Appendix A). Access to both intakes is available via

gravel road. The road is gated and blocked at the Cabin Creek reservoir to prevent vehicular traffic.

80% of the households in [Petersburg](#) are connected to the water system. Remaining homes use water delivery or private wells. Virtually all homes are plumbed. The City ships baled refuse to Washington State. Petersburg Municipal Power & Light purchases electricity from the Tyee Lake Hydro Facility, and also owns the Crystal Lake Hydro Facility and three diesel-fueled generators. (ADCED, 2003).

Rounded mountains underlain by fine sandstone, mudstone, and volcanic rocks with basaltic and/or andesitic composition are present in the Petersburg area. Glacial scour and drainage networks often reflect the geologic structure and bedding orientations. Soils reflect the original texture of the bedrock. A mixture of vegetation types is present depending upon drainage, aspect, and elevation (USDA, 2001).

The area is dominated by mild winters, cool summers, and year-round rainfall. Average temperatures in the summer range from 40 to 56; winter temperatures range from 27 to 43. Annual precipitation is approximately 106-inches, with 97-inches of snow. (ADCED, 2003).

The most recent Sanitary Survey (2001) indicates that the Cabin Creek intake is screened and protected from ice buildup and siltation. Water system operators stated that, in 2002, the [Cabin Creek Dam](#) impounded approximately 215-million gallons of water with stream flows averaging 46.3 CFS.

CABIN CREEK DRINKING WATER PROTECTION AREA

Identifying the pathways most likely for surface contamination to reach water intake areas is the first step in determining the water system's risk. These are initially determined by looking at the drainage area contributing overland water flow to a surface water source intake. The entire drainage area is also known as the "drinking water protection area". Please refer to pages 10-11 of the "Guidance Manual for Class A Public Water Systems" for additional information.

The protection area established for surface water sources by the ADEC is usually separated into three zones, limited by the watershed boundary. These zones

correspond to the overland-flow distance that water travels to get to the source. The ADEC Drinking Water Protection Program’s Technical Advisory Committee developed guidelines for derivation of these zones in 1998. The following is a summary of the three protection area zones:

Table 1. Definition of Zones

Zone	Definition
A	Areas within 1000-ft of lakes or streams
B	Areas within 1-mile of lakes or streams
C	The watershed boundary

The protection area for [Cabin Creek](#) includes each of these Zones (See Map 1 of Appendix A). It should be noted here that, because of the small watershed size, Zones C and B are identical.

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 [Cabin Creek](#) protection area. This inventory was completed through a search of agency records and other publicly available information. There is a wide array of potential contamination sources to surface water. These contaminants are found within agricultural, residential, commercial, and industrial areas, but *can also occur within areas that have little or no development*.

For 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 Organic Chemicals.

Sources identified in the [Cabin Creek](#) protection area are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once potential and existing sources of contamination have been identified, they are assigned a ranking according to what category and level of risk they represent. Ranking of contaminant risks for “potential” or “existing” sources of contamination is a function of

the toxicity and the volume of specific contaminants associated with that source. Rankings include:

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

The time-of-travel for contaminants within the water is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zone A because of their short life span. Only “Very High” and “High” rankings are inventoried within Zones B and C due to the probability of contaminant dilution by the time the contaminants reach the water intake.

The remaining tables in Appendix B (if necessary) contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF THE CABIN CREEK DRINKING WATER SYSTEM

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

- Surface Water Susceptibility; and
- Contaminant risks.

Appendix D contains 13 charts, which together form the ‘Vulnerability Analysis’ for the public drinking water Source Water Assessment. Chart 1 analyzes the ‘Susceptibility of the Surface Water Source’ to contamination by looking at the climate, terrain, and intake location. Chart 2 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the intake area. Chart 3 contains the ‘Vulnerability Analysis for Bacteria and Viruses’, which is a composite score of the Vulnerability Analysis and the overall Susceptibility. Charts 4 through 13 repeat 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 Surface Water Susceptibility of the source is reached by considering the properties of the water intake and the surrounding area. The derivation of this information is presented below and the data for this source is shown in Chart 1 of Appendix D.

$$\begin{aligned}
 &\text{Susceptibility of the Surface Water Source – always} \\
 &\quad \text{considered to be “high” (30 points)} \\
 &\quad + \\
 &\text{Adequate Construction of the Intake (0 – 5 Points)} \\
 &\quad + \\
 &\text{Runoff Potential Within Zone B (0 – 5 Points)} \\
 &\quad + \\
 &\text{Dilution Capacity of the Surface Water (0 – 10 Points)} \\
 &\quad = \\
 &\quad \text{Natural Susceptibility} \\
 &\quad \text{(0 – 50 Points)}
 \end{aligned}$$

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

Surface Water Source Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High

Table 2. Susceptibility of the Cabin Creek Water Source

	Score	Rating
Minimum Allowable Susceptibility	30	
Intake Construction Adequate	0	
Runoff Potential	5	
Dilution Capacity	15	
Overall Susceptibility	50	Very High

For contaminants, risks to a drinking water source depend on the type, number or density, and distribution of the contaminant sources. The Contaminant Risk score has been derived from an examination of existing, and historical contamination sources that have been detected in the protection area through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point

score, and ratings are assigned in the same way as the 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. Cabin Creek Contaminant Risks for each category of drinking water contaminants.

Table 3. Cabin Creek Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	2	Low
Nitrates and/or Nitrites	2	Low
Volatile Organic Chemicals	0	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	0	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	0	Low

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

$$\begin{aligned}
 &\text{Susceptibility of the Surface Water Source} \\
 &\quad \text{(0 – 50 points)} \\
 &\quad + \\
 &\text{Contaminant Risks (0 – 50 points)} \\
 &\quad = \\
 &\quad \text{Vulnerability of the} \\
 &\quad \text{Drinking Water Source to Contamination (0 – 100).}
 \end{aligned}$$

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 and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Cabin Creek Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	50	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	50	Medium
Synthetic Organic Chemicals	50	Medium
Other Organic Chemicals	50	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is “low”. Typically, coliform detection in raw water samples collected from surface water sources is normal. (See Chart 2 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Coliforms (a bacteria) are found naturally in the environment and although they aren’t necessarily a health threat, they are 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. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2003). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

No positive bacteria counts have been detected in the sampling period 2000 – 2003. A potential source of bacteria and viruses in this protection area is the blocked gravel access road above the intake.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the source, the overall vulnerability of the source to bacteria and virus contamination becomes “medium”.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is “low” (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for the water source indicates that no nitrates have been detected in samples collected in 2001 - 2002. The Maximum Contaminant Level (MCL) for nitrates is 10 milligrams per liter (mg/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 (EPA, 2003).

A potential source of nitrates and nitrites in the protection area is the blocked gravel access road above

the intake.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the source, the overall vulnerability of the reservoir to contamination is “medium”.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is “low” (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Chloroform and trihalomethanes were detected during sampling in 2001-2002. The MCL for chloroform is 0.2 milligrams per liter (mg/L) and the MCL for total trihalomethanes is 0.1 mg/L. Both of these chemicals typically originate during the process of water treatment.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the reservoir to contamination is “medium”.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is “low”. Copper was detected in trace amounts in 2002 (See Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). The MCL for copper is 1.3 mg/l.

A typical source of these chemicals is through the distribution system following the treatment process.

After combining the contaminant risk for heavy metals with the natural susceptibility of the source, the overall vulnerability of the reservoir to contamination is “medium”.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is “low”. After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the reservoir is “medium” (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no recent testing for synthetic organic chemicals has occurred.

Other Organic Chemicals

The contaminant risk for other organic chemicals is “low”. After combining the contaminant risk with the natural susceptibility of the source, the overall

vulnerability to other organic chemicals of the source is “medium” (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

Review of the historical sampling data indicates that no other organic chemicals have been sampled recently.

REFERENCES

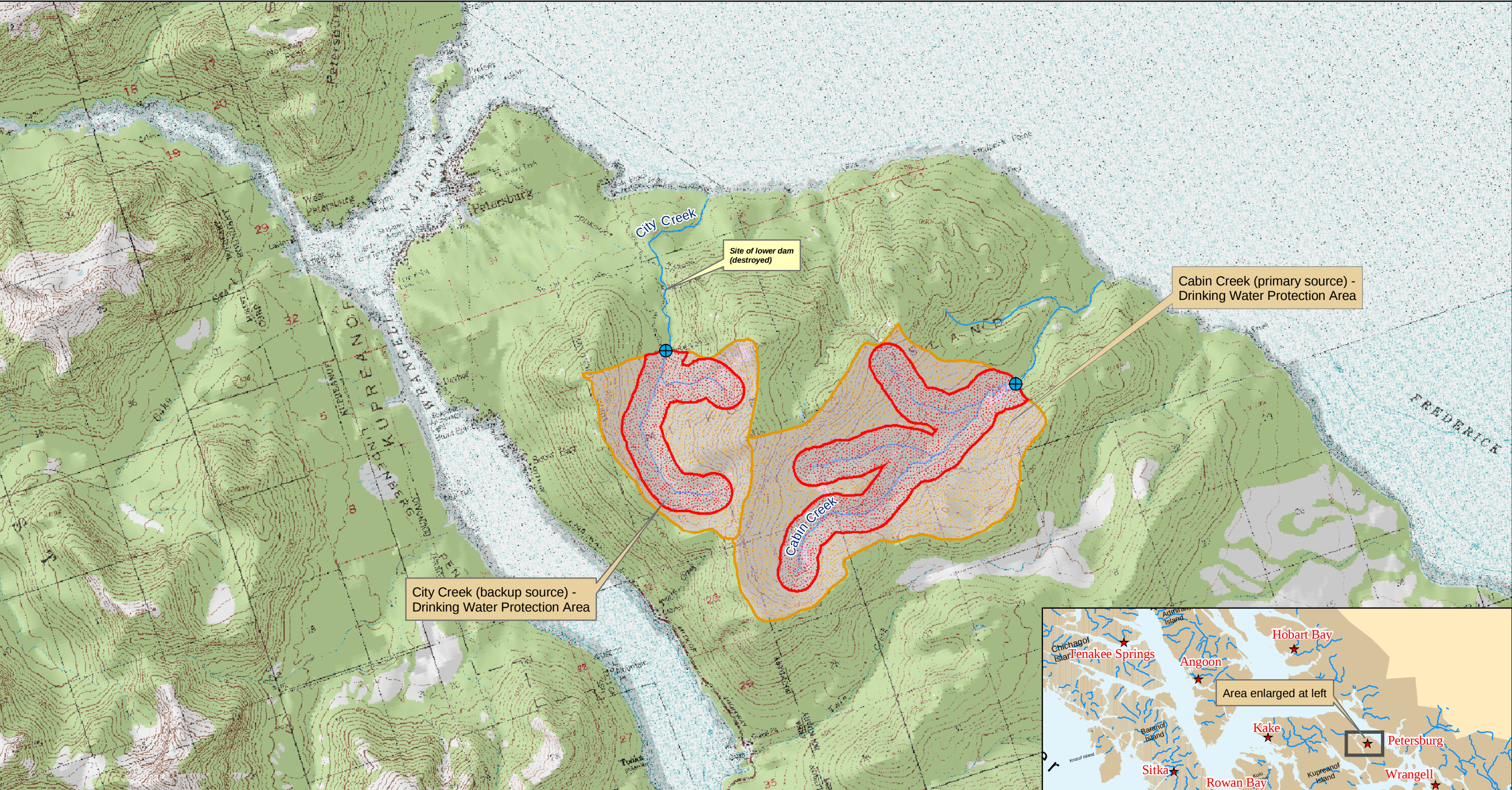
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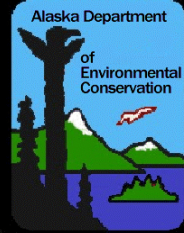
APPENDIX A

City of Petersburg Drinking Water Protection Area Location Map (Map 1)



Map 1: City of Petersburg - Drinking Water Protection Area

PWSID: 130148.001 & 130148.003



0 2,500 5,000 10,000 15,000 Feet

1:60,000

Data Sources:
Background image
- USGS 1:63,000 mapping
Lakes, streams, & roads
- U.S. Forest Service, Tongass

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

For this PWS, Zone C (the entire watershed) covers the same area as Zone B (areas within 1-mile of the stream).

Legend

	City of Petersburg PWS		Stream
	Zone A Protection Area		Roads
	Zone B Protection Area		
	Zone C Protection Area		



Archipelago

September 10, 2003

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables [1-3](#))

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Foot trails	X46	X46-1	A	2	From operator information

Table 2

*Contaminant Source Inventory and Risk Ranking for
City of Petersburg
Sources of Bacteria and Viruses*

PWSID 130148.003

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Foot trails	X46	X46-1	A	Low	2	From operator information

Table 3

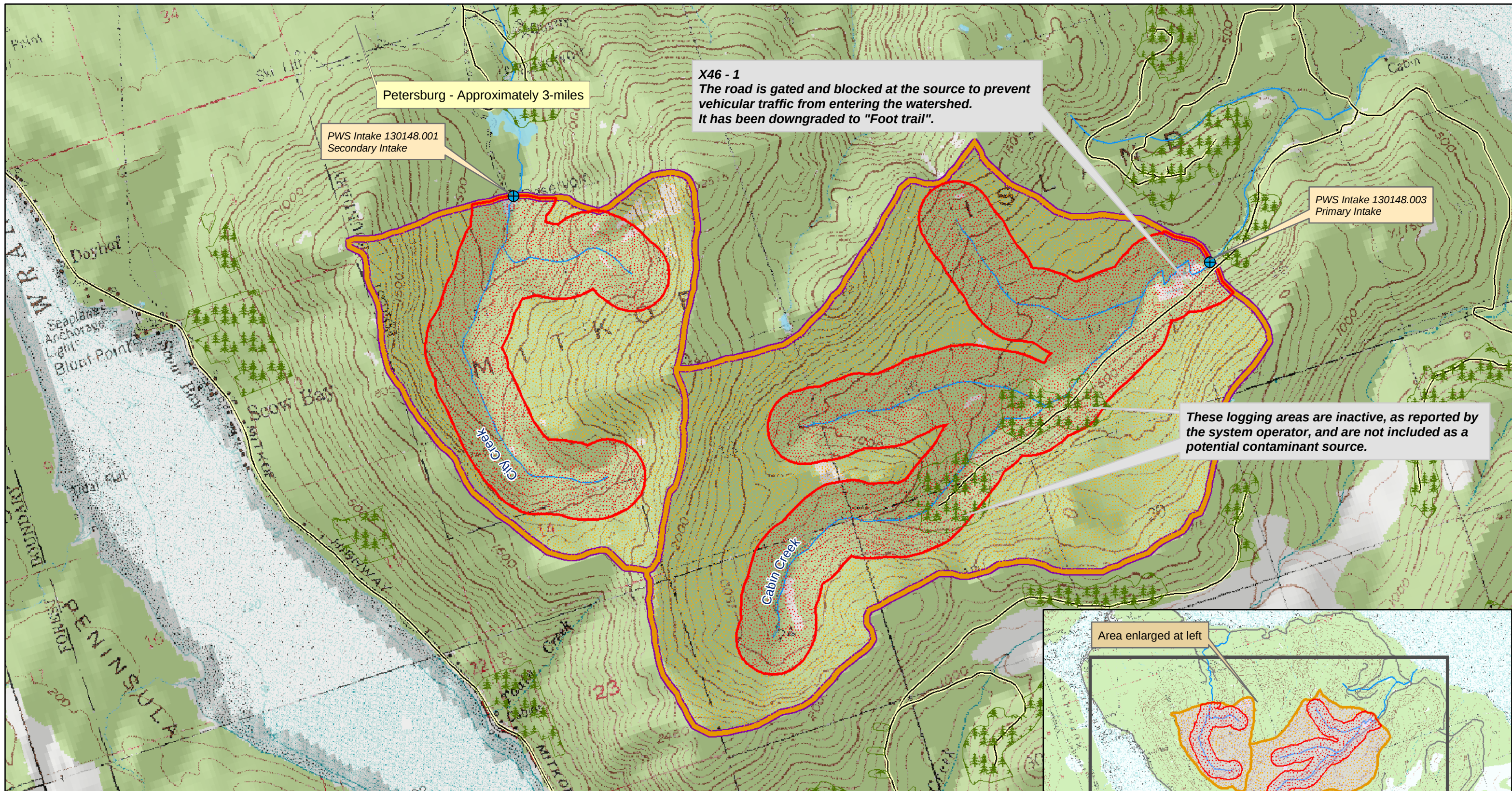
*Contaminant Source Inventory and Risk Ranking for
City of Petersburg
Sources of Nitrates/Nitrites*

PWSID 130148.003

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Foot trails	X46	X46-1	A	Low	2	From operator information

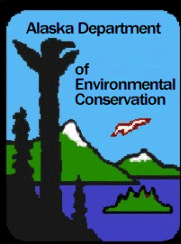
APPENDIX C

City of Petersburg Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2: Potential and Existing Contaminant Sources

PWSID: 130148.001 & 130148.003




Data Sources:

Background image - USGS 1:63,000 mapping
Lakes, streams, & roads - U.S. Forest Service

0 1,250 2,500 5,000 7,500 Feet

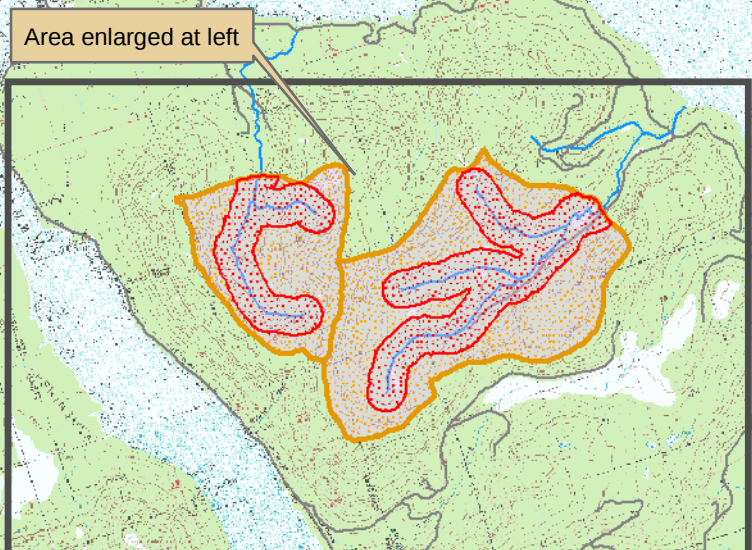
1:30,051

Protection zones were delineated based upon streams noted on USGS 1:63,000 mapping.

For this PWS, Zone C (the entire watershed) covers the same area as Zone B (areas within 1-mile of the stream).

Legend

City of Petersburg PWS	Potential Logging Area
Zone A Protection Area	Roads
Zone B Protection Area	Stream
Zone C Protection Area	
Lake	



Area enlarged at left



0 1 2 Miles

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APPENDIX D

Vulnerability Analysis and Contaminant Risks (Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - City of Petersburg - Cabin Creek

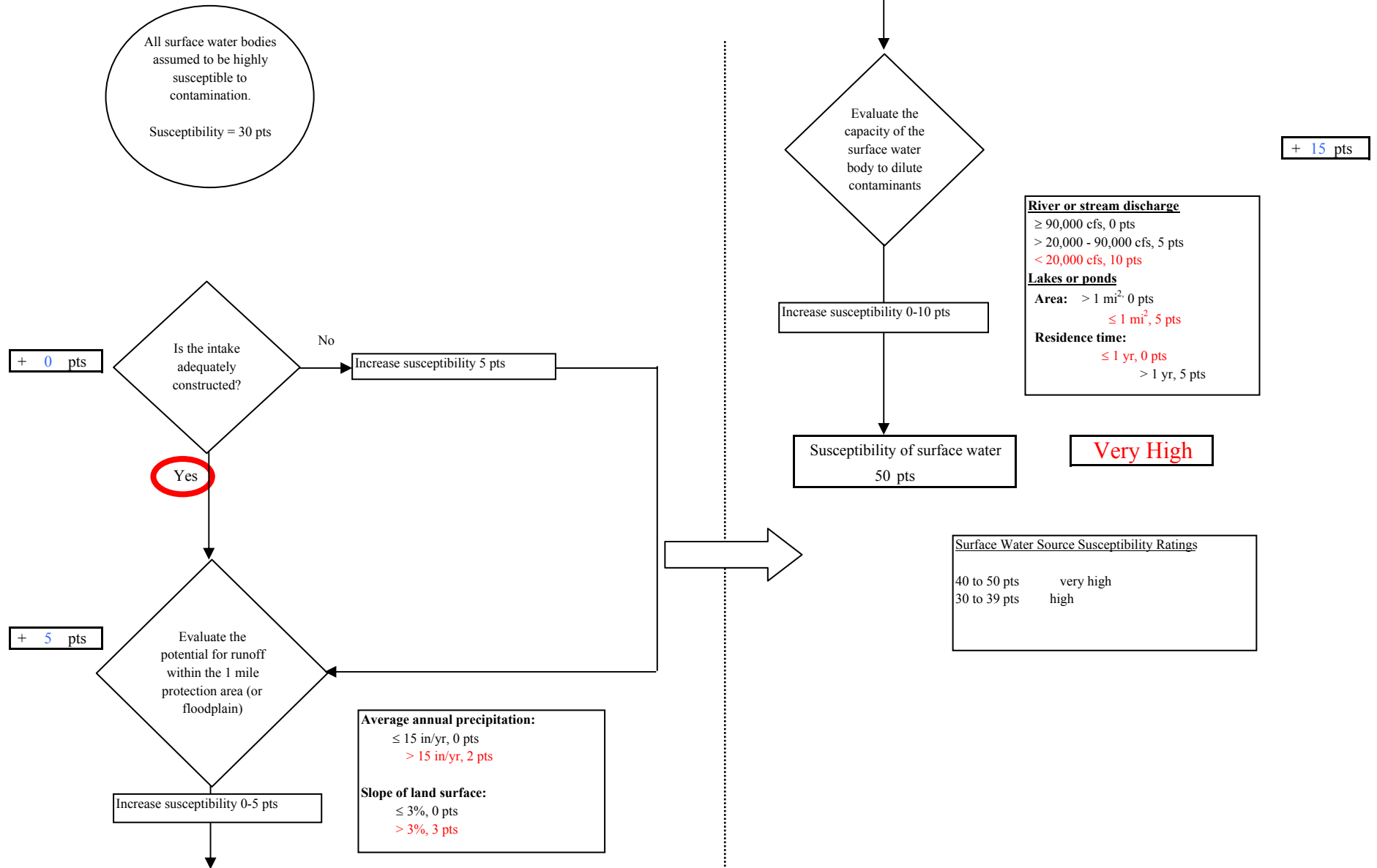


Chart 2. Contaminant risks for City of Petersburg - Cabin Creek - Bacteria & Viruses

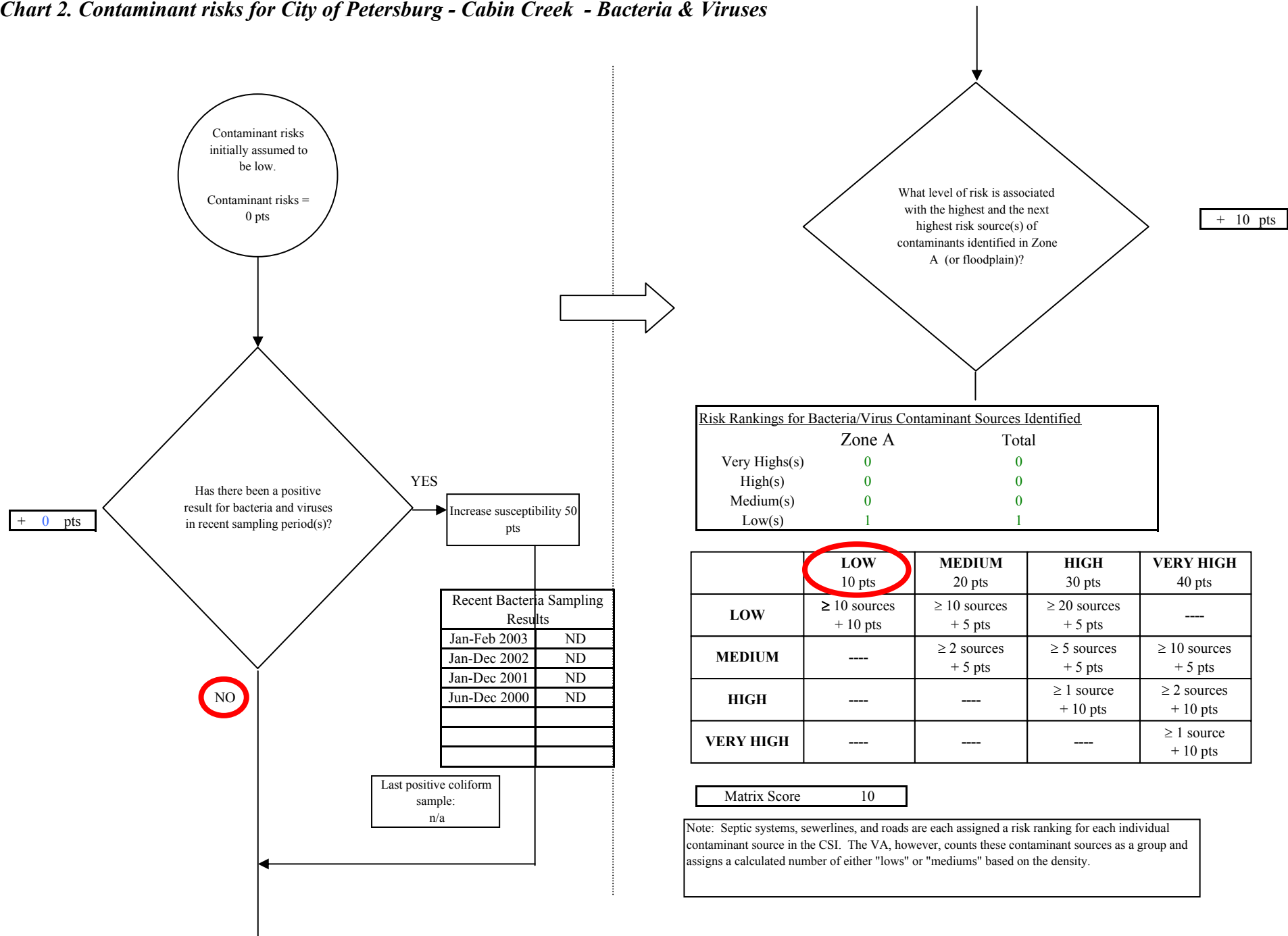


Chart 2. Contaminant risks for City of Petersburg - Cabin Creek - Bacteria & Viruses

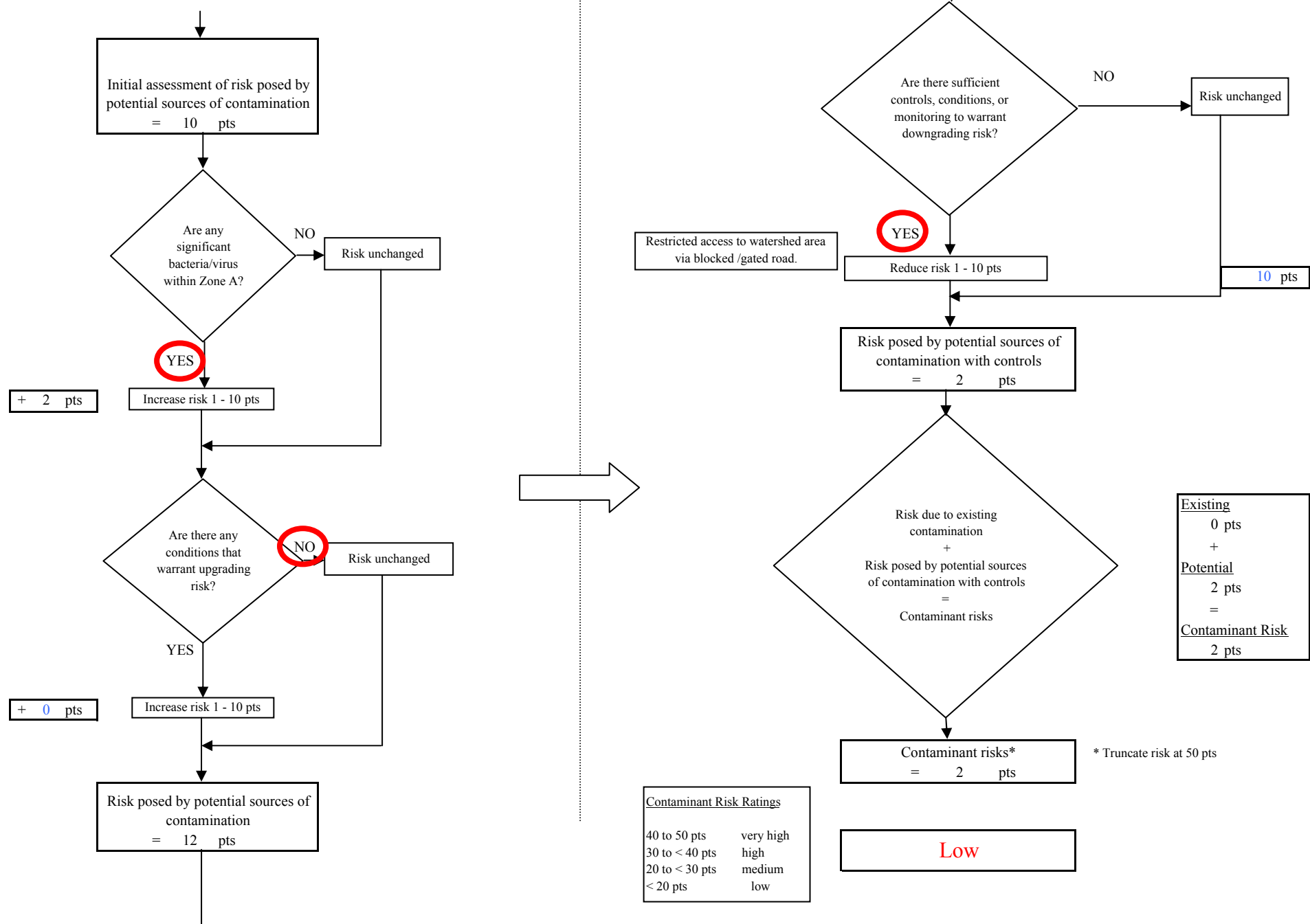


Chart 3. Vulnerability analysis for City of Petersburg - Cabin Creek - Bacteria & Viruses

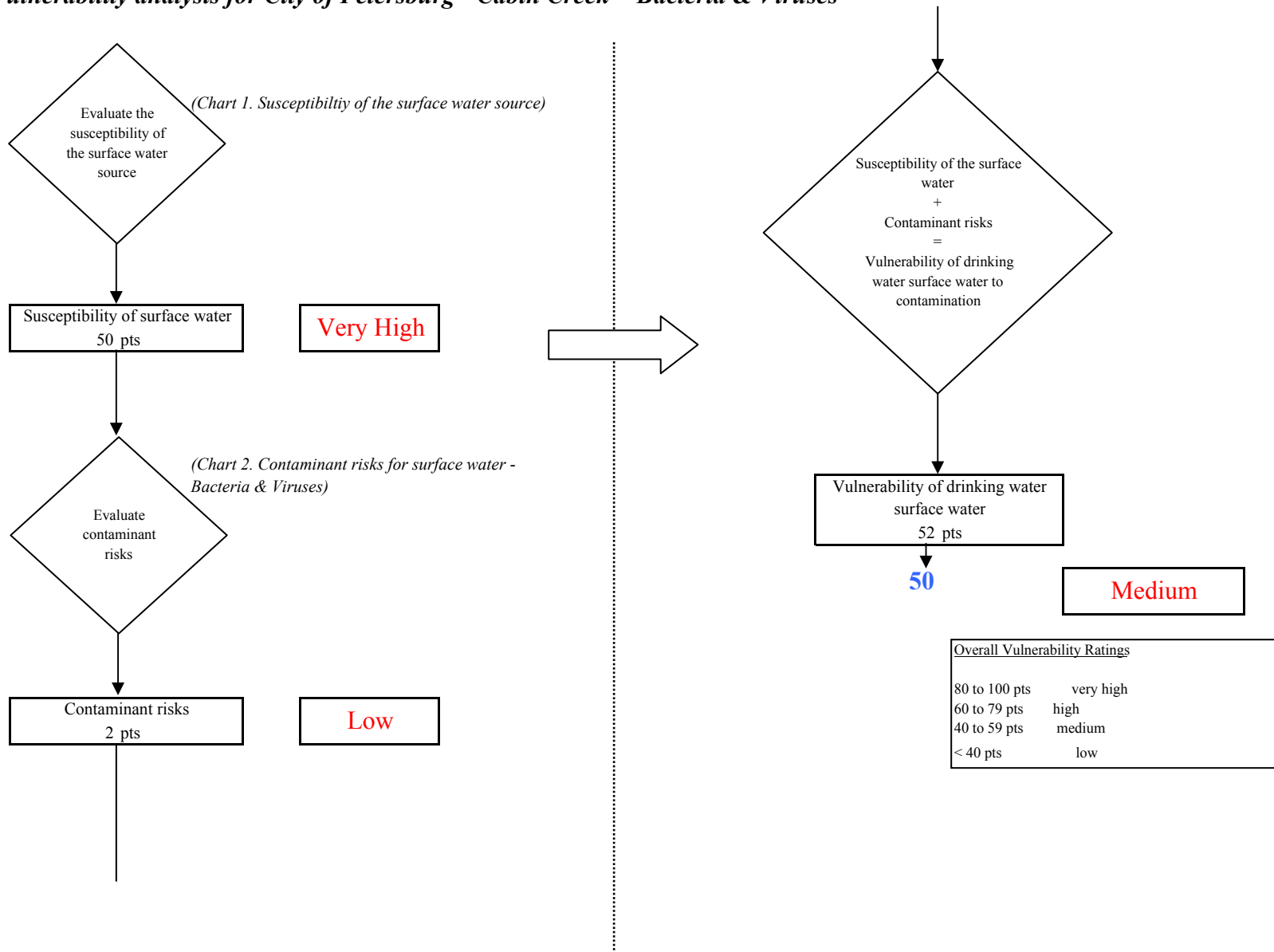


Chart 4. Contaminant risks for City of Petersburg - Cabin Creek - Nitrates and Nitrites

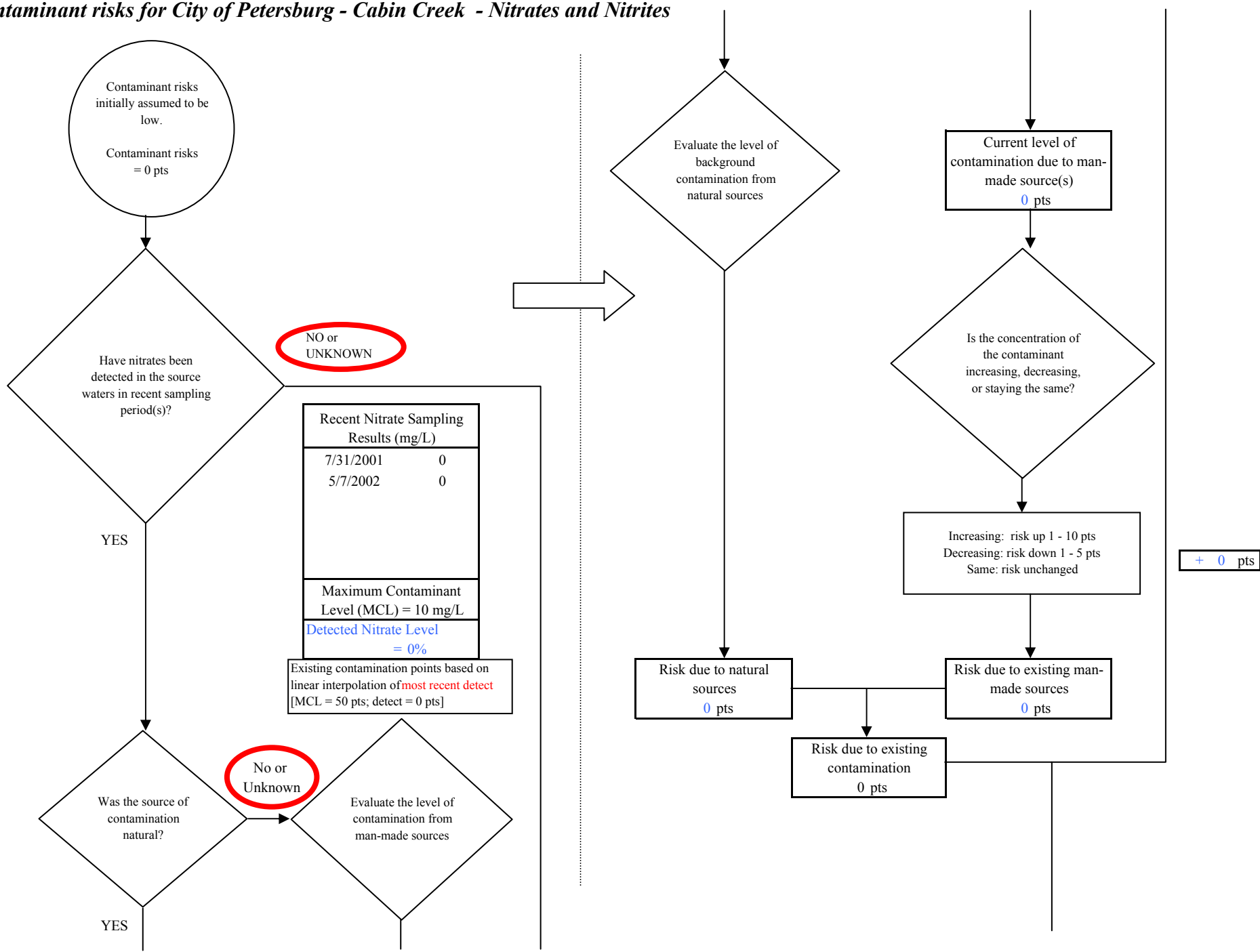


Chart 4. Contaminant risks for City of Petersburg - Cabin Creek - Nitrates and Nitrites

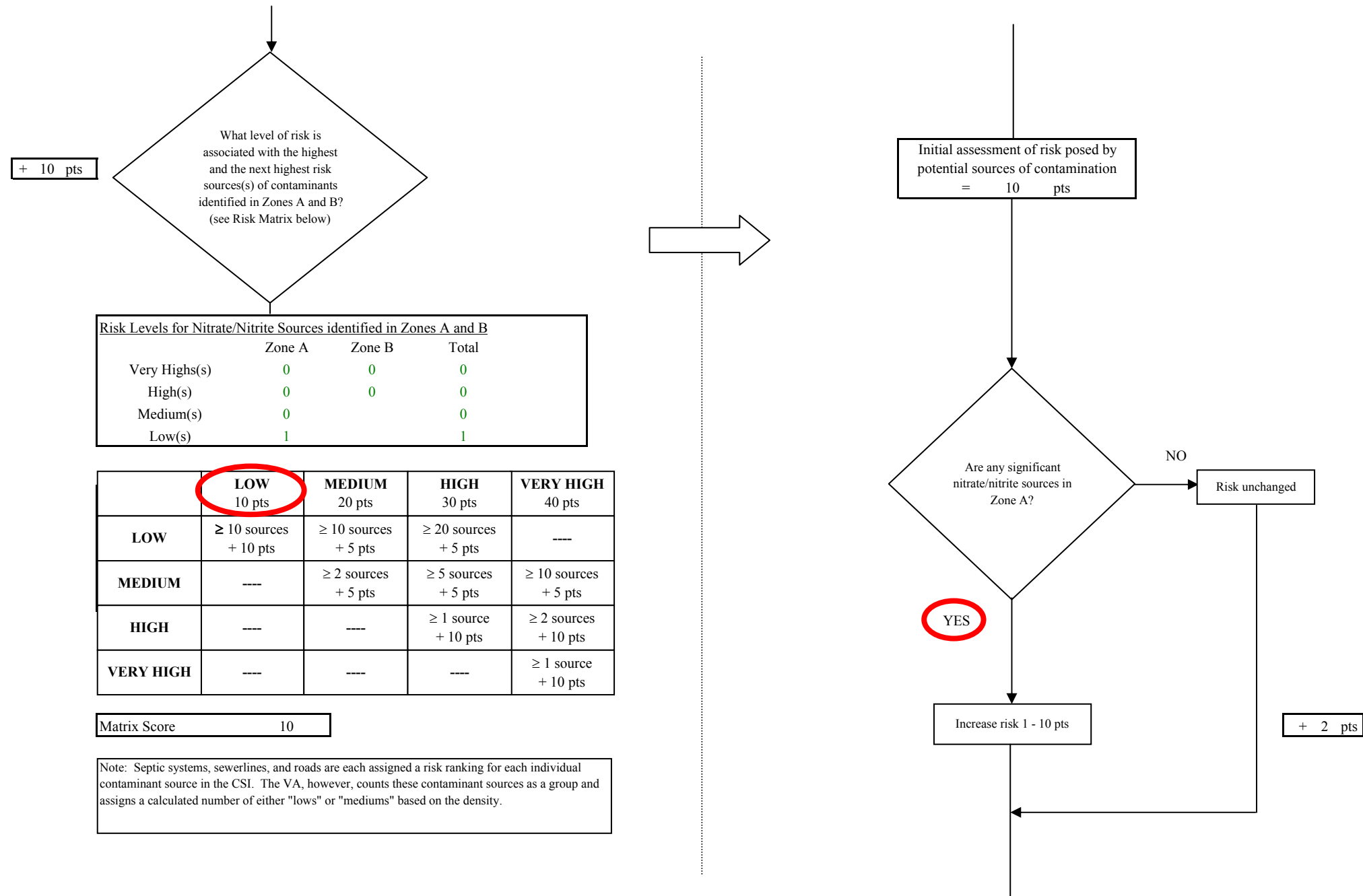


Chart 4. Contaminant risks for City of Petersburg - Cabin Creek - Nitrates and Nitrites

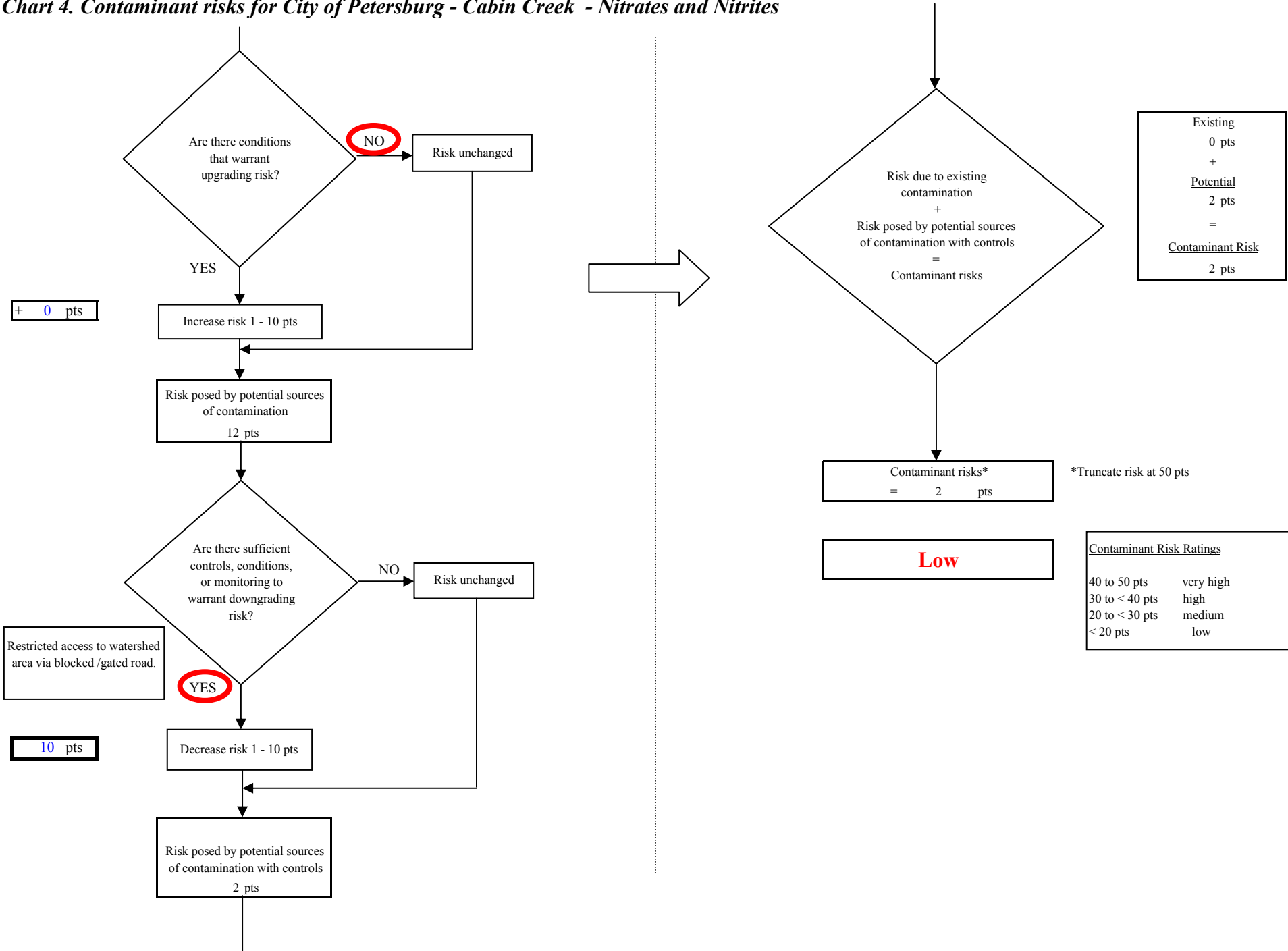


Chart 5. Vulnerability analysis for City of Petersburg - Cabin Creek - Nitrates and Nitrites

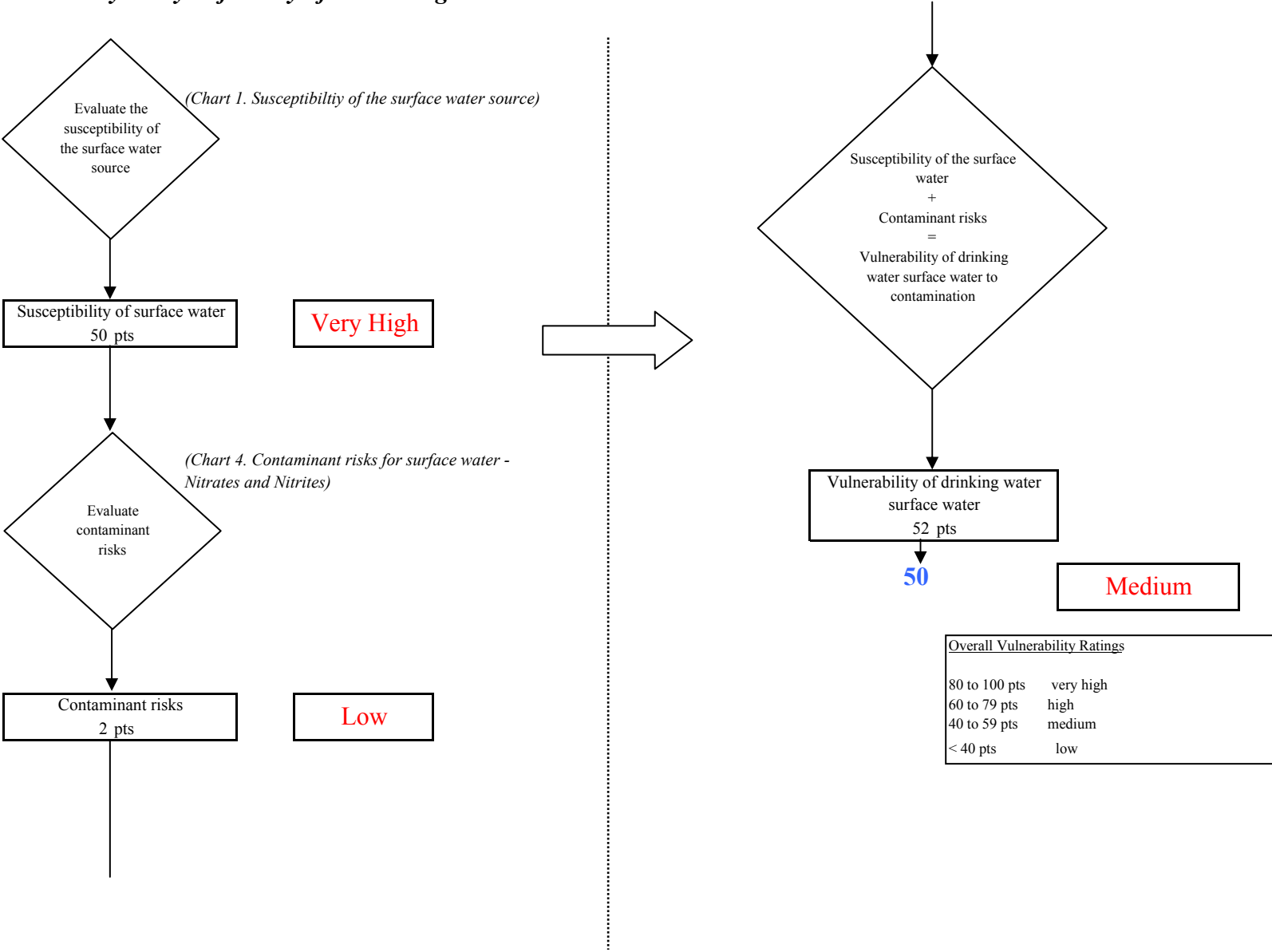


Chart 6. Contaminant risks for City of Petersburg - Cabin Creek - Volatile Organic Chemicals

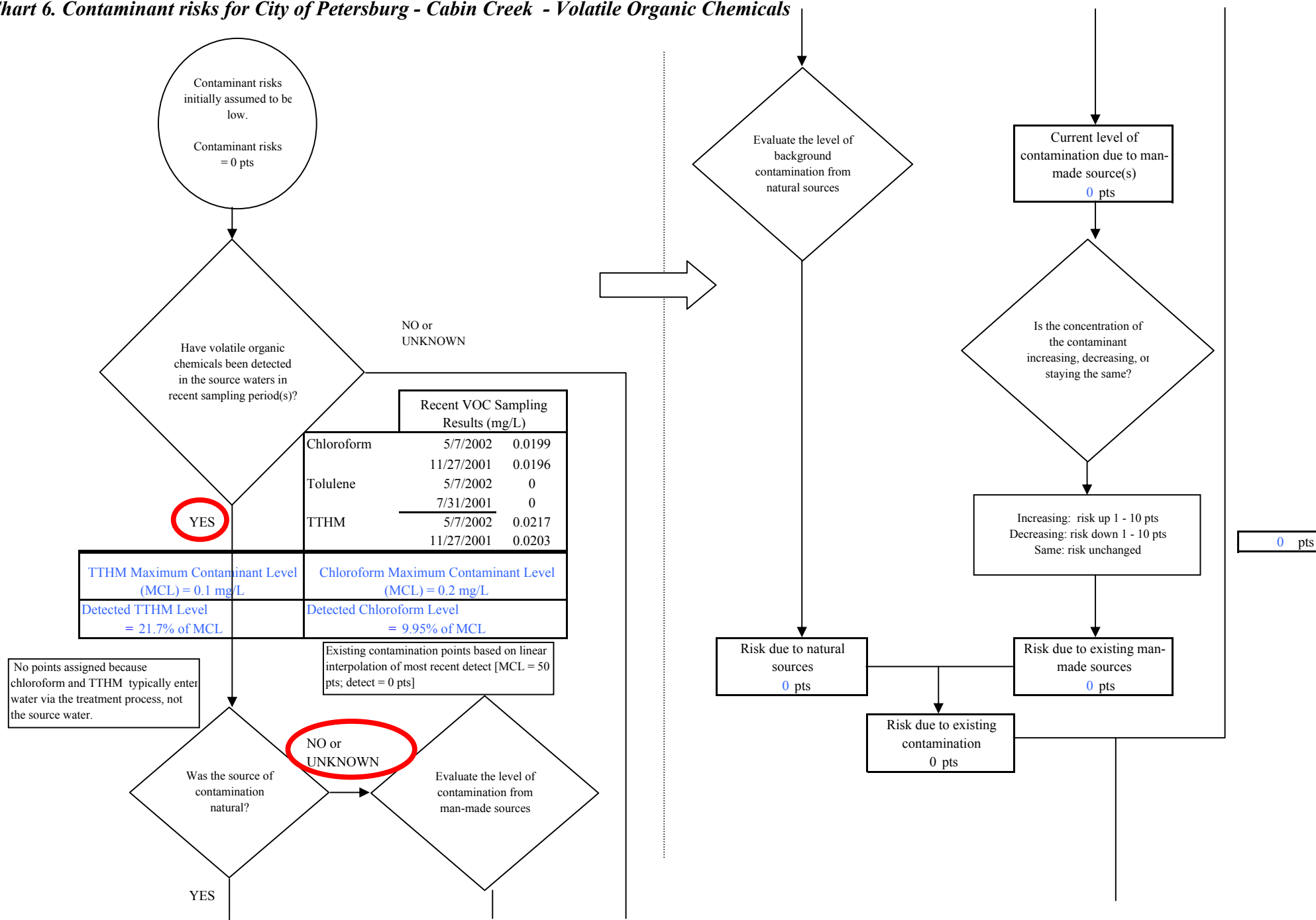


Chart 6. Contaminant risks for City of Petersburg - Cabin Creek - Volatile Organic Chemicals

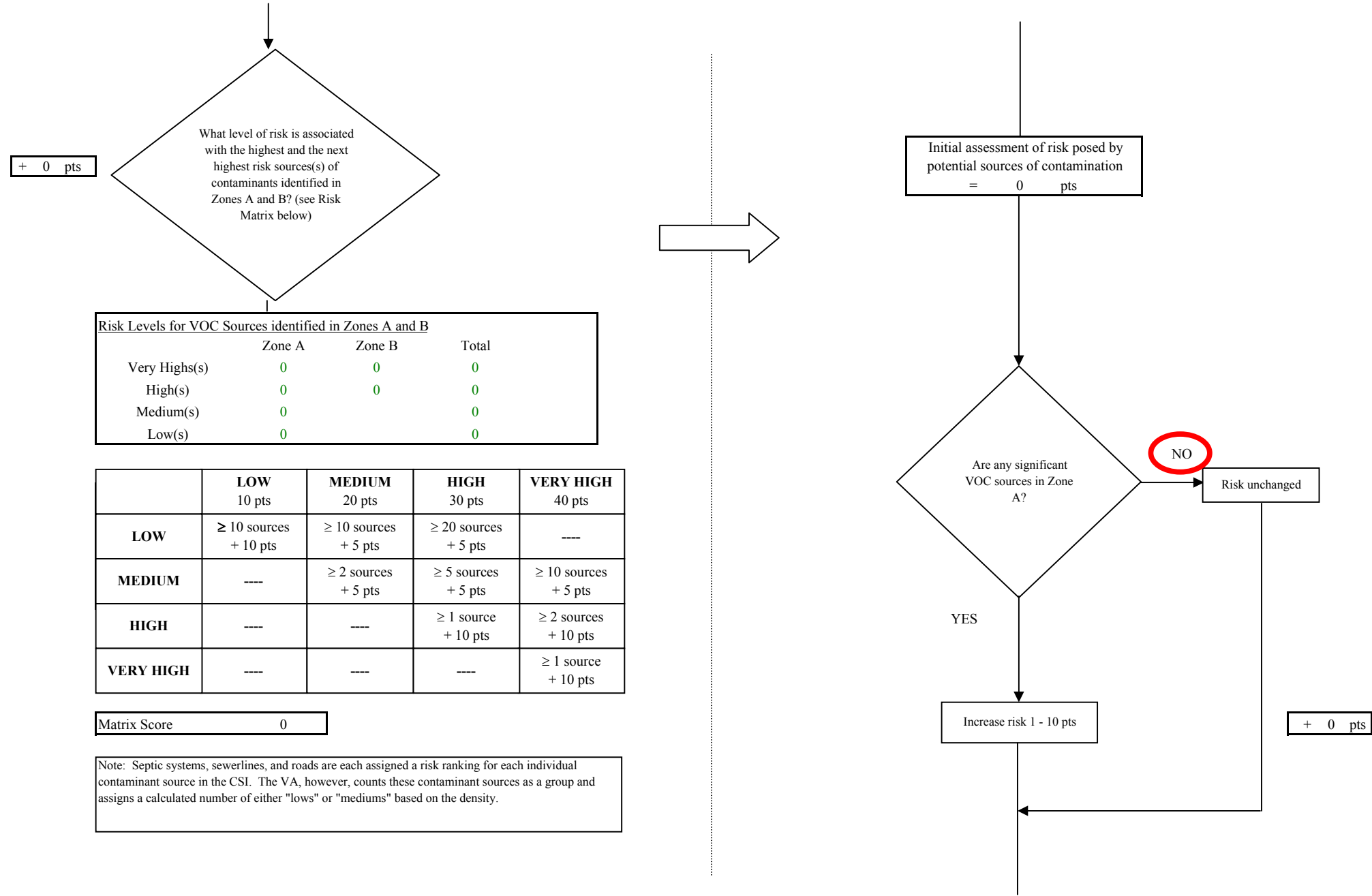


Chart 6. Contaminant risks for City of Petersburg - Cabin Creek - Volatile Organic Chemicals

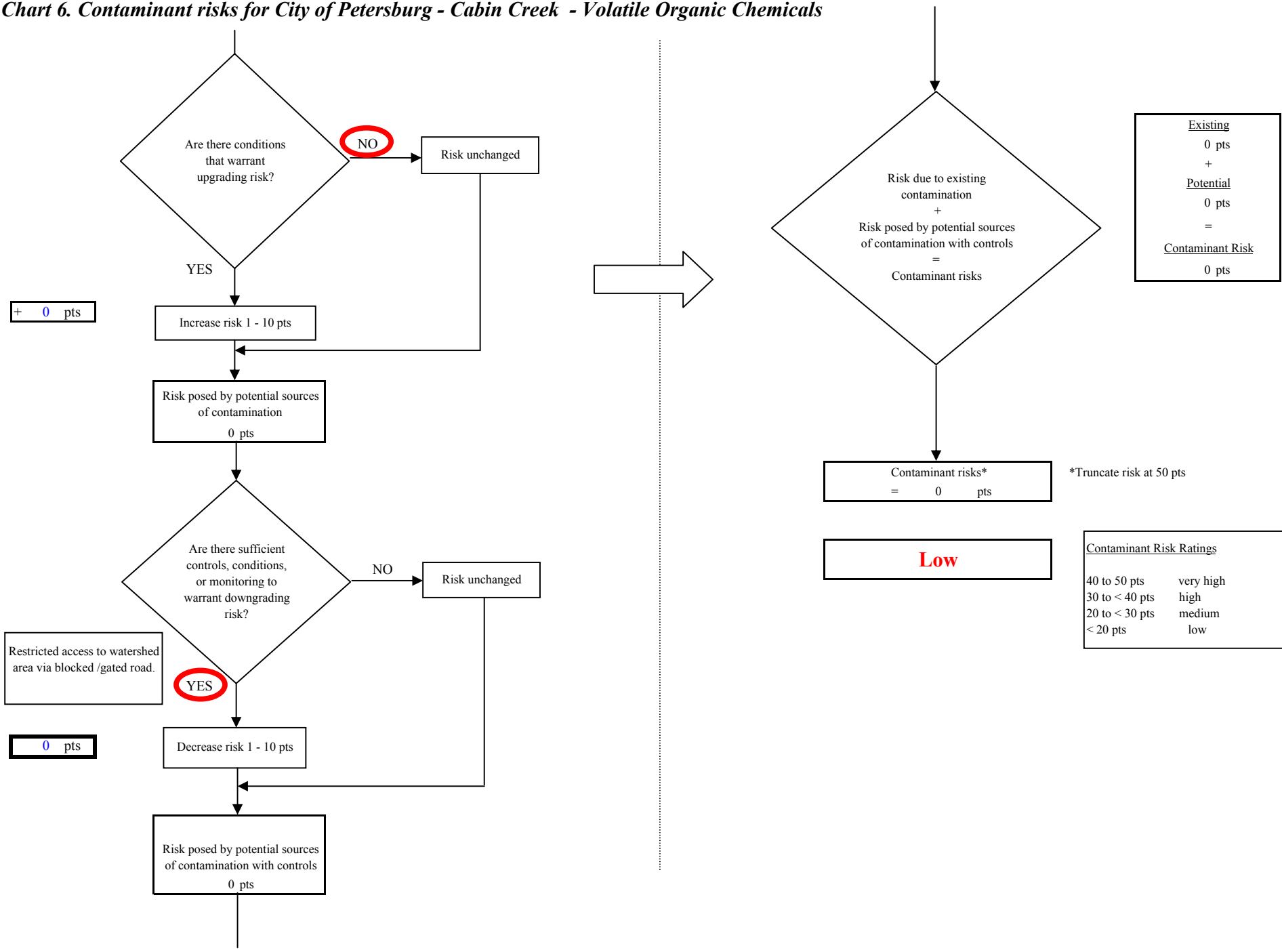


Chart 7. Vulnerability analysis for City of Petersburg - Cabin Creek - Volatile Organic Chemicals

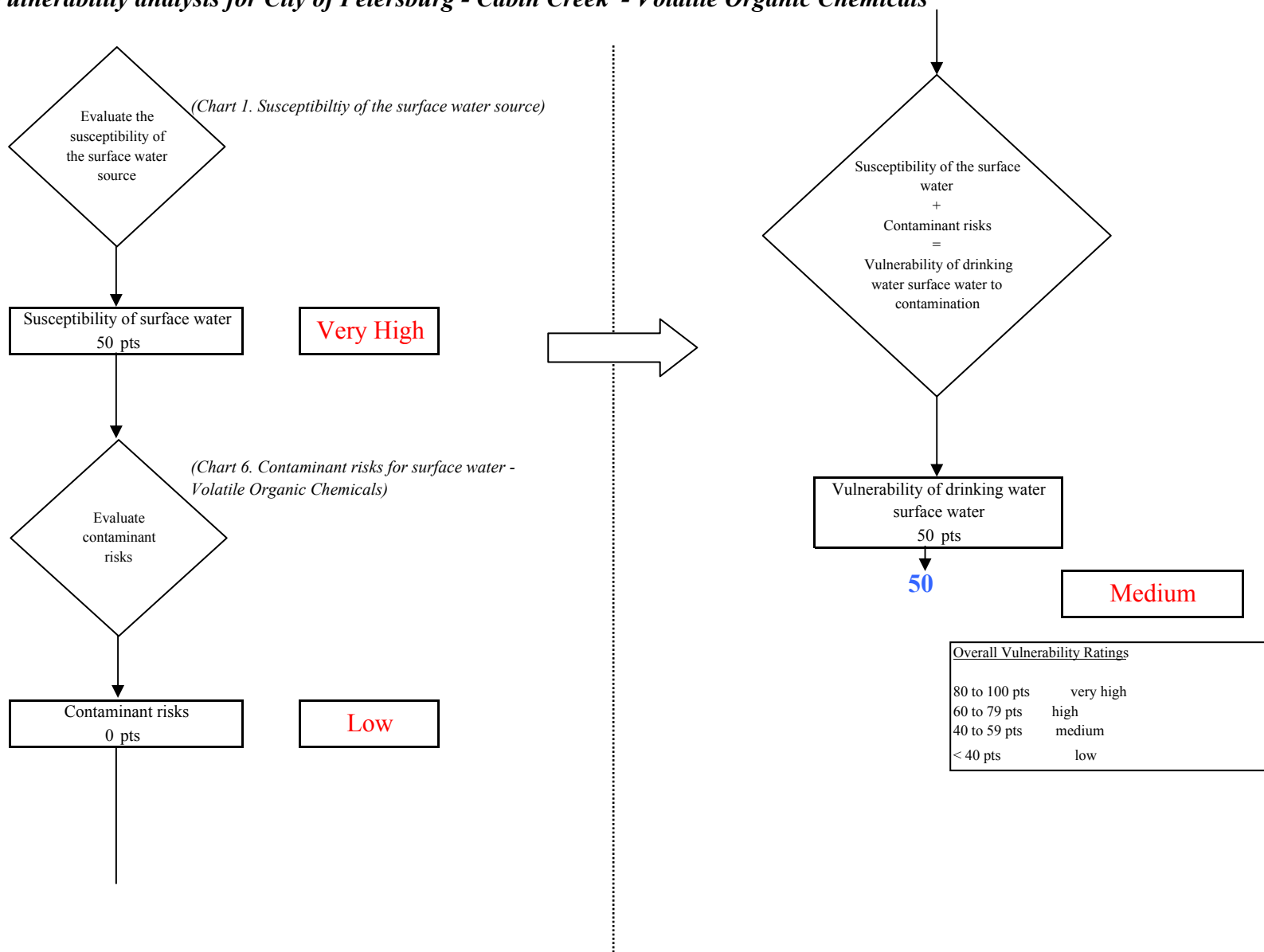


Chart 8. Contaminant risks for City of Petersburg - Cabin Creek - Heavy Metals, Cyanide and Other Inorganic Chemicals

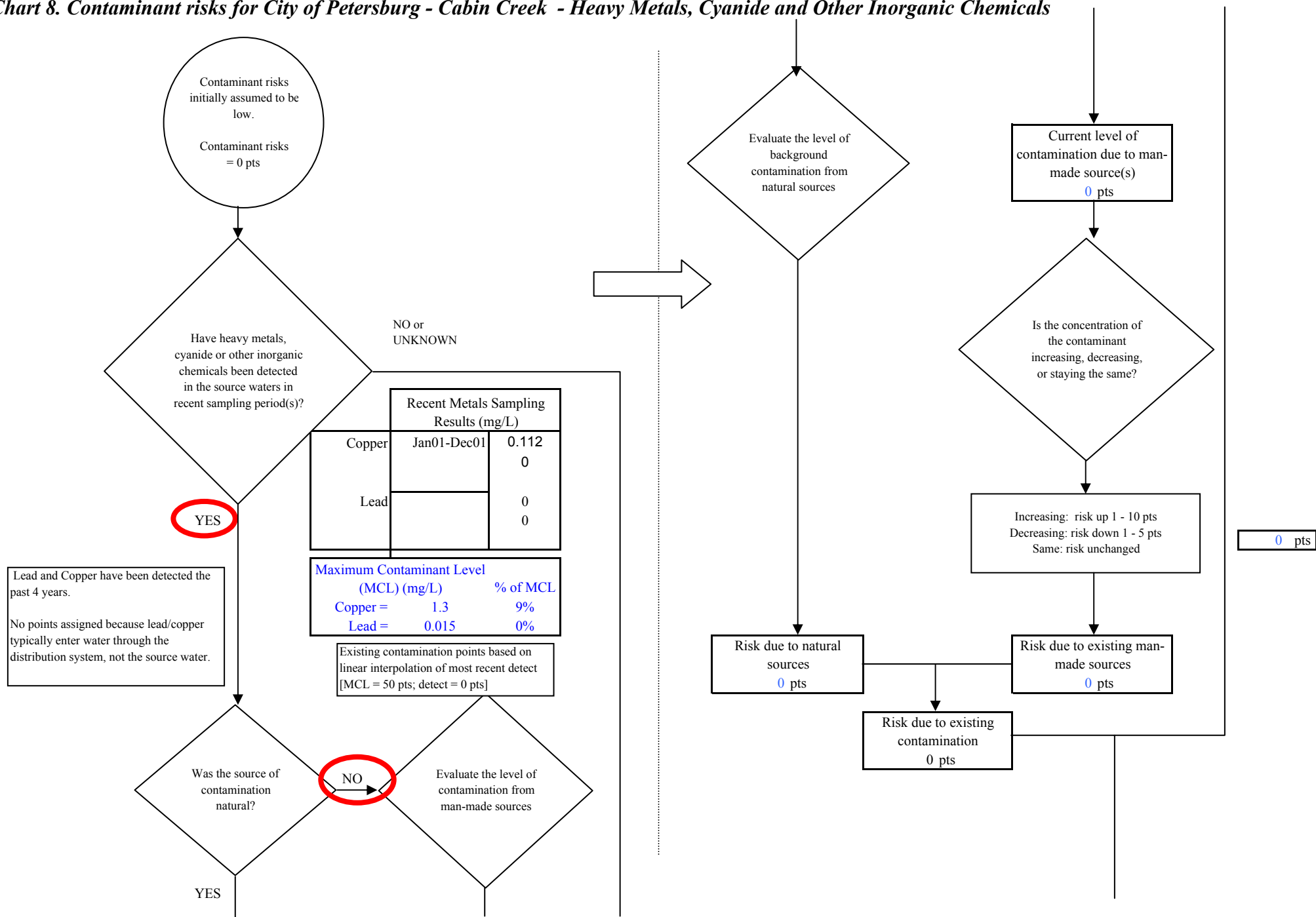


Chart 8. Contaminant risks for City of Petersburg - Cabin Creek - Heavy Metals, Cyanide and Other Inorganic Chemicals

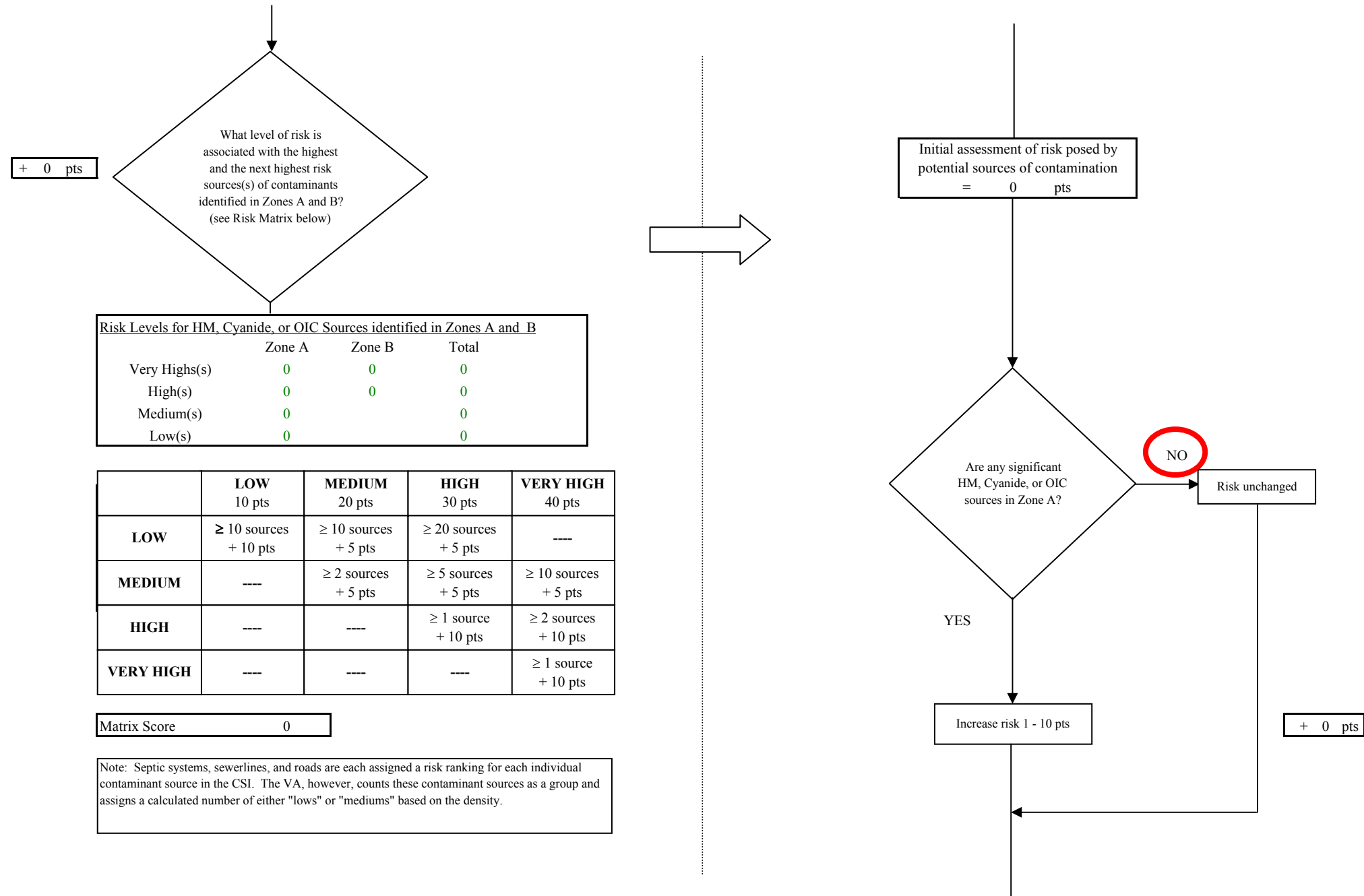


Chart 8. Contaminant risks for City of Petersburg - Cabin Creek - Heavy Metals, Cyanide and Other Inorganic Chemicals

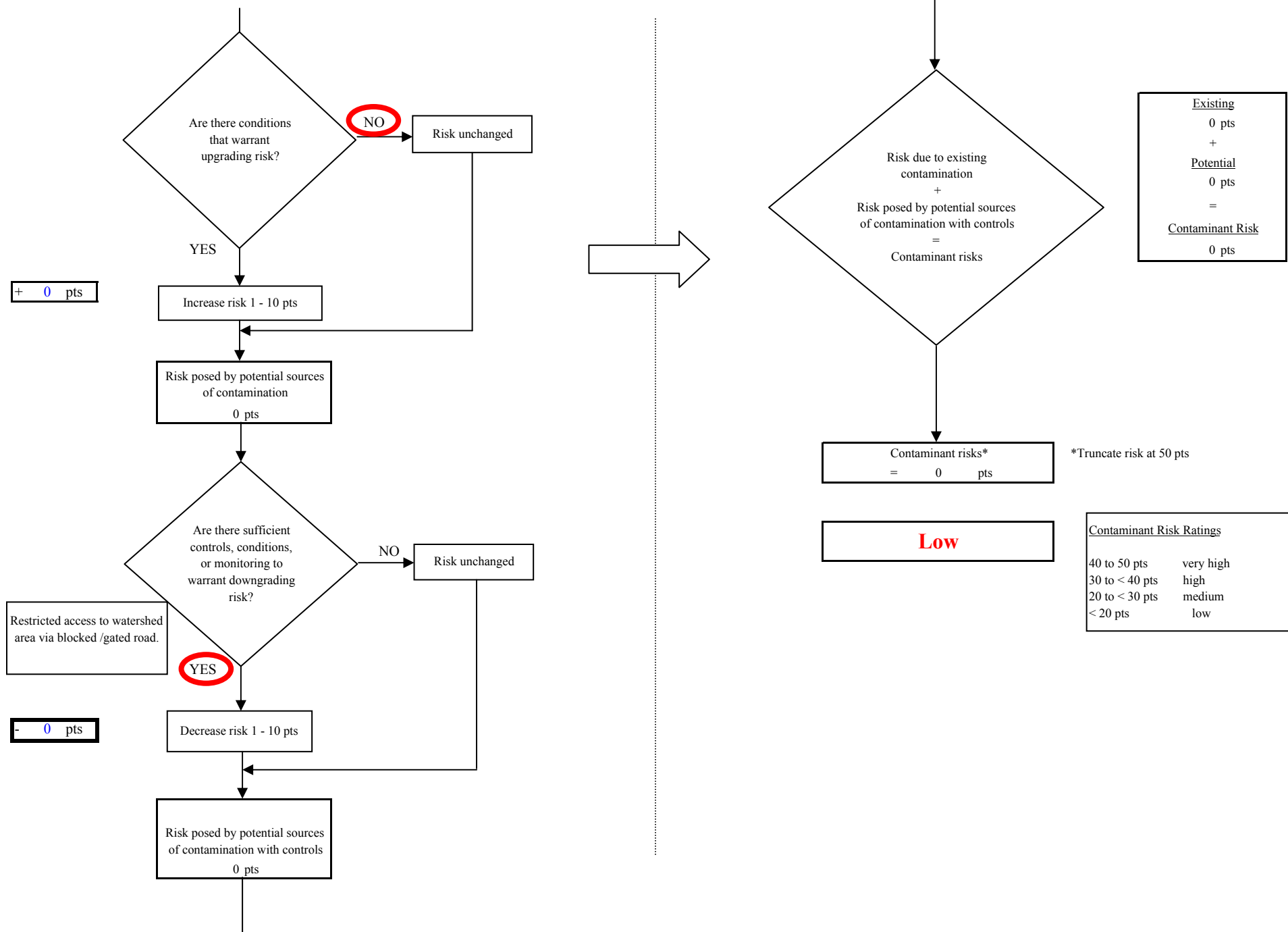


Chart 9. Vulnerability analysis for City of Petersburg - Cabin Creek - Heavy Metals, Cyanide and Other Inorganic Chemicals

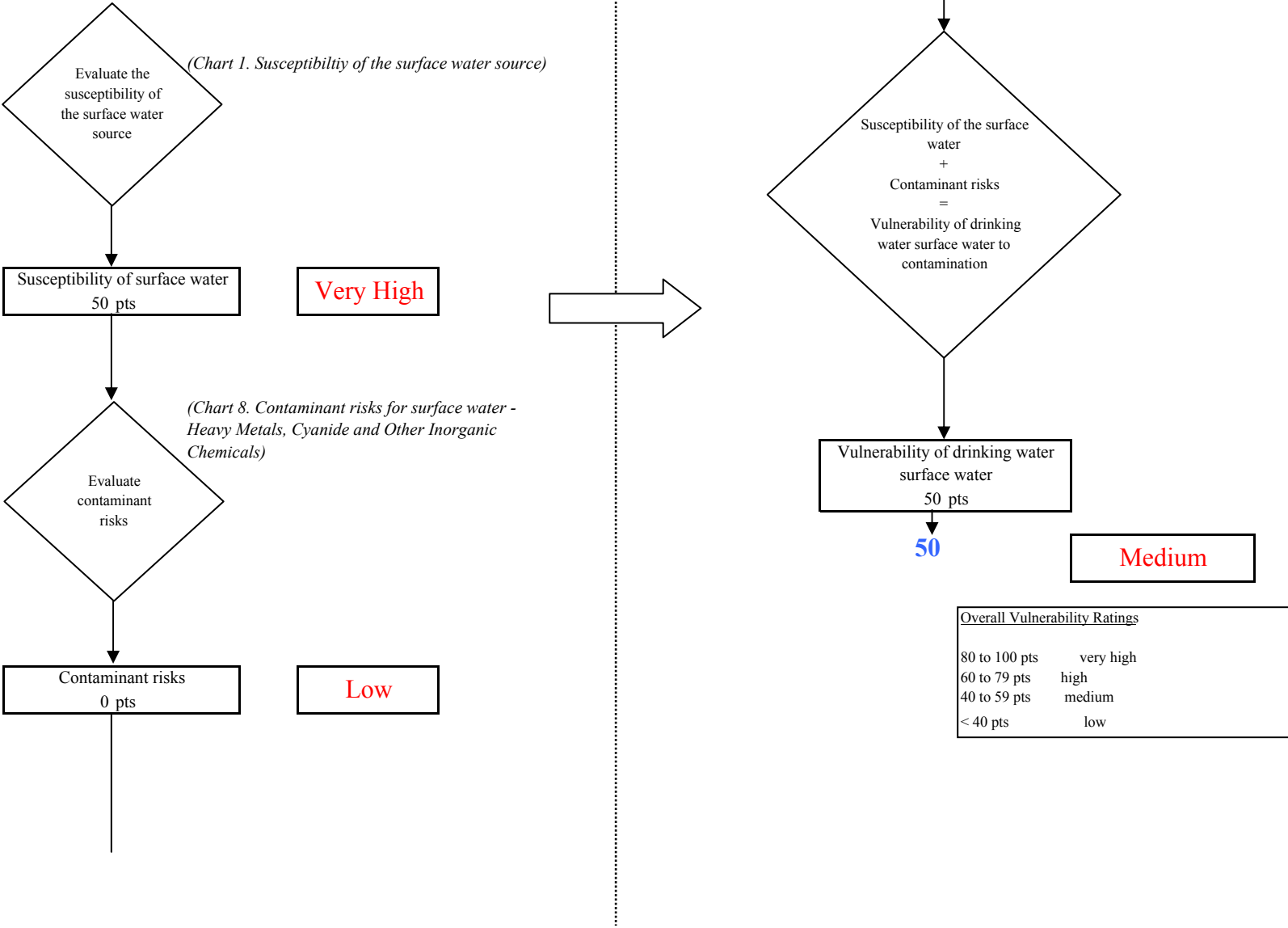


Chart 10. Contaminant risks for City of Petersburg - Cabin Creek - Synthetic Organic Chemicals

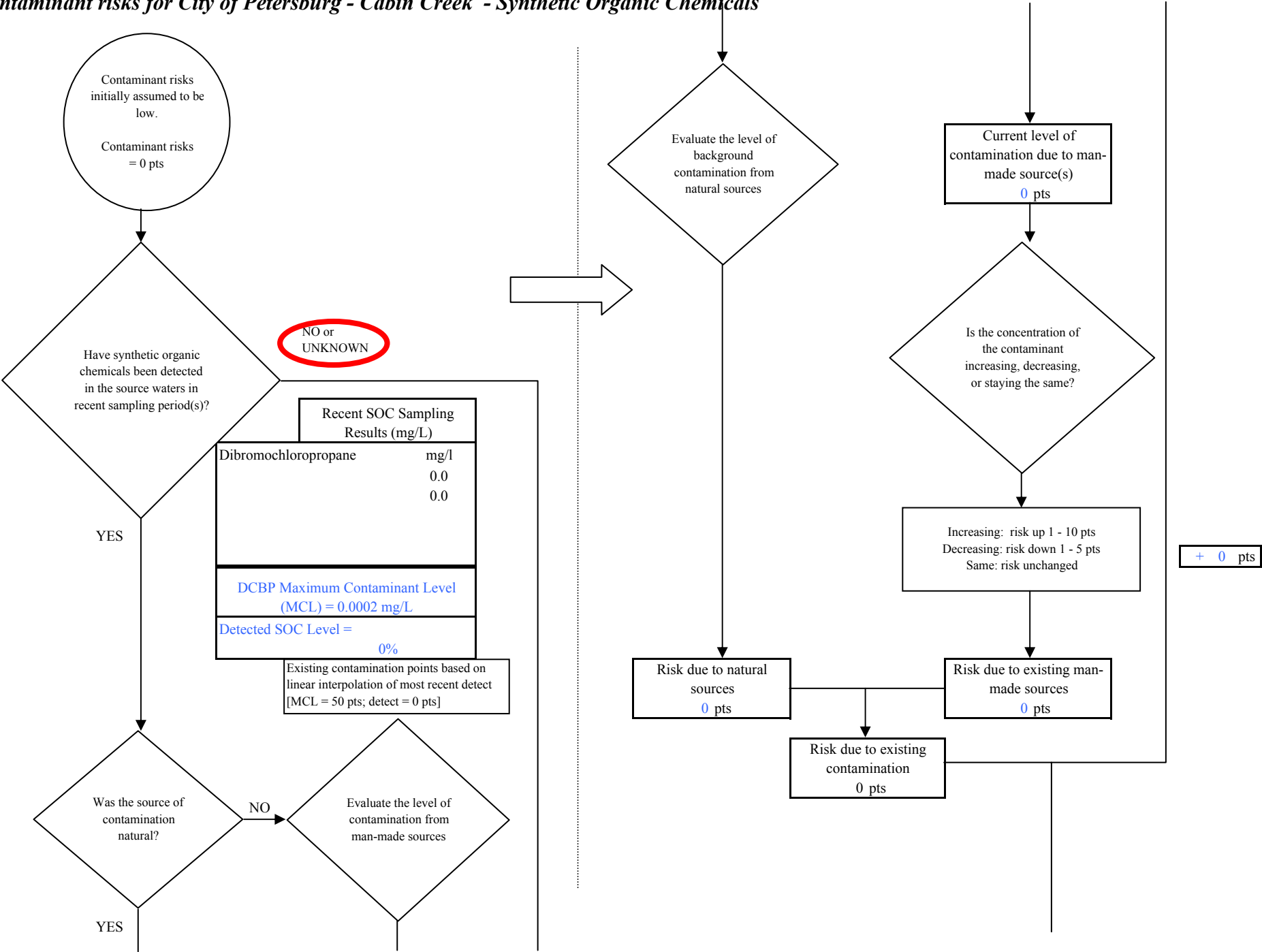


Chart 10. Contaminant risks for City of Petersburg - Cabin Creek - Synthetic Organic Chemicals

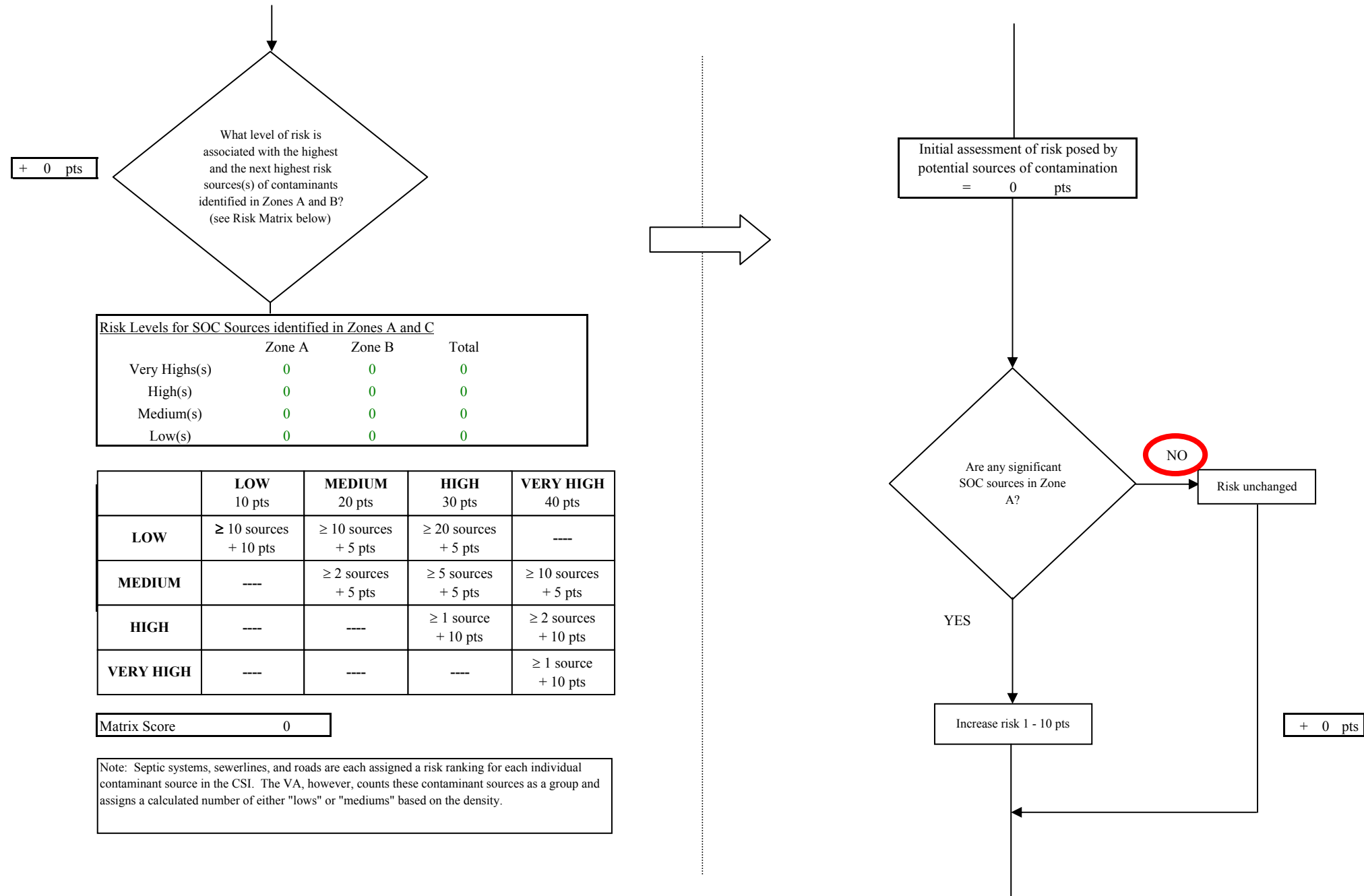


Chart 10. Contaminant risks for City of Petersburg - Cabin Creek - Synthetic Organic Chemicals

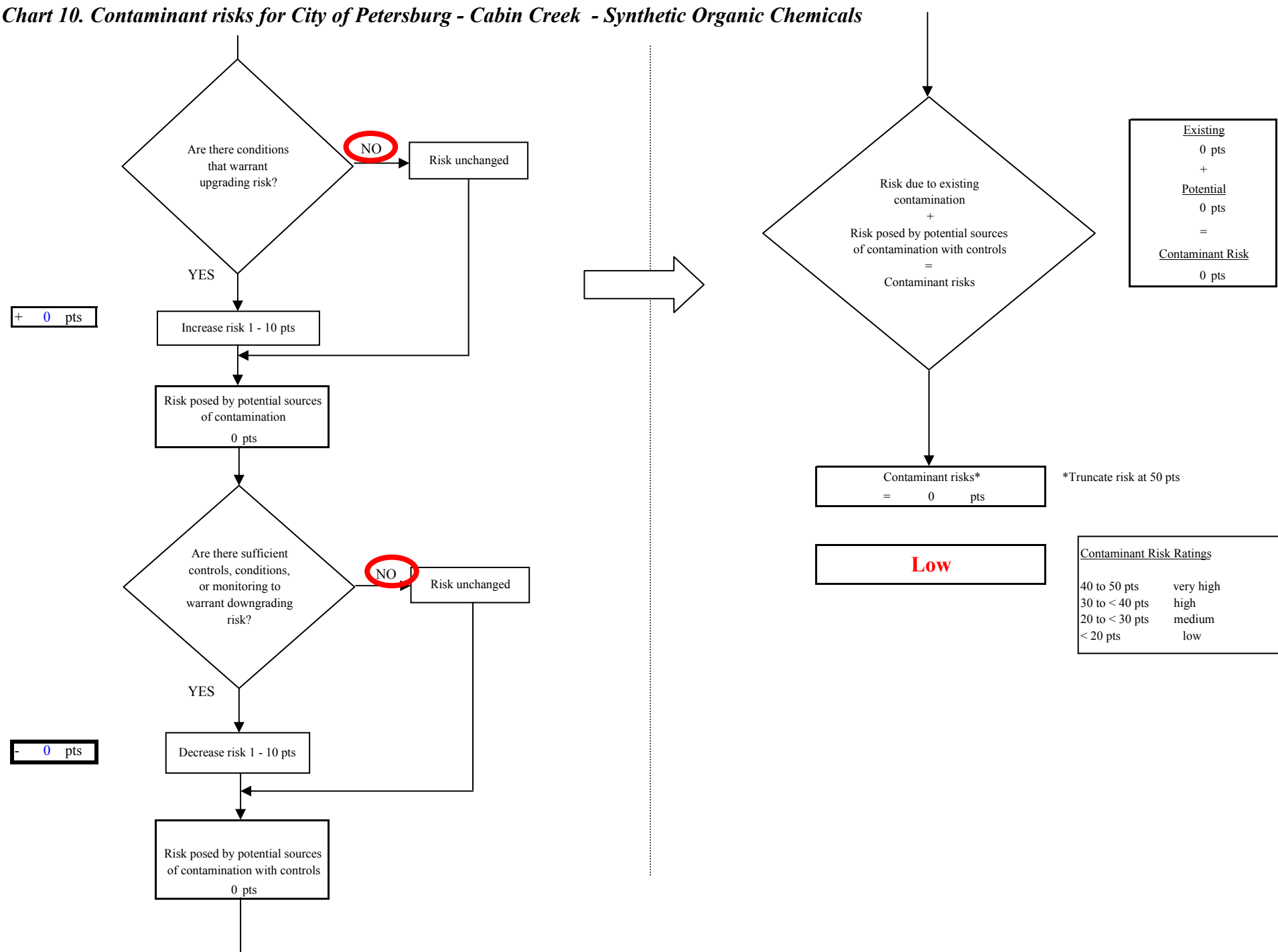


Chart 11. Vulnerability analysis for City of Petersburg - Cabin Creek - Synthetic Organic Chemicals

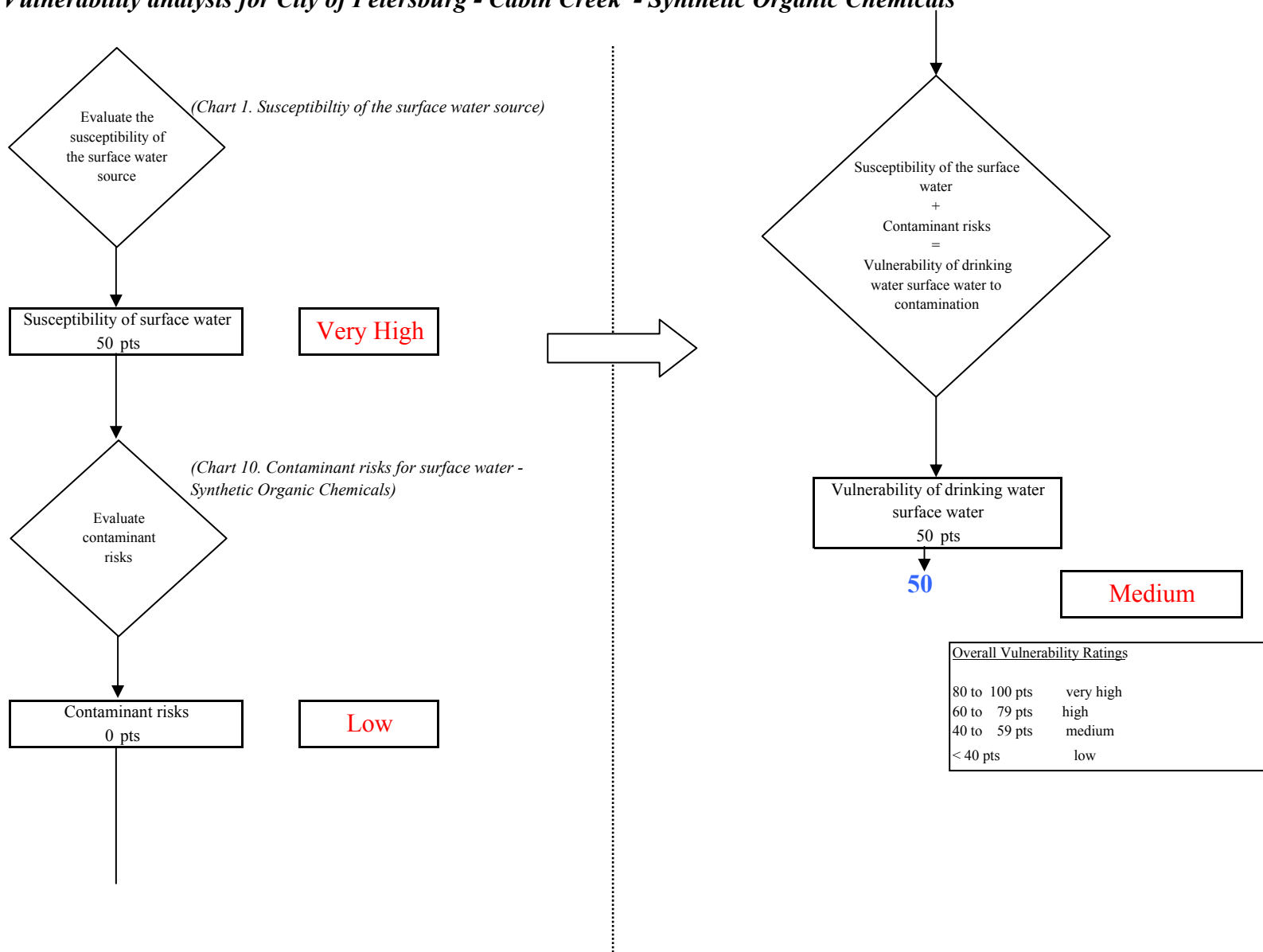


Chart 12. Contaminant risks for City of Petersburg - Cabin Creek - Other Organic Chemicals

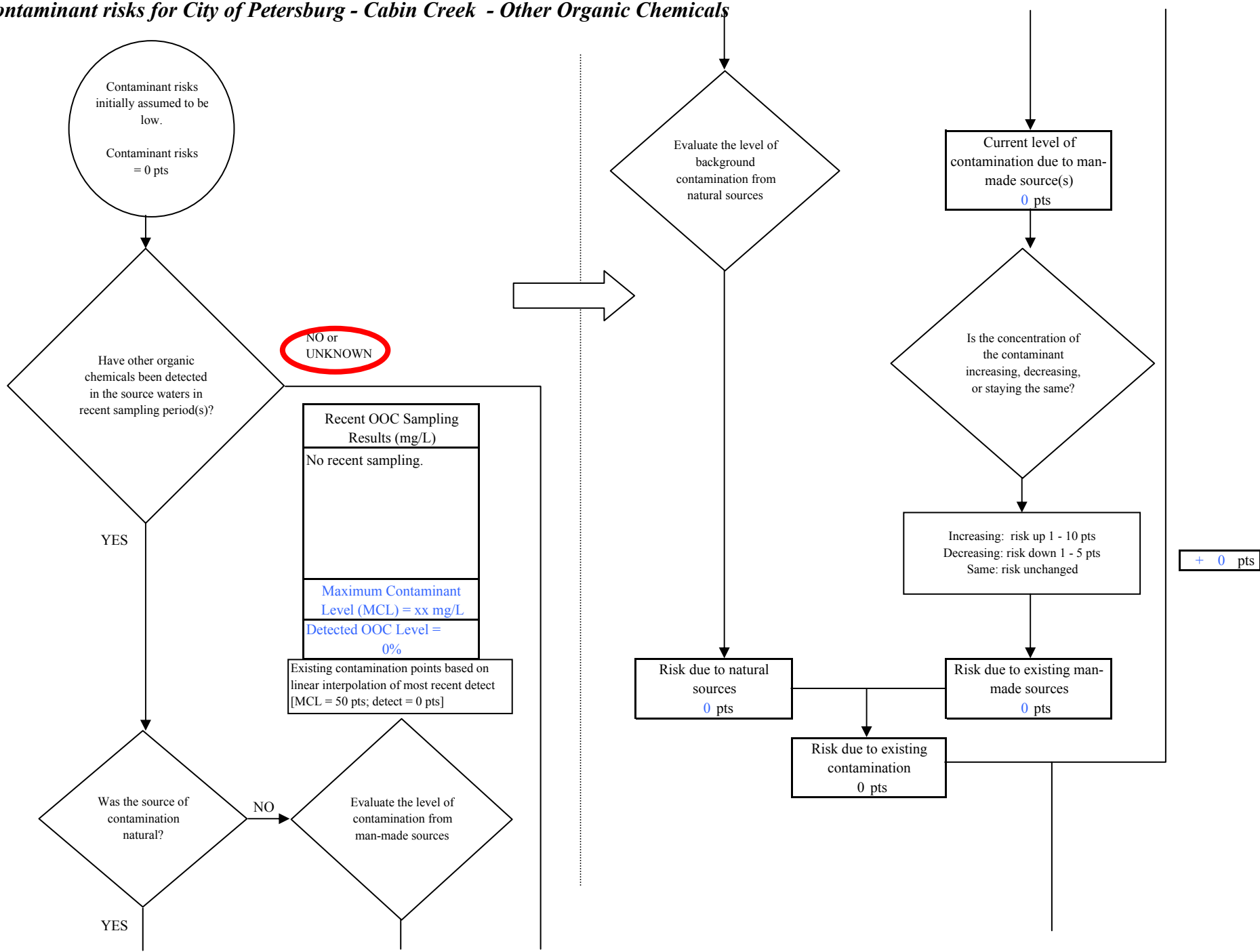


Chart 12. Contaminant risks for City of Petersburg - Cabin Creek - Other Organic Chemicals

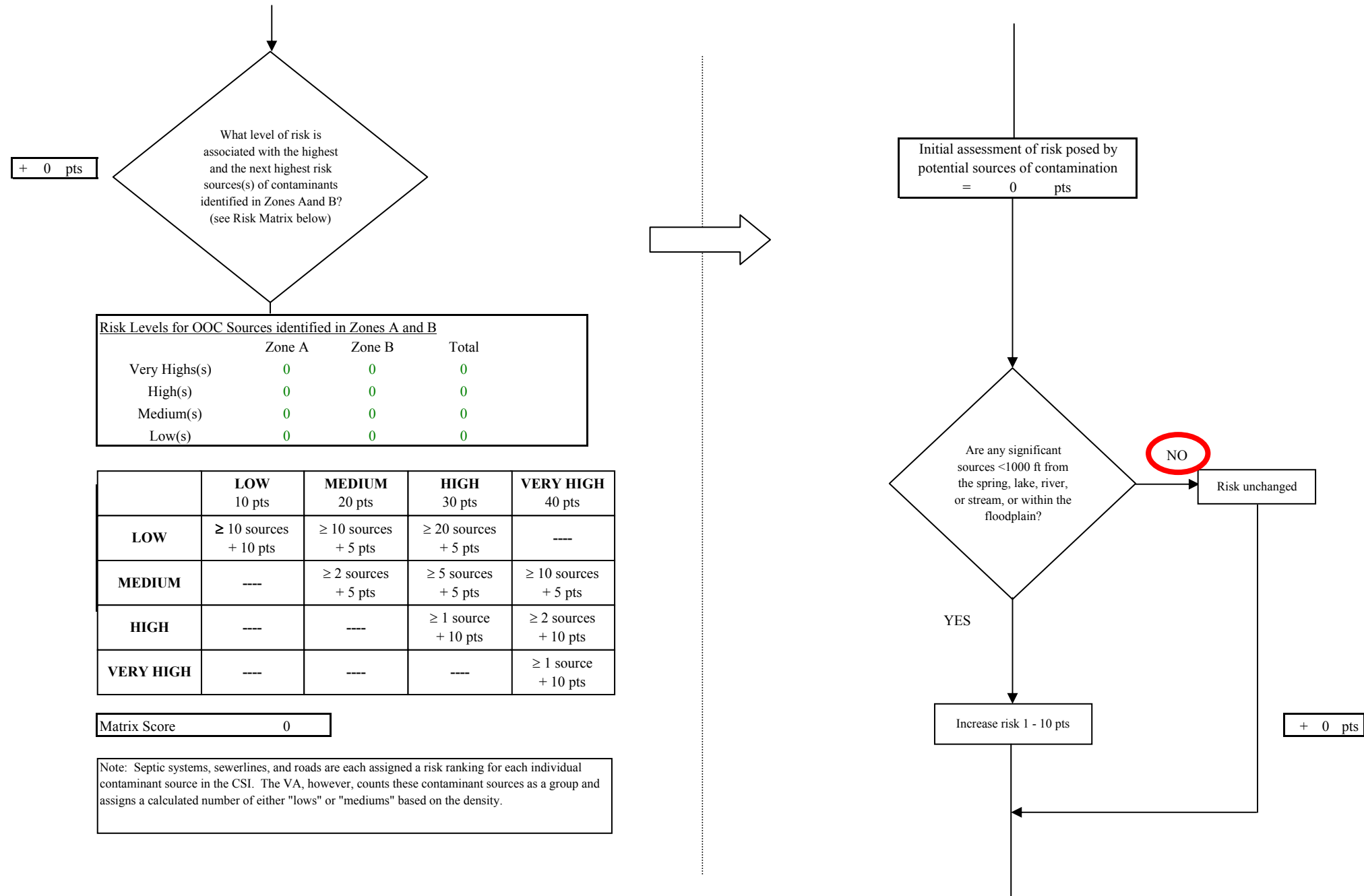


Chart 12. Contaminant risks for City of Petersburg - Cabin Creek - Other Organic Chemicals

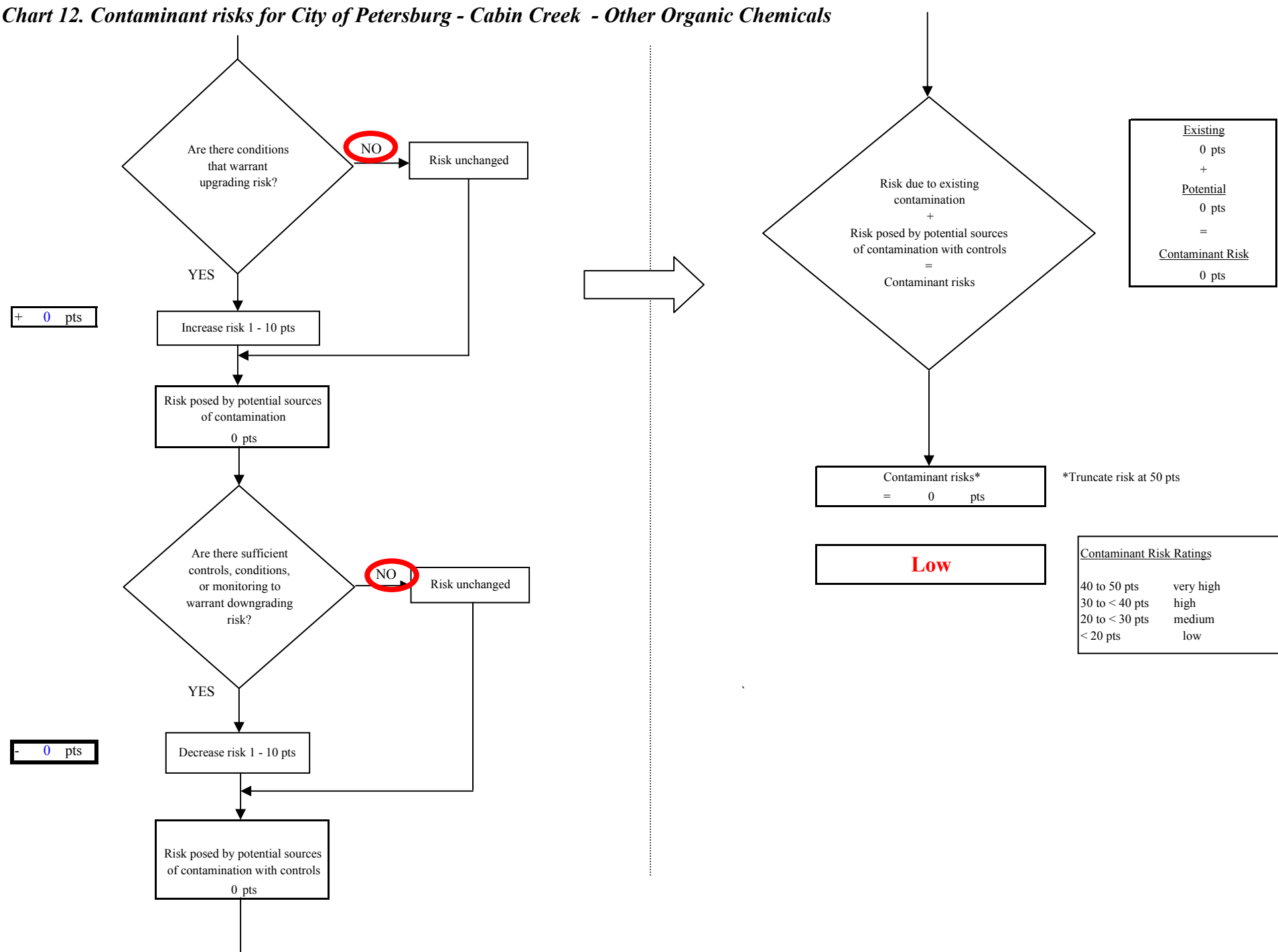


Chart 13. Vulnerability analysis for City of Petersburg - Cabin Creek - Other Organic Chemicals

