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# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Toksook Bay Water System  
Drinking Water System,  
Toksook Bay, Alaska

PWSID # 270215.001

April 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1079  
Alaska Department of Environmental Conservation

# Source Water Assessment for Toksook Bay Water System Drinking Water System Toksook Bay, Alaska

PWSID # 270215.001

## DRINKING WATER PROTECTION PROGRAM REPORT 1079

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 Toksook Bay Water System Source of Public Drinking Water, Toksook Bay, Alaska

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## Drinking Water Protection Program Alaska Department of Environmental Conservation

### EXECUTIVE SUMMARY

The Toksook Bay Water System has one Public Water System (PWS) well. The well (PWS No. 270215.001) has been used as a drinking water source since it was drilled in 1998.

The well is a Class A (community and non-transient non-community) water system located approximately 0.5 miles north of the village of Toksook Bay, Alaska. Available records indicate that there is secondary storage of drinking water, with a combined capacity of 212,000-gallons, and that the drinking water source is treated with calcium hypochlorite. This system operates year round and serves approximately 515 residents through 105 service connections. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produce a **High** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: roads. These identified potential and existing sources of contamination 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 contaminant categories.

Overall, the water well received a vulnerability rating of **Medium** for the bacteria and viruses, nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, and other organic chemicals contaminant categories, and a vulnerability rating of **Low** for synthetic organic chemicals.

### PUBLIC DRINKING WATER SYSTEM

The Toksook Bay Water System well is a Class A (community/non-transient/non-community) public water system. The system is located approximately 0.5 miles north of the village of Toksook Bay, Alaska

(Sec. 8, T5N, R90W, Seward Meridian; see Map A of Appendix A). Toksook Bay is located on Nelson Island, on Kangirivak Bay across the water from Nunivak Island. The community is located 115 miles northwest of Bethel. The community has a population of 572 (ADCED, 2003). Average annual precipitation in Toksook Bay is 22 inches, including approximately 43 inches of snowfall. Temperatures range from 41 to 57°F in summer and 6 to 24°F in winter.

The community of Toksook Bay obtains most of their water supply from a community well. Most households are served by the piped sewage collection system (ADCED, 2003). Toksook Bay receives electrical power from AVEC, operated by the REA Cooperative. Power generating facilities are fueled by diesel. Refuse is collected by the City of Toksook Bay and transported to the landfill (ADCED, 2003).

According to information supplied by ADEC for the Toksook Bay Water System PWS, the depth of the primary water well is 165 feet below the ground surface and is screened in an unconfined aquifer based on available construction details. The well is not located within a floodplain.

Information acquired from a February 2000 sanitary survey for the public water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Toksook Bay is within the Bering Shelf physiographic province of southwestern Alaska. The Yukon-Kuskokwim Coastal Lowland, a section of the physiographic province, is a delta complex consisting of a lake-dotted marshy plain rising from the sea level. The largest geologic unit is the delta itself. The delta consists of three very similar units that chiefly consist of silt, sands, silty sands, and organic

soils (peat bogs). The sediments of these units are a complex of river deposits, marine deposits, swamp deposits, and wind deposits. Toksook Bay lies within the discontinuous permafrost region of Alaska (R&M Consultants, Inc., 1979).

## DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. 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 well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the Toksook Bay Water System PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

The protection areas established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four protection area 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 the 2 year time-of-travel
C	Less Than the 5 year time -of-travel
D	Less than the 10 year time -of-travel

The DWPA for the Toksook Bay Water System PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A of Appendix A).

## INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Toksook Bay Water System DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class 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,
- Other organic chemicals.

The sources are displayed on Map C 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 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 function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low,
- Medium,
- High, and
- Very High.

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. 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 4 in Appendix B 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 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 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. Chart 4 contains 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 Toksook Bay Water System’s water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

**Table 2. Susceptibility**

	Score	Rating
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	14	Medium
Natural Susceptibility	34	High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source 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 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	12	Low
Nitrates and/or Nitrites	12	Low
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide and		
Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	12	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:

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

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	50	Medium
Nitrates and Nitrites	50	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide and		
Other Inorganic Chemicals	50	Medium
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	50	Medium

### Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Low**. The risk is primarily attributed to the presence of roads Zone A (see Table 2 – Appendix B).

No positive bacteria counts have been reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Only a small amount of bacteria and viruses are required to endanger public health.

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 **Medium**.

### Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Low**. The risk to this source of public drinking water is primarily attributed to the presence of roads in Zone A (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in recent sampling events. However, the reported concentrations of nitrates do not exceed the maximum contaminant level (MCL) of 10 mg/L. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Nitrate levels are often derived from the decomposition of organic matter in soils. Although the nitrate source is unknown, such occurrences may be attributed to septic systems or other sources. After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to nitrate and nitrite contamination is **Medium**.

### Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low**. The risk is primarily attributed to the presence of roads located in Zone A (see Table 4 – Appendix B).

Detectable concentrations of trihalomethanes were reported in sampling events for this public water system. However, the detectable concentrations of trihalomethanes reported in 1998, 2000, and 2002 were well below the MCL of 0.08 mg/L. Trihalomethanes are considered byproducts of the

water treatment process and are not from the source waters. Since the reported concentration of TTHM's in recent sampling events did not exceed the applicable MCLs, risk points were not retained.

Aside from being byproducts of the drinking water treatment process, possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, roads, and airports.

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 **Medium**.

#### **Heavy Metals, Cyanide and Other Inorganic Chemicals**

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Low**. The risk is primarily attributed to the presence of roads located in Zone A (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, moderate levels of copper and lead have been detected in recent sampling history, but have not exceeded their respective MCLs of 1.3 mg/L and 0.015 mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The reported concentrations of copper and lead in recent sampling events are not likely to be representative of source water conditions. These two analytes are likely attributed to either the water treatment process or water distribution network; therefore, no risk points were assigned based on the presence of these analytes.

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 contaminant risk for synthetic organic chemicals is **Low**. The risk is primarily attributed to the lack of contaminant sources present within the protection area (see Chart 11 – Appendix D).

No recent sampling data was available in ADEC records for the Toksook Bay Water System (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

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 contaminant risk for other organic chemicals is **Low**. The risk is primarily attributed to the presence of roads located in Zone A (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Toksook Bay Water System (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

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 **Medium**.

#### **Using the Source Water Assessment**

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 the community of Toksook Bay 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 the drinking water source.



## REFERENCES

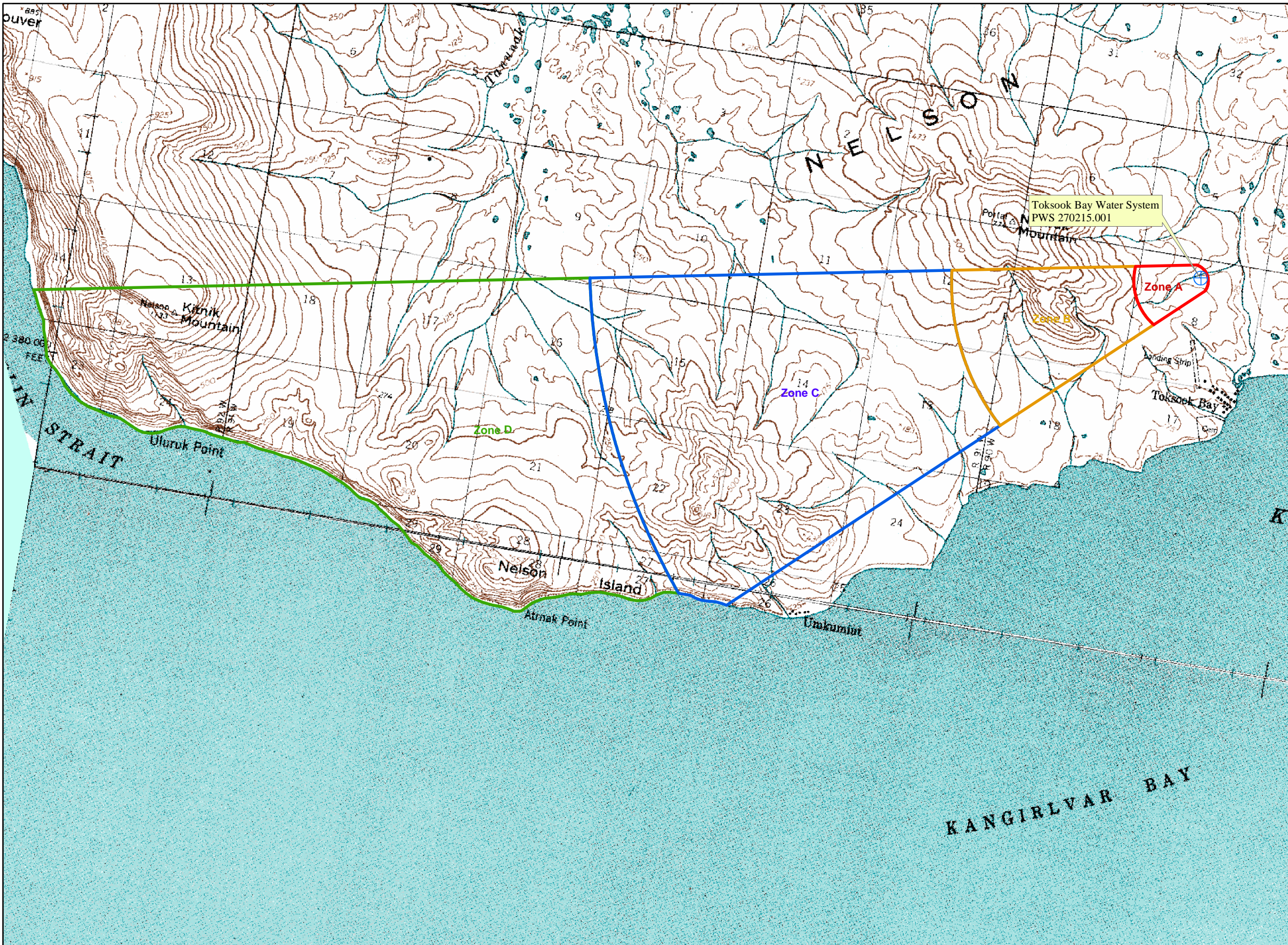
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## **APPENDIX A**

### **Drinking Water Protection Area Location Map (Map A)**




## Public Water Well System for PWS #270215.001 Toksook Bay Water System







## LEGEND

- 
- Public Water System Well





**Hydrography/Physical**

-  Parcels
-  Stream
-  Lake or Pond
-  Contours

## Transportation

-  Primary Route (Class 1)
-  Secondary Route (Class 2)
-  Road (Class 3)
-  Road (Class 4)
-  Road (Class 5, Four-wheel drive)

### Groundwater Protection Zones

-  Zone A Protection Area– Several Months Travel Time  
 Zone B Protection Area– 2 Years Travel Time  
 Zone C Protection Area– 5 Years Travel Time  
 Zone D Protection Area– 10 Years Travel Time

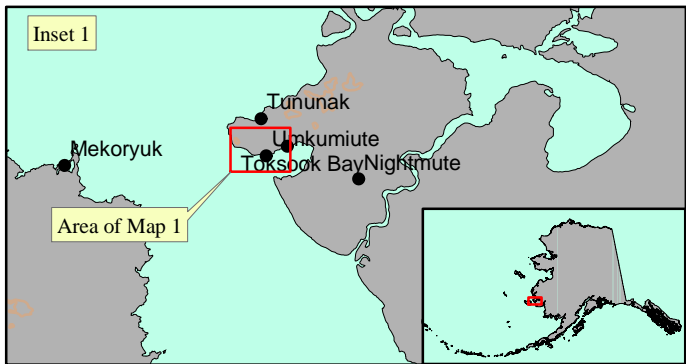
Data Sources:  
Contaminant Sources, Public Water System Wells, Contours  
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities, Federal Emergency Management Agency (FEMA)

All other data:  
United States Geological Survey (USGS)

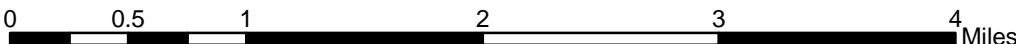
Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



Toksook Bay Water System  
PWS 270215.001

## Appendix A      Map A





## **APPENDIX B**

### **Contaminant Source Inventory and Risk Ranking (Tables 1-7)**

Table 1

Contaminant Source Inventory for  
Toksook Bay Water System

PWSID 270215.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	C	

Table 2

Contaminant Source Inventory and Risk Ranking for  
Toksook Bay Water System  
Sources of Bacteria and Viruses

PWSID 270215.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	

Table 3

Contaminant Source Inventory and Risk Ranking for  
Toksook Bay Water System  
Sources of Nitrates/Nitrites

PWSID 270215.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	

**Table 4**

*Contaminant Source Inventory and Risk Ranking for  
Toksook Bay Water System  
Sources of Volatile Organic Chemicals*

**PWSID 270215.001**

<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>
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	



**Table 5**

*Contaminant Source Inventory and Risk Ranking for  
Toksook Bay Water System  
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

**PWSID 270215.001**

<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>
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	

Table 6

Contaminant Source Inventory and Risk Ranking for  
Toksook Bay Water System  
Sources of Other Organic Chemicals

PWSID 270215.001

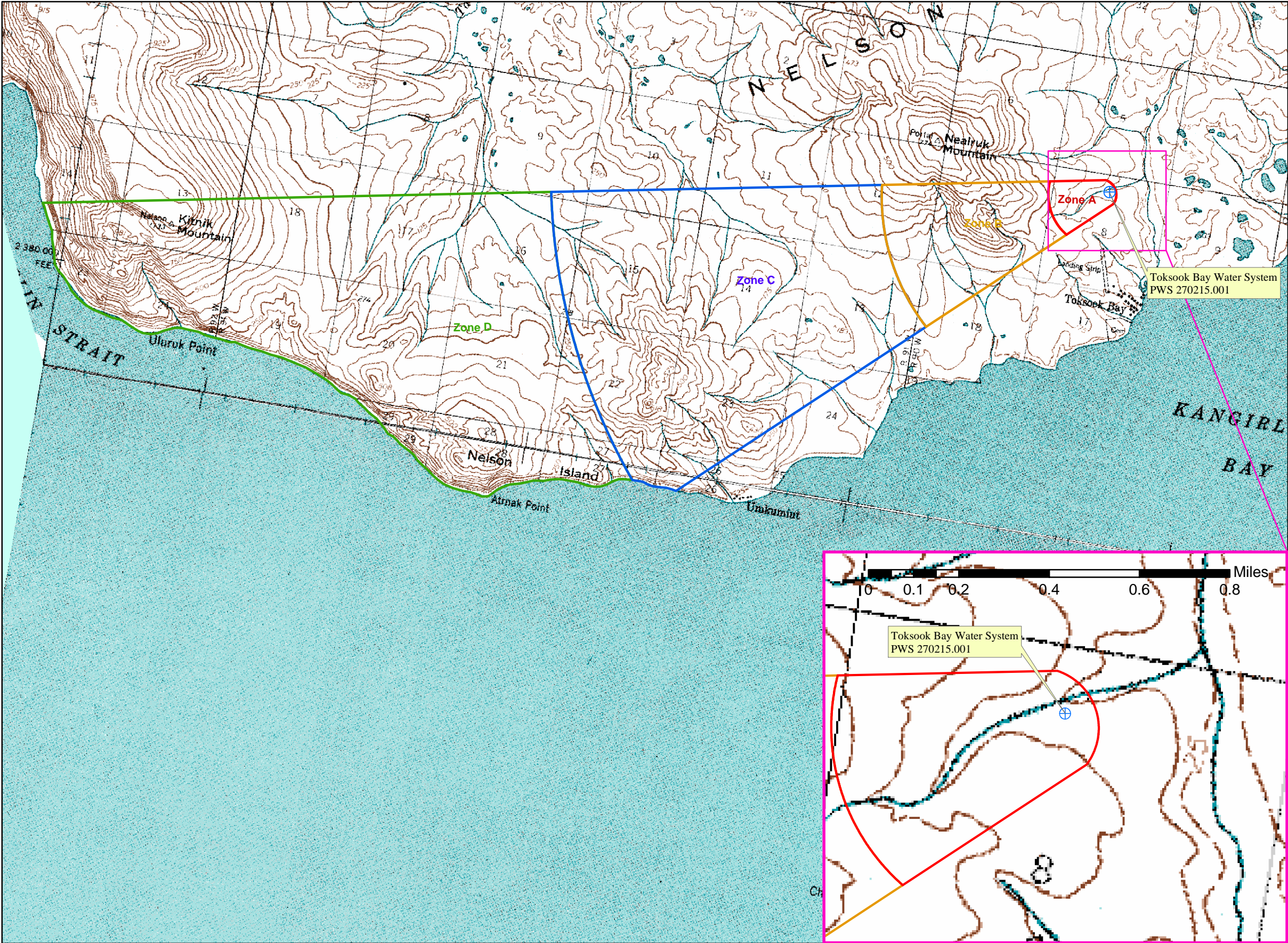
Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	

## **APPENDIX C**

### **Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map C)**



Public Water Well System for PWS #270215.001 Toksook Bay Water System  
Showing Potential and Existing Sources of Contamination



**LEGEND**

Public Water System Well

**Hydrography/Physical**

Parcels  
Stream  
Lake or Pond  
Contours

**Transportation**

Primary Route (Class 1)  
Secondary Route (Class 2)  
Road (Class 3)  
Road (Class 4)  
Road (Class 5, Four-wheel drive)

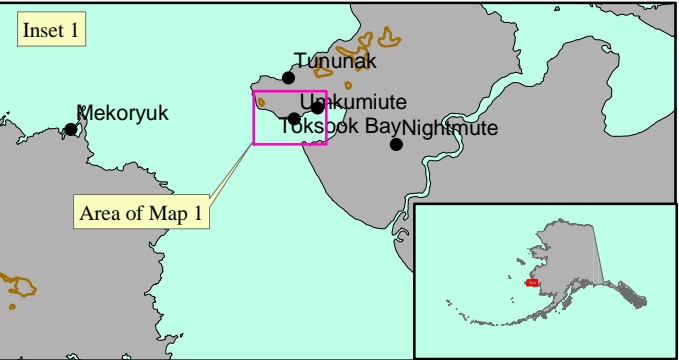
**Groundwater Protection Zones**

Zone A Protection Area- Several Months Travel Time  
Zone B Protection Area- 2 Years Travel Time  
Zone C Protection Area- 5 Years Travel Time  
Zone D Protection Area- 10 Years Travel Time

**Existing or Potential Contaminant Sources**

No known potential contaminant sources in the protection zones.

Data Sources:  
Contaminant Sources, Public Water System Wells, Contours  
Alaska Department of Environmental Conservation (ADEC)  
  
Critical Facilities, Federal Emergency Management Agency (FEMA)  
  
All other data:  
United States Geological Survey (USGS)  
  
Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC  
  
URS Corporation does not guarantee the accuracy or validity of the data provided.

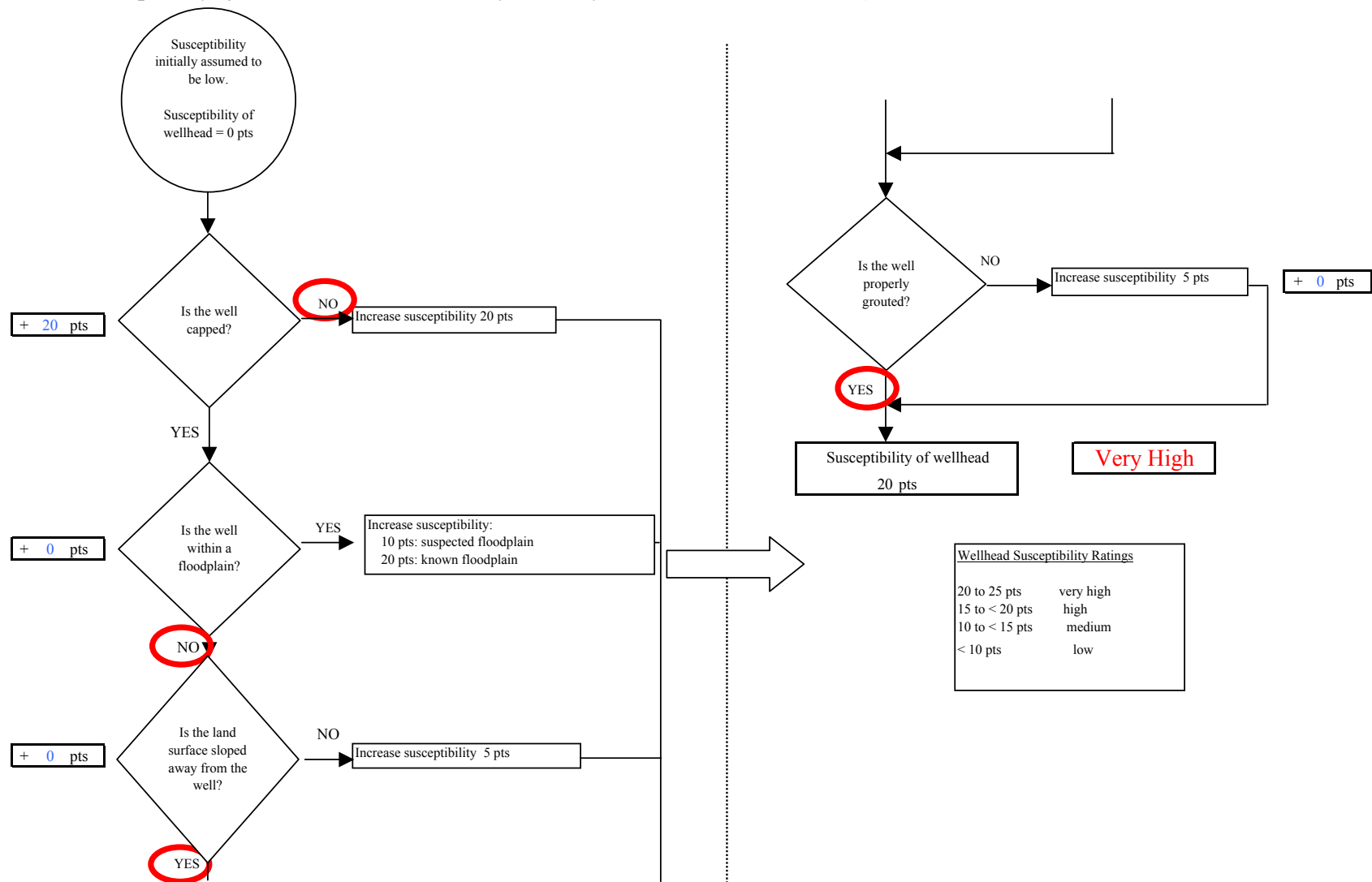




## **APPENDIX D**

### **Vulnerability Analysis for Public Drinking Water Source (Charts 1-14)**

Chart 1. Susceptibility of the wellhead - Toksook Bay Water System (PWS No. 270215.001)



**Chart 2. Susceptibility of the aquifer Toksook Bay Water System (PWS No. 270215.001)**

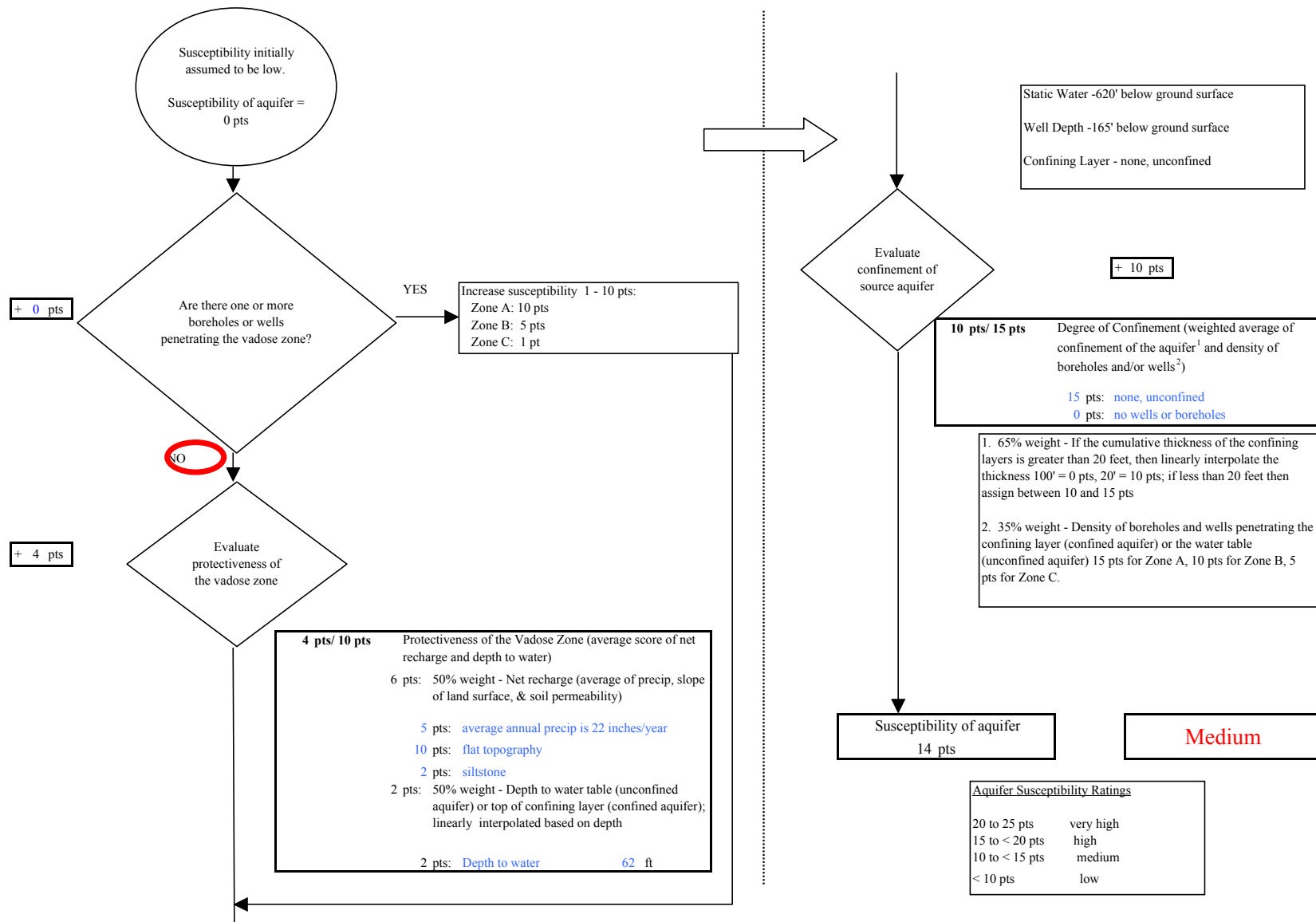


Chart 3. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Bacteria & Viruses

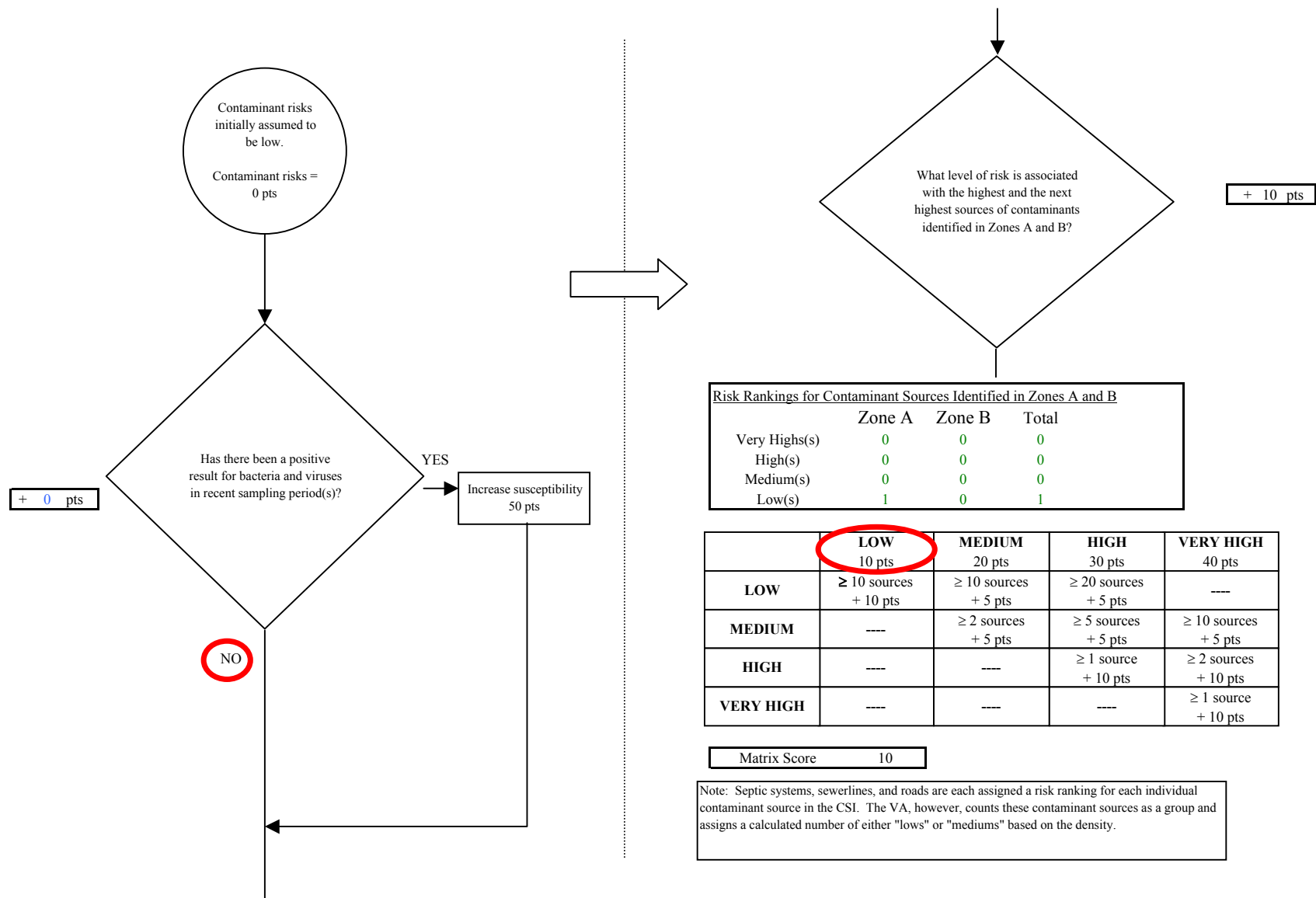
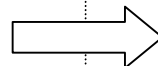
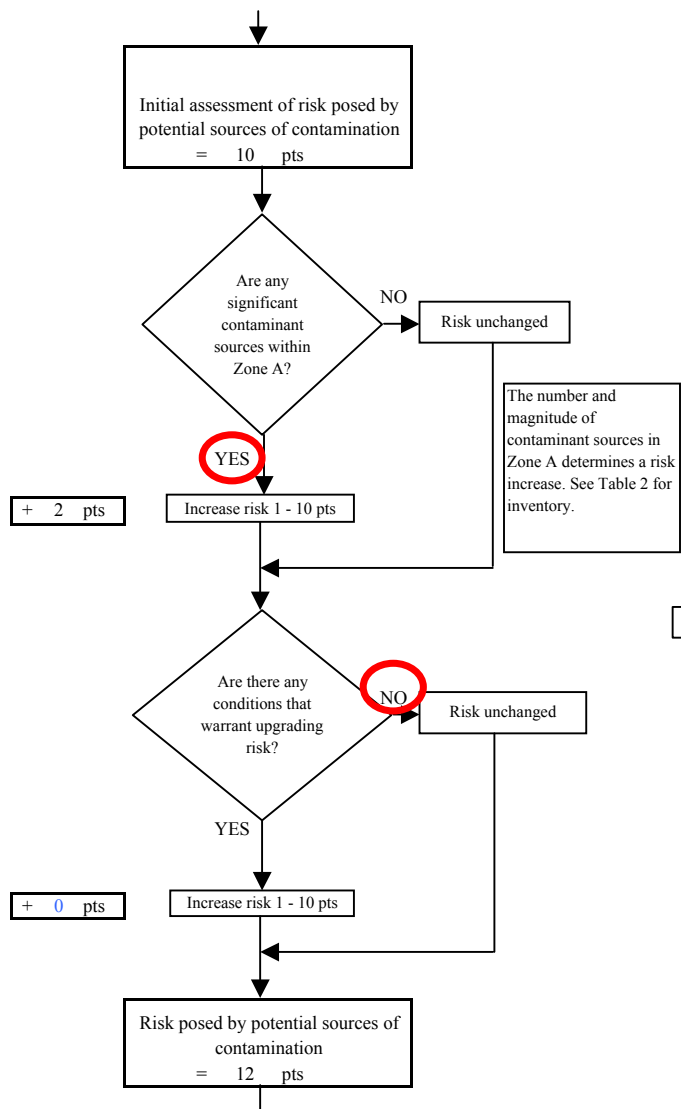
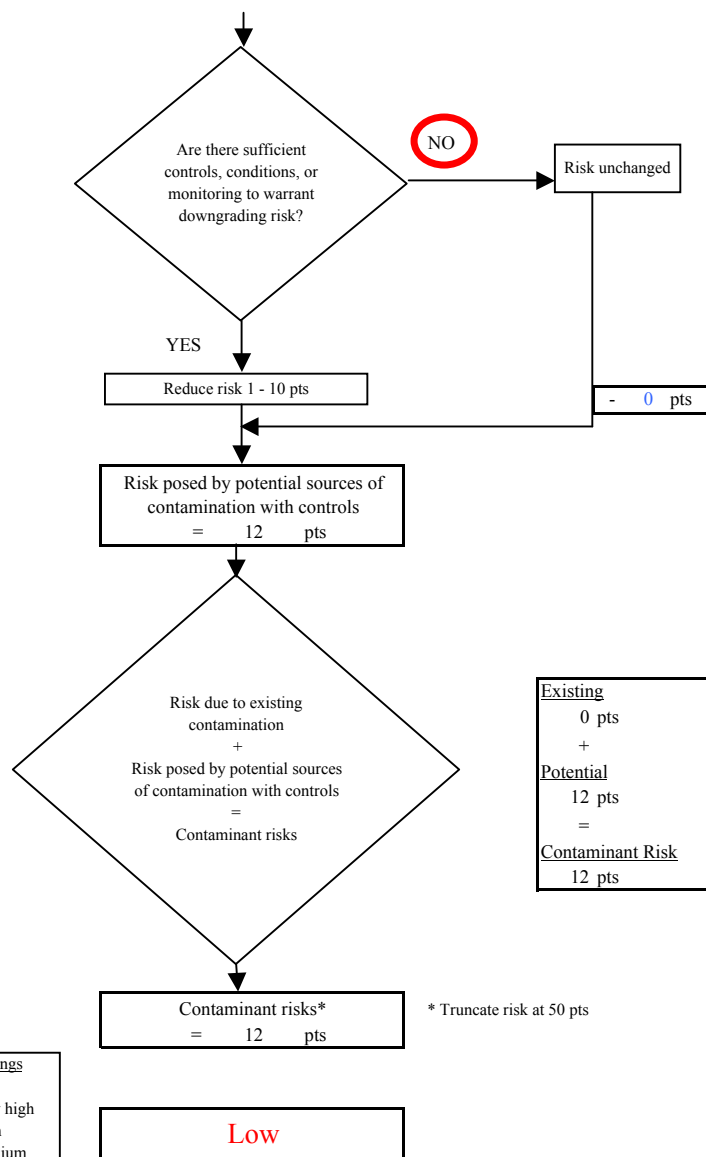


Chart 3. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Bacteria & Viruses

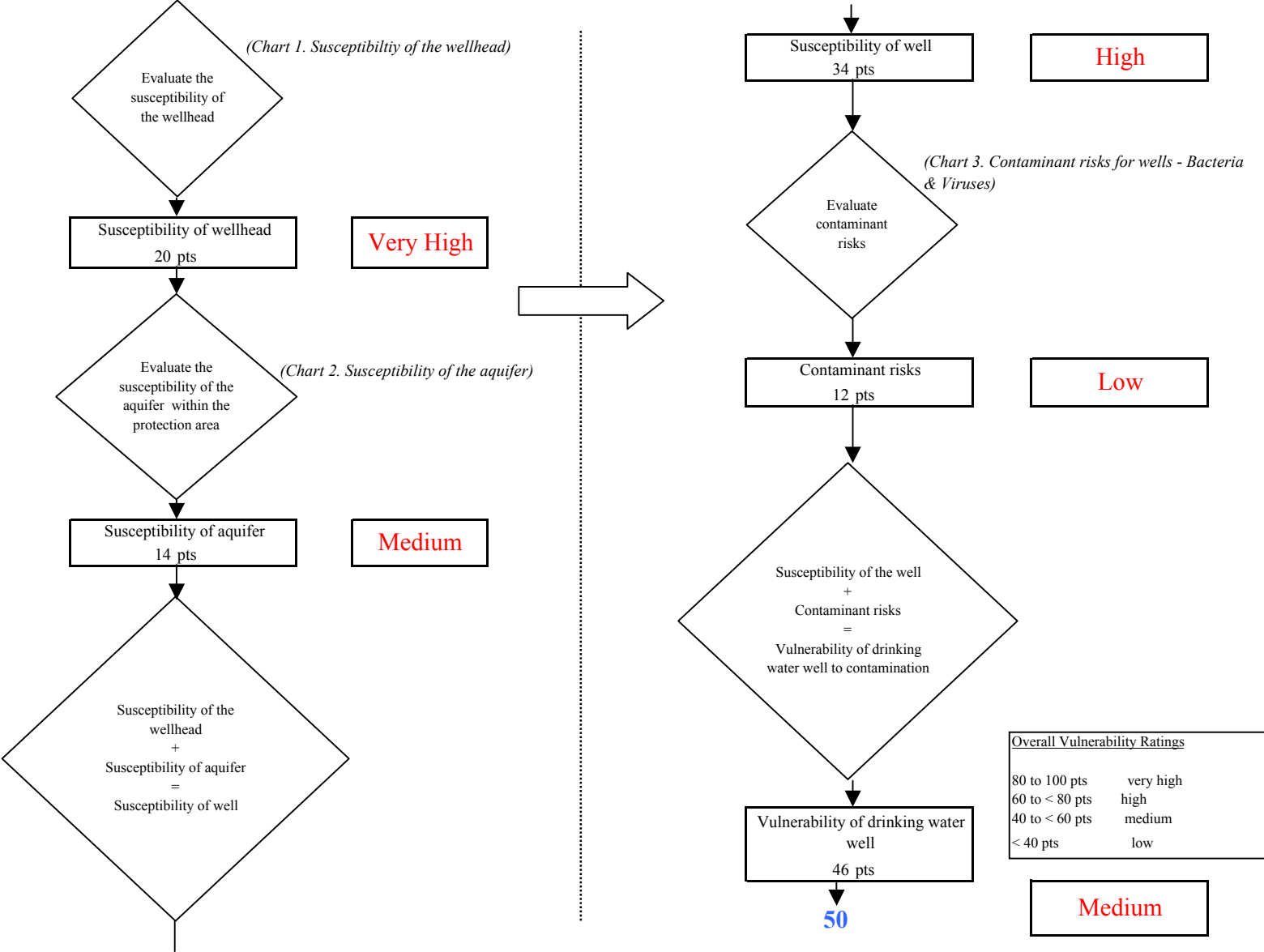




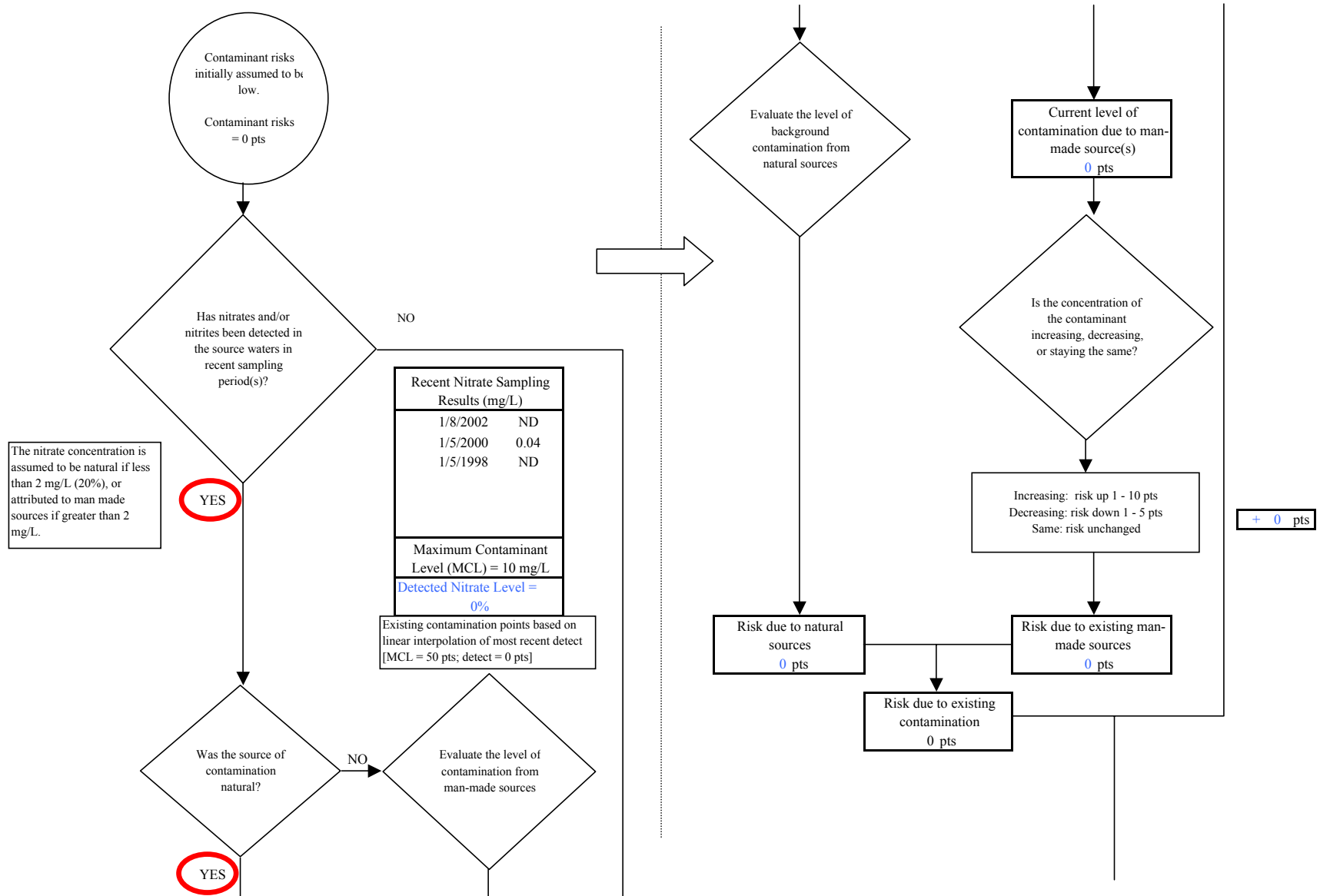
Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium



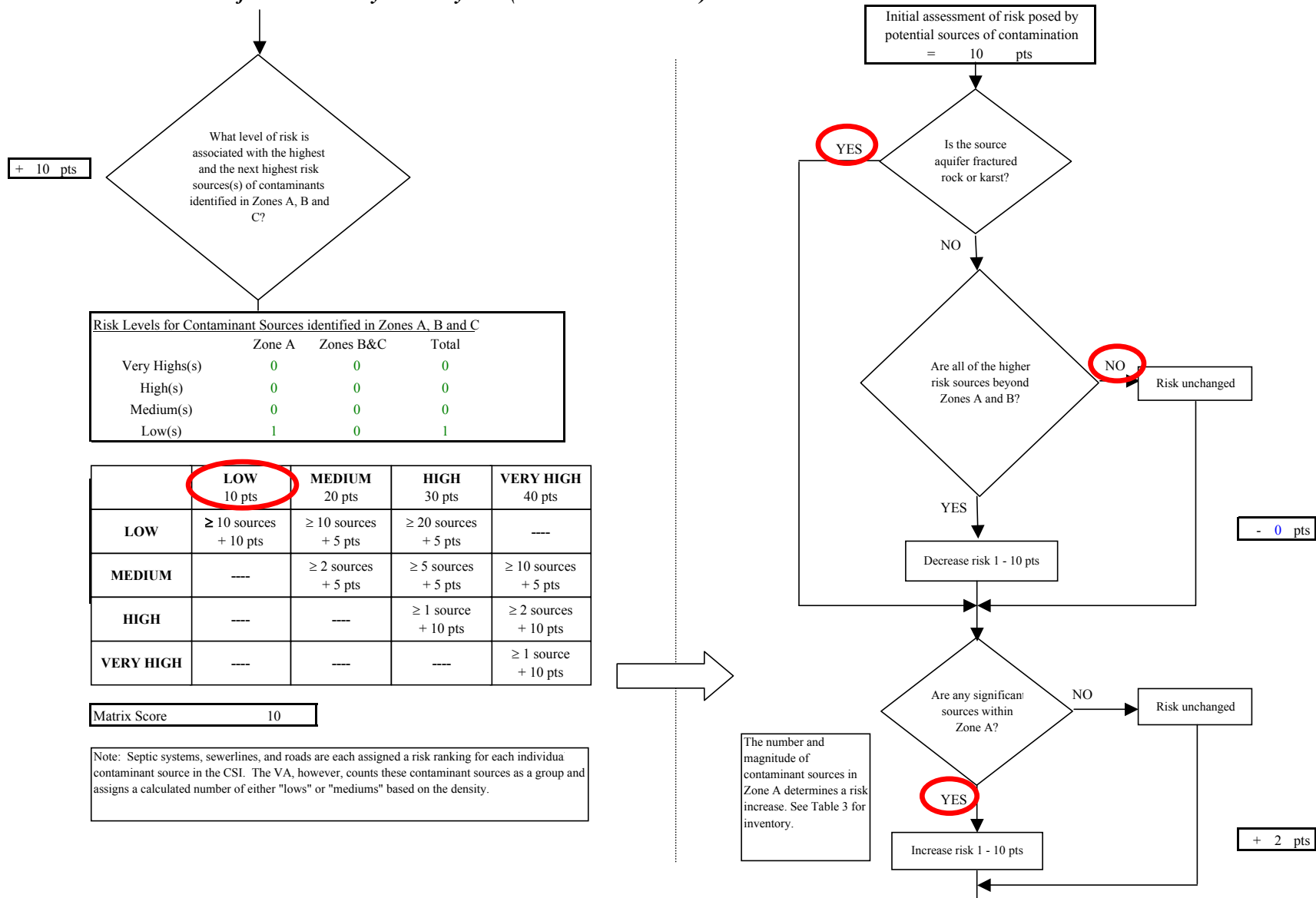
**Chart 4. Vulnerability analysis for Toksook Bay Water System (PWS No. 270215.001) - Bacteria & Viruses**



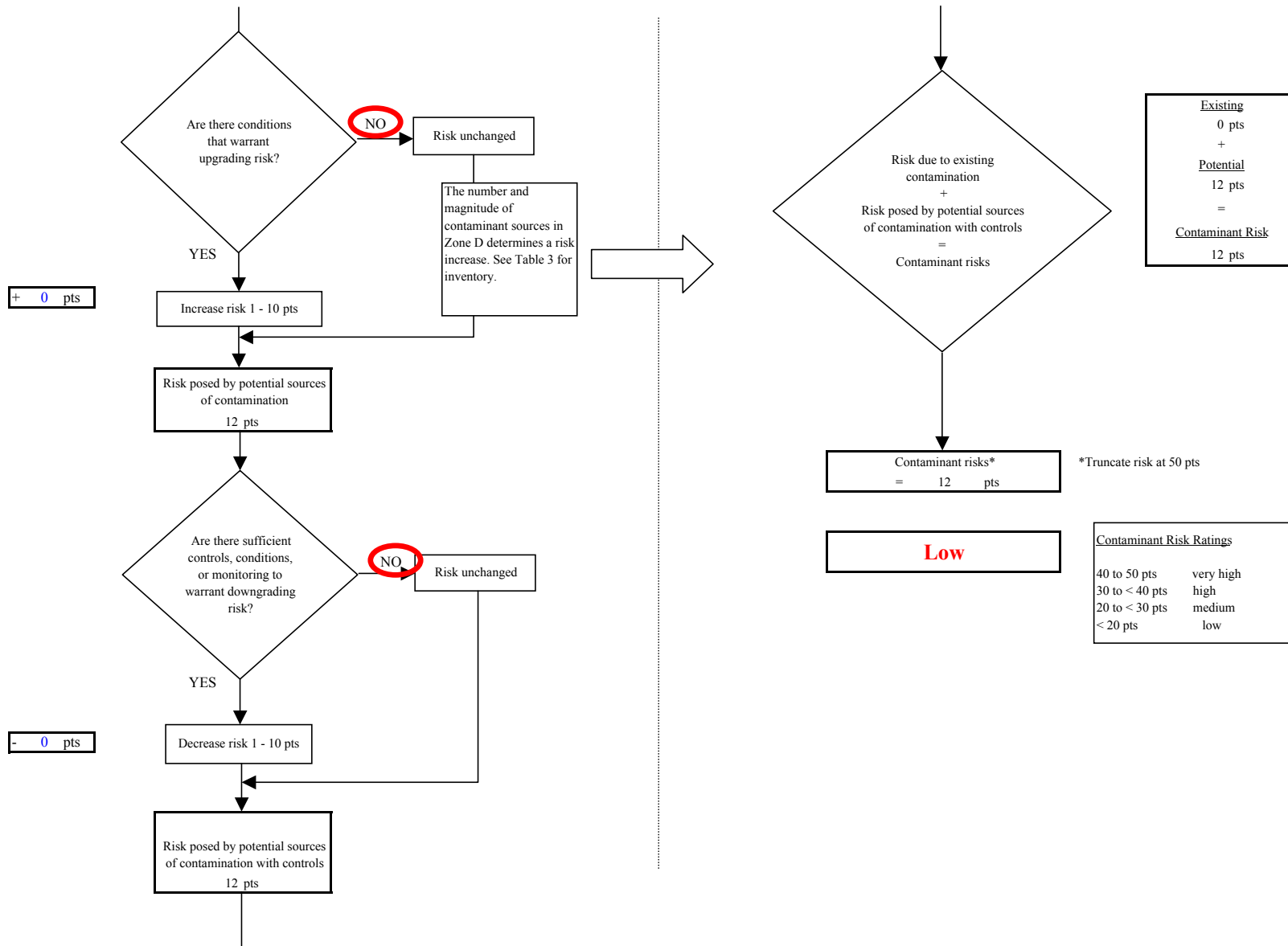
**Chart 5. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Nitrates and Nitrites**



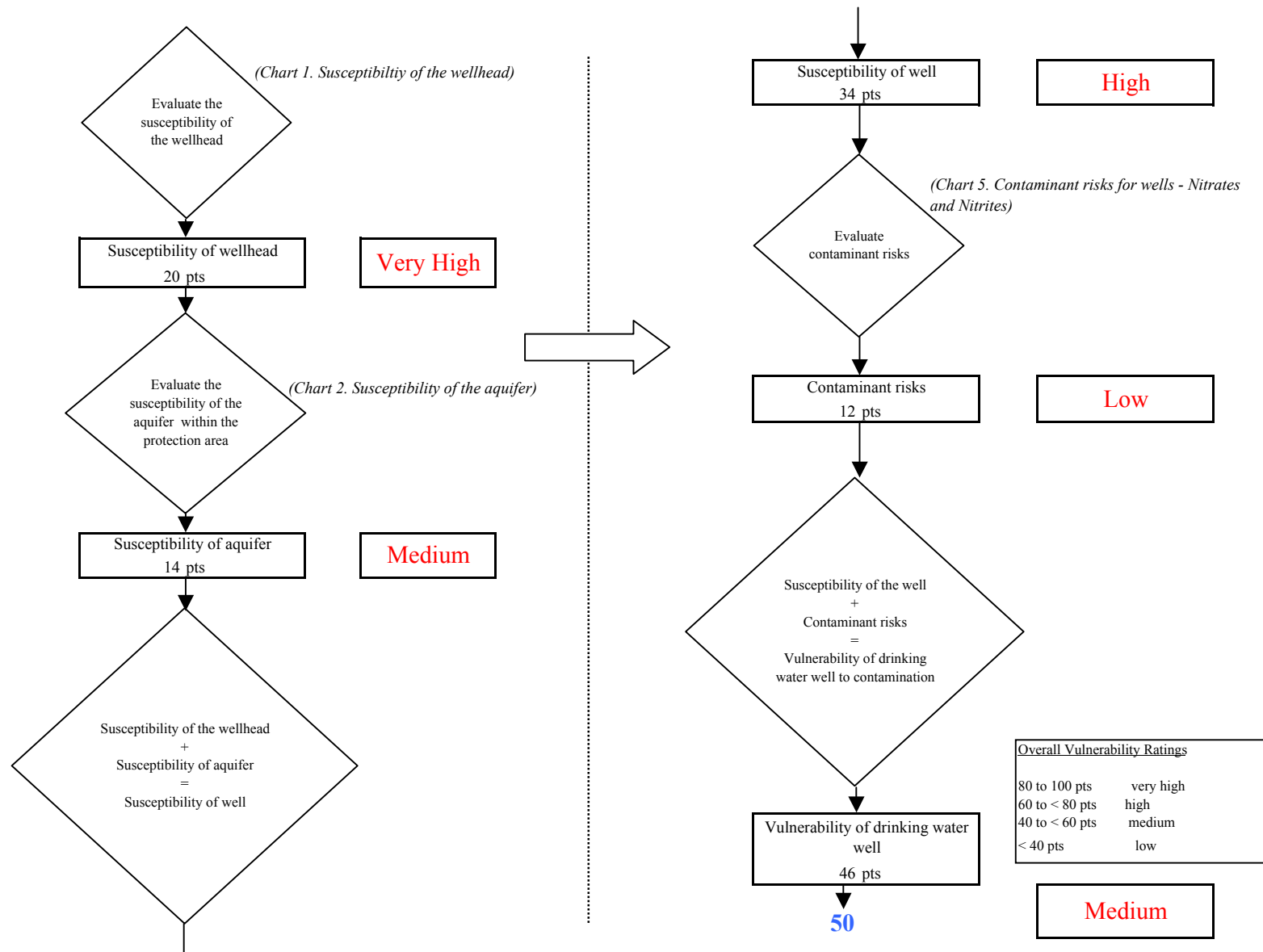
**Chart 5. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Nitrates and Nitrites**



**Chart 5. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Nitrates and Nitrites**



**Chart 6. Vulnerability analysis for Toksook Bay Water System (PWS No. 270215.001) - Nitrates and Nitrites**



**Chart 7. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Volatile Organic Chemicals**

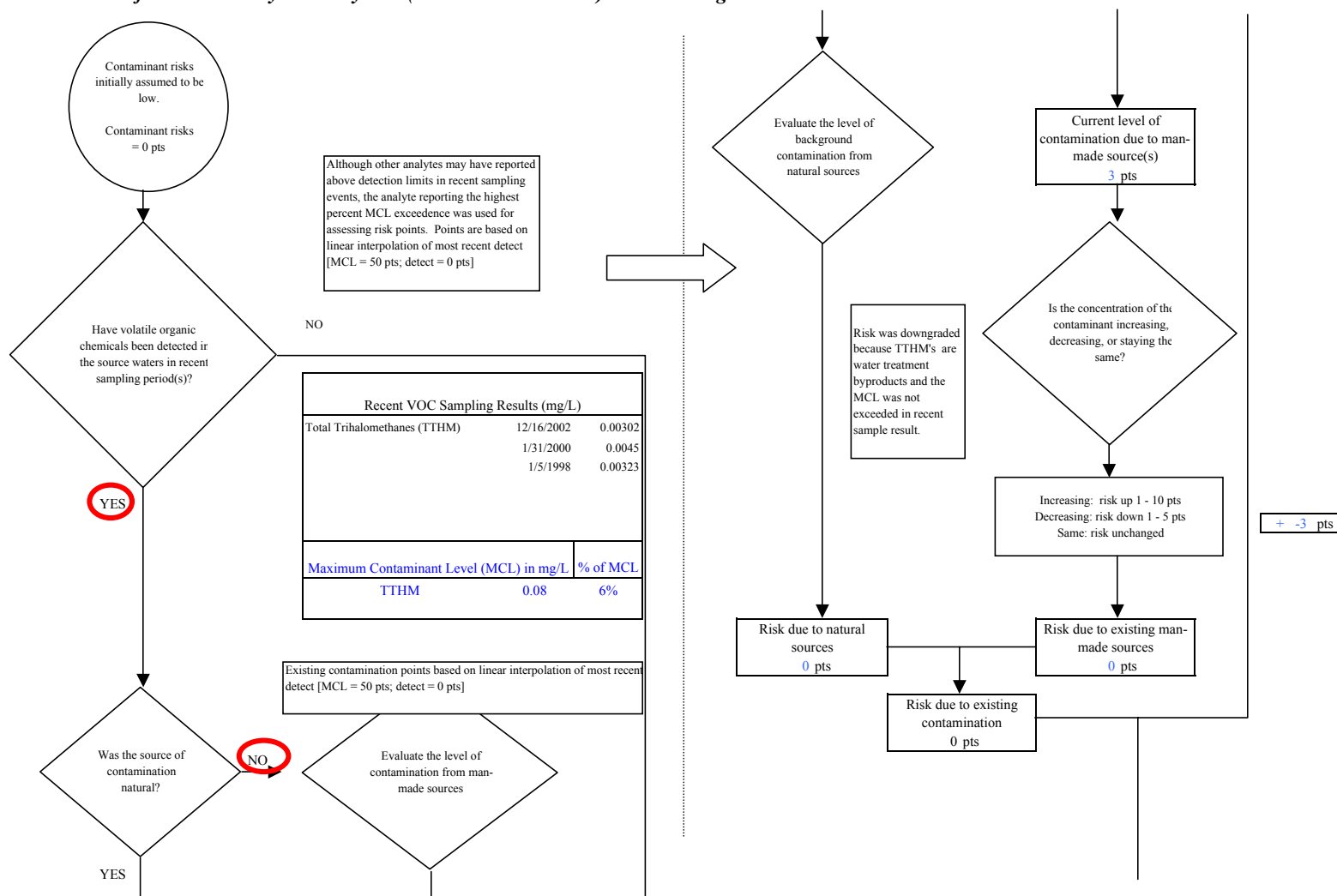
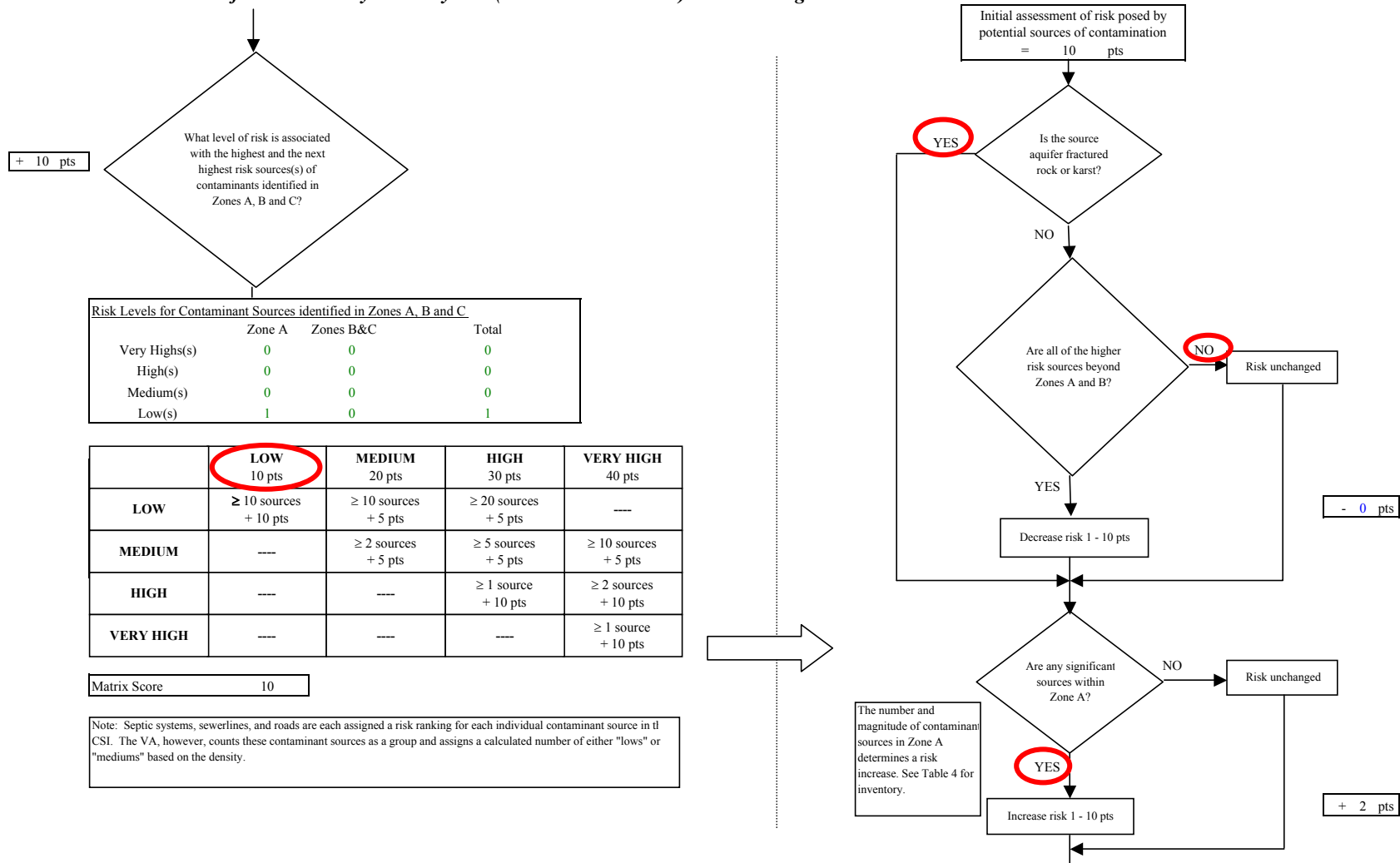
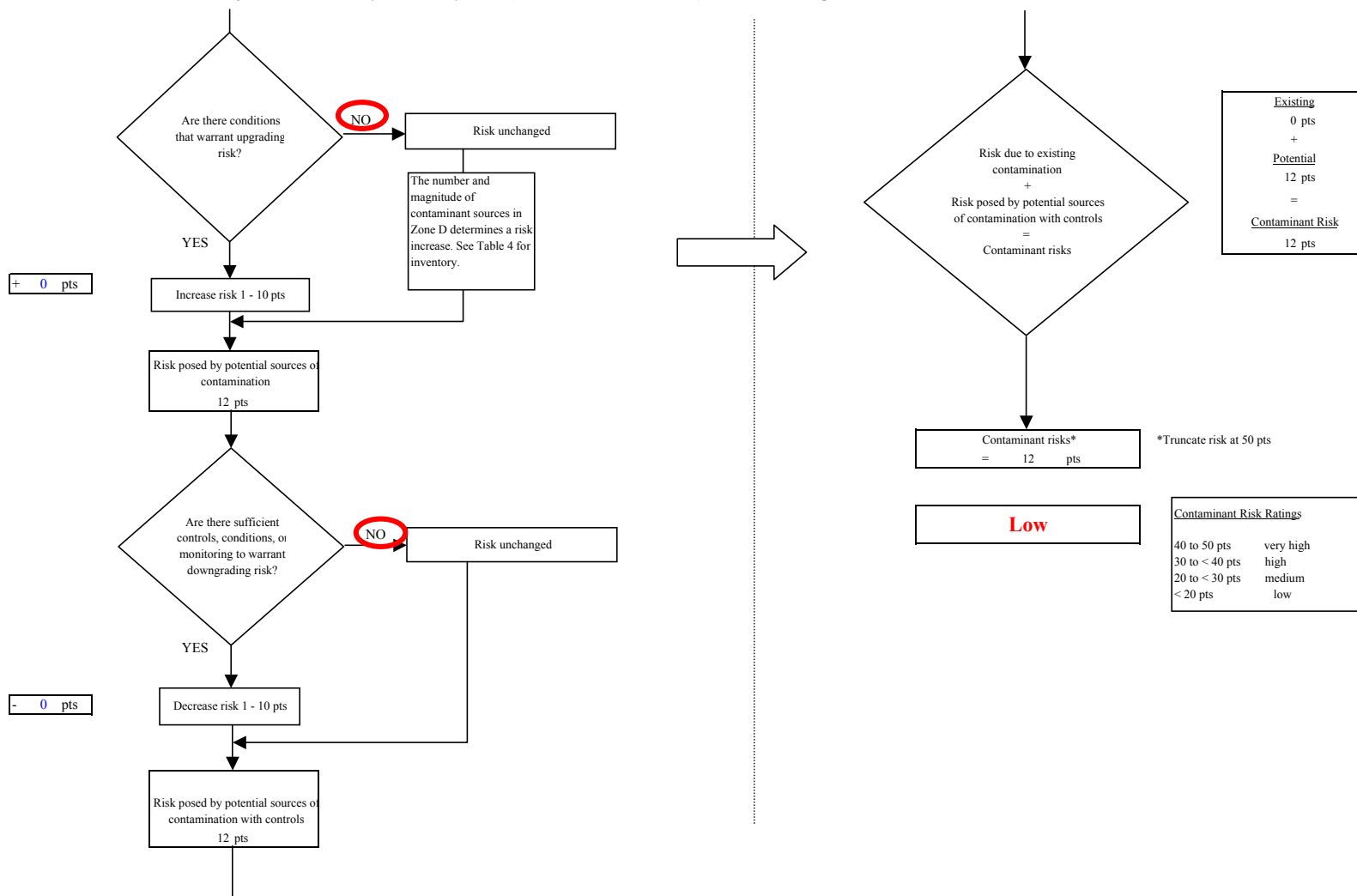


Chart 7. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Volatile Organic Chemicals

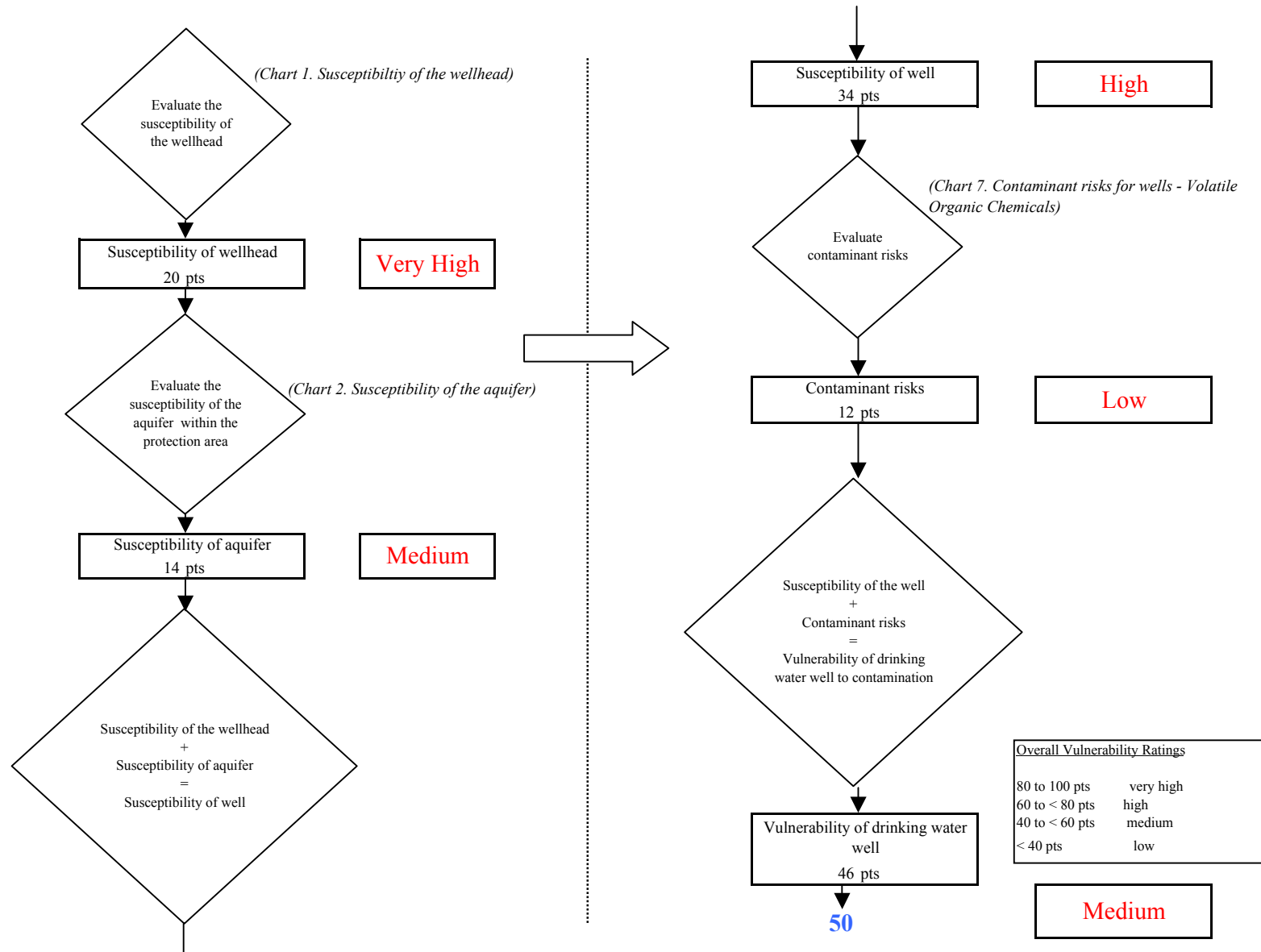




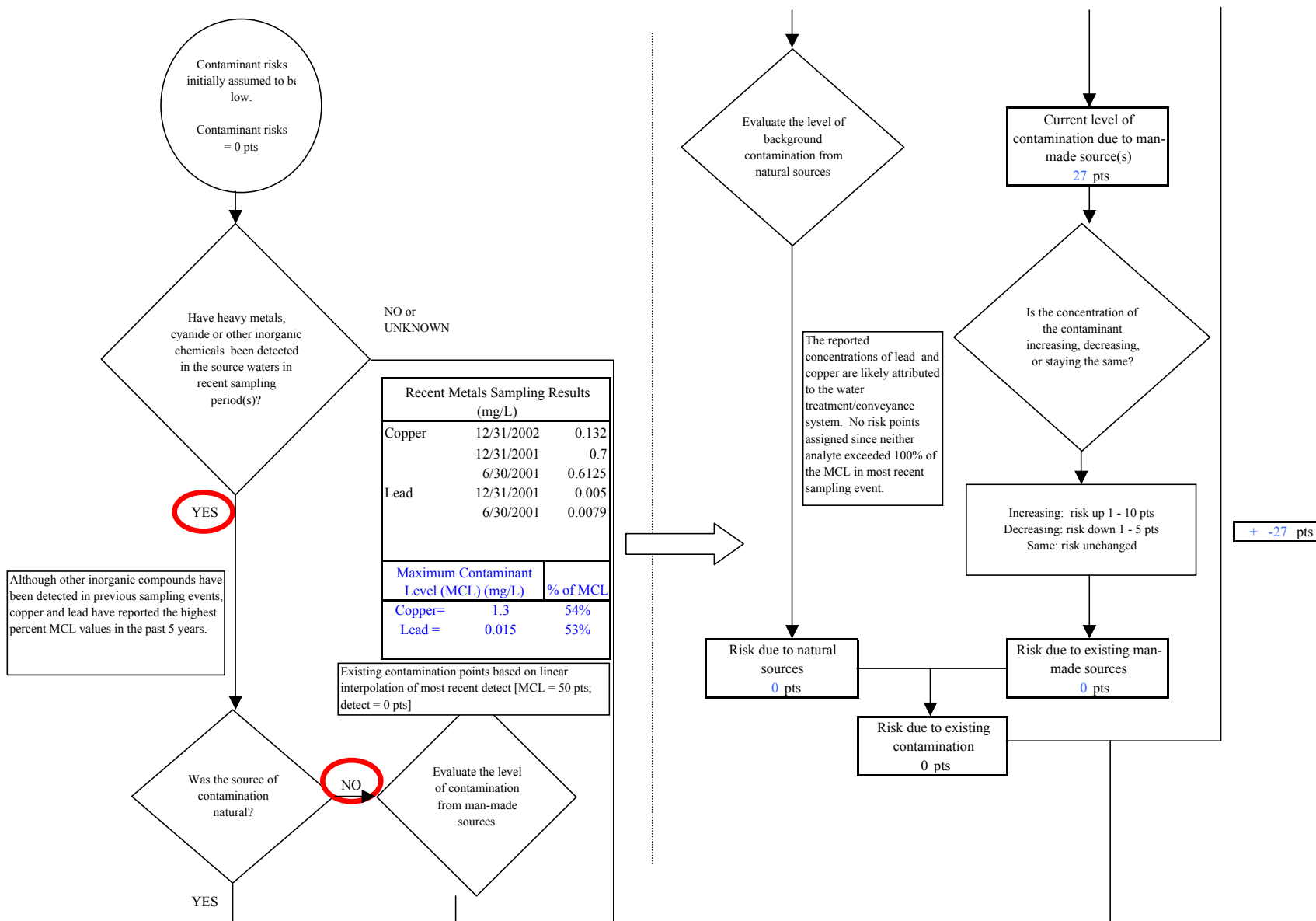
**Chart 7. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Volatile Organic Chemicals**



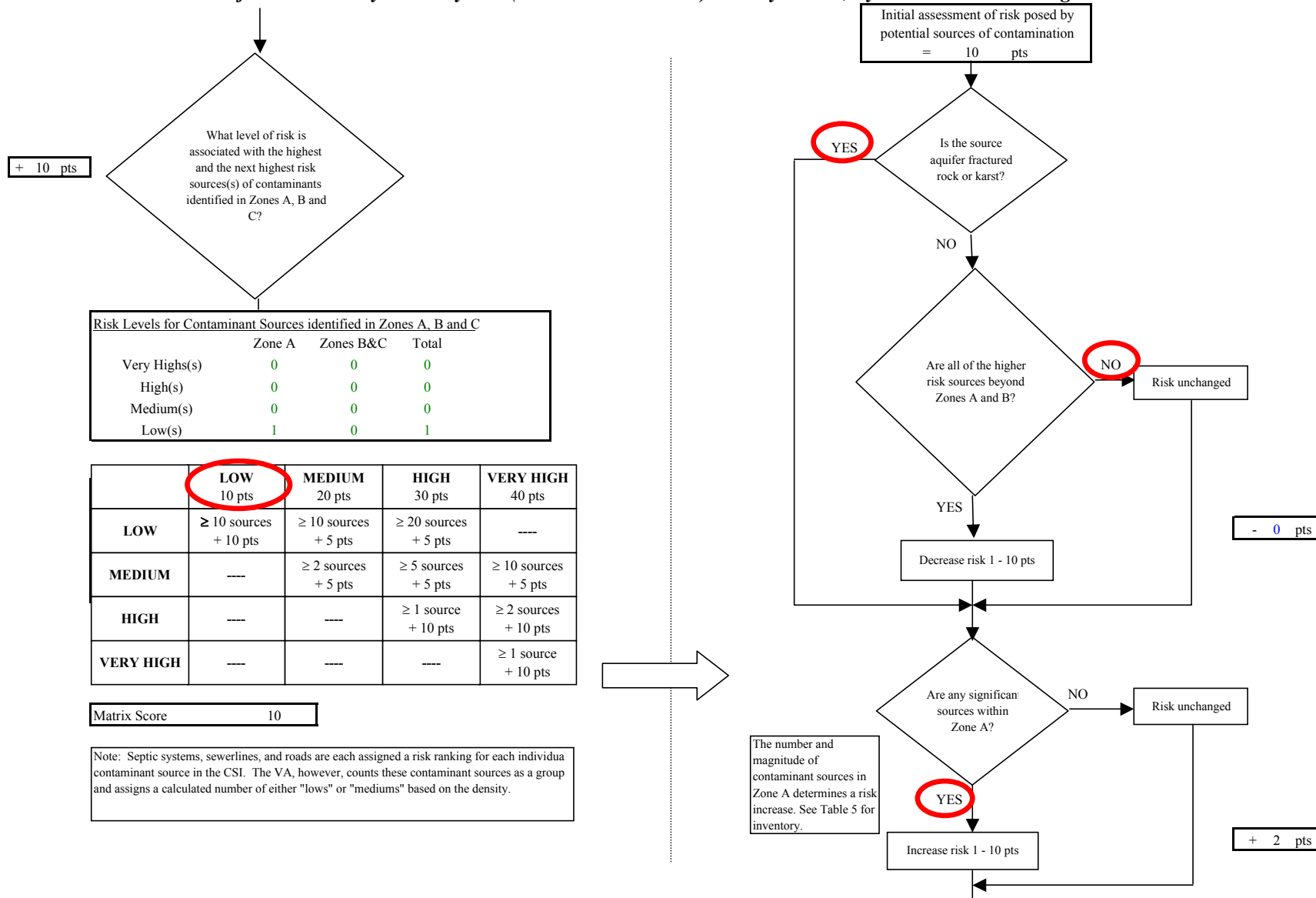
**Chart 8. Vulnerability analysis for Toksook Bay Water System (PWS No. 270215.001) - Volatile Organic Chemicals**



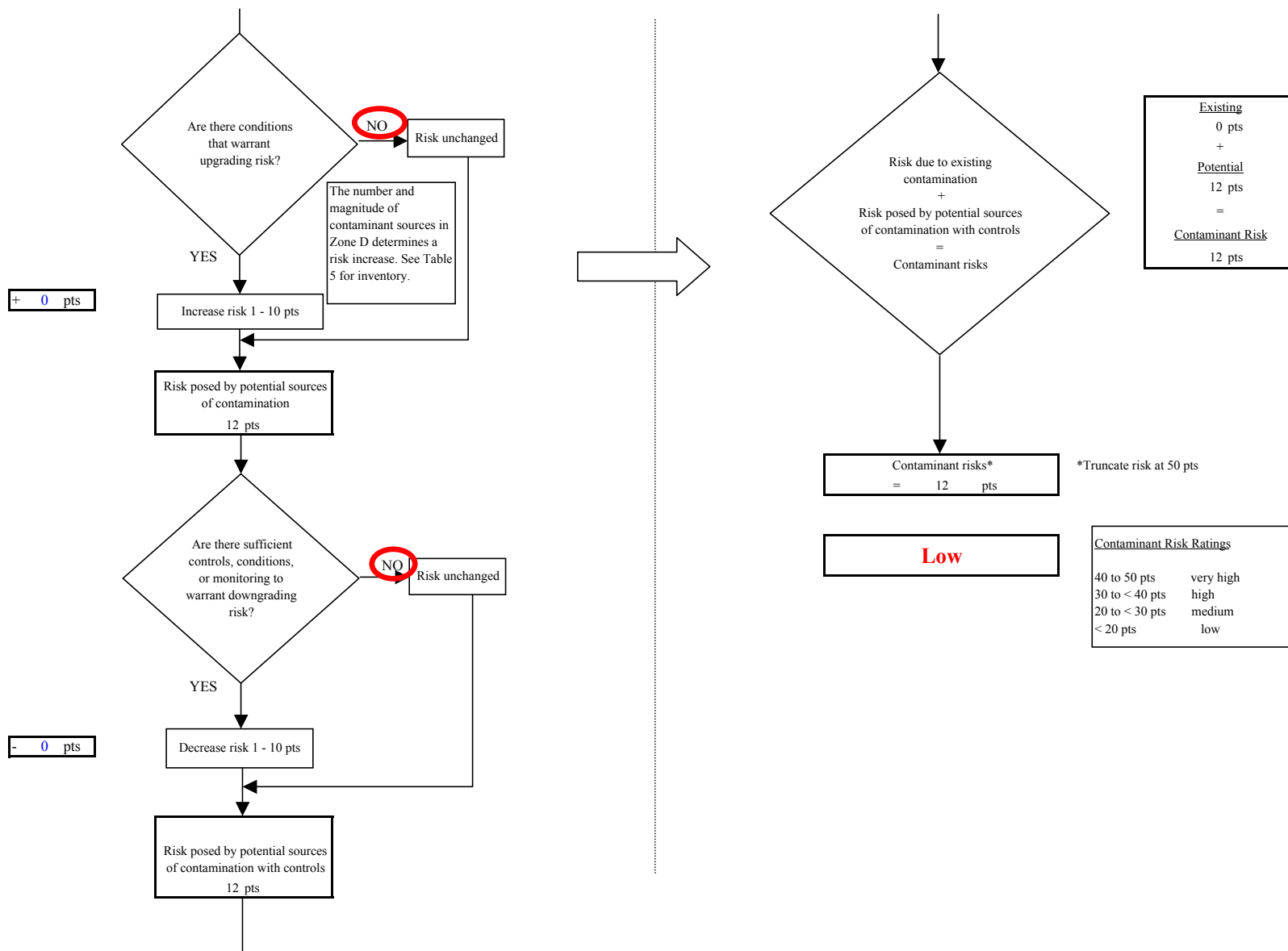
**Chart 9. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



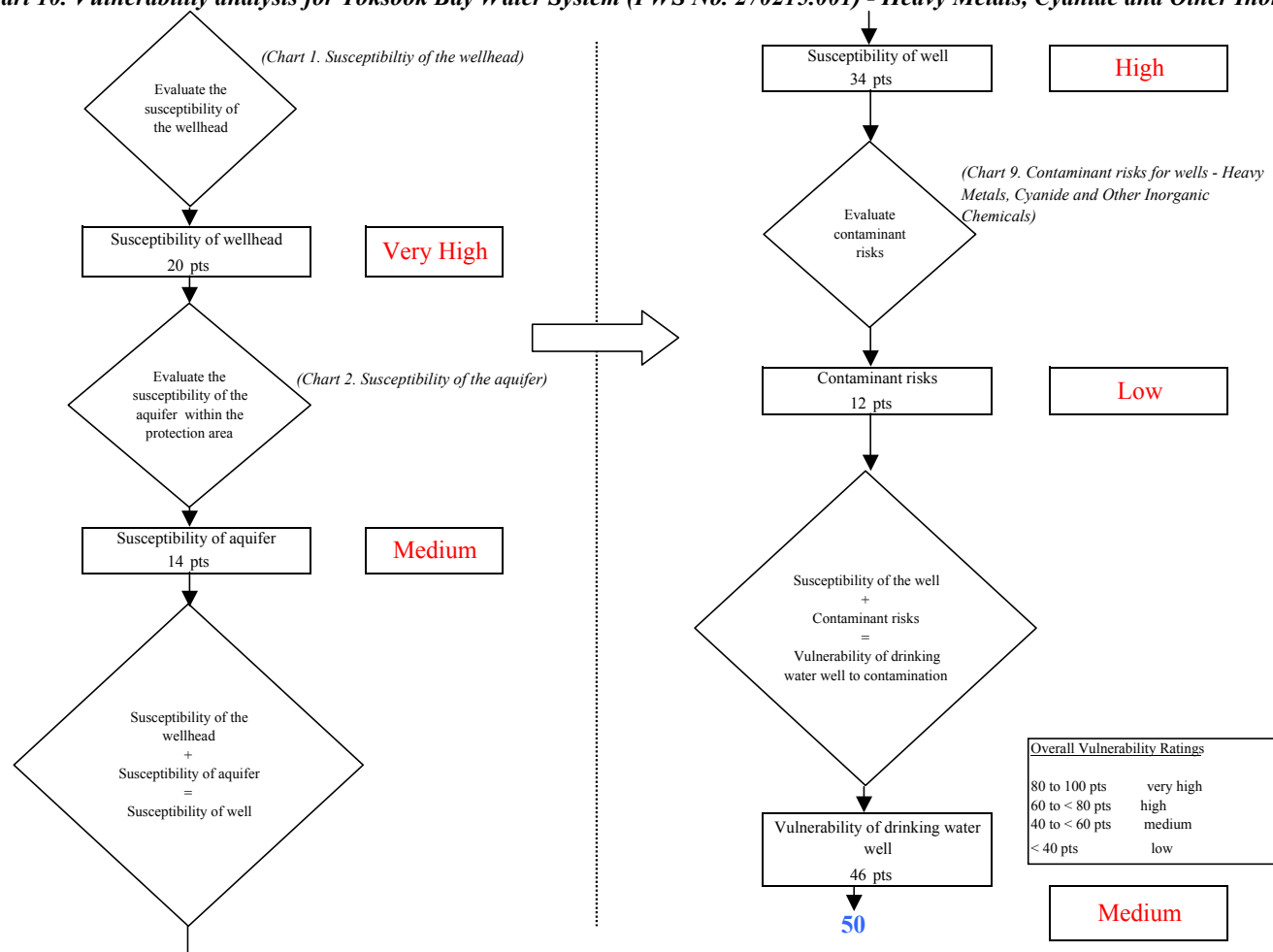
**Chart 9. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



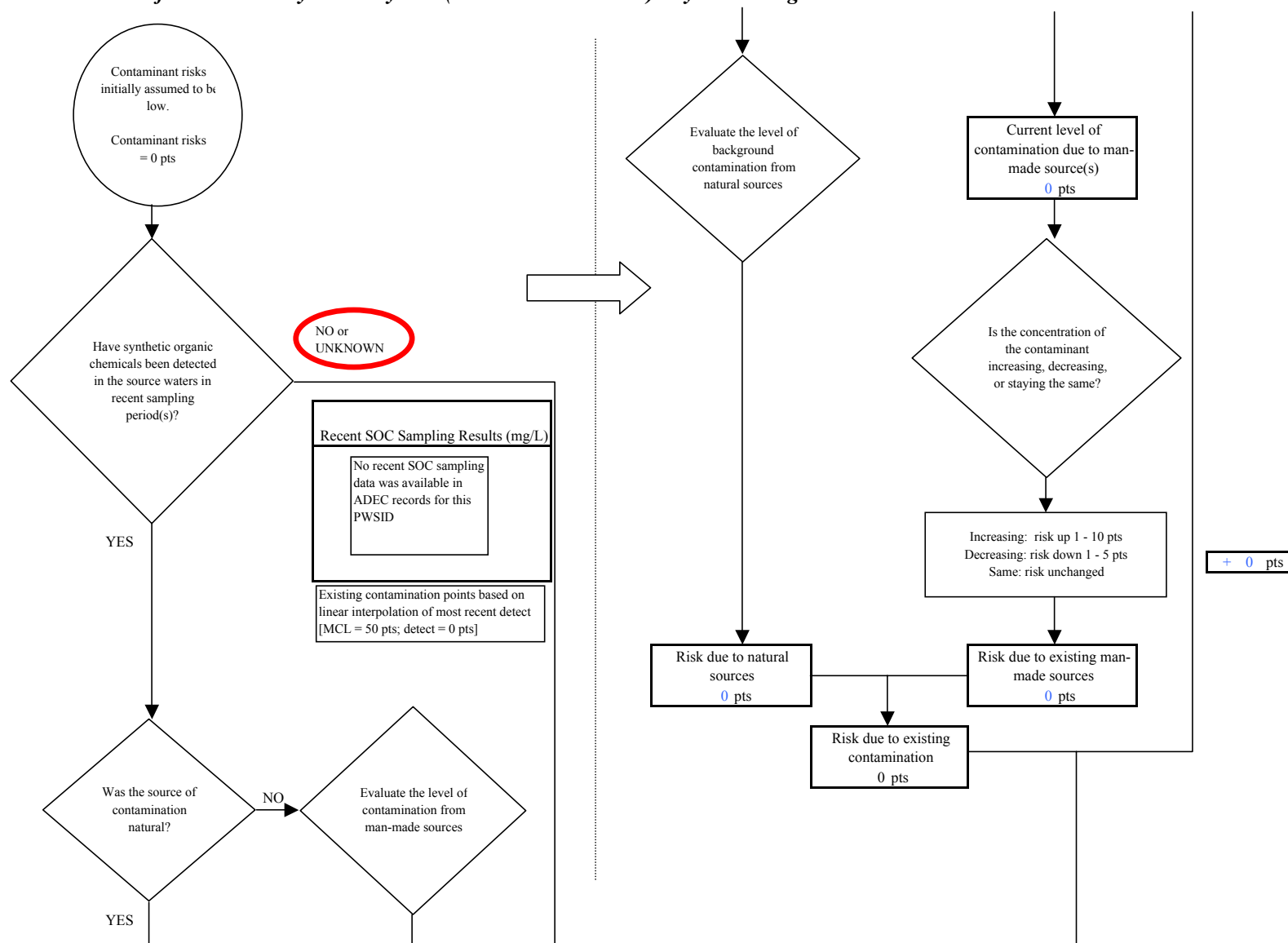
**Chart 9. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



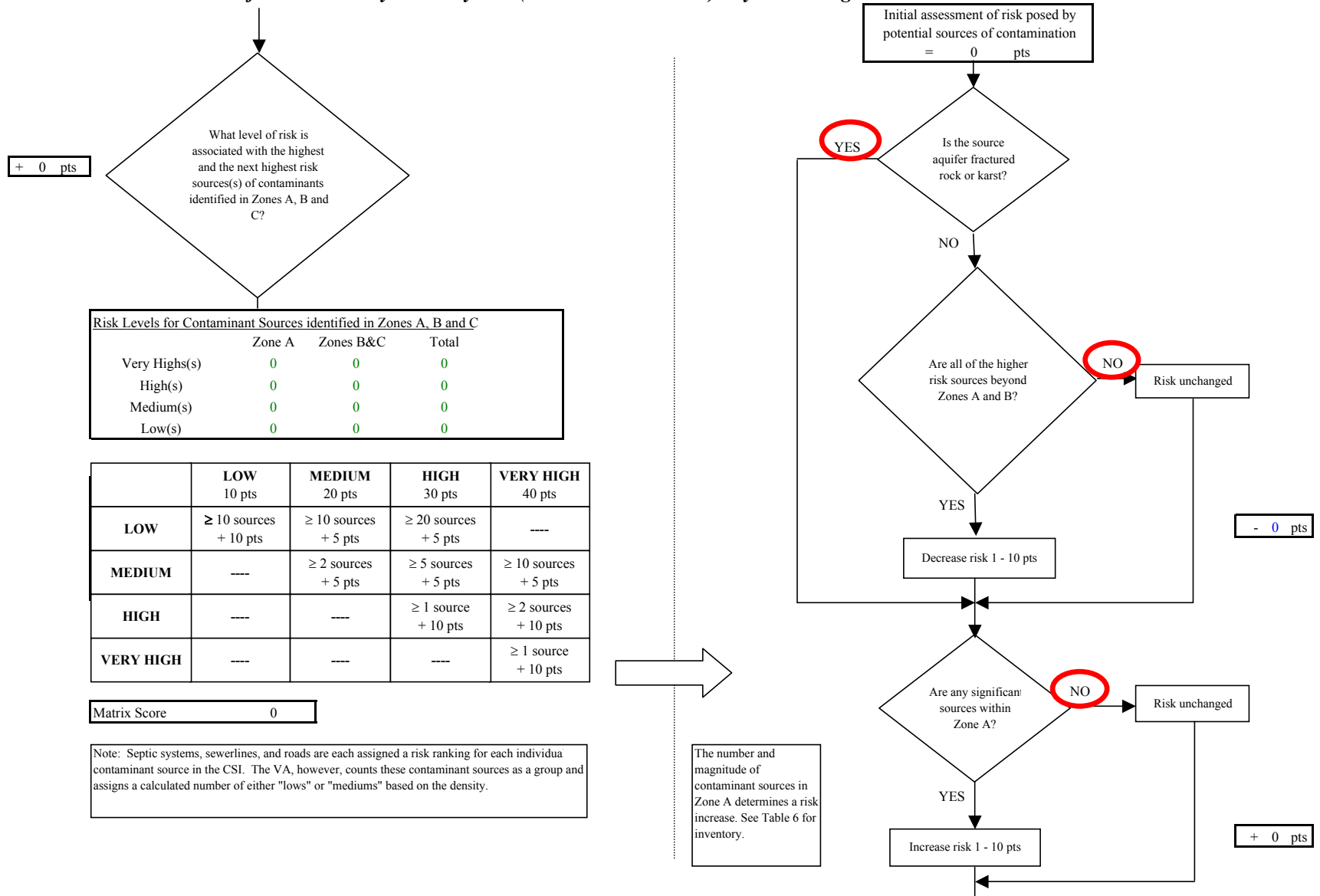
**Chart 10. Vulnerability analysis for Toksook Bay Water System (PWS No. 270215.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



**Chart 11. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Synthetic Organic Chemicals**

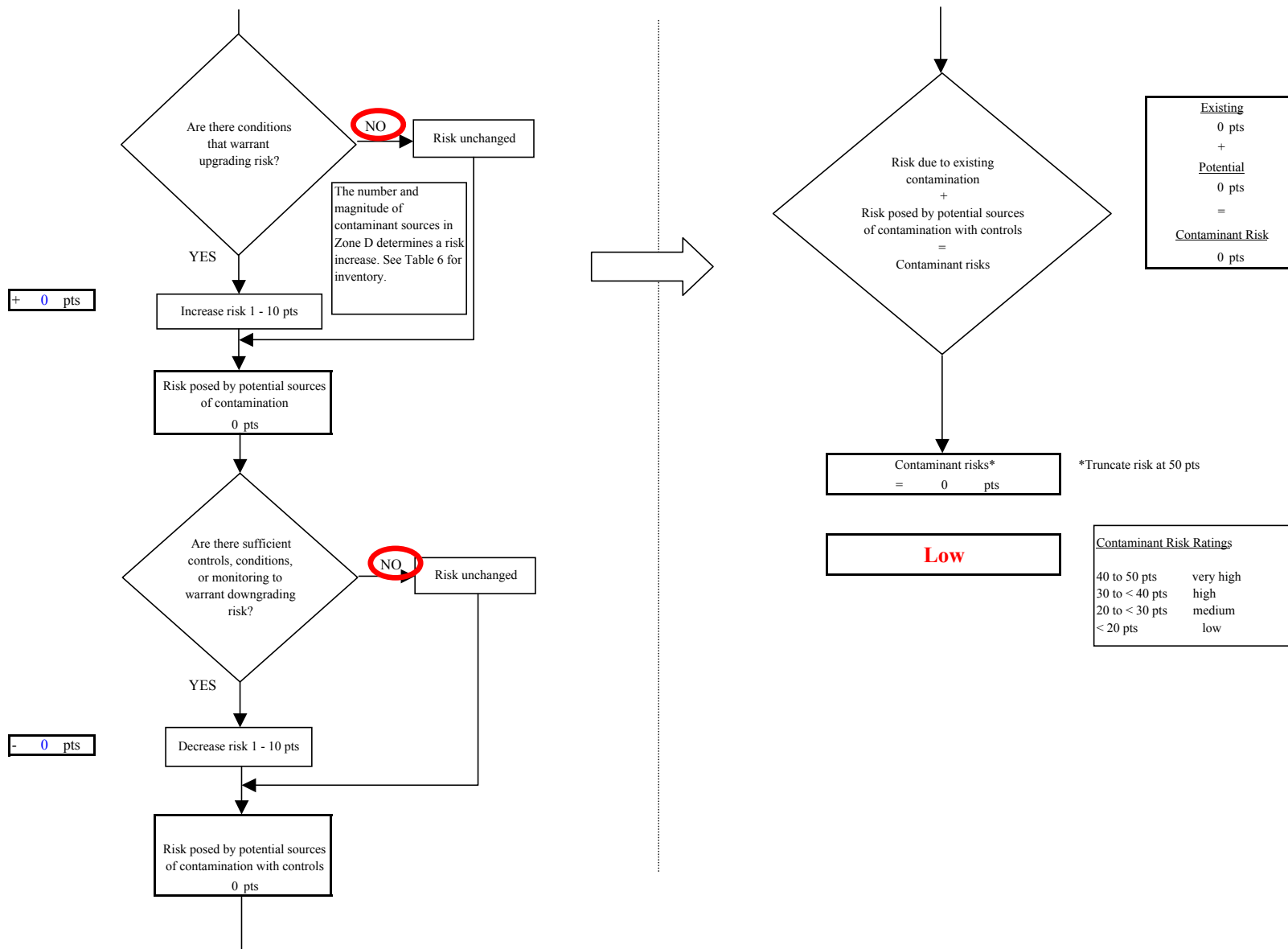


**Chart 11. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Synthetic Organic Chemicals**

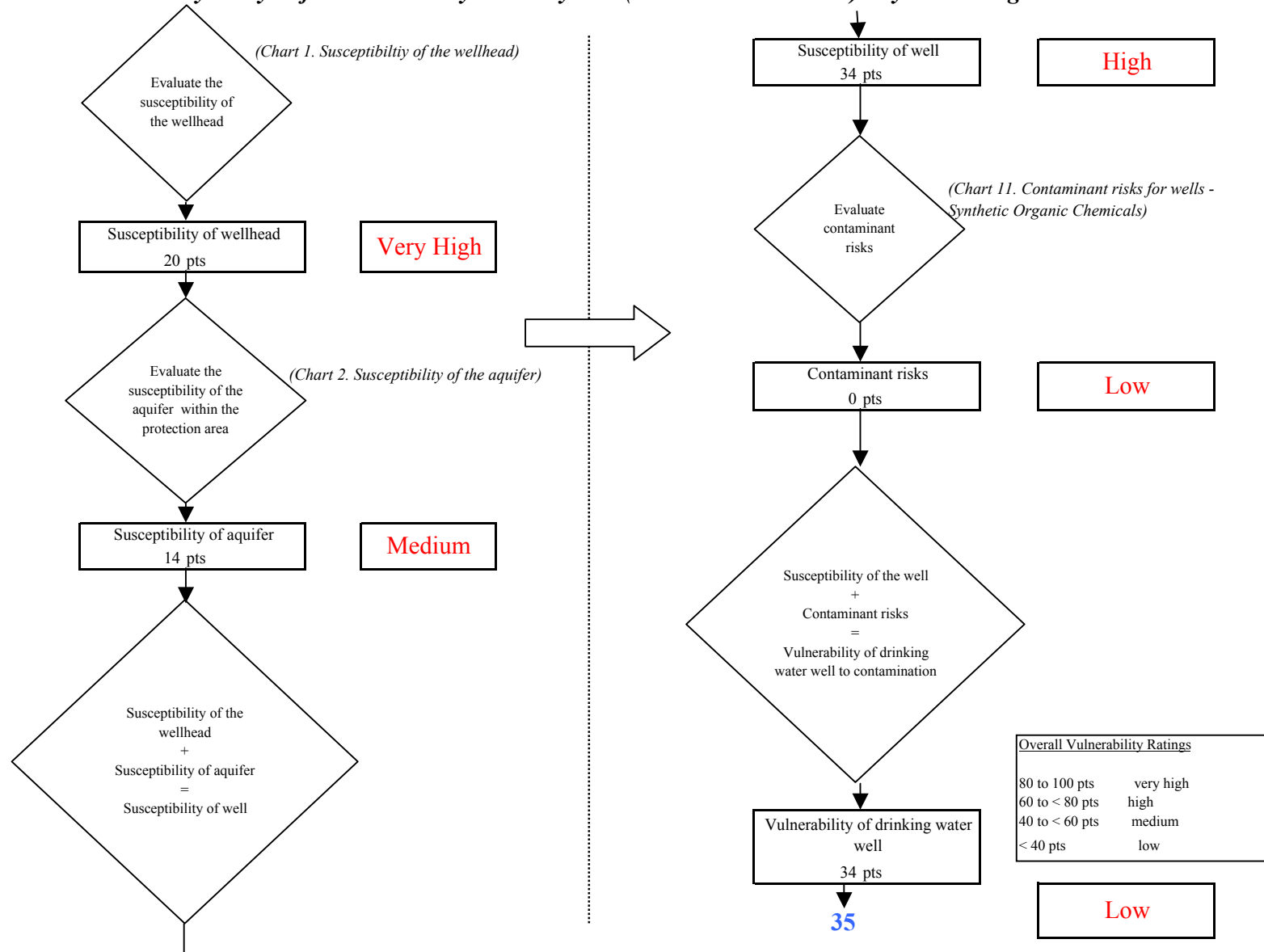




**Chart 11. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Synthetic Organic Chemicals**



**Chart 12. Vulnerability analysis for Toksook Bay Water System (PWS No. 270215.001) - Synthetic Organic Chemicals**



**Chart 13. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Other Organic Chemicals**

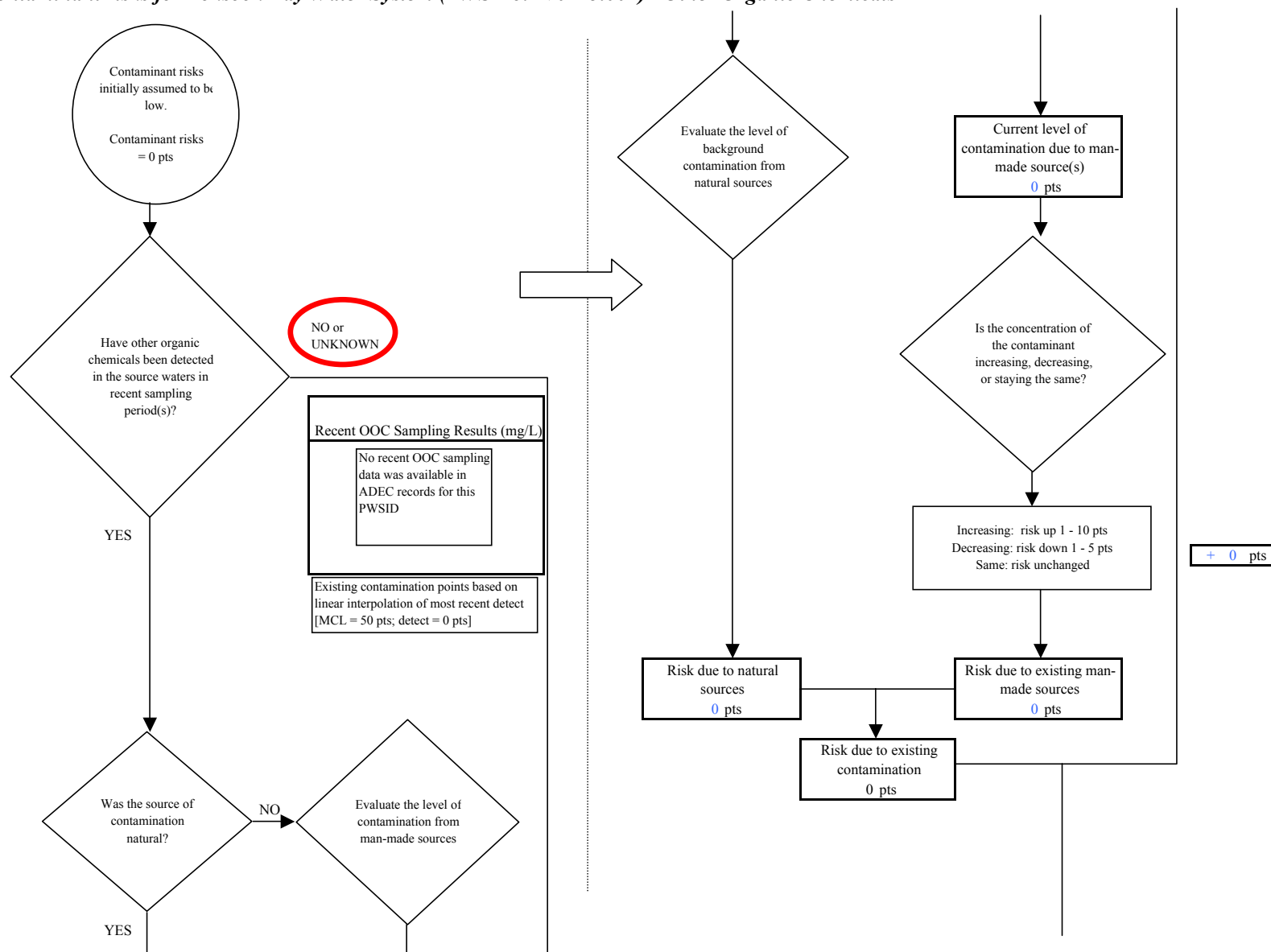
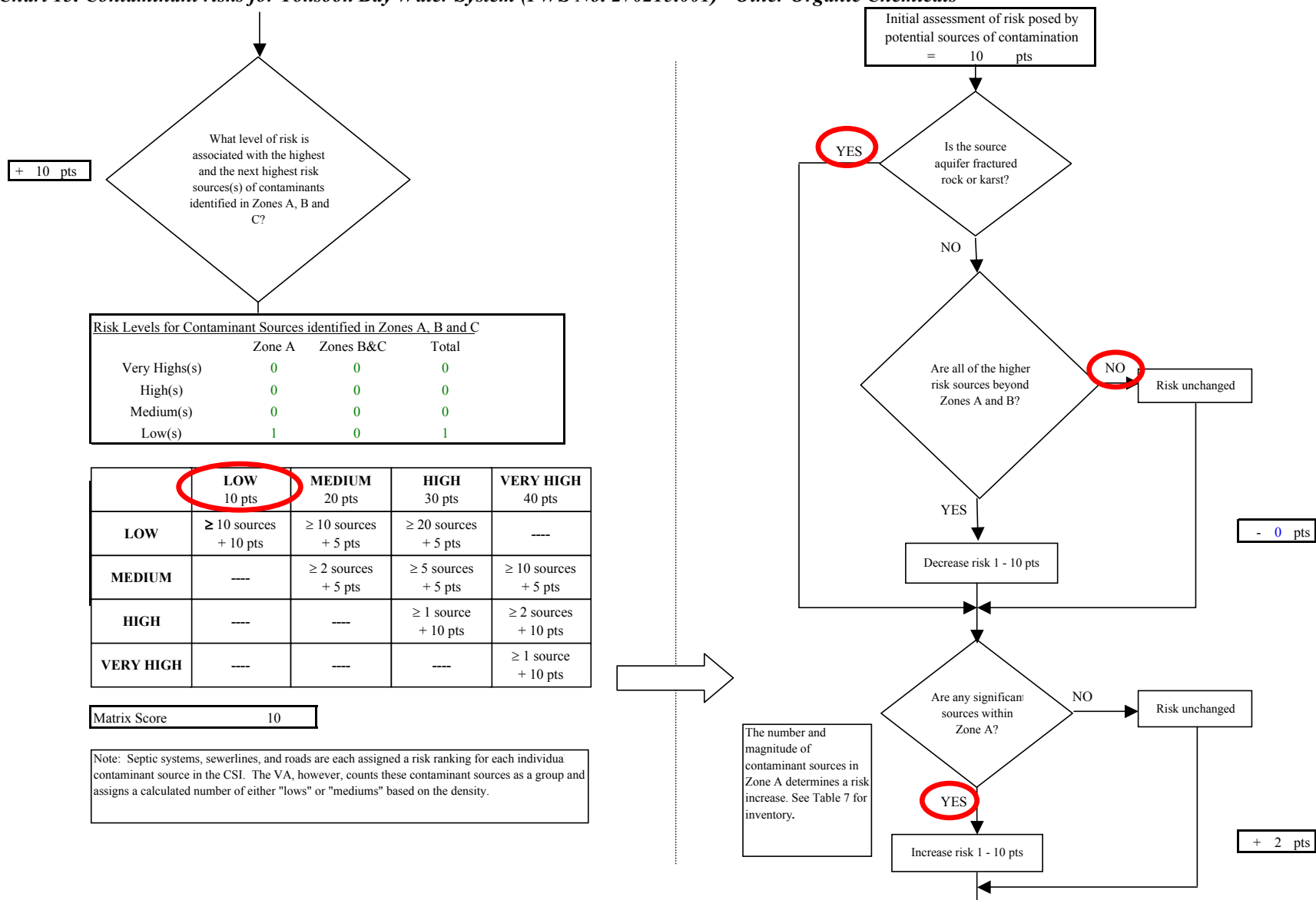
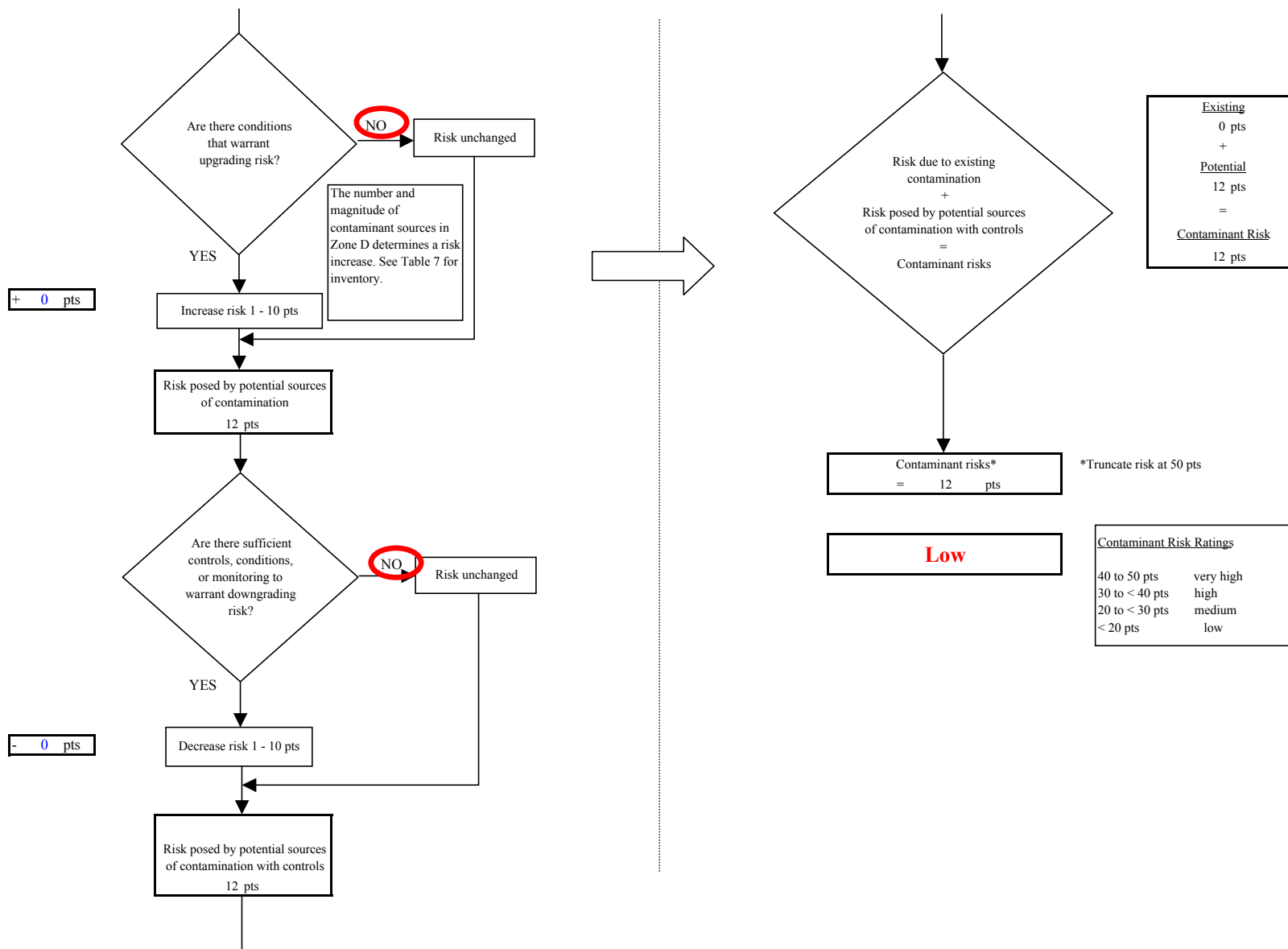


Chart 13. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Other Organic Chemicals



**Chart 13. Contaminant risks for Toksook Bay Water System (PWS No. 270215.001) - Other Organic Chemicals**



**Chart 14. Vulnerability analysis for Toksook Bay Water System (PWS No. 270215.001) - Other Organic Chemicals**

