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# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Russian Mission Water System  
Drinking Water System,  
Russian Mission, Alaska

PWSID # 270168.001

March 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1075  
Alaska Department of Environmental Conservation

# Source Water Assessment for Russian Mission Water System Drinking Water System Russian Mission, Alaska

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DRINKING WATER PROTECTION PROGRAM REPORT 1075

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 Russian Mission Water System Source of Public Drinking Water, Russian Mission, Alaska

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## Drinking Water Protection Program Alaska Department of Environmental Conservation

### EXECUTIVE SUMMARY

The Russian Mission Water System has one Public Water System (PWS) well. The well (PWS No. 270168.001) has been used as a drinking water source since it was drilled in 1979.

The well is a Class A (community and non-transient non-community) water system located approximately 650 feet west of the Yukon River in Russian Mission, Alaska. Available records indicate that there is secondary storage of drinking water, with a combined capacity of 60,000-gallons, and that the untreated drinking water source is derived directly from the wellhead. This system operates year round and serves approximately 300 residents through 72 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: domestic wastewater collection systems, a large capacity septic system, nonresidential pit toilets, aboveground fuel tanks, cemeteries, municipal or city parks, petroleum product bulk station/terminals, roads, electric power generation, medical/veterinary facilities, placer mining, and quarries. 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 **Very High** for the bacteria and viruses, nitrates and nitrites, volatile organic chemicals, and other organic chemicals, a vulnerability rating of **High** for heavy metals, cyanide and other inorganic chemicals, and a vulnerability rating of **Medium** for synthetic organic chemicals.

### PUBLIC DRINKING WATER SYSTEM

The Russian Mission Water System well is a Class A (community/non-transient/non-community) public water system. The system is located approximately 650 feet west of the Yukon River in Russian Mission, Alaska (Sec. 31, T20N, R66W, Seward Meridian; see Map A of Appendix A). Russian Mission is located on the west bank of the Yukon River in the Yukon-Kuskokwim Delta. The community is located 25 miles southeast of Marshall, and 376 miles west of Anchorage. The community has a population of 310 (ADCED, 2003). Average annual precipitation in Russian Mission is 16 inches, including approximately 60 inches of snowfall. Temperatures range from -54 to 86°F.

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

According to information supplied by ADEC for the Russian Mission Water System PWS, the depth of the primary water well is 160 feet below the ground surface. Well construction details are unknown; however, it is assumed that the well is screened in an unconfined aquifer, based on information from surrounding wells. The well is assumed to be located within a floodplain.

Information acquired from a January 2003 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.

The floodplain of the Yukon River consists of deep deposits of alluvial silts and sands. Topography is nearly level and dissected by sloughs, oxbows, and former stream channels (Hinton & Hogan, 1966).

## 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 Russian Mission 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 Russian Mission 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 Russian Mission 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 Russian Mission 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	11	Medium
Natural Susceptibility	31	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	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	32	High
Synthetic Organic Chemicals	23	Medium
Other Organic Chemicals	50	Very High

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	80	Very High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	80	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	65	High
Synthetic Organic Chemicals	55	Medium
Other Organic Chemicals	80	Very High

### Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of a large capacity septic system and nonresidential pit toilets in 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 **Very High**.

### Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High**. The risk to this source of public drinking water is primarily attributed to the presence of a large capacity septic system 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 nitrates have been detected in recent sampling events; however, the reported concentrations of nitrates did 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 **Very High**.

### Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of petroleum product bulk station/terminals located in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

All recent sampling data for VOCs were below detection limits (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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 **Very High**.

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

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **High**. The risk is primarily attributed to the presence of electric power generation located in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 5 – Appendix B).

No recent sampling data was available in ADEC records for the Russian Mission Water System (See Chart 9 – Contaminant Risks for Heavy Metals, Cyanide and Other Inorganic Chemicals in Appendix D).

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 **High**.

### **Synthetic Organic Chemicals**

The contaminant risk for synthetic organic chemicals is **Medium**. The risk is primarily attributed to the presence of cemeteries located in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Russian Mission 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 **Medium**.

### **Other Organic Chemicals**

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of petroleum product bulk station/terminals and electric power generation located in Zones A. Numerous other potential contaminant sources are also found within the protection area (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for the Russian Mission 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 **Very High**.

### **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 Russian Mission 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

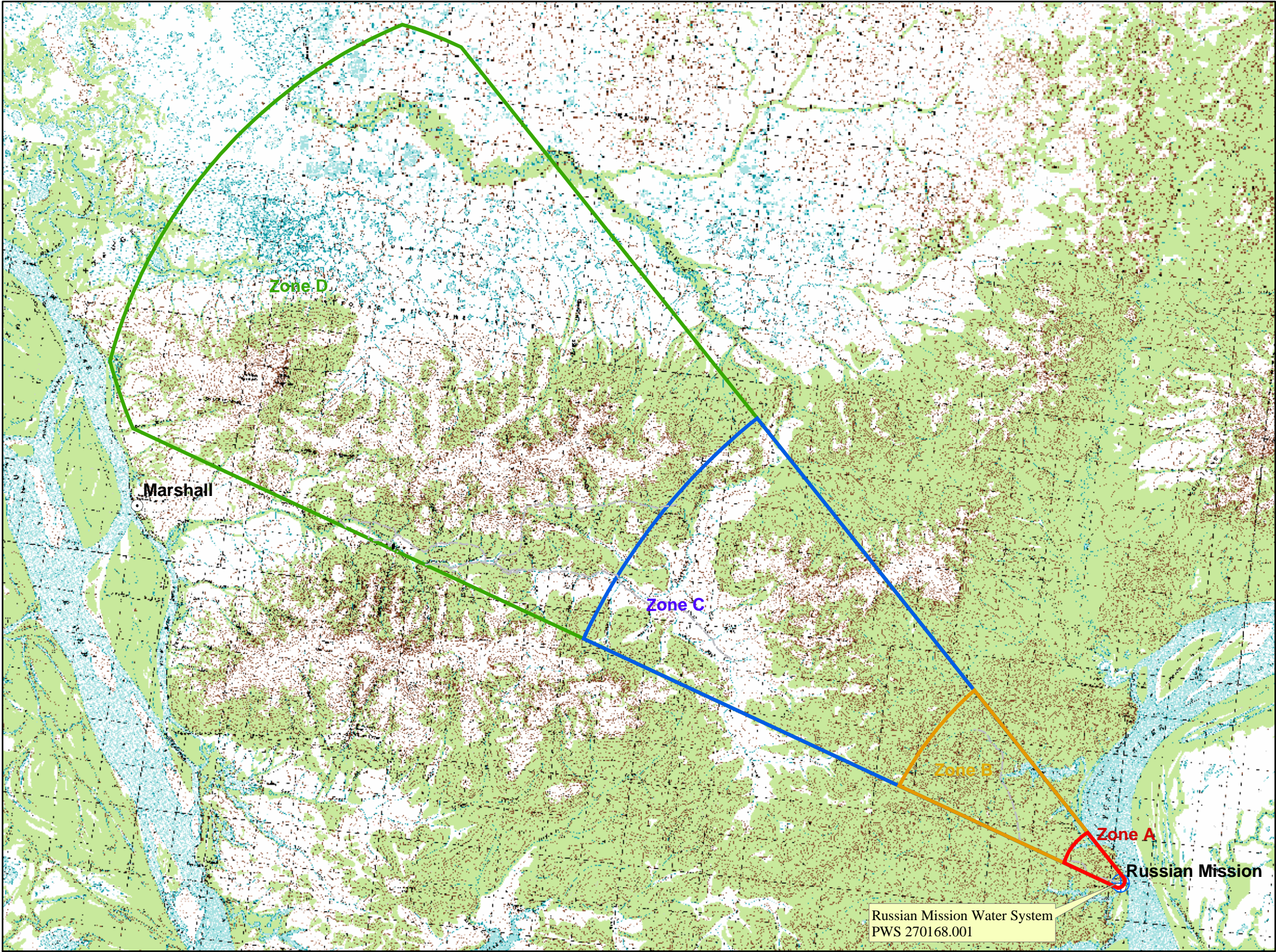
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## **APPENDIX A**

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



Public Water Well System for PWS #270168.001 Russian Mission Water System



LEGEND

- Public Water System Well
- 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 or Watershed Boundary
- Hydrography/Physical**
- Parcels
  - Stream
  - Lake or Pond
  - Contours

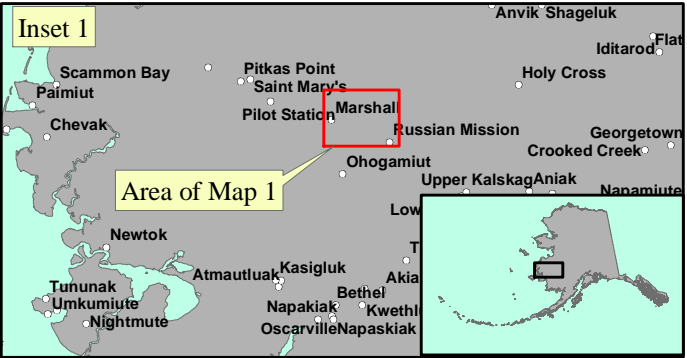
Data Sources:

- 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 A Public Water Systems" published by ADEC

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



0 1.25 2.5 5 7.5 10 Miles



## **APPENDIX B**

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

**Table 1**

**Contaminant Source Inventory for  
Russian Mission Water System**

**PWSID 270168.001**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Map Number</b>	<b>Comments</b>
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	C	LYSD
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	C	Assume 10 or less honeybucket pits in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assume 45 or less residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	C	City of Russian Mission
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	C	Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	C	Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	C	UUT
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	C	LYSD Elementary School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	C	LYSD High School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	C	LYSD Preschool
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	C	City of Russian Mission
Cemeteries	X01	X01-01	A	C	
Cemeteries	X01	X01-02	A	C	
Municipal or city parks (with green areas)	X04	X04-01	A	C	
Petroleum product bulk station/terminals	X11	X11-01	A	C	AVEC Fuel Storage
Petroleum product bulk station/terminals	X11	X11-02	A	C	LYSD Fuel Storage
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	C	City of Russian Mission
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	C	Health Clinic
Metals mining, placer (active or inactive?)	E04	E04-01	C	C	Quartz Creek
Metals mining, placer (active or inactive?)	E04	E04-02	D	C	Disappointment Mine

<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>
Metals mining, placer (active or inactive?)	E04	E04-03	D	C	Happy Creek
Metals mining, placer (active or inactive?)	E04	E04-04	D	C	Wilson Creek
Quarries (sand, gravel, rock, other?)	E10	E10-01	D	C	Edgar Creek
Quarries (sand, gravel, rock, other?)	E10	E10-02	D	C	Whiskey Creek

**Table 2**

*Contaminant Source Inventory and Risk Ranking for  
Russian Mission Water System  
Sources of Bacteria and Viruses*

**PWSID 270168.001**

<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>
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	LYSD
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	High	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 10 or less honeybucket pits in Zone A
Municipal or city parks (with green areas)	X04	X04-01	A	Medium	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Medium	C	Health Clinic

Table 3

*Contaminant Source Inventory and Risk Ranking for  
Russian Mission Water System  
Sources of Nitrates/Nitrites*

PWSID 270168.001

<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>
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	C	LYSD
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 10 or less honeybucket pits in Zone A
Cemeteries	X01	X01-01	A	Medium	C	
Cemeteries	X01	X01-02	A	Medium	C	
Municipal or city parks (with green areas)	X04	X04-01	A	Medium	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Health Clinic
Quarries (sand, gravel, rock, other?)	E10	E10-01	D	Low	C	Edgar Creek
Quarries (sand, gravel, rock, other?)	E10	E10-02	D	Low	C	Whiskey Creek



Table 4

*Contaminant Source Inventory and Risk Ranking for  
Russian Mission Water System  
Sources of Volatile Organic Chemicals*

PWSID 270168.001

<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>
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	LYSD
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 10 or less honeybucket pits in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 45 or less residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	City of Russian Mission
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	UUT
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	LYSD Elementary School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	LYSD High School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	LYSD Preschool
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	City of Russian Mission
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	AVEC Fuel Storage
Petroleum product bulk station/terminals	X11	X11-02	A	Very High	C	LYSD Fuel Storage
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	City of Russian Mission
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Health Clinic
Quarries (sand, gravel, rock, other?)	E10	E10-01	D	Low	C	Edgar Creek
Quarries (sand, gravel, rock, other?)	E10	E10-02	D	Low	C	Whiskey Creek

Table 5

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

PWSID 270168.001

<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>
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	LYSD
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 10 or less honeybucket pits in Zone A
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 10 or less honeybucket pits in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	UUT
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	LYSD Elementary School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	LYSD High School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	LYSD Preschool
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	City of Russian Mission
Cemeteries	X01	X01-01	A	Low	C	
Cemeteries	X01	X01-02	A	Low	C	
Municipal or city parks (with green areas)	X04	X04-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	AVEC Fuel Storage
Petroleum product bulk station/terminals	X11	X11-02	A	Low	C	LYSD Fuel Storage
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	City of Russian Mission
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Health Clinic
Metals mining, placer (active or inactive?)	E04	E04-01	C	Low	C	Quartz Creek

**Table 5 (continued)**

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

***PWSID 270168.001***

<b><i>Contaminant Source Type</i></b>	<b><i>Contaminant Source ID</i></b>	<b><i>CS ID tag</i></b>	<b><i>Zone</i></b>	<b><i>Risk Ranking for Analysis</i></b>	<b><i>Map Number</i></b>	<b><i>Comments</i></b>
Metals mining, placer (active or inactive?)	E04	E04-02	D	Low	C	Disappointment Mine
Metals mining, placer (active or inactive?)	E04	E04-03	D	Low	C	Happy Creek
Metals mining, placer (active or inactive?)	E04	E04-04	D	Low	C	Wilson Creek

Table 6

*Contaminant Source Inventory and Risk Ranking for  
Russian Mission Water System  
Sources of Synthetic Organic Chemicals*

PWSID 270168.001

<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>
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	LYSD
Cemeteries	X01	X01-01	A	Medium	C	
Cemeteries	X01	X01-02	A	Medium	C	
Municipal or city parks (with green areas)	X04	X04-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	AVEC Fuel Storage
Petroleum product bulk station/terminals	X11	X11-02	A	Low	C	LYSD Fuel Storage
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Health Clinic

**Table 7**

*Contaminant Source Inventory and Risk Ranking for  
Russian Mission Water System  
Sources of Other Organic Chemicals*

**PWSID 270168.001**

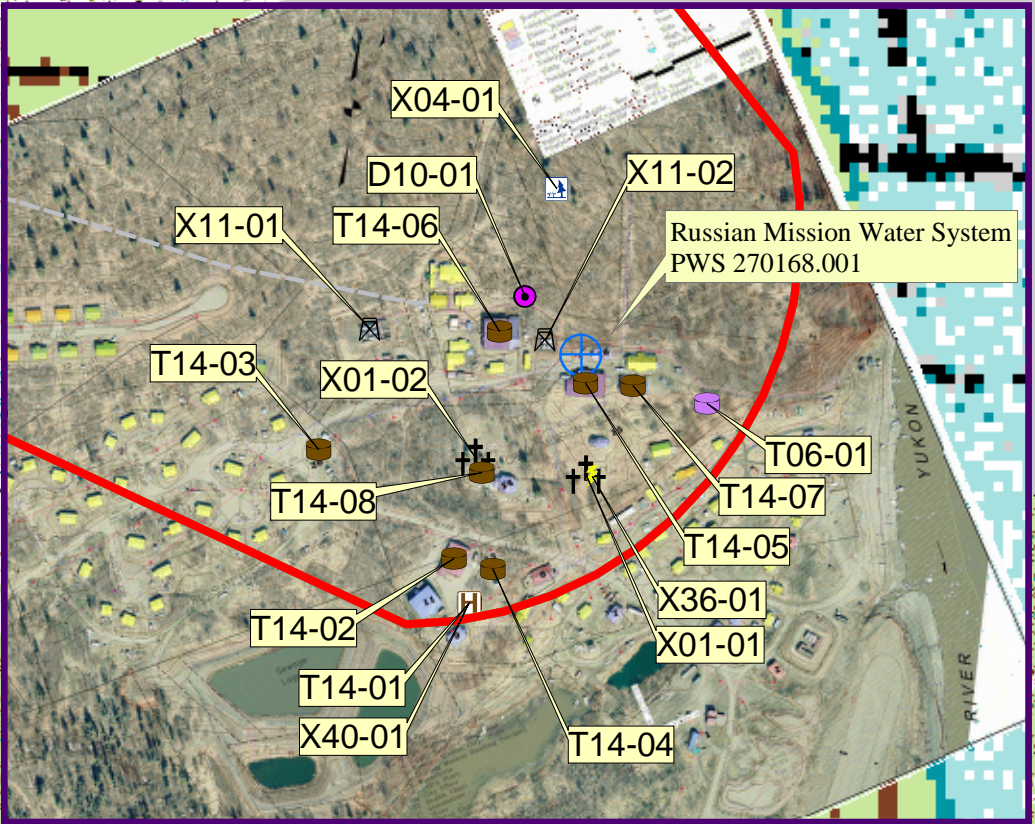
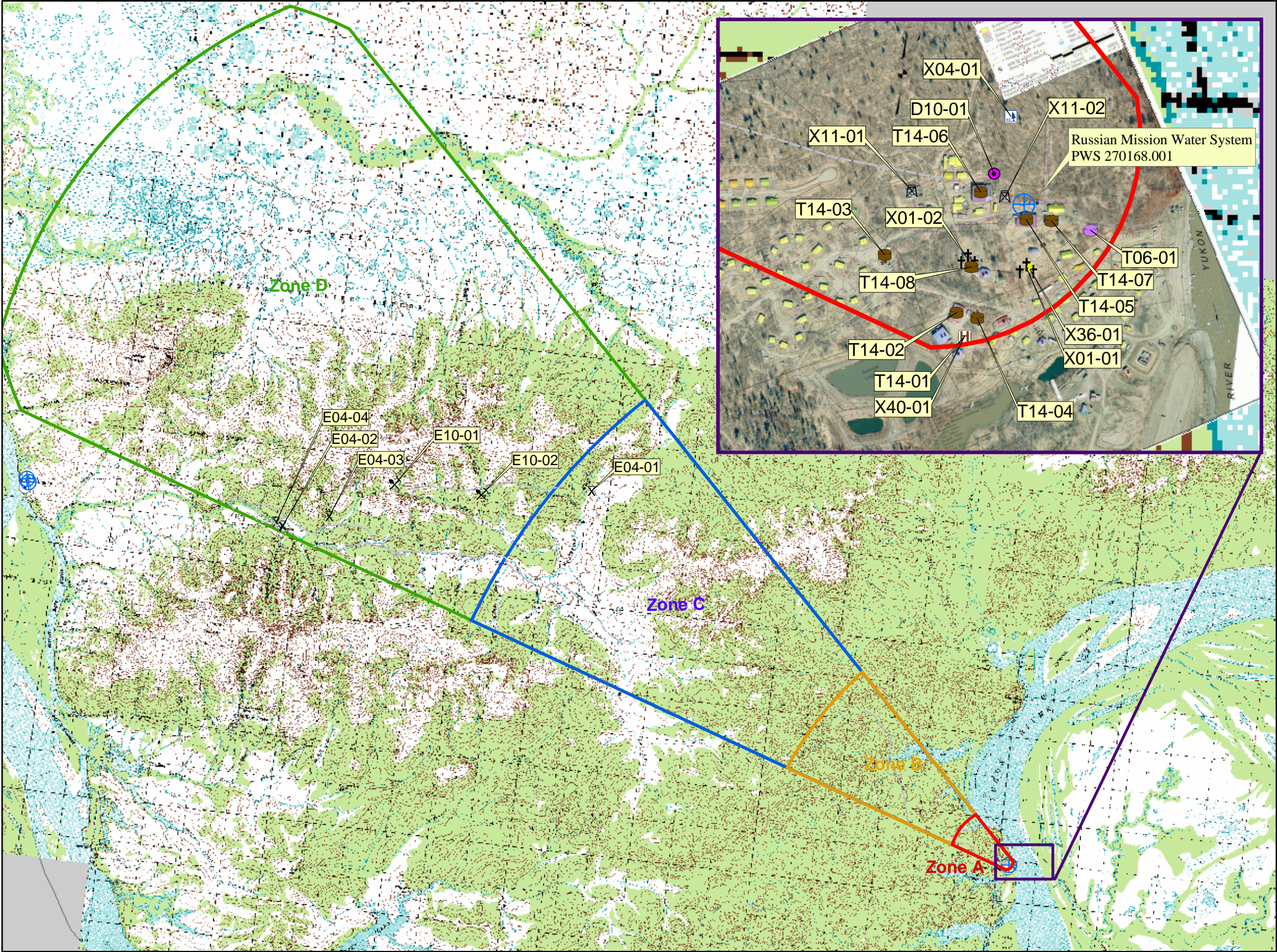
<b><i>Contaminant Source Type</i></b>	<b><i>Contaminant Source ID</i></b>	<b><i>CS ID tag</i></b>	<b><i>Zone</i></b>	<b><i>Risk Ranking for Analysis</i></b>	<b><i>Map Number</i></b>	<b><i>Comments</i></b>
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	Assume 80% of households connected to municipal sewage
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	C	LYSD
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	AVEC Fuel Storage
Petroleum product bulk station/terminals	X11	X11-02	A	High	C	LYSD Fuel Storage
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	High	C	City of Russian Mission
Quarries (sand, gravel, rock, other?)	E10	E10-01	D	Low	C	Edgar Creek
Quarries (sand, gravel, rock, other?)	E10	E10-02	D	Low	C	Whiskey Creek

## **APPENDIX C**

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



Public Water Well System for PWS #270168.001 Russian Mission Water System  
Showing Potential and Existing Sources of Contamination



LEGEND

- Public Water System Well
- 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 or Watershed Boundary

- 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)
  - Road Ferry Crossing

- Existing or Potential Contaminant Sources**
- Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) (D10)
  - Placer mine (E04)
  - Other mine or quarry (E10)
  - Tanks, diesel, above ground (T06)
  - Tanks, heating oil, nonresidential (aboveground) (T14)
  - Cemetery (X01)
  - Municipal Park (X04)
  - Fuel Storage >500 gallons (X11)
  - Electric power generation (fossil fuel) (X36)
  - Hospital/Clinic/ER (X40)

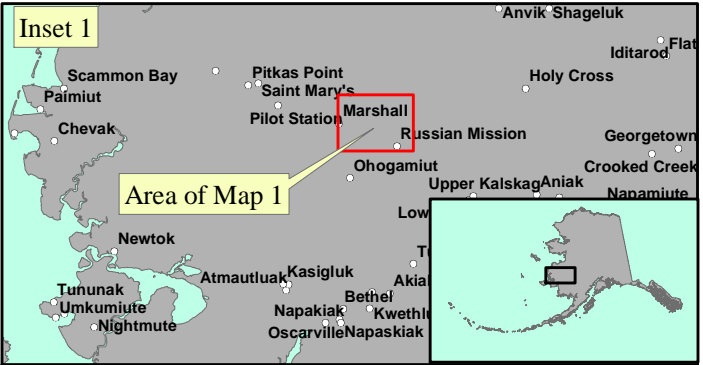
Data Sources:

- 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 A Public Water Systems" published by ADEC

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



0 1.25 2.5 5 7.5 10 Miles



## **APPENDIX D**

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



Chart 1. Susceptibility of the wellhead - Russian Mission Water System (PWS No. 270168.001)

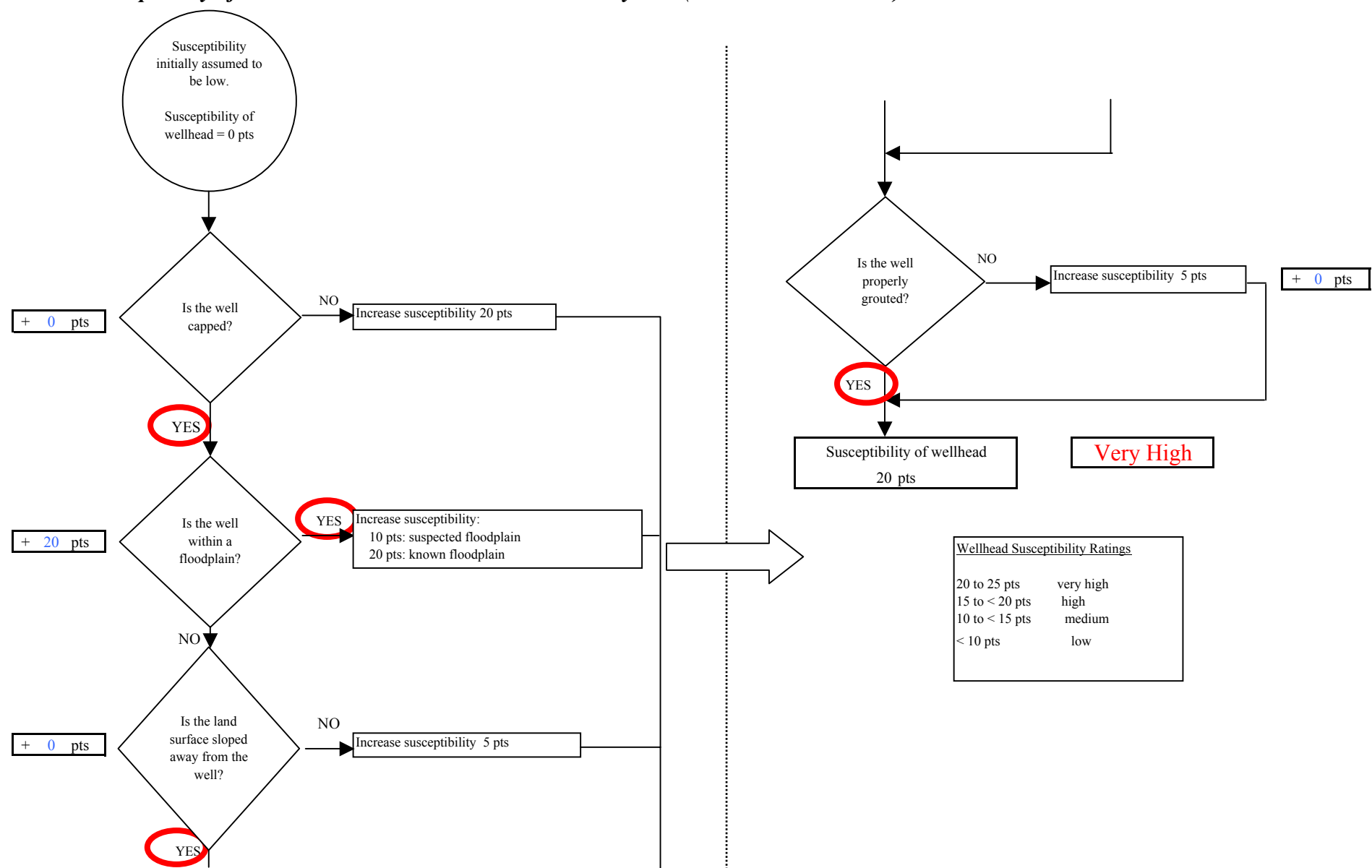


Chart 2. Susceptibility of the aquifer Russian Mission Water System (PWS No. 270168.001)

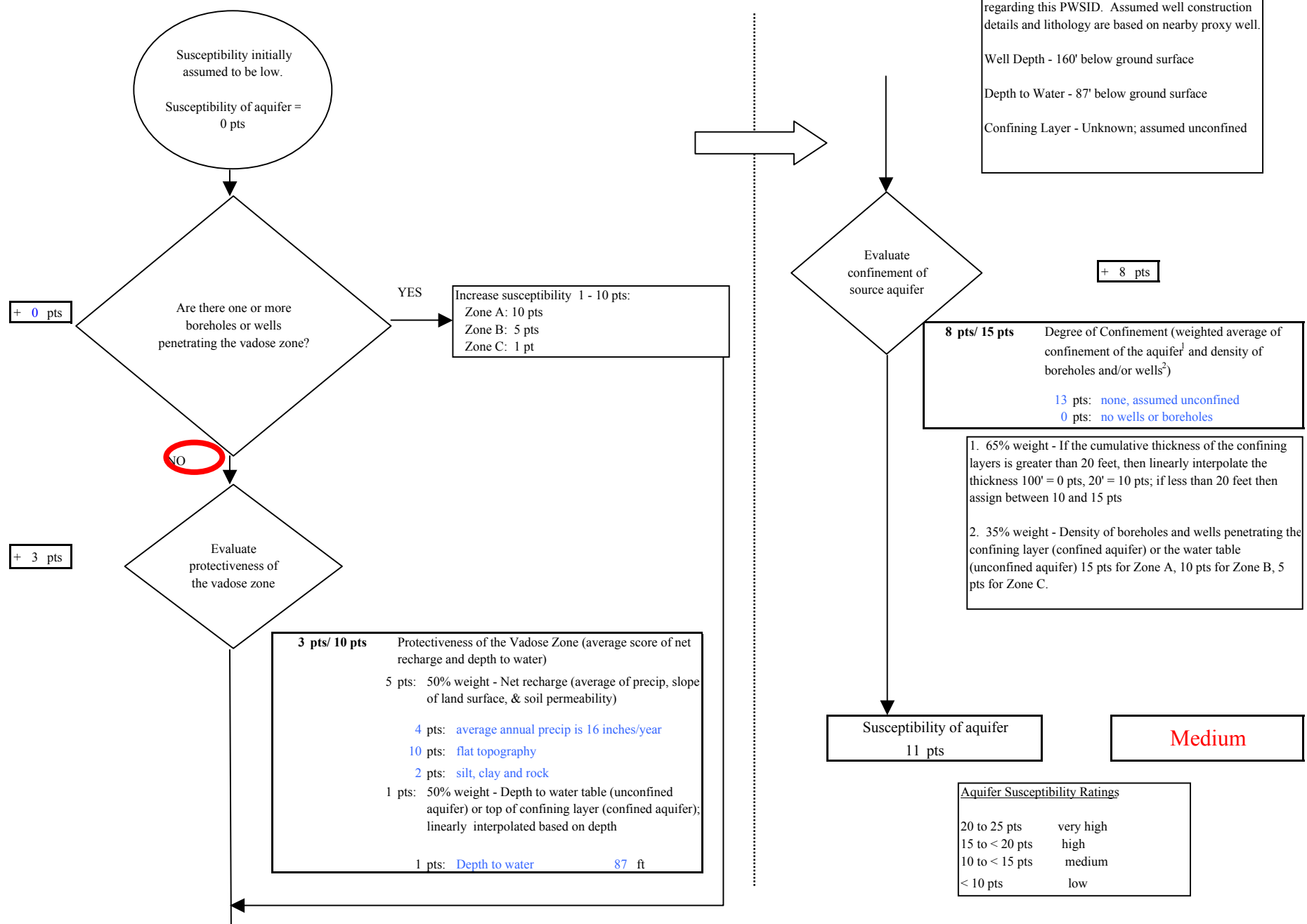


Chart 3. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Bacteria & Viruses

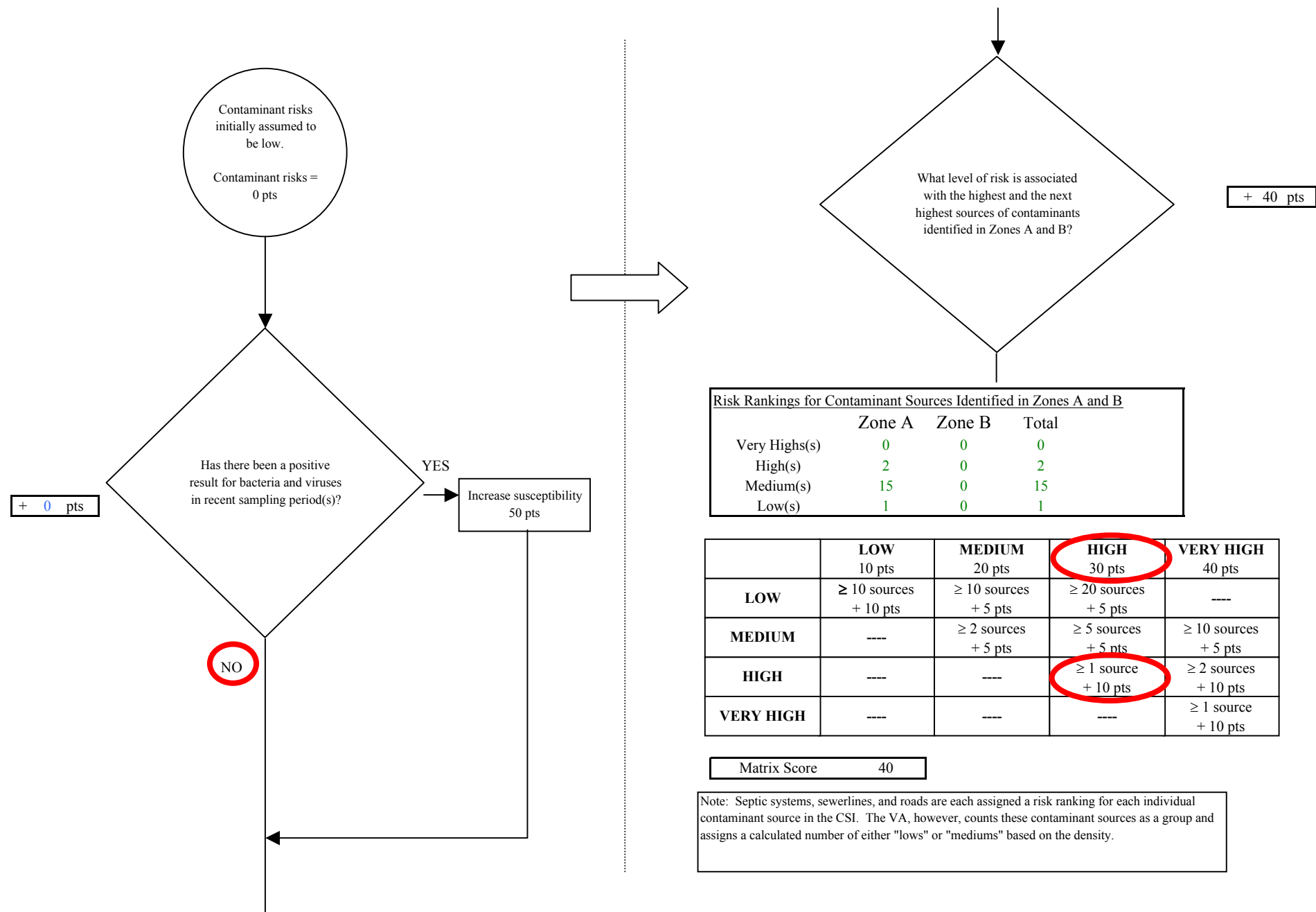
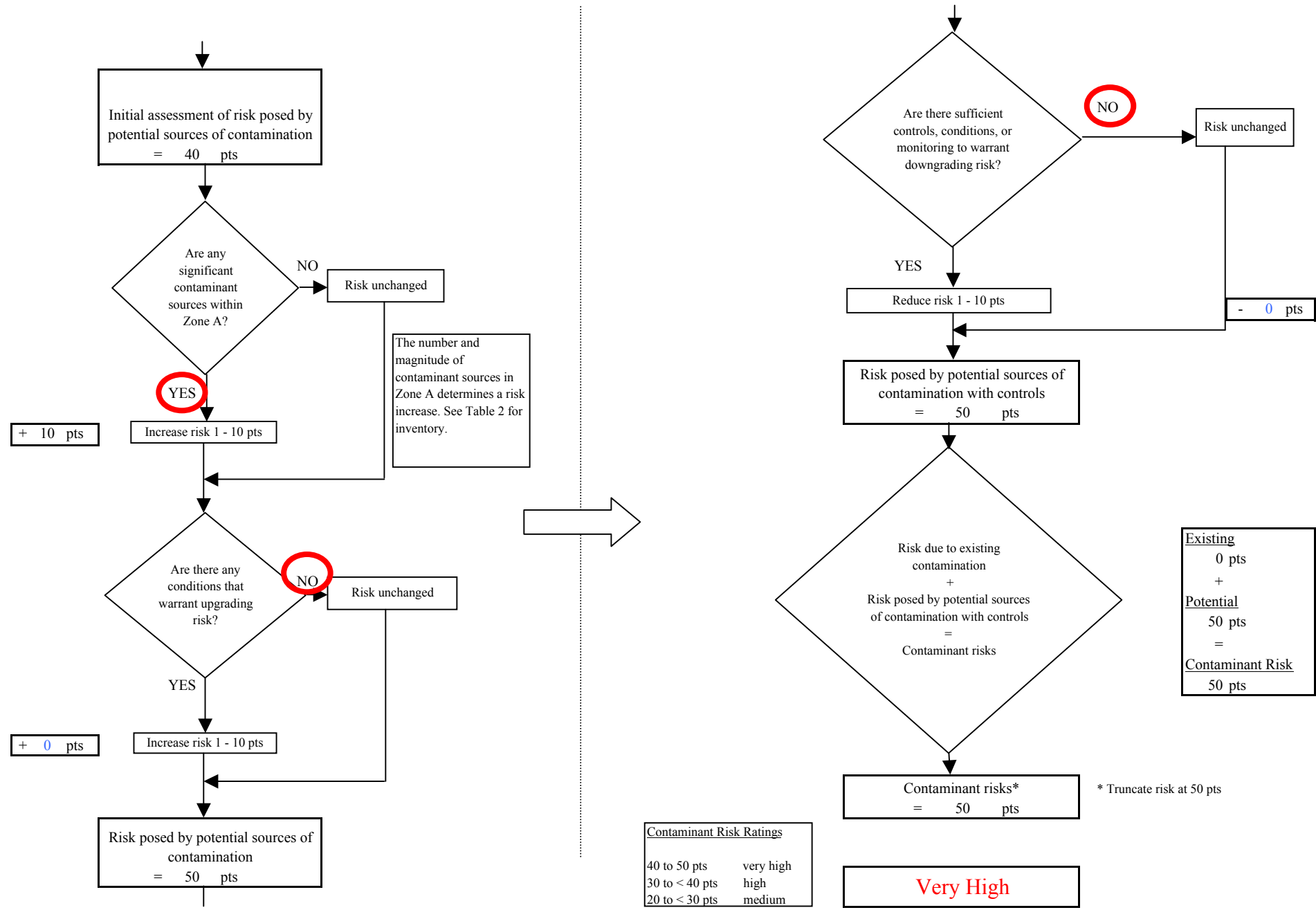


Chart 3. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Bacteria & Viruses



**Chart 4. Vulnerability analysis for Russian Mission Water System (PWS No. 270168.001) - Bacteria & Viruses**

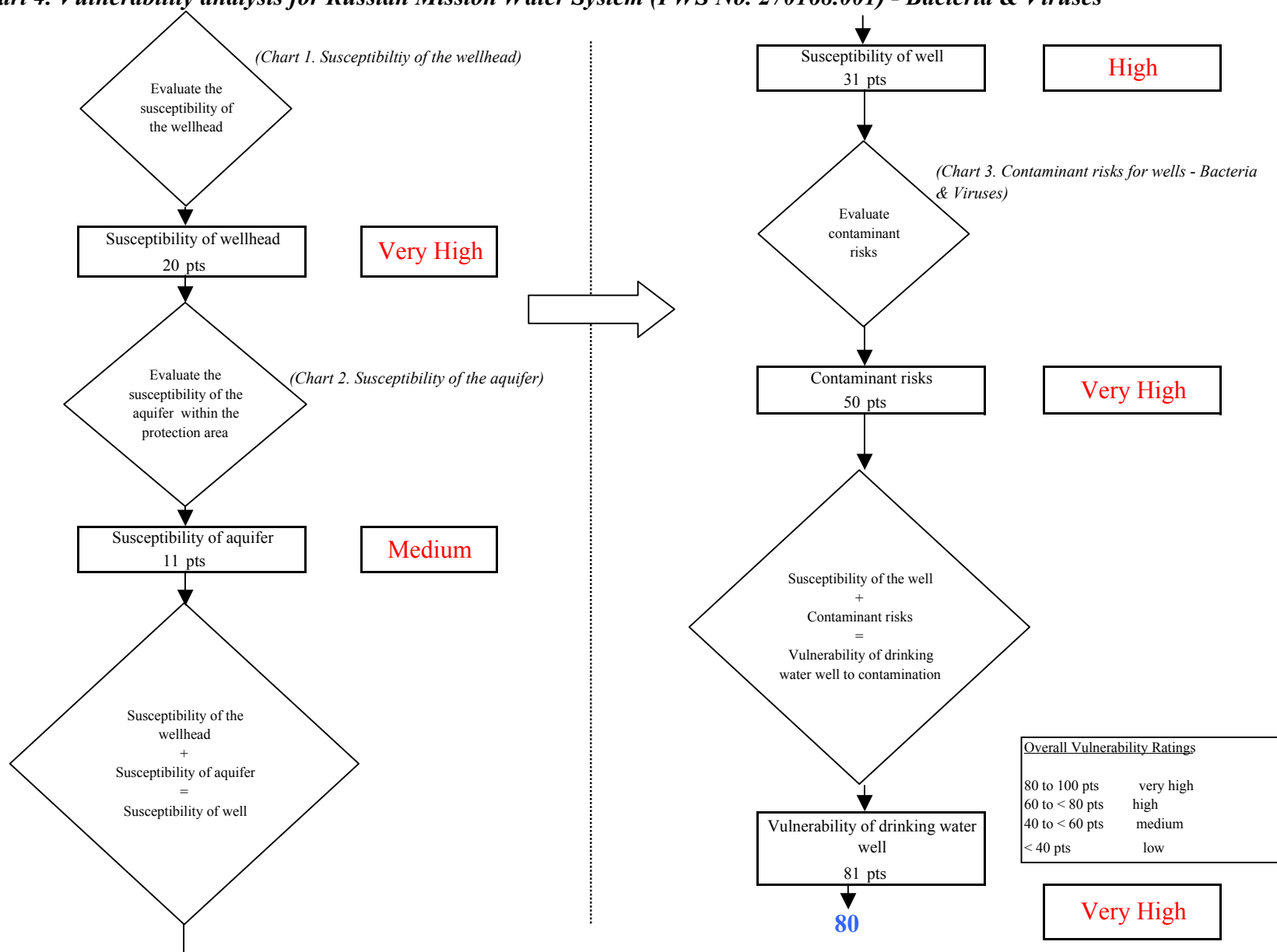


Chart 5. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Nitrates and Nitrites

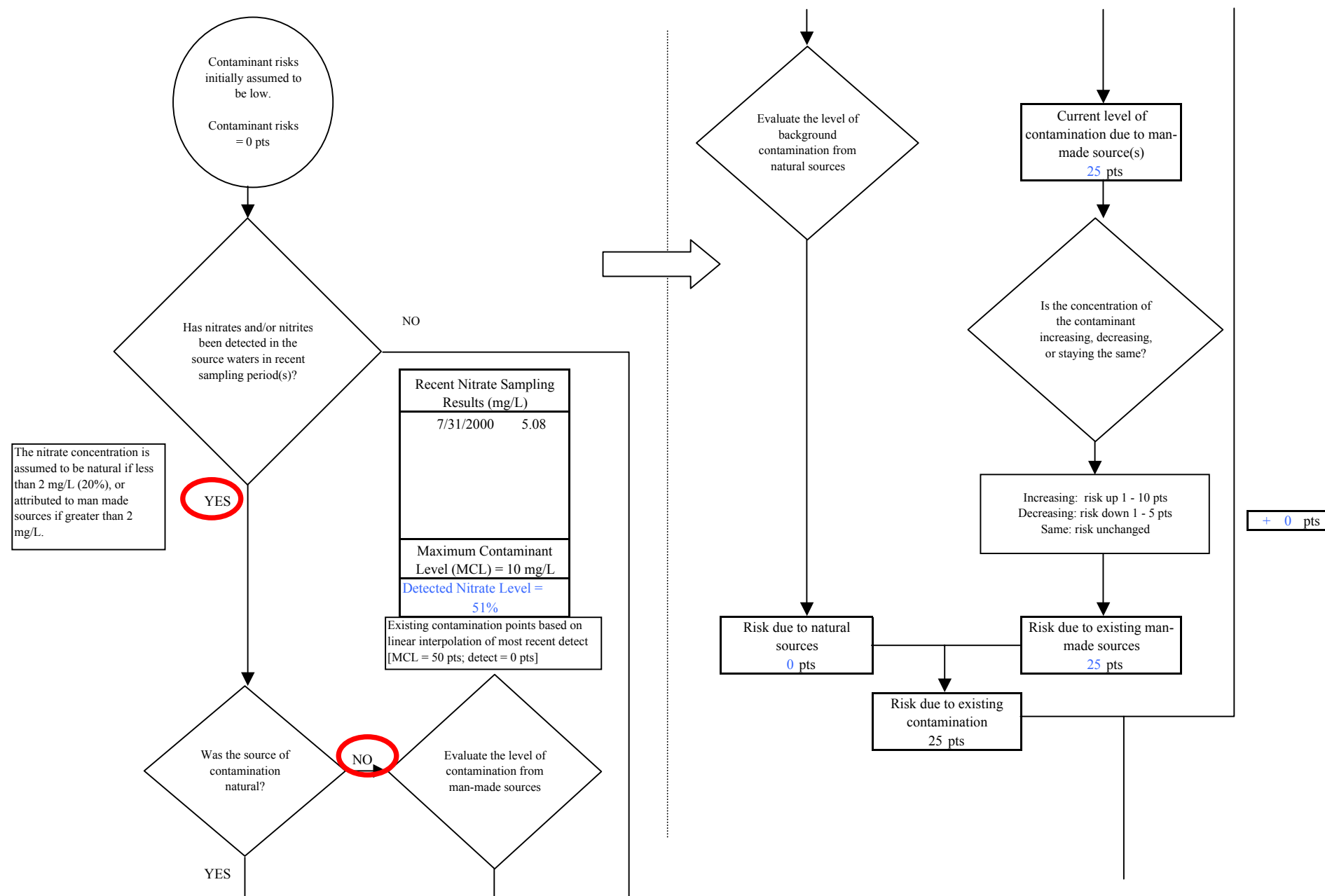


Chart 5. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Nitrates and Nitrites

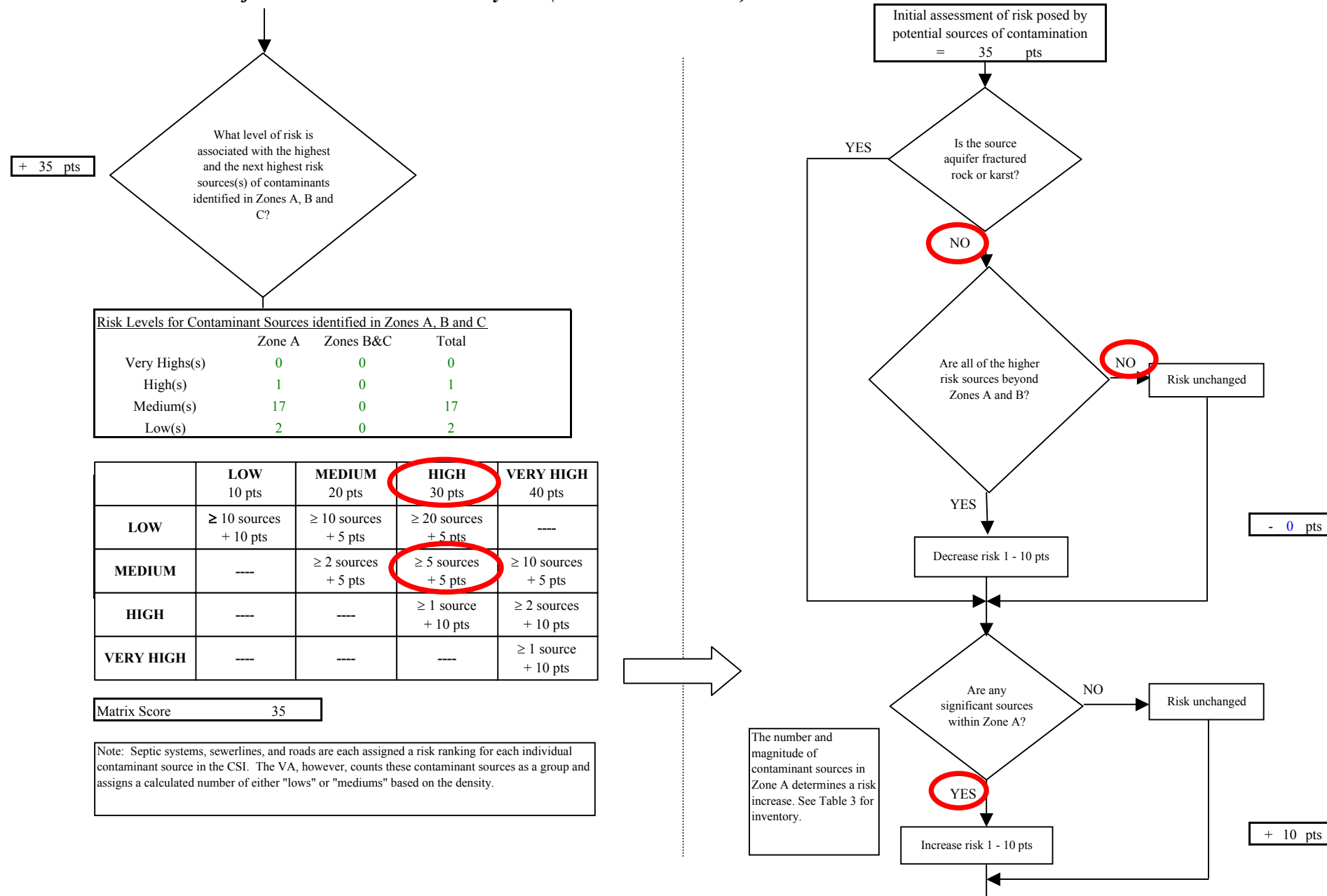
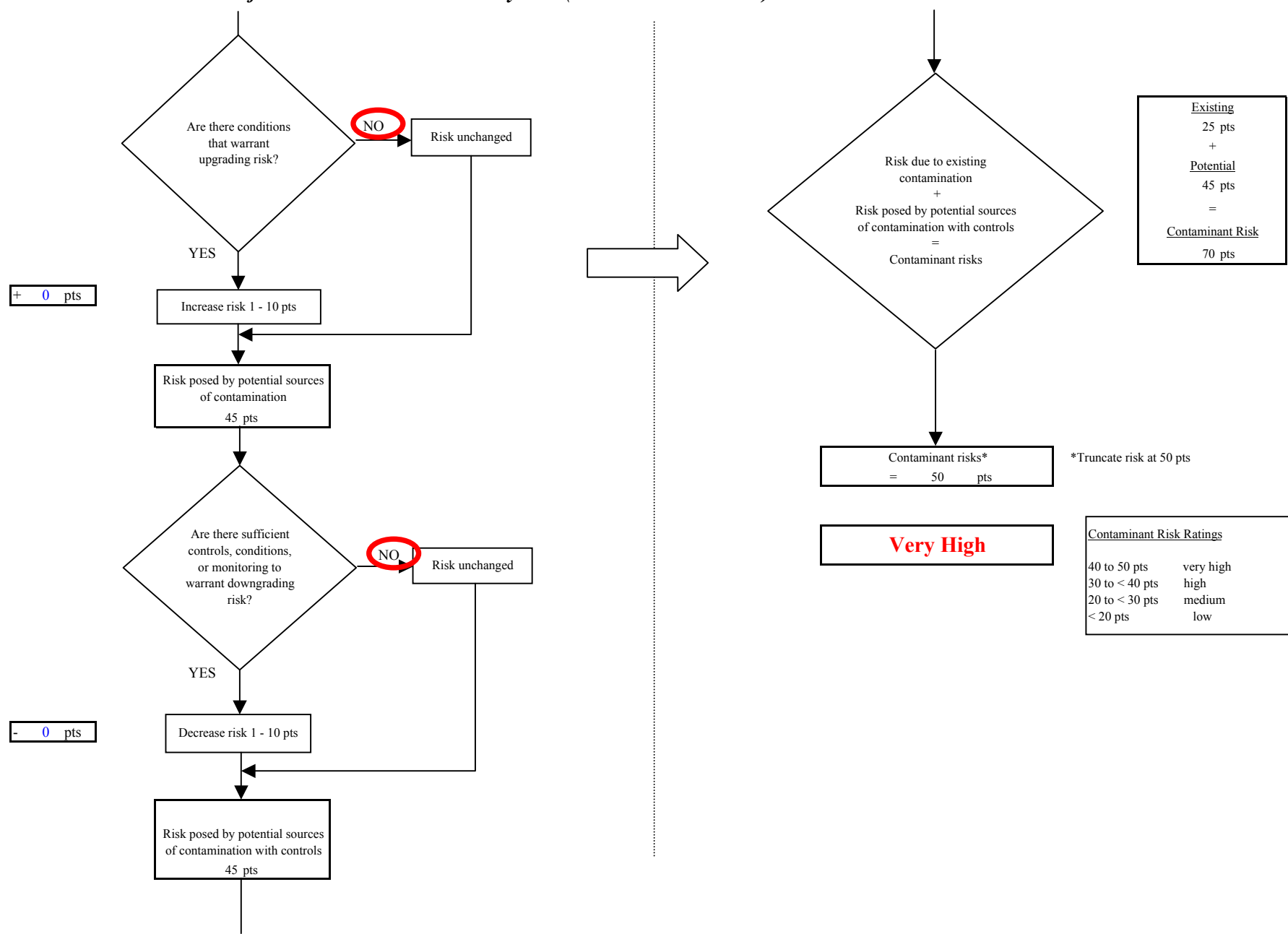
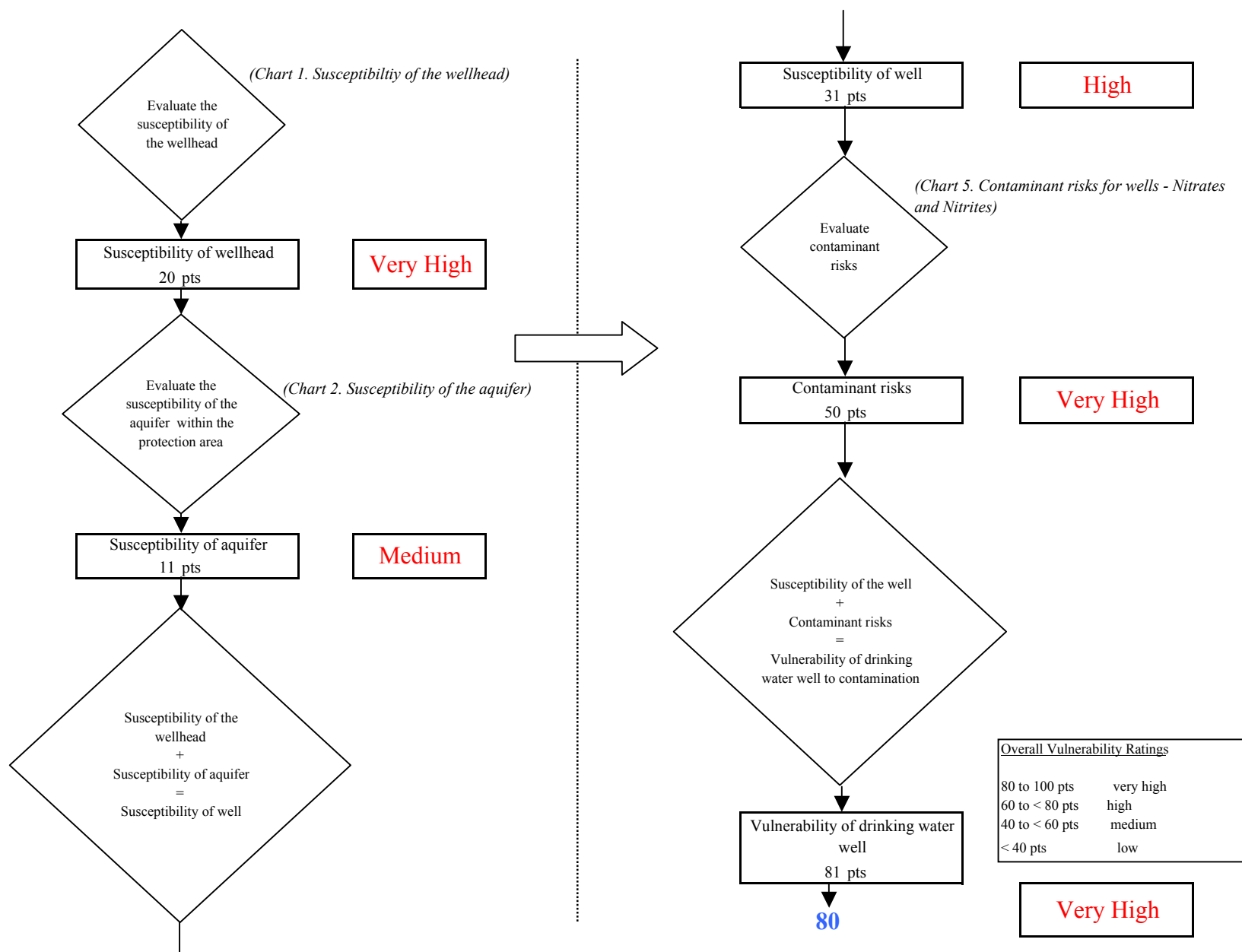


Chart 5. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Nitrates and Nitrites

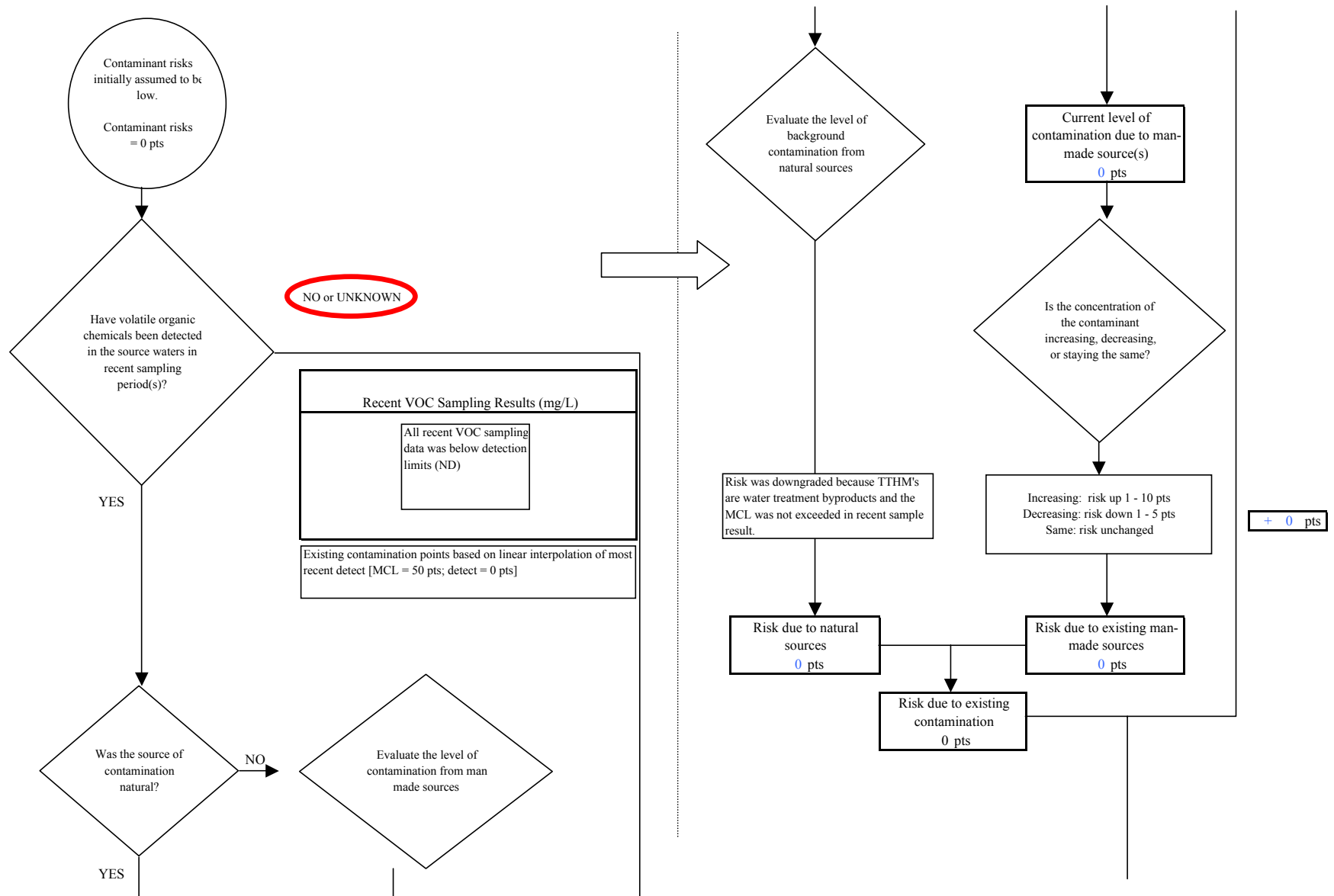




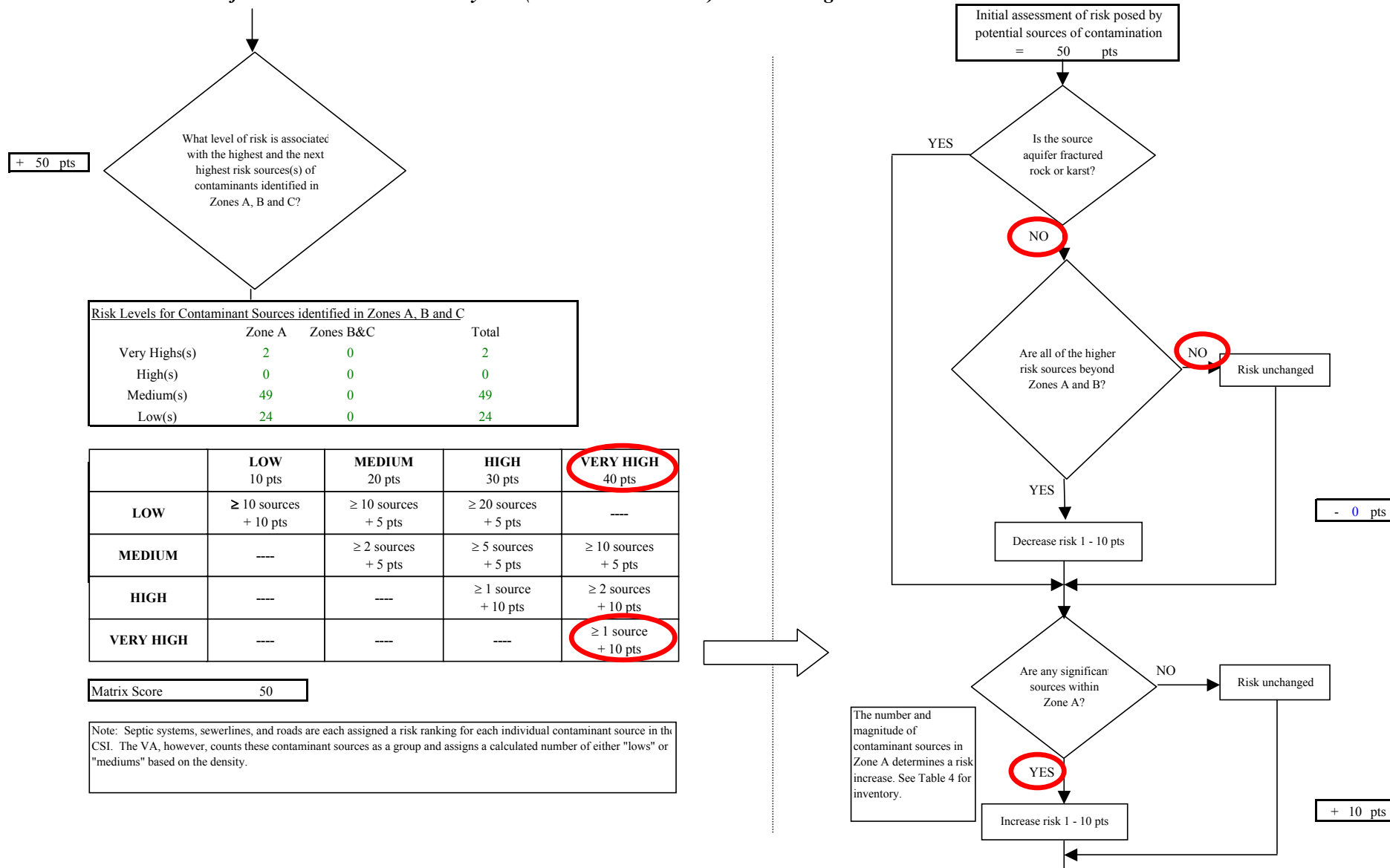
**Chart 6. Vulnerability analysis for Russian Mission Water System (PWS No. 270168.001) - Nitrates and Nitrites**



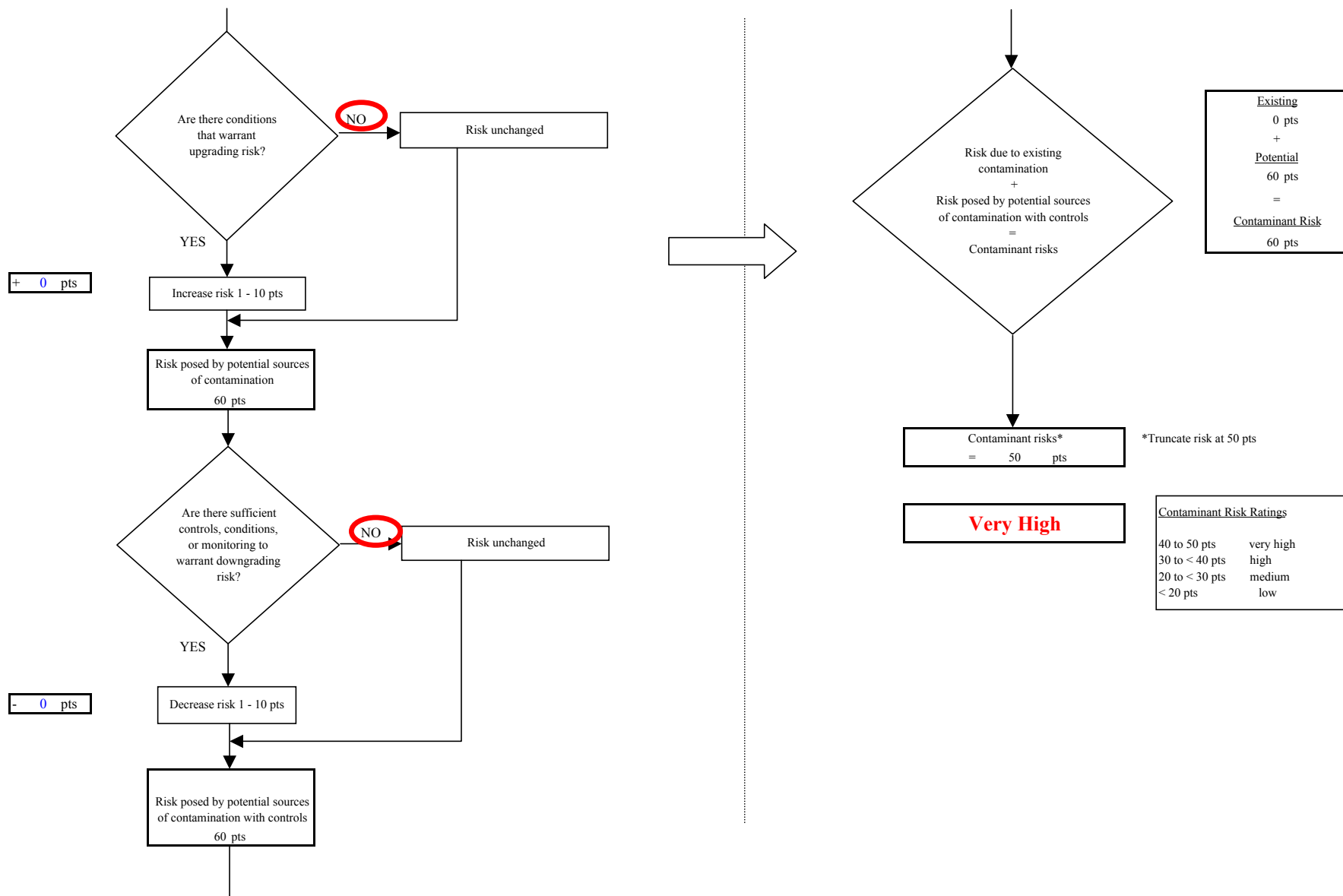
**Chart 7. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Volatile Organic Chemicals**



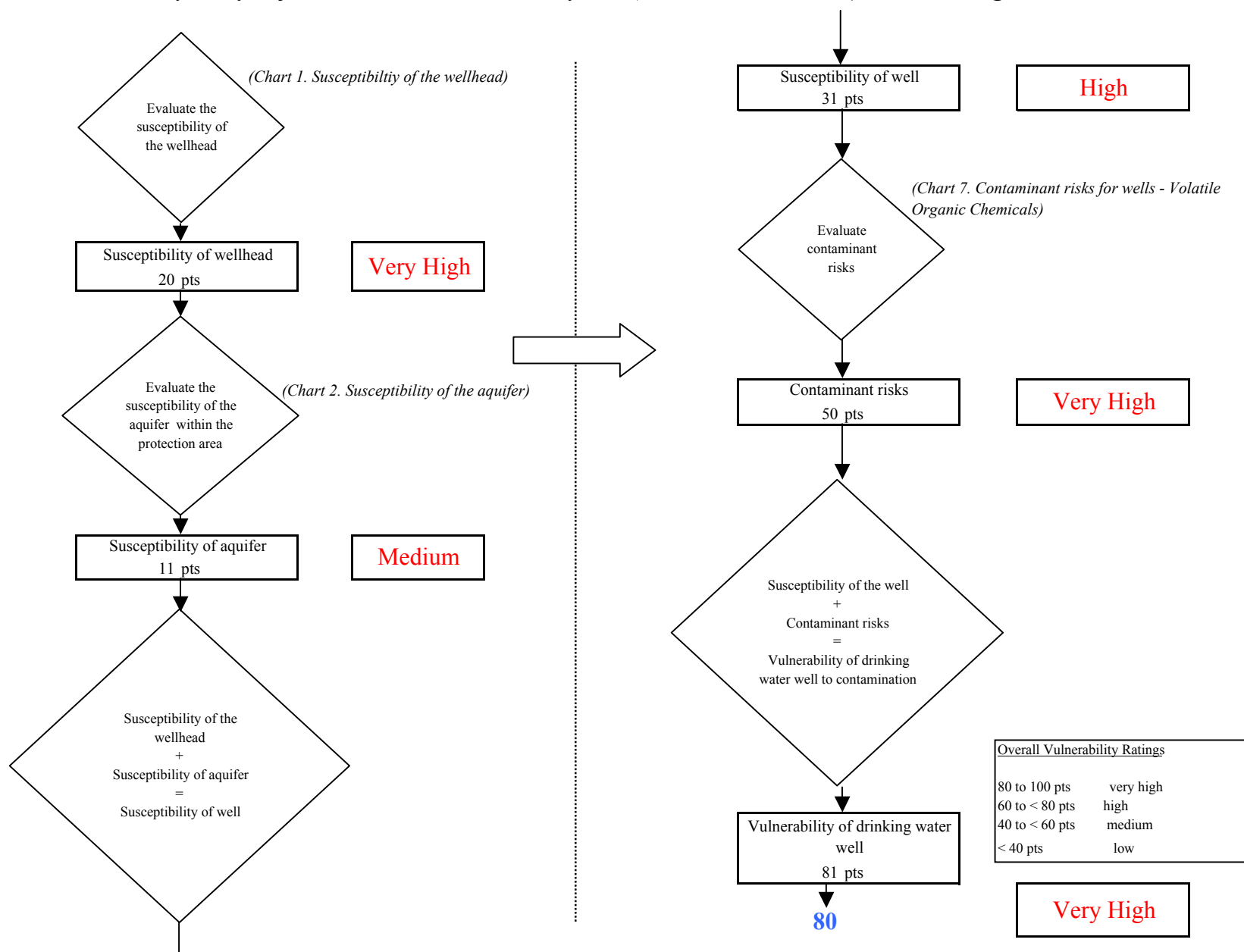
**Chart 7. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Volatile Organic Chemicals**



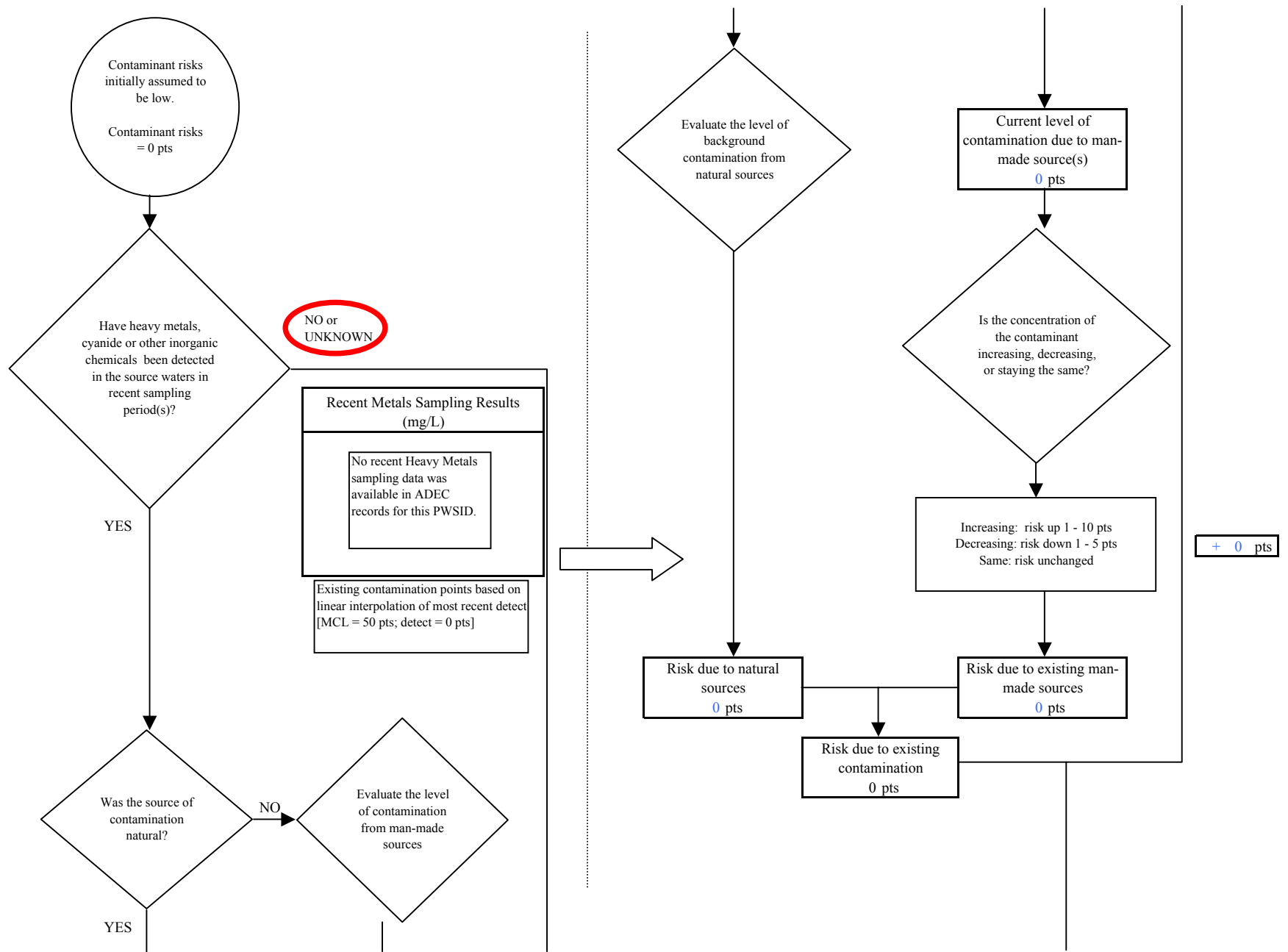
**Chart 7. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Volatile Organic Chemicals**



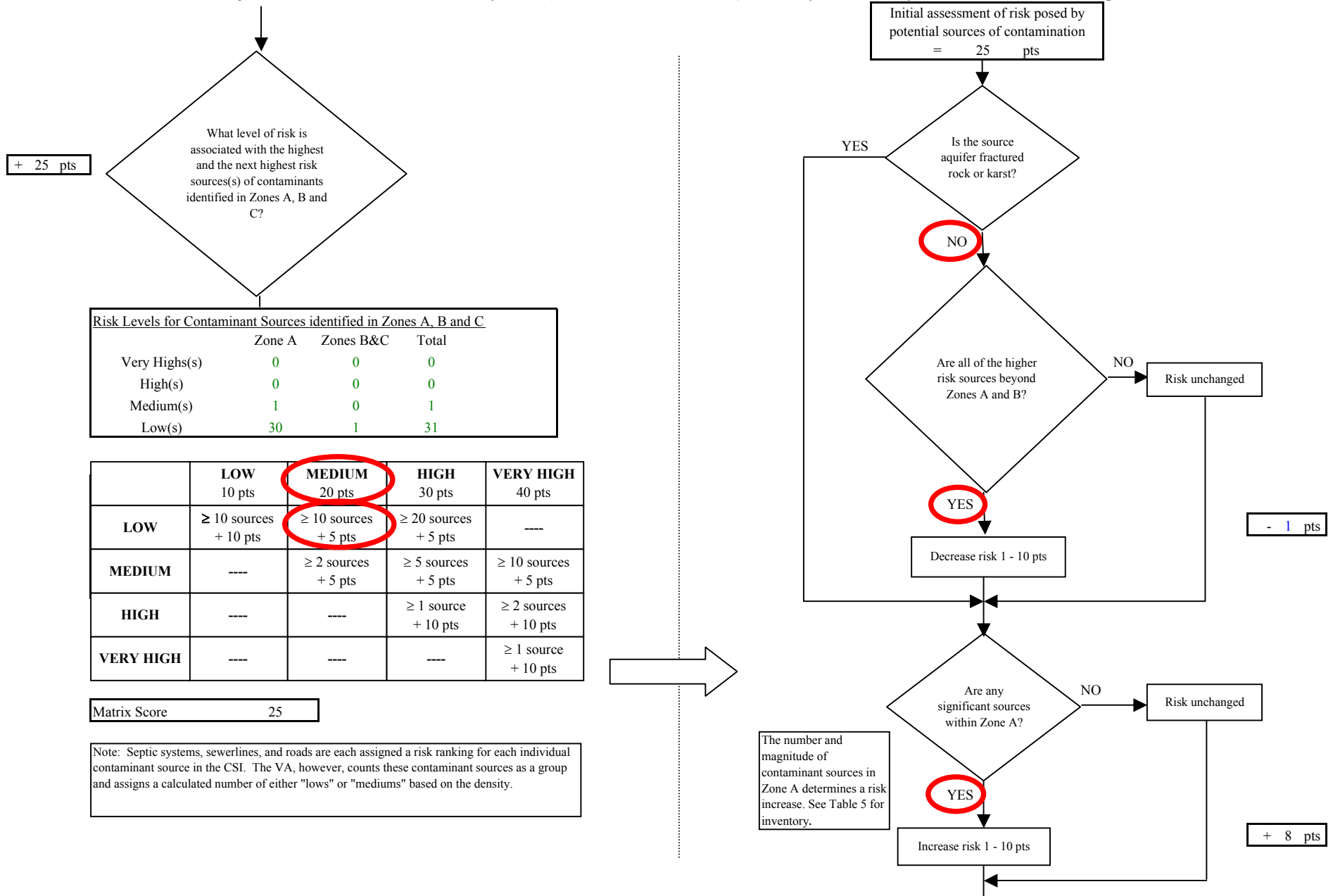
**Chart 8. Vulnerability analysis for Russian Mission Water System (PWS No. 270168.001) - Volatile Organic Chemicals**



**Chart 9. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**

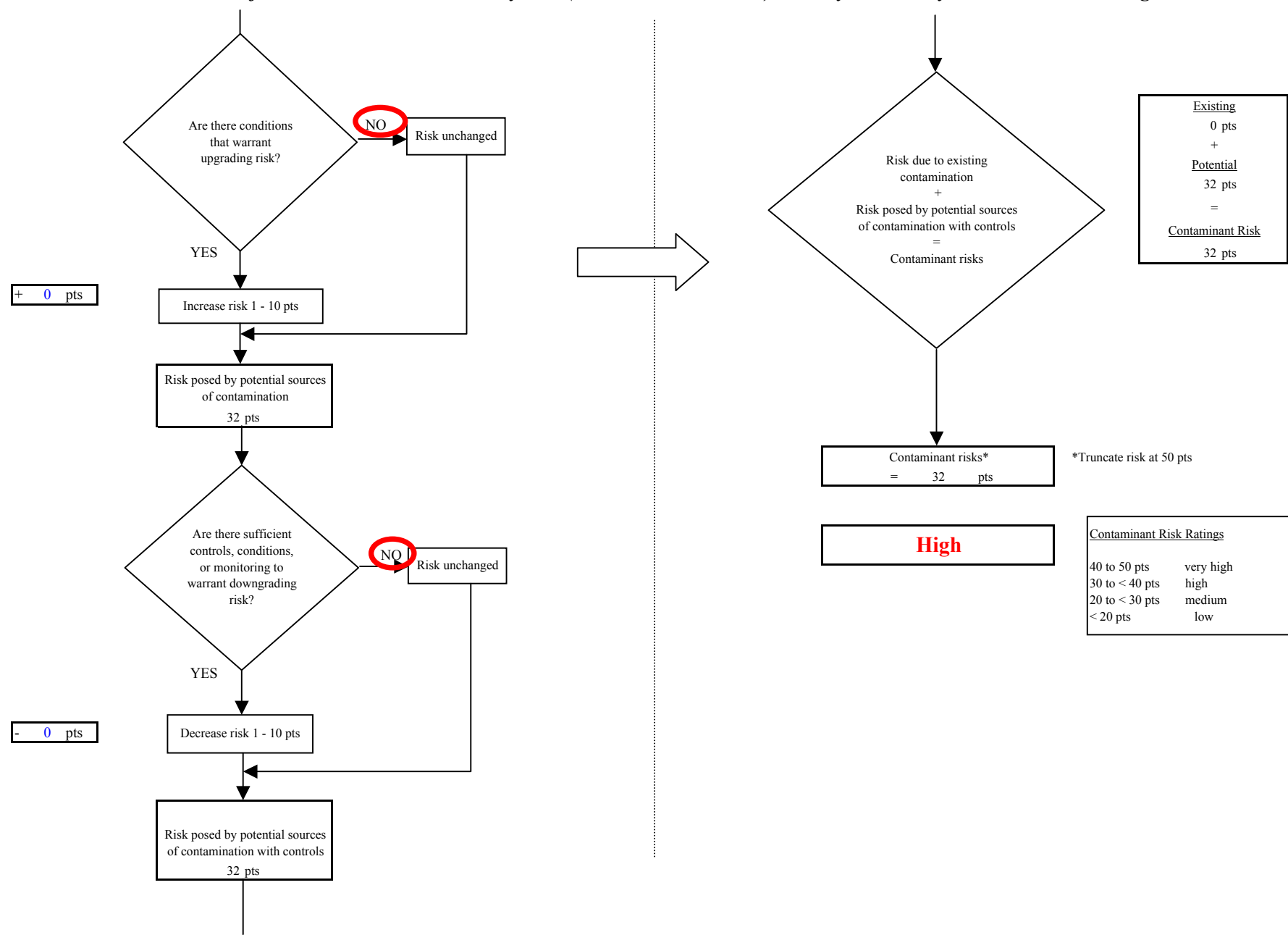


**Chart 9. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**

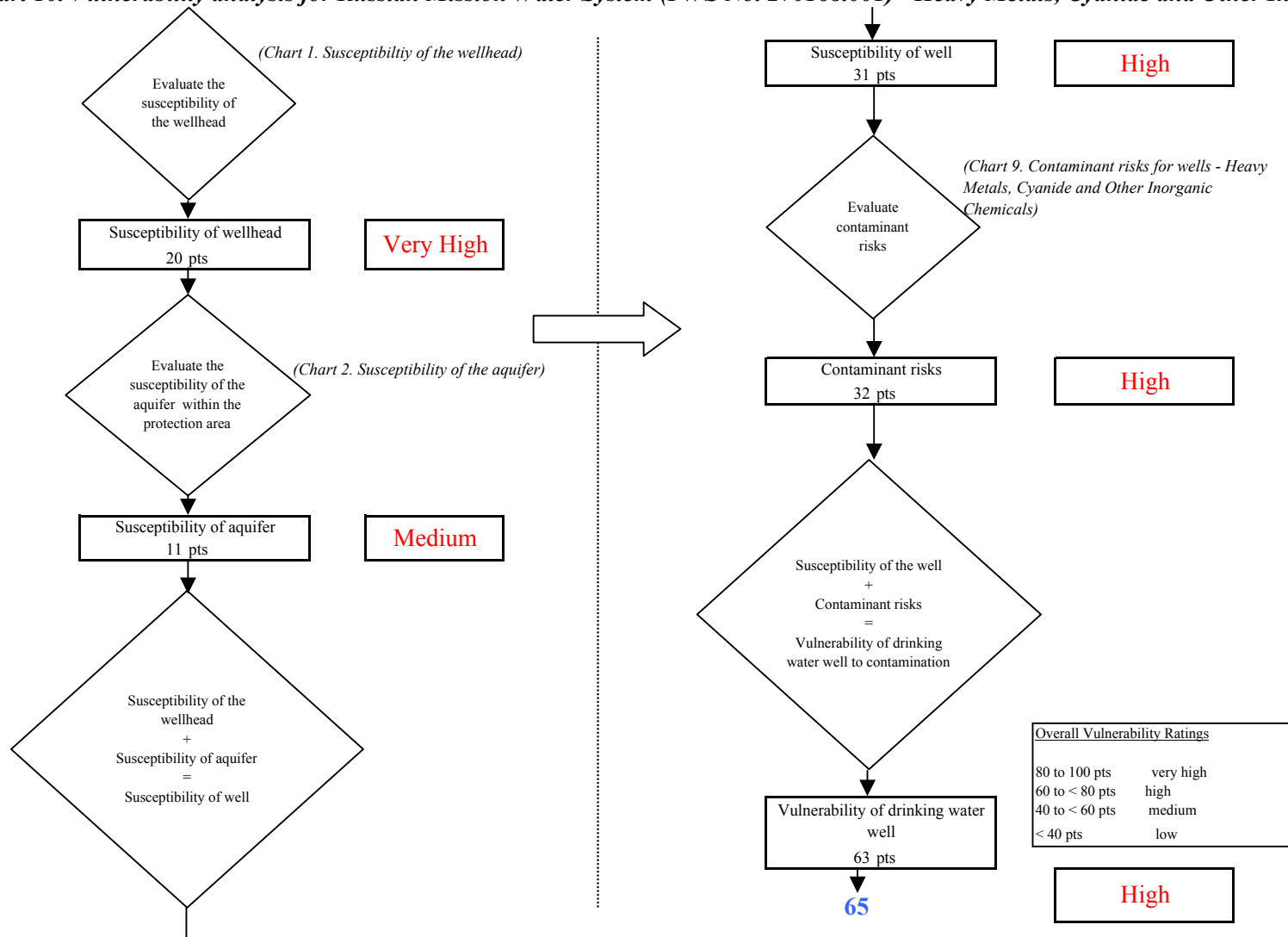




**Chart 9. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



**Chart 10. Vulnerability analysis for Russian Mission Water System (PWS No. 270168.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals**



**Chart 11. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Synthetic Organic Chemicals**

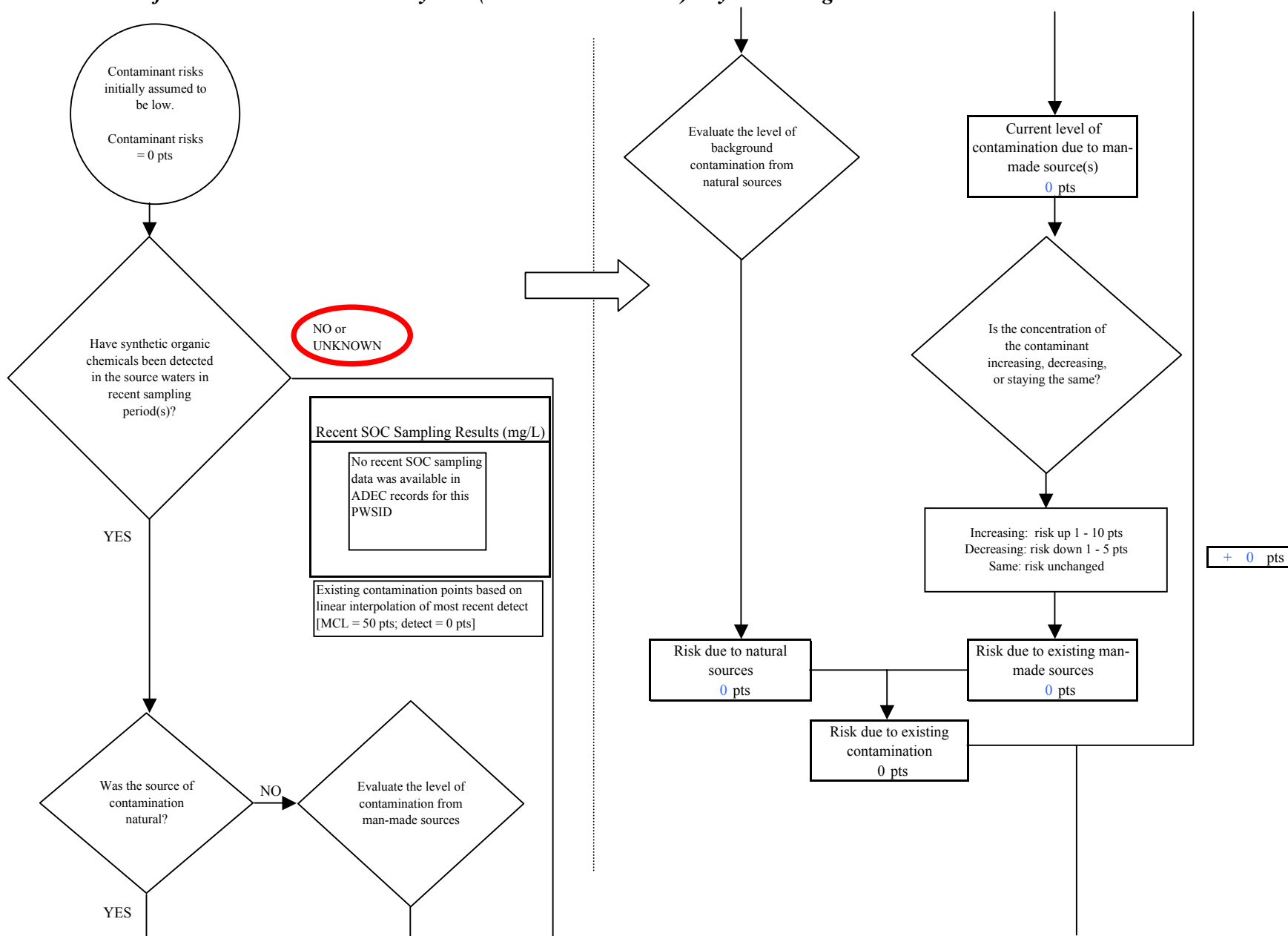


Chart 11. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Synthetic Organic Chemicals

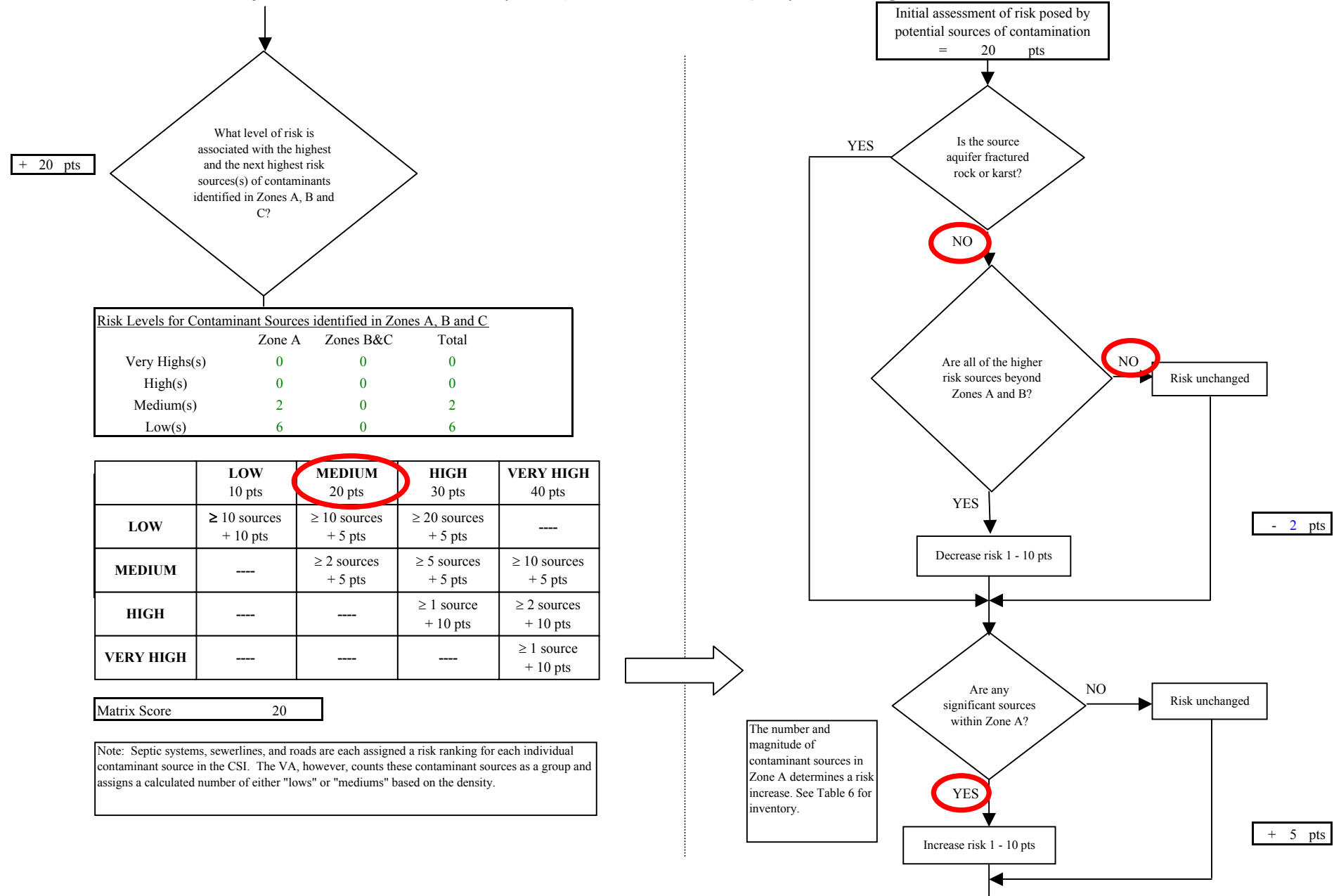
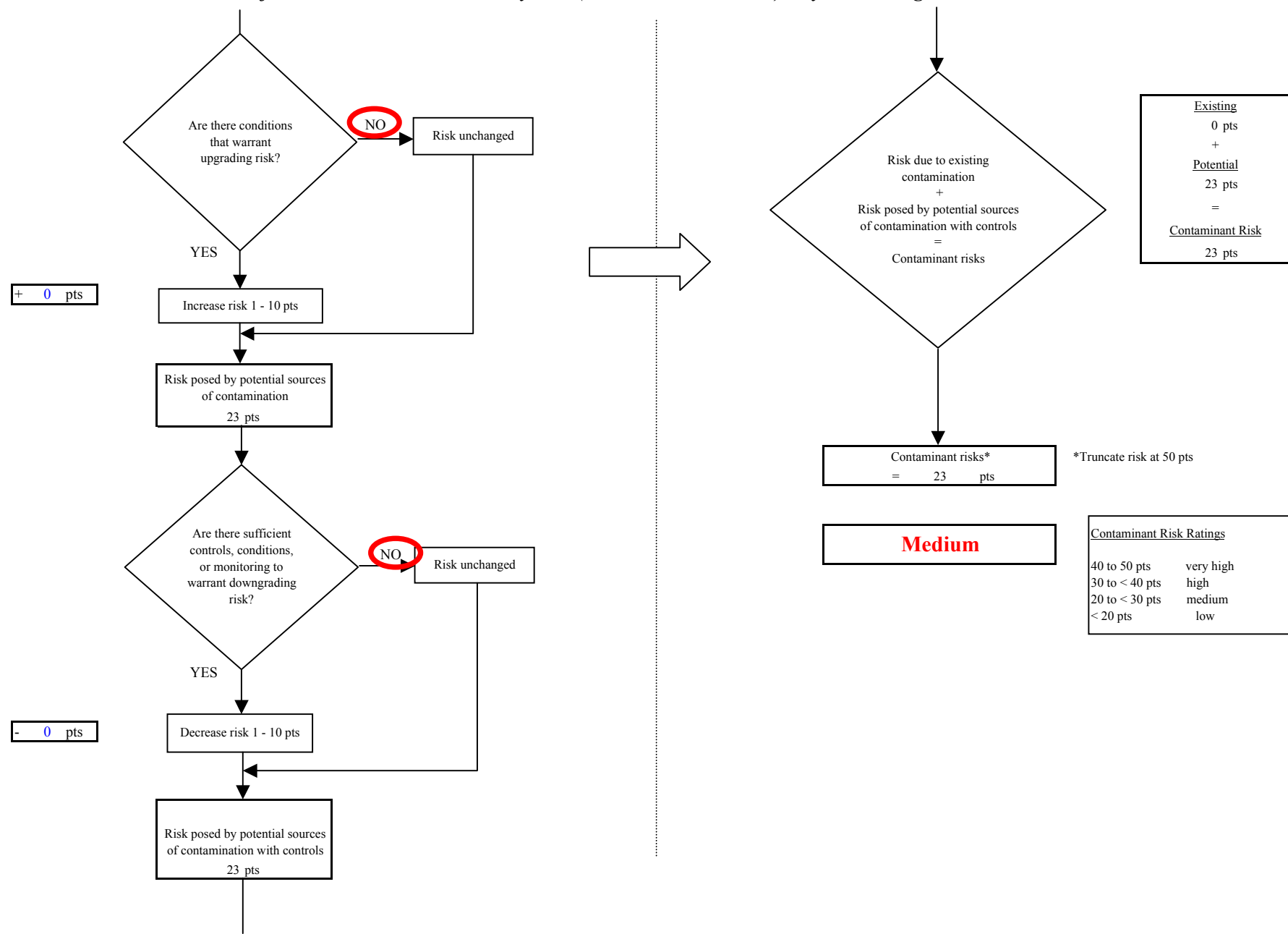
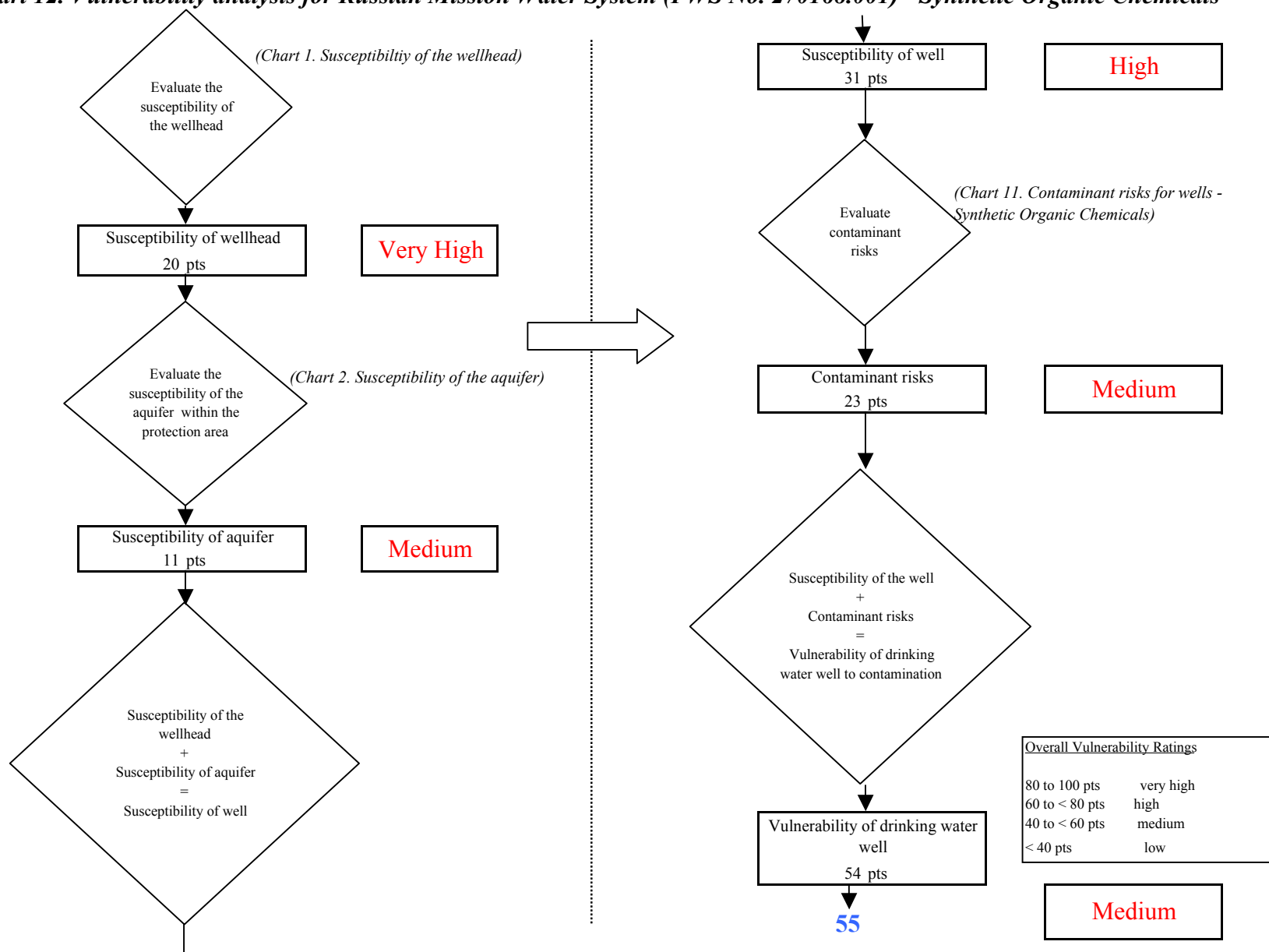


Chart 11. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Synthetic Organic Chemicals



**Chart 12. Vulnerability analysis for Russian Mission Water System (PWS No. 270168.001) - Synthetic Organic Chemicals**



**Chart 13. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Other Organic Chemicals**

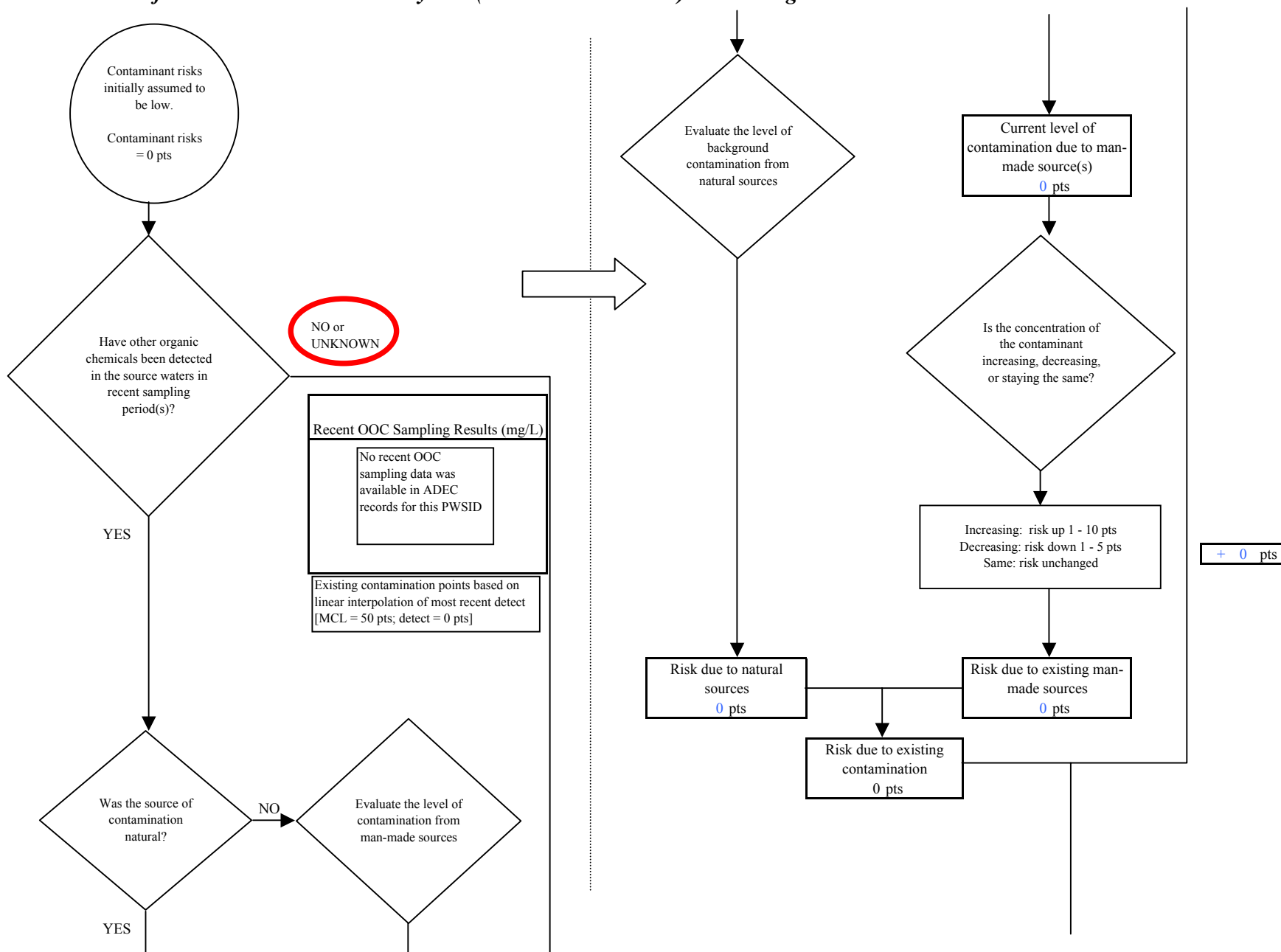


Chart 13. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Other Organic Chemicals

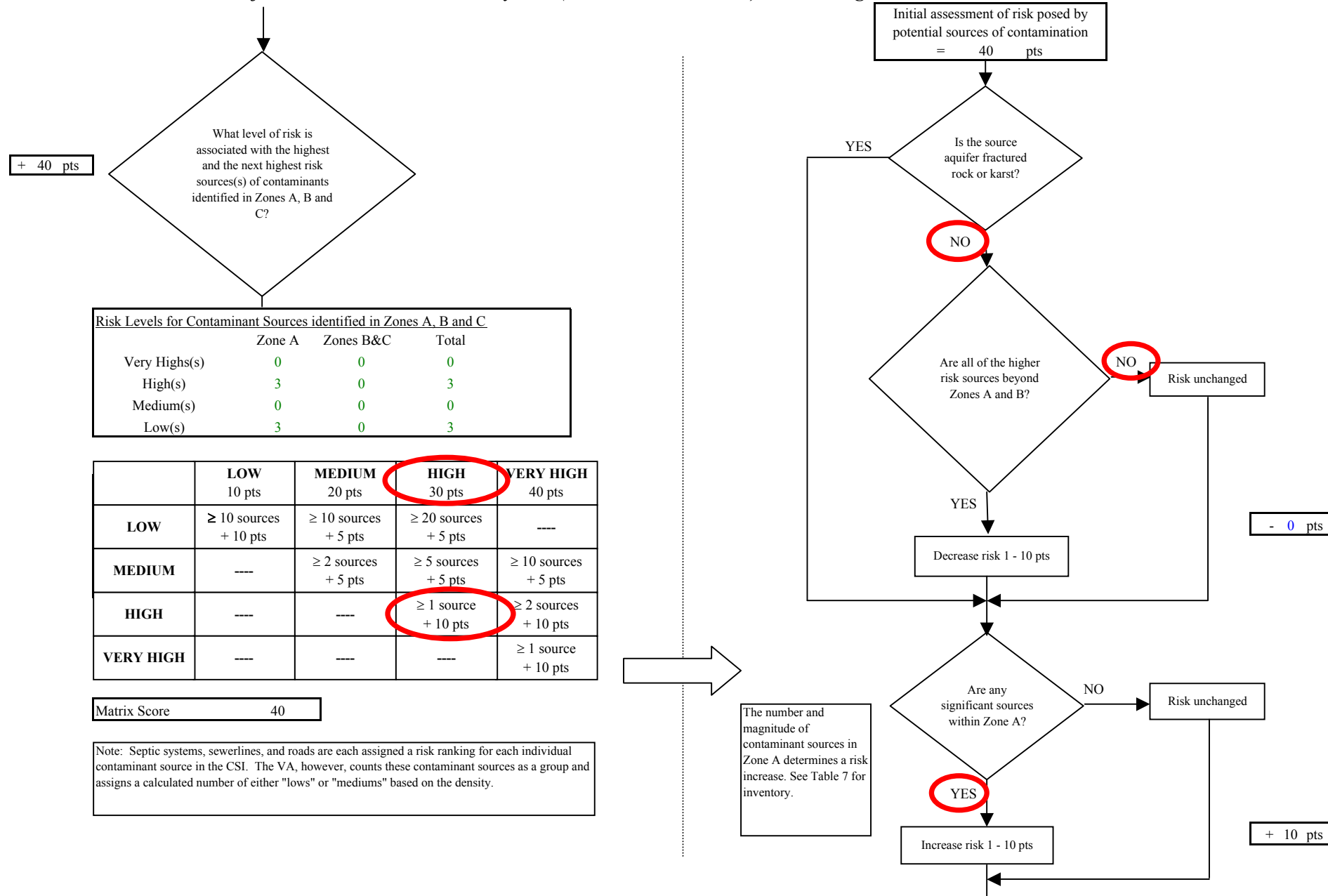
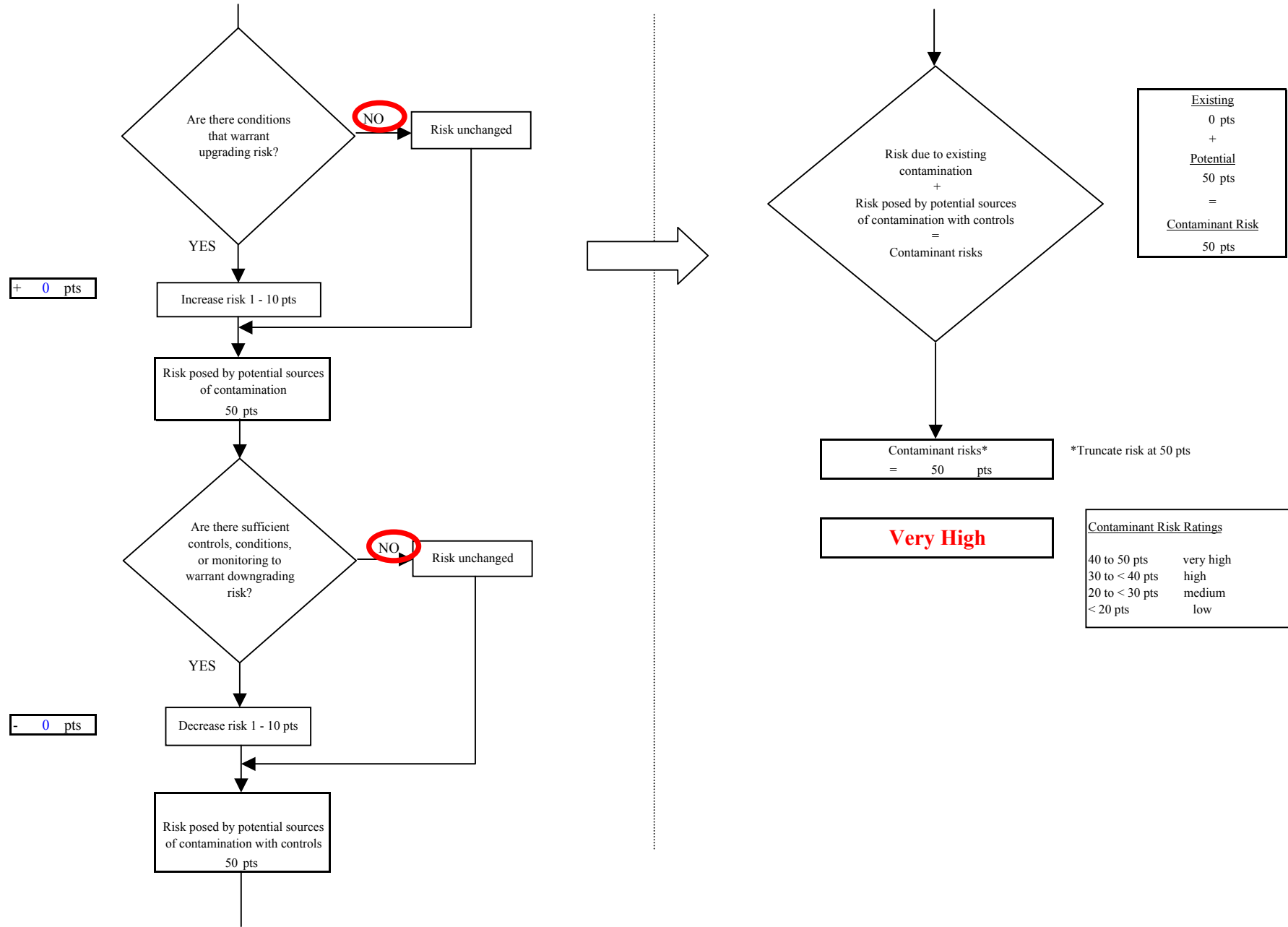




Chart 13. Contaminant risks for Russian Mission Water System (PWS No. 270168.001) - Other Organic Chemicals



**Chart 14. Vulnerability analysis for Russian Mission Water System (PWS No. 270168.001) - Other Organic Chemicals**

