Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Alakanuk Water System

Alakanuk, Alaska

PWSID #270362.001

January 2004

Drinking Water Protection Program Report #1091

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 (EPA), the 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 that 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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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for the City of Alakanuk, Alaska, is a Class A surface water system that obtains water from Alakanuk Slough - located west of the village near the mouth of the Yukon River. Water from the slough is filtered, treated for particulate matter, chlorinated, and stored in a large storage tank near the water treatment facility. The storage tank has an approximate storage capacity of 300,000 gallons.

The Alakanuk protection area is approximately 375 square miles in size and has received a susceptibility rating of **High**. *A rating of High to Very High is typical for all systems with surface water intakes*. Potential and existing sources of the following contaminants were evaluated for the Source Water 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.

Known potential contaminant sources are located within the surface water protection area and include: water and wastewater treatment plants, landfills, fuel storage tanks (residential and bulk), medical facilities, and roads. These sources may affect drinking water at the source and could potentially influence sampling results. Samples were collected from post-treated water. Contaminant sources identified within the surface water protection area for this public water system have been considered in order to provide the most conservative evaluation.

This evaluation included all available water sampling data submitted to the Alaska Department of Environmental Conservation (ADEC) by the system operator. As stated previously, the samples were collected from post-treated water. Vulnerability ratings for the water system have been determined by combining the susceptibility of the surface water source with the contaminant risks. The system received a vulnerability rating of **Very High** in five of the six source water assessment categories: bacteria and viruses, nitrates and nitrites, volatile organic chemicals, synthetic organic compounds, and other organic compounds. The category for heavy metals, cyanide and other inorganic chemicals received a **High** rating.

This assessment 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 Alakanuk to protect public health.

DRINKING WATER SYSTEM AND AREA OVERVIEW

Alakanuk (Sec. 14, T030N, R082W, Seward Meridian) is located at the mouth of the Yukon River in the Yukon Delta Wildlife Refuge (ADCED, 2003). The Yup'ik Eskimo community lies about 120 miles northwest of Bethel and 500 miles northwest of Anchorage on the Yukon-Kuskokwim Delta. Alakanuk has a current population of 659 (ADCED, 2003). Average annual precipitation in Alakanuk is 19 inches, including approximately 60 inches of snowfall. Temperatures range from -25 to 79°F.

The public water system is a Class A surface water system that operates year-round and obtains water from the Alakanuk Slough, located west of the village. Water from the river is piped to the village water treatment plant, filtered, treated using coagulation, flocculation, sedimentation, and chlorinated, and stored in a 300,000-gallon storage tank. The majority of households (approximately 90%) are connected to a piped water and sewer system. A small percentage of the population hauls their water from the washeteria and uses the honeybucket system for sewage disposal (ADCED, 2003).

Alakanuk receives its electrical power from AVEC operated by the REA Co-op. The electric company is located near the center of the village. Power generating facilities are fueled by diesel. The City operates sewage and refuse collection services and the local landfill (ADCED, 2003).

Information acquired from a February 1999 sanitary survey for the public water system indicated that the surface water intake is adequately constructed. The water intake is screened and protected against ice buildup and siltation. The average production of the system is 27,000 gallons per day.

The Yukon River, located in the northern portion of the Y-K Delta, discharges up to 500,000 cubic feet per

second of sediment-laden water, and annually deposits up to 100 million metric tons of sediment on the delta and in the Bering Sea (Outdoor Alaska – The Land). The Yukon River has an approximate drainage basin of 330,000 square miles and which extends to a group of lakes located in the Canadian Provinces of British Columbia and the Yukon Territory (Map A of Appendix A).

Alakanuk is located on the Yukon-Kuskokwim (Y-K) Delta. The Y-K Delta is located on the southwest coast of Alaska and primarily consists of lowlands formed by the deposition of fluvial sediment from the Yukon and Kuskokwim Rivers.

The Y-K Delta topography is relatively flat and approximately 40% to 50% of the delta surface is wet (Alaska Geographic Society). The lower delta area generally receives about 20 inches of precipitation annually. Areas of both discontinuous and continuous permafrost are present on the Y-K Delta. Permafrost is often present within 10 feet of ground surface and varies in thickness from 15 feet to 600 feet thick (R&M, 1979b). Thaw bulbs generally persist around areas of standing and flowing water.

ALAKANUK 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 pathways 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. 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 the Alakanuk water intake includes each of these Zones (See Map B 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 Alakanuk surface water 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.

Numerous contaminant sources were identified in the Alakanuk protection area as displayed on Map C1 and C2 of Appendix C and 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 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:

- 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.

Susceptibility of the Surface Water Source – always considered to be "high" (30 points)

+

Adequate Construction of the Intake (0 – 5 Points)

+

Runoff Potential Within Zone B (0 – 5 Points)

+

Dilution Capacity of the Surface Water (0 – 10 Points)

=

Natural Susceptibility
(0 – 50 Points)

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 Water Source

	Score	**Rating**
Minimum Allowable Susceptibility	30	
Intake Construction Adequate	0	
Runoff Potential	2	
Dilution Capacity	0	
Overall Susceptibility	***32***	***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 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Alakanuk 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	42	Very High
Synthetic Organic Chemicals	50	Very High
Other Organic Chemicals	50	Very High

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

Susceptibility of the Surface Water Source

(0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

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

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

Table 4. Alakanuk Water System 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	75	Very High
Synthetic Organic Chemicals	80	Very High
Other Organic Chemicals	80	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The contaminant risk for bacteria and viruses is primarily attributed to the presence of the landfill and wastewater treatment facility in Zone A (see Table 2 – Appendix B).

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. 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).

No positive bacteria counts were reported in recent (previous 5 years) sampling events.

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 remains **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** (See Chart 4 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Several potential contaminant risk sources for nitrates were identified in the protection area for this public water system. The contaminate risk is primary attributed to the presence of landfills in Zone A and C (see Table 3 – Appendix B). Nitrates are very mobile, moving at approximately the same rate as water.

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).

Although low concentrations of nitrates have been reported in recent sampling history, none of the concentrations exceed the MCL of 10 mg/L.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the source, the overall vulnerability of the source to contamination remains **Very High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High** (See Chart 6 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). Numerous potential contaminant sources for volatile organic chemicals were identified in the protection area for this public water system (See Table 4 – Appendix B). The contaminate risk is primary attributed to the presence of numerous bulk fuel terminals in Zones A and C.

Detectable concentrations of trihalomethane were reported in sampling events for this public water system. However, the detectible concentrations of trihalomethane reported in 1998, 2000, 2001 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. See Table 4 in Appendix D for a complete listing.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the source, the overall vulnerability of the source to contamination remains **Very High**.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is **High**. Numerous contaminant sources for heavy metals, cyanide, and other inorganic chemicals were identified in the protection area for this public water system. The contaminate risk is primary attributed to the presence of landfills in Zones A and C (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. 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 8 – 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 with the natural susceptibility of the source, the overall vulnerability of the well to contamination remains **Very High**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Very High**. Several contaminant sources for synthetic organic chemicals were identified in the protection area for this public water system. The contaminant risk is primary attributed to the landfills in Zone A and B and partially attributed to the bulk fuel terminals in Zone A.

Review of historical sampling data found no recent sampling results for synthetic organic chemical contaminants.

After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to synthetic organic chemicals of the source remains **Very High** (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. Several contaminant risk sources for other organic chemicals were identified in the protection area. The contaminate risk is primary attributed to the presence of the landfills in Zones A and C (see Table 7 – Appendix B).

Review of the historical sampling data found no recent sampling results for other organic chemicals.

After combining the contaminant risk with the natural susceptibility of the source, the overall vulnerability to other organic chemicals of the source remains **Very High** (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

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 Alakanuk 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

Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL: http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm

Alaska Geographic Society, 1979, The Yukon Kuskokwim Delta. Alaska Geographic, v. 6, no. 1, 95 p.

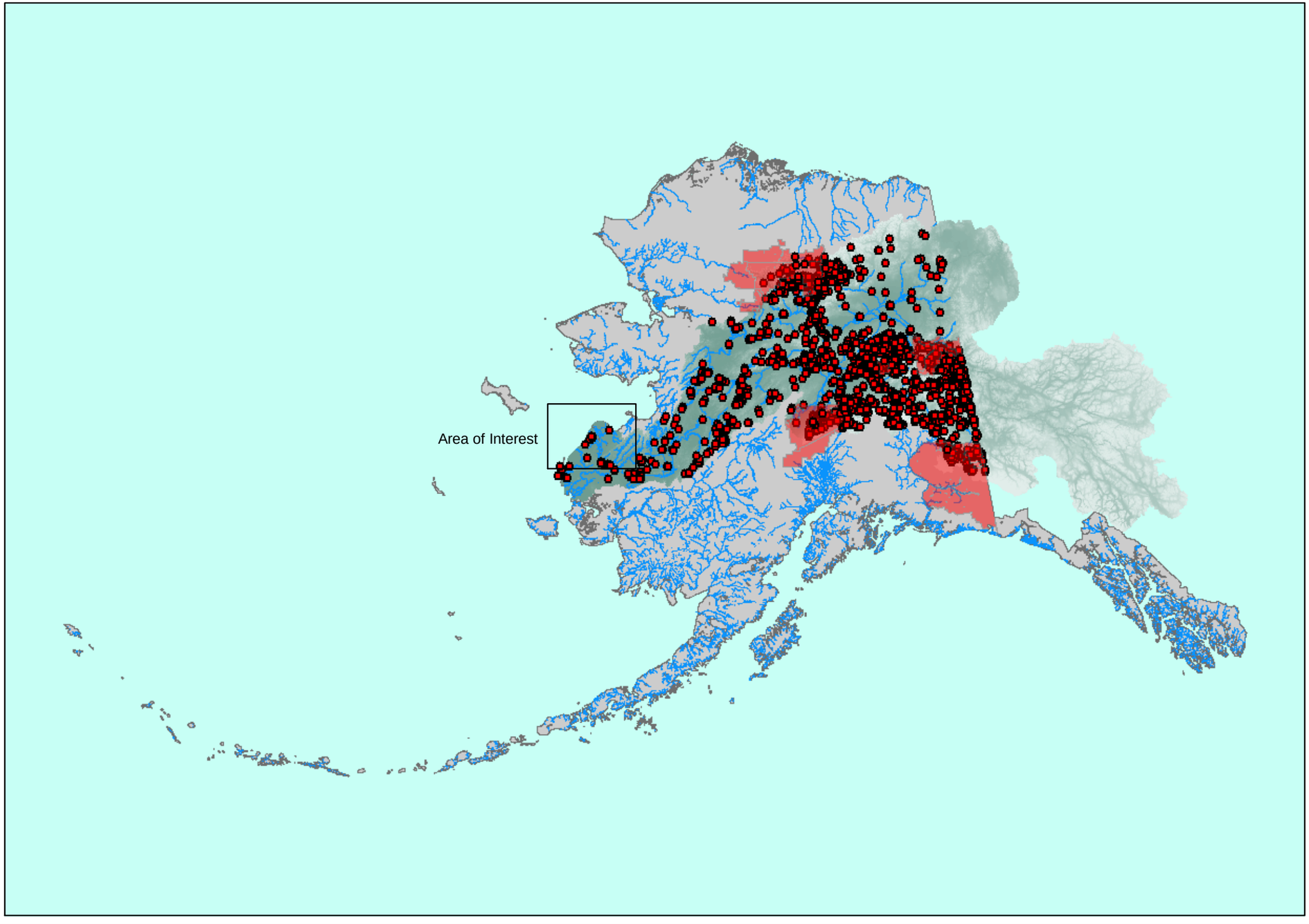
R&M Consultants, Inc., 1979b, Lower Kuskokwim School District School Site Investigation for Tununak, Alaska.

United States Environmental Protection Agency (EPA), 2003 [WWW document]. URL: http://www.epa.gov/safewater/mcl.html .

APPENDIX A

Drinking Water Protection Area Location Map
(Maps A and B)

Map A - Potential Contaminant Sources in the Yukon River Basin



N
W
E
S

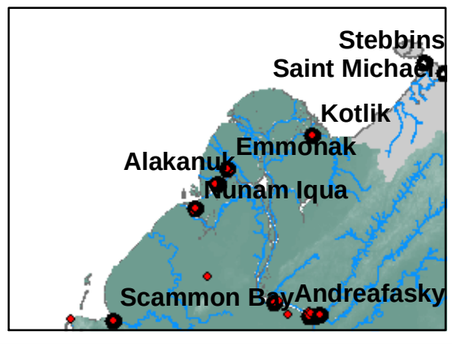
Legend

Potential or known contaminant source

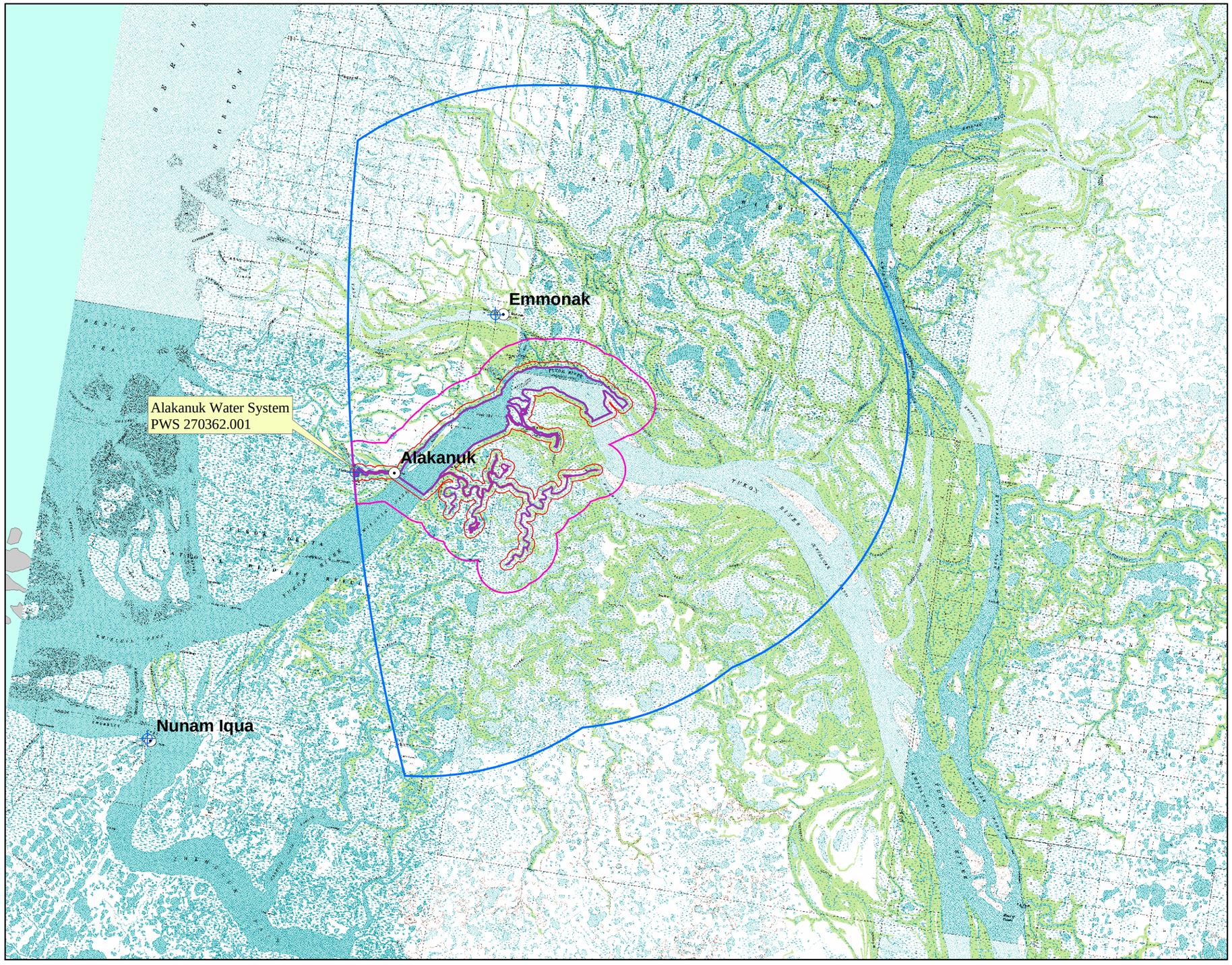
River

Yukon River Basin

0 50 100 200 300 400 Miles



Public Water System for PWS #270362.001 Alakanuk Water System



LEGEND

Public Water System

Surface Water Protection Zones

- Zone A – 1000 Feet from Surface Water
- Zone B – 1 Mile from Surface Water
- Zone C – Watershed Boundary

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft. or as indicated)

Transportation

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

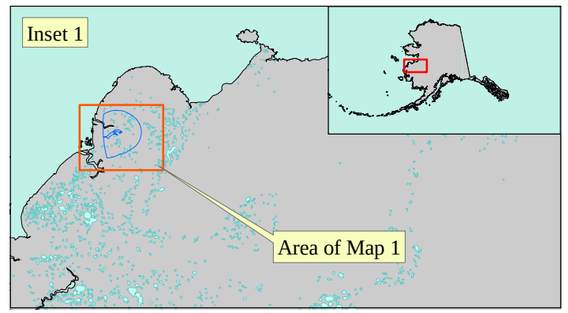
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for
Class A Public Water Systems"

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



N
W E
S

0 1.5 3 6 9 12 Miles

Alakanuk Water System PWS 270362.001
Appendix A Map B

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables 1-7)

Table 1

Contaminant Source Inventory for ***Alakunak Water System***

PWSID 270362.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	C	
Domestic wastewater treatment plants	D05	D05-01	A	C	
Landfills (municipal; Class III)	D51	D51-01	A	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Residential Areas	R01	R01-01	A	C	It is assumed that there are less than 50 acres of residential area located in Z
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	
Tanks, heating oil, residential (above ground)	R08	R08-02	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-03	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-04	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-05	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-06	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-07	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-08	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-10	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-11	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-12	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-13	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-14	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-15	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-16	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-17	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-18	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-19	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-20	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-21	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-22	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-23	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-24	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-25	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-26	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-27	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-28	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-29	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-30	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-31	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-32	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-33	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-34	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-35	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-36	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-37	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-38	A	C	Based on available daBased on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone At.
Tanks, heating oil, residential (above ground)	R08	R08-39	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-40	A	C	Based on available data, it is assumed that 40 residential above ground heating oil tanks are located in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	C	
Water supply wells	W09	W09-01	A	C	
Petroleum product bulk station/terminals	X11	X11-01	A	C	
Petroleum product bulk station/terminals	X11	X11-02	A	C	
Highways and roads, dirt/gravel	X24	X24-01	A	C	It is assumed that there are less than 20 roads located in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals nursing homes)	X40	X40-01	A	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	B	C	Alakunuk Power Plant. ADEC RecKey # - 1994250109301. Site status is cl with no ranked priority. Former 10,000 gallon fuel spill. Estimated 98% recovered within a week of spill.
Airports	X14	X14-01	B	C	Alakanuk landing strip
Laundromats without dry cleaning	C22	C22-02	C	C	
Laundromats without dry cleaning	C22	C22-03	C	C	
Motor /motor vehicle repair shops	C31	C31-01	C	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	C	C	
Domestic wastewater treatment plants	D05	D05-02	C	C	
Landfills (municipal; Class III)	D51	D51-02	C	C	Emmonak landfill. Domestic and sefood processing wastes
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-17	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-18	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-20	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-21	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-22	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-23	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-24	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-25	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-26	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-27	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-28	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-29	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-30	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-31	C	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, heating oil, nonresidential (aboveground)	T14	T14-32	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-33	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-34	C	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-35	C	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	C	C	Emmonak fuel system. ADEC RecKey # - 1994250115702. Site status is inactive with low priority. Fuel was released from pipeline at tank farm. No other recent data availble.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	C	C	AKARNG Emmonak FSA.. ADEC RecKey # - 1995250114401. Site status i inactive with lmedium priority. Petroleum contamination. Last corresponde from ADEC was recommendation for Voluntary Cleanup Program
Water supply wells	W09	W09-02	C	C	
Petroleum product bulk station/terminals	X11	X11-03	C	C	
Petroleum product bulk station/terminals	X11	X11-04	C	C	
Petroleum product bulk station/terminals	X11	X11-05	C	C	
Petroleum product bulk station/terminals	X11	X11-06	C	C	
Petroleum product bulk station/terminals	X11	X11-07	C	C	
Petroleum product bulk station/terminals	X11	X11-08	C	C	
Petroleum product bulk station/terminals	X11	X11-09	C	C	
Petroleum product bulk station/terminals	X11	X11-10	C	C	
Airports	X14	X14-02	C	C	Emmonak landing strip
Boat yards and marinas	X15	X15-01	C	C	
Electric power generation (fossil fuels)	X36	X36-01	C	C	
Firehouses	X38	X38-01	C	C	
Medical/veterinary facilities (doctor or dentist offices, hospitals nursing homes)	X40	X40-02	C	C	

Table 2

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

PWSID 270362.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	C	High	C	
Landfills (municipal; Class III)	D51	D51-02	C	High	C	Emmonak landfill. Domestic and sefood processing wastes

Table 3

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

PWSID 270362.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	C	High	C	
Landfills (municipal; Class III)	D51	D51-02	C	Very High	C	Emmonak landfill. Domestic and sefood processing wastes

Table 4

Contaminant Source Inventory and Risk Ranking for Alakunak Water System
Sources of Volatile Organic Chemicals

PWSID 270362.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	Low	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Low	C	
Tanks, heating oil, residential (above ground)	R08	R08-02	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-02	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-03	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-04	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-05	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-06	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-07	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-08	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-10	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-11	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-12	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-13	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-14	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-15	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-16	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-17	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-18	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-19	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-20	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-21	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-22	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-23	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-24	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-25	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-26	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-27	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-28	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-29	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-30	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-31	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-32	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-33	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-34	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-35	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-36	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-37	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-38	A	Low	C	Based on available daBased on available data, it is assumed that 40 residenti above ground heating oil tanks are located in Zone At.
Tanks, heating oil, residential (above ground)	R08	R08-39	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-40	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	
Petroleum product bulk station/terminals	X11	X11-02	A	Very High	C	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	C	Low	C	
Petroleum product bulk station/terminals	X11	X11-03	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-04	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-05	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-06	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-07	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-08	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-09	C	Very High	C	
Petroleum product bulk station/terminals	X11	X11-10	C	Very High	C	

Table 5

Contaminant Source Inventory and Risk Ranking for Alakunak Water System

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 270362.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Tanks, heating oil, residential (above ground)	R08	R08-02	A	Low	C	Based on available data, it is assumed that 40 residential above ground heati oil tanks are located in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-02	A	Low	C	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Landfills (municipal; Class III)	D51	D51-02	C	High	C	Emmonak landfill. Domestic and sefood processing wastes
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	C	Low	C	

Table 6

Contaminant Source Inventory and Risk Ranking for Alakunak Water System
Sources of Synthetic Organic Chemicals

PWSID 270362.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	
Petroleum product bulk station/terminals	X11	X11-02	A	Low	C	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	
Landfills (municipal; Class III)	D51	D51-02	C	Very High	C	Emmonak landfill. Domestic and sefood processing wastes

Table 7

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

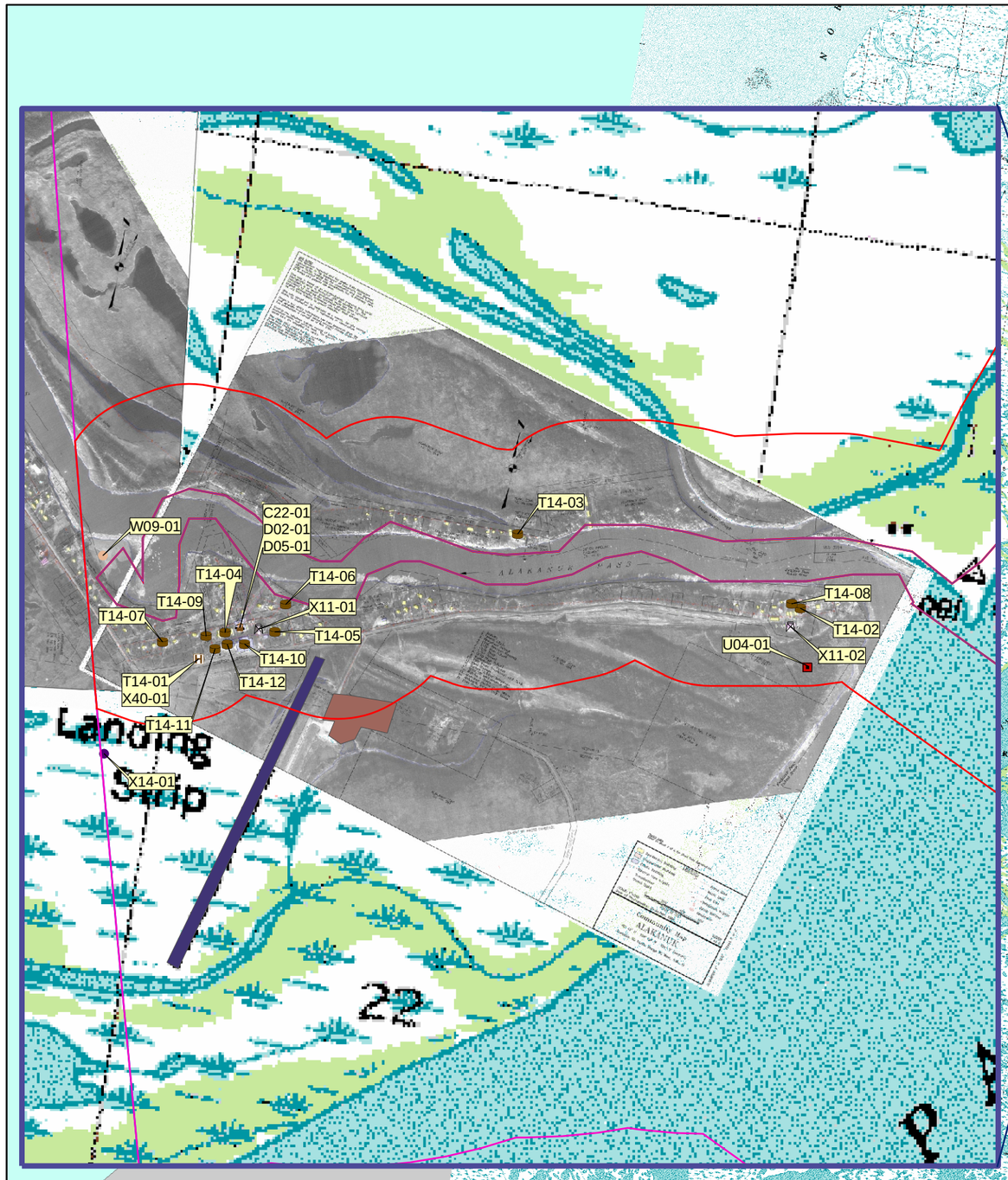
PWSID 270362.001

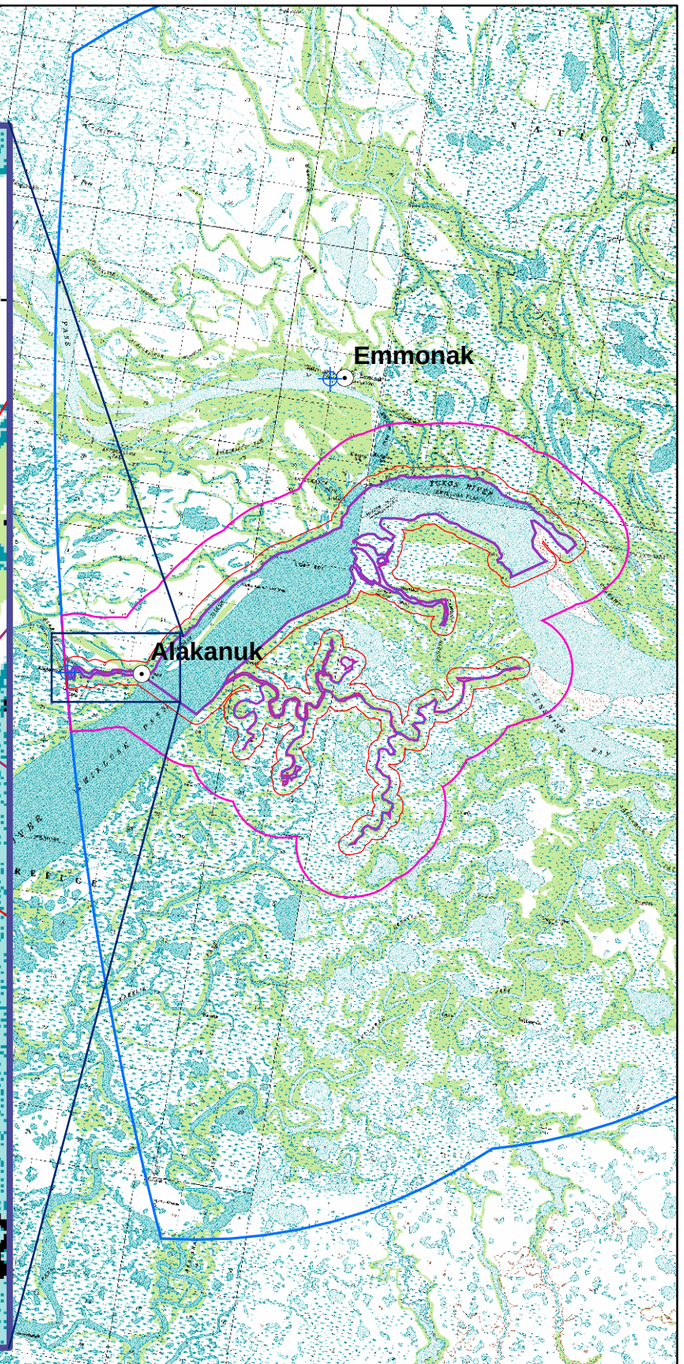
Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Alakanuk landfill. Junked vehicles, animal and fish wastes
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	
Petroleum product bulk station/terminals	X11	X11-02	A	High	C	
Landfills (municipal; Class III)	D51	D51-02	C	Very High	C	Emmonak landfill. Domestic and sefood processing wastes
Petroleum product bulk station/terminals	X11	X11-03	C	High	C	
Petroleum product bulk station/terminals	X11	X11-04	C	High	C	
Petroleum product bulk station/terminals	X11	X11-05	C	High	C	
Petroleum product bulk station/terminals	X11	X11-06	C	High	C	
Petroleum product bulk station/terminals	X11	X11-07	C	High	C	
Petroleum product bulk station/terminals	X11	X11-08	C	High	C	
Petroleum product bulk station/terminals	X11	X11-09	C	High	C	
Petroleum product bulk station/terminals	X11	X11-10	C	High	C	
Boat yards and marinas	X15	X15-01	C	High	C	
Electric power generation (fossil fuels)	X36	X36-01	C	High	C	

APPENDIX C

Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps C and D)

Public Water System for PWS #270362.001 Alakanuk Water System
Showing Potential and Existing Sources of Contamination





LEGEND

Public Water System

Surface Water Protection Zones

- Zone A – 1000 Feet from Surface Water
- Zone B – 1 Mile from Surface Water
- Zone C – Watershed Boundary

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft. or as indicated)

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

- Laundromats w/o dry cleaning (C22)
- Motor vehicle repair shop (C31)
- Sewage Lagoon (D02)
- Waste Water Treatment Facility (D05)
- Tanks, heating oil, nonresidential (aboveground) (T14)
- Reservoir/Water Supply (W09)
- Fuel Storage >500 gallons (X11)
- Harbor/Dock/Port (X15)
- Power Generation Facility (X36)
- Fire Station (X38)
- Hospital/Clinic/ER (X40)
- Landfills (Municipal, Class III) (D51)
- Airport/Landing Strip (X14)

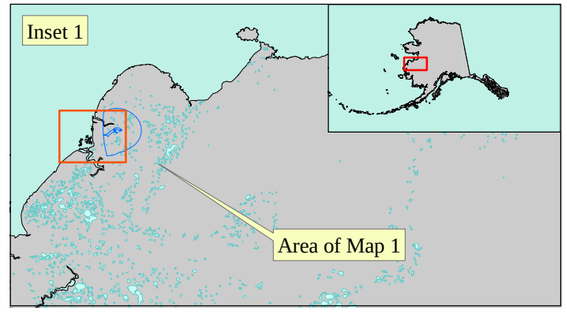
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for
Class A Public Water Systems"

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

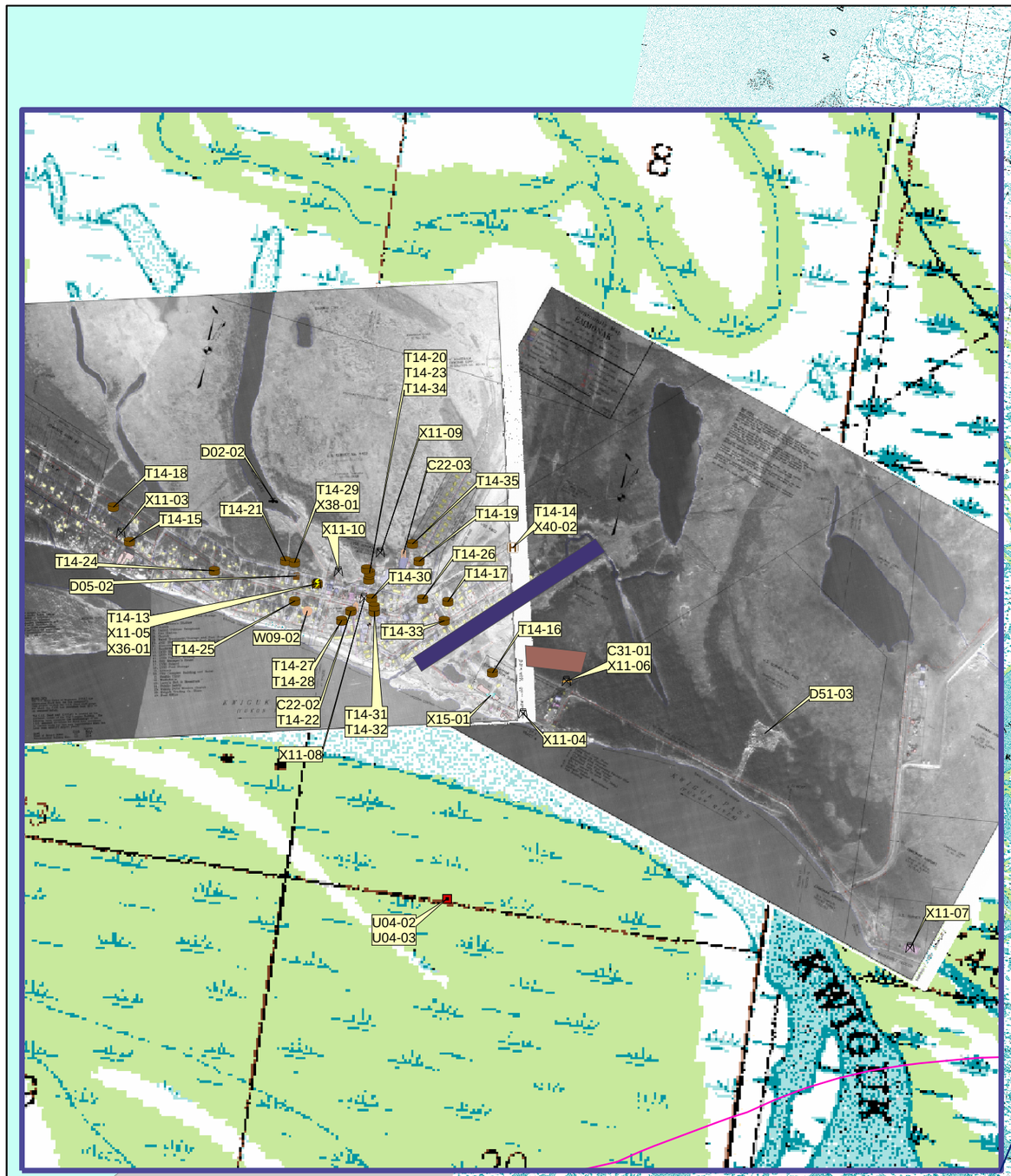


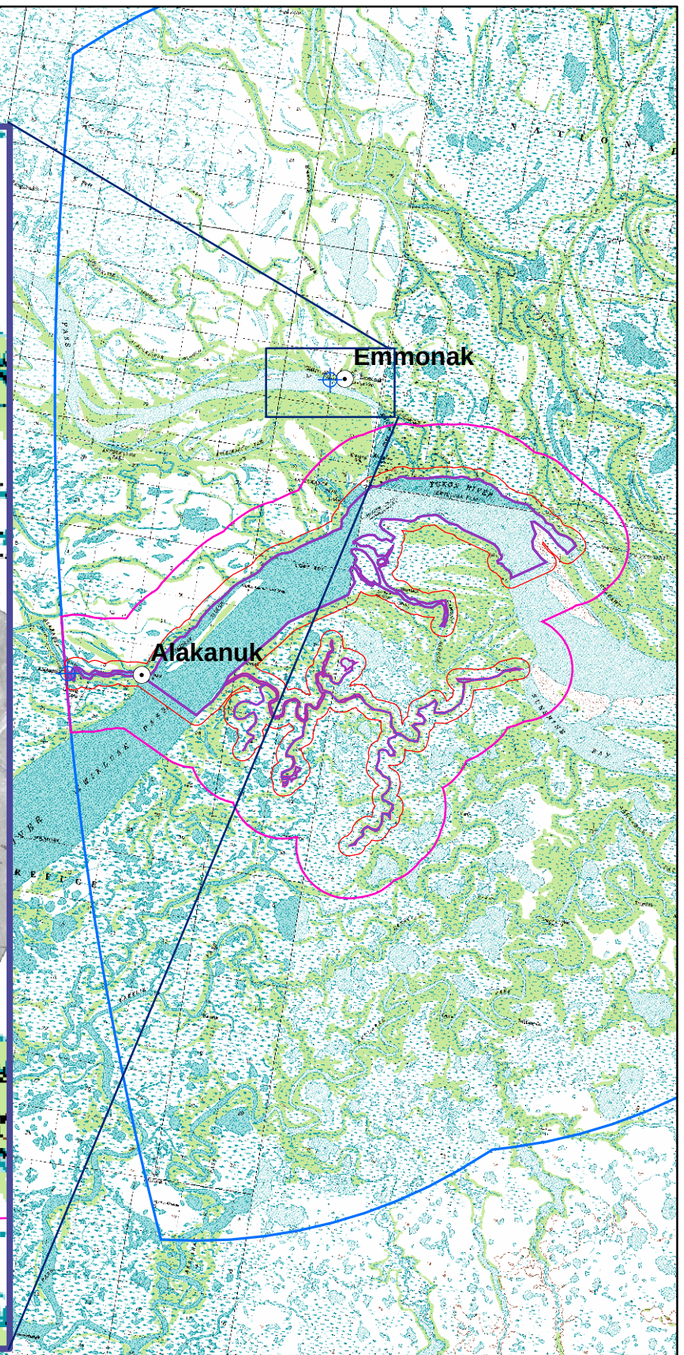
N W E S

0 1 2 4 6 8 Miles

Alakanuk Water System PWS 270362.001
Appendix C Map C1

Public Water System for PWS #270362.001 Alakanuk Water System
Showing Potential and Existing Sources of Contamination





LEGEND

Public Water System Well

Surface Water Protection Zones

- Zone A – 1000 Feet from Surface Water
- Zone B – 1 Mile from Surface Water
- Zone C – Watershed Boundary

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft. or as indicated)

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

- Laundromats w/o dry cleaning (C22)
- Motor vehicle repair shop (C31)
- Sewage Lagoon (D02)
- Waste Water Treatment Facility (D05)
- Tanks, heating oil, nonresidential (aboveground) (T14)
- Reservoir/Water Supply (W09)
- Fuel Storage >500 gallons (X11)
- Harbor/Dock/Port (X15)
- Power Generation Facility (X36)
- Fire Station (X38)
- Hospital/Clinic/ER (X40)
- Landfills (Municipal, Class III) (D51)
- Airport/Landing Strip (X14)

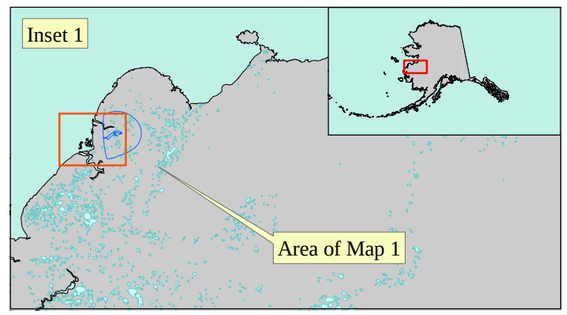
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities
Federal Emergency Management Agency (FEMA)

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC published document:
"Alaska Drinking Water Protection Progarm - Guidance Manual for
Class A Public Water Systems"

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



N
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0 1 2 4 6 8 Miles

Alakanuk Water System PWS 270362.001
Appendix C Map C2

APPENDIX D

Vulnerability Analysis and Contaminant Risks
(Charts 1-13)

Chart 1. Susceptibility of the Surface Water Source - Alakanuk Water System (PWS No. 270362.001)

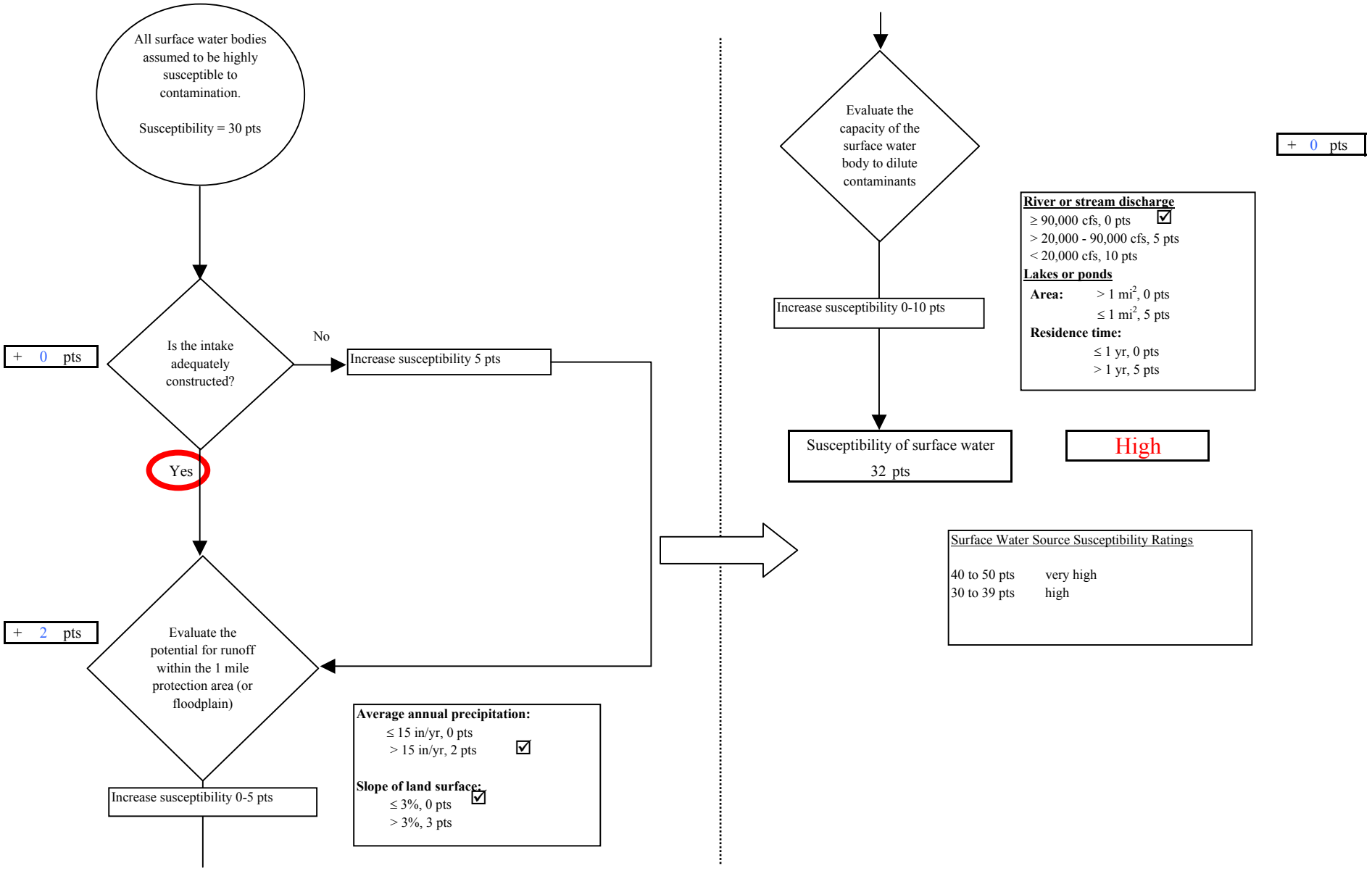
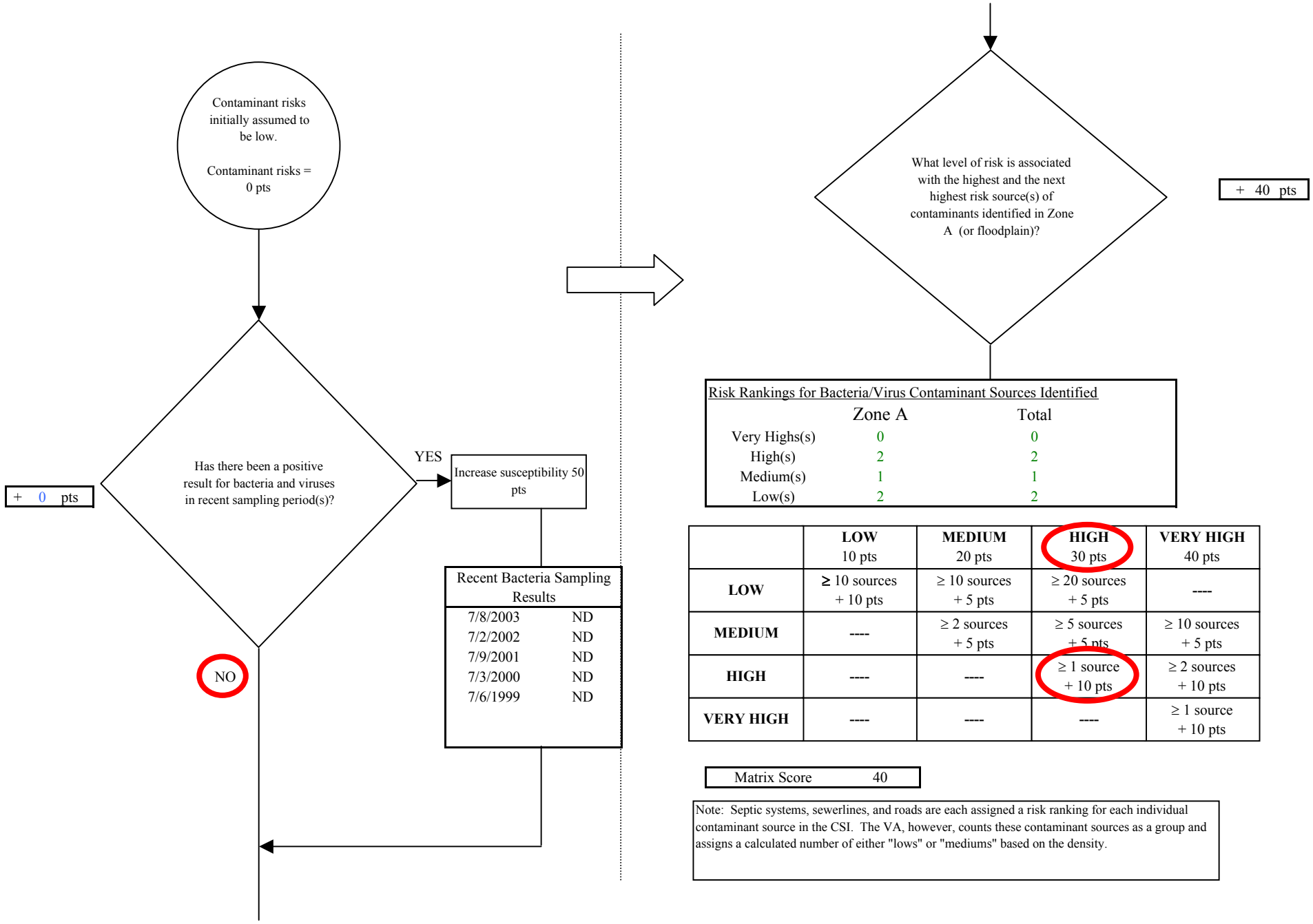


Chart 2. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Bacteria & Viruses



Risk Rankings for Bacteria/Virus Contaminant Sources Identified

	Zone A	Total
Very Highs(s)	0	0
High(s)	2	2
Medium(s)	1	1
Low(s)	2	2

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

Matrix Score 40

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

Chart 2. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Bacteria & Viruses

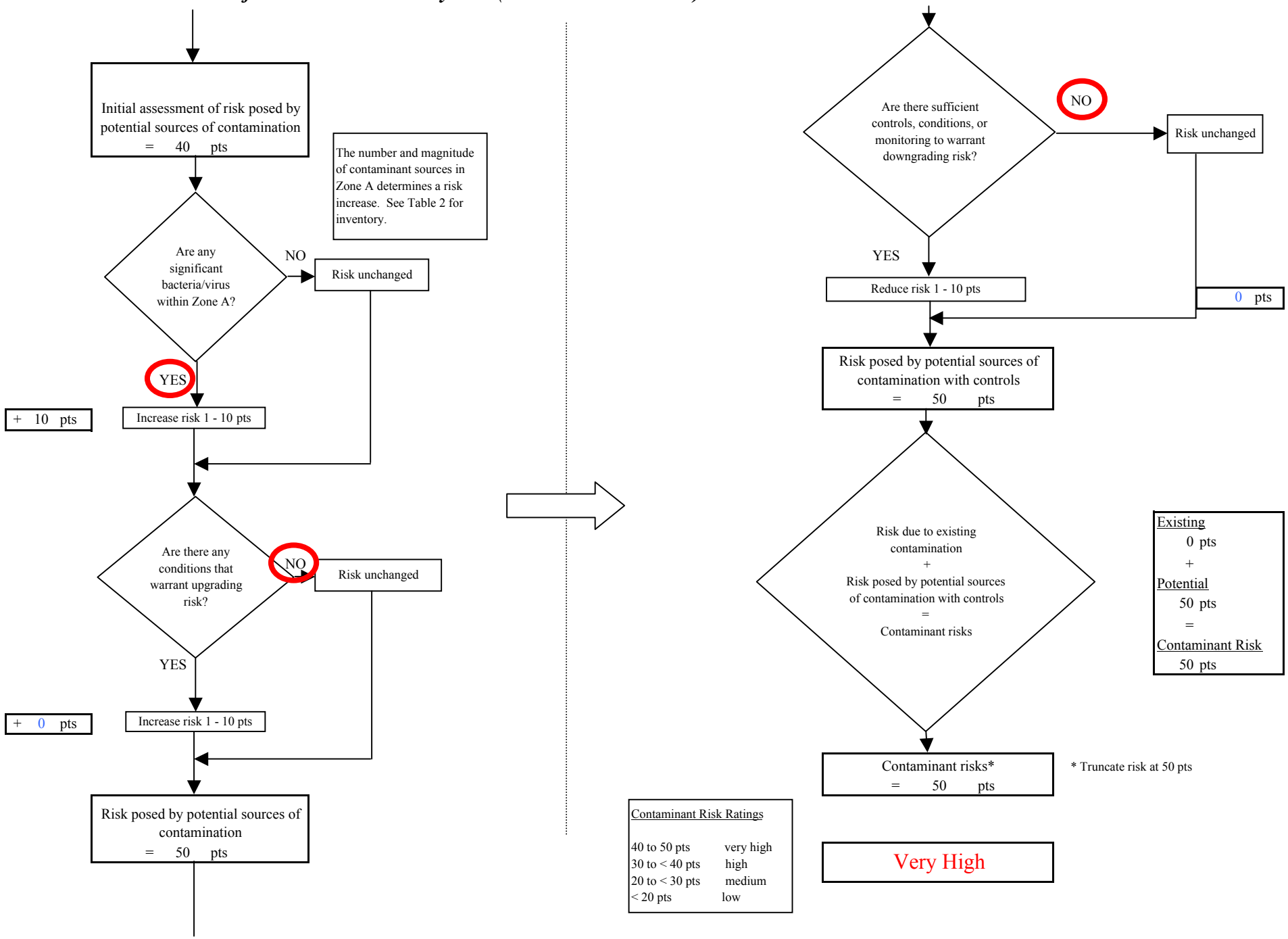


Chart 3. Vulnerability analysis for Alakanuk Water System (PWS No. 270362.001) - Bacteria & Viruses

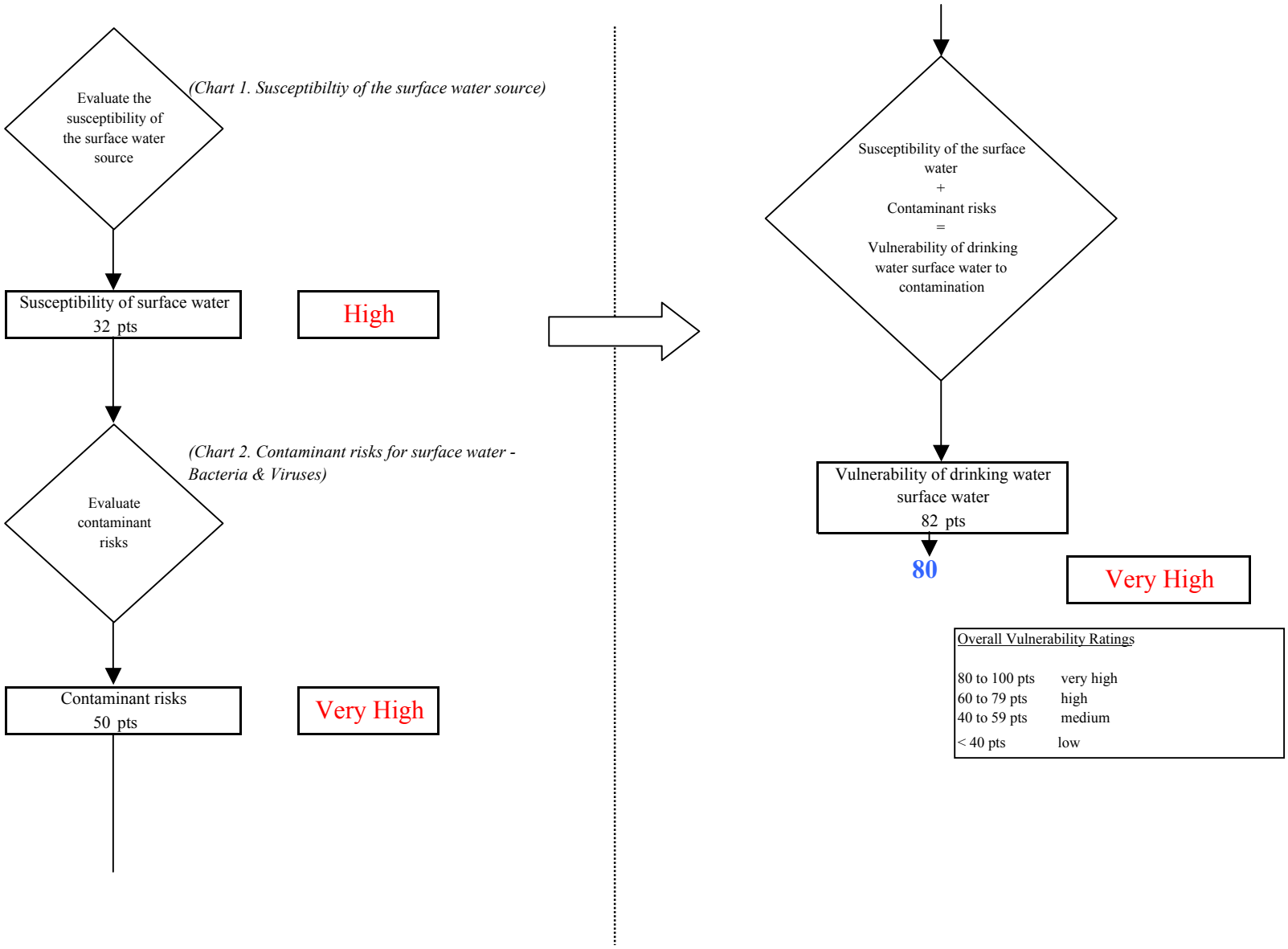


Chart 4. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Nitrates and Nitrites

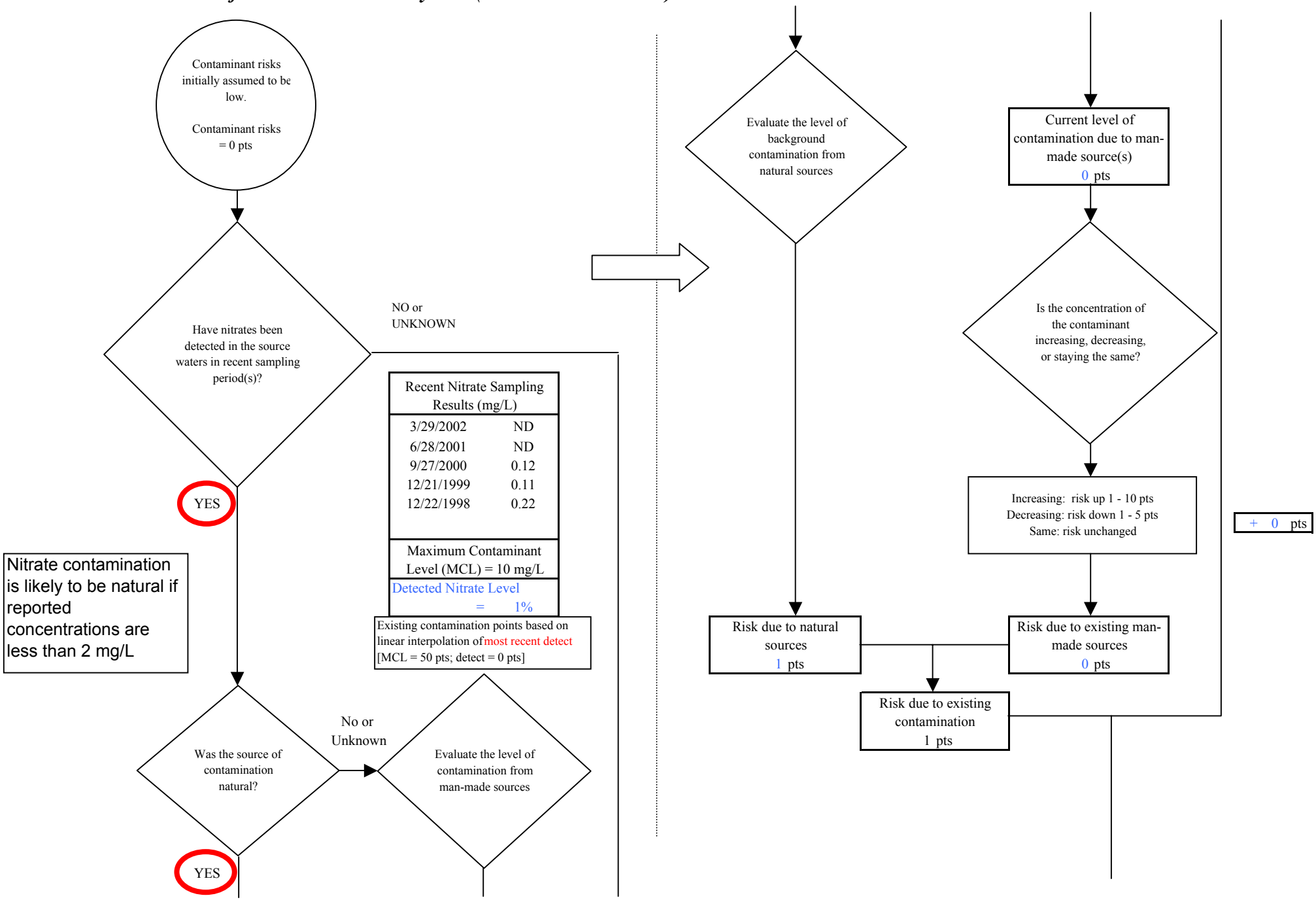


Chart 4. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Nitrates and Nitrites

+ 40 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

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

Are any significant nitrate/nitrite sources in Zone A?

NO → Risk unchanged → + 10 pts

YES → Increase risk 1 - 10 pts

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 3 for inventory.

Risk Levels for Nitrate/Nitrite Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	1	0	1
High(s)	1	0	1
Medium(s)	1		1
Low(s)	2		2

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

Matrix Score 40

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

Chart 4. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Nitrates and Nitrites

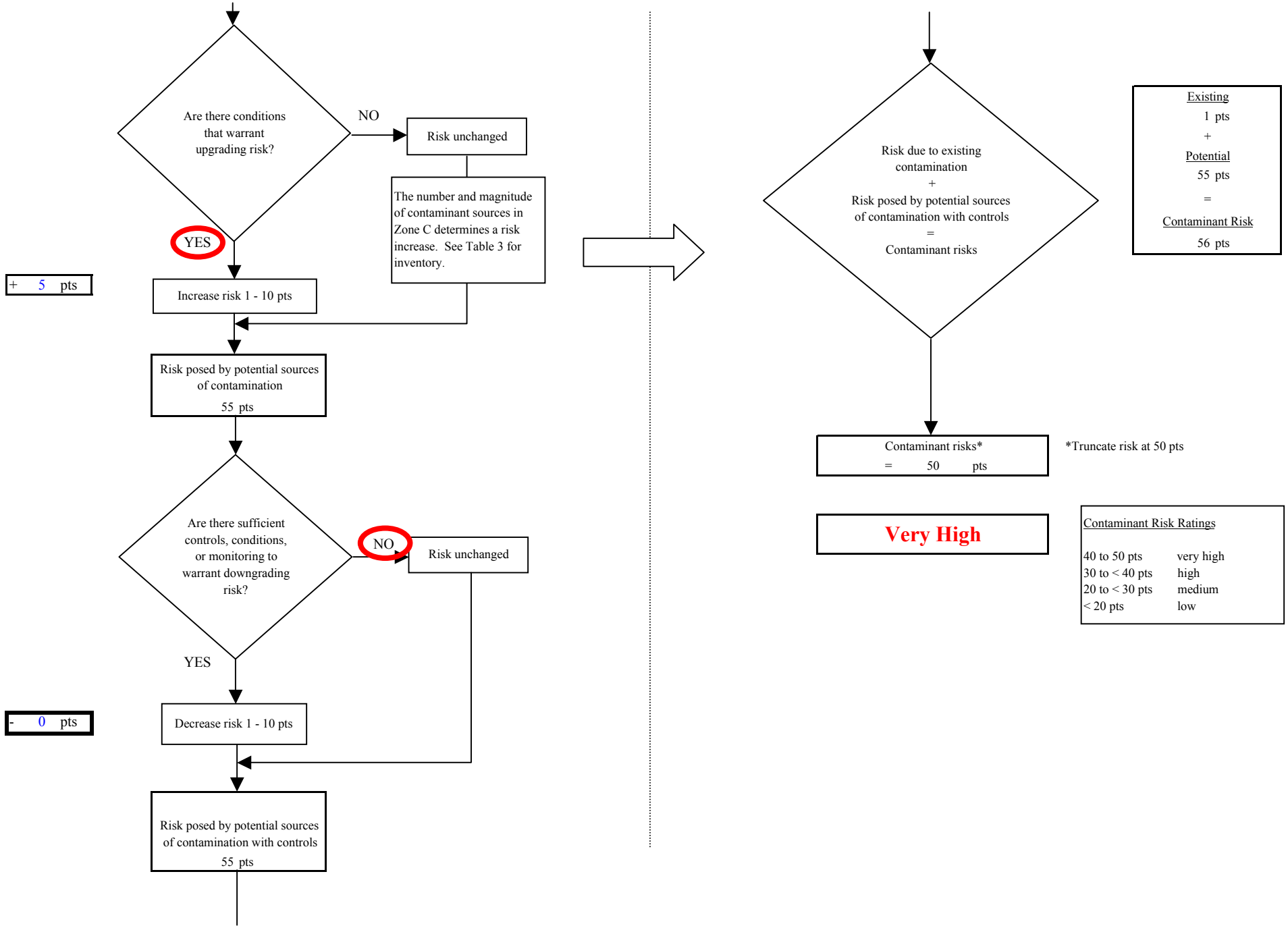


Chart 5. Vulnerability analysis for Alakanuk Water System (PWS No. 270362.001) - Nitrates and Nitrites

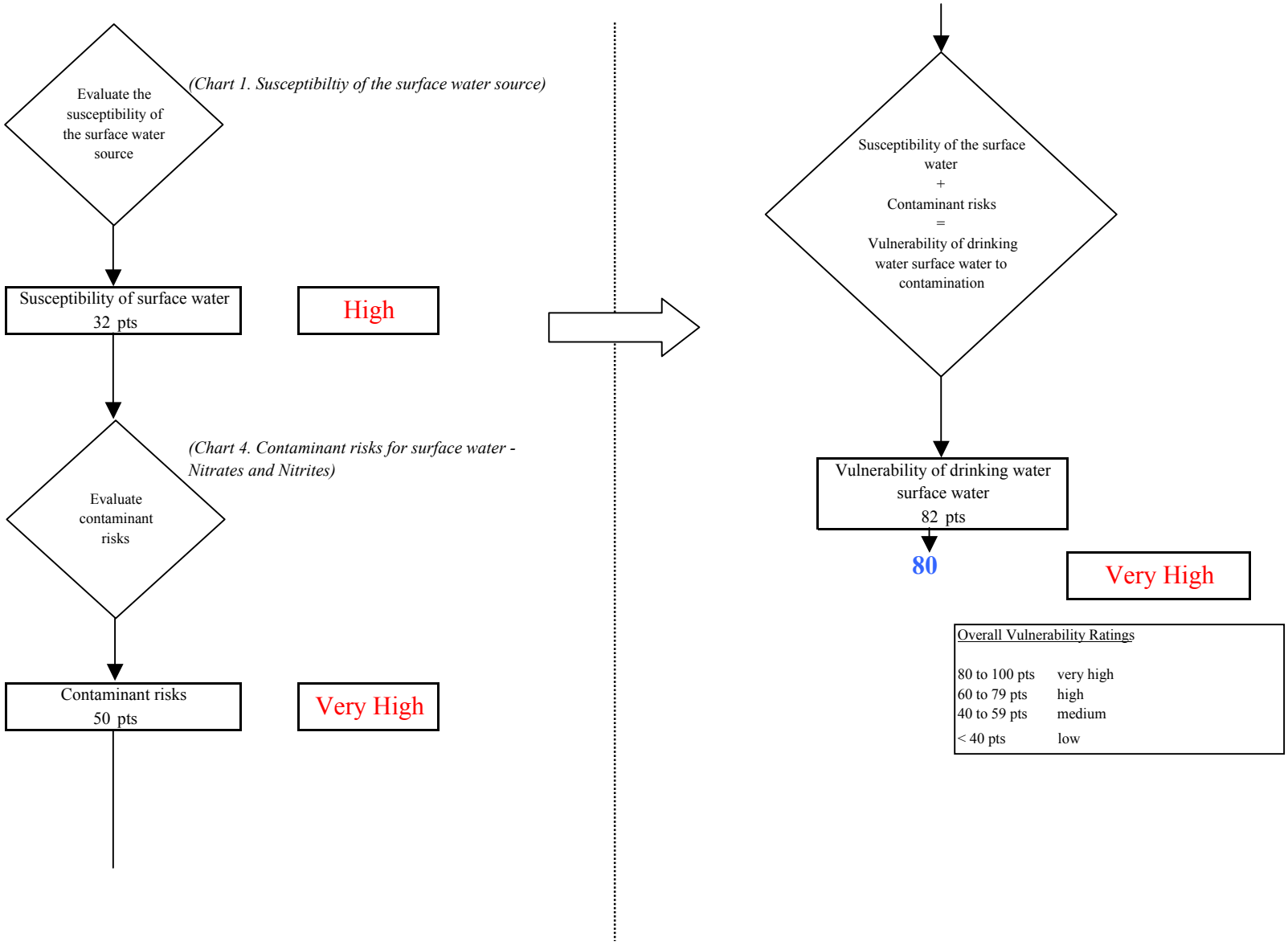


Chart 6. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Volatile Organic Chemicals

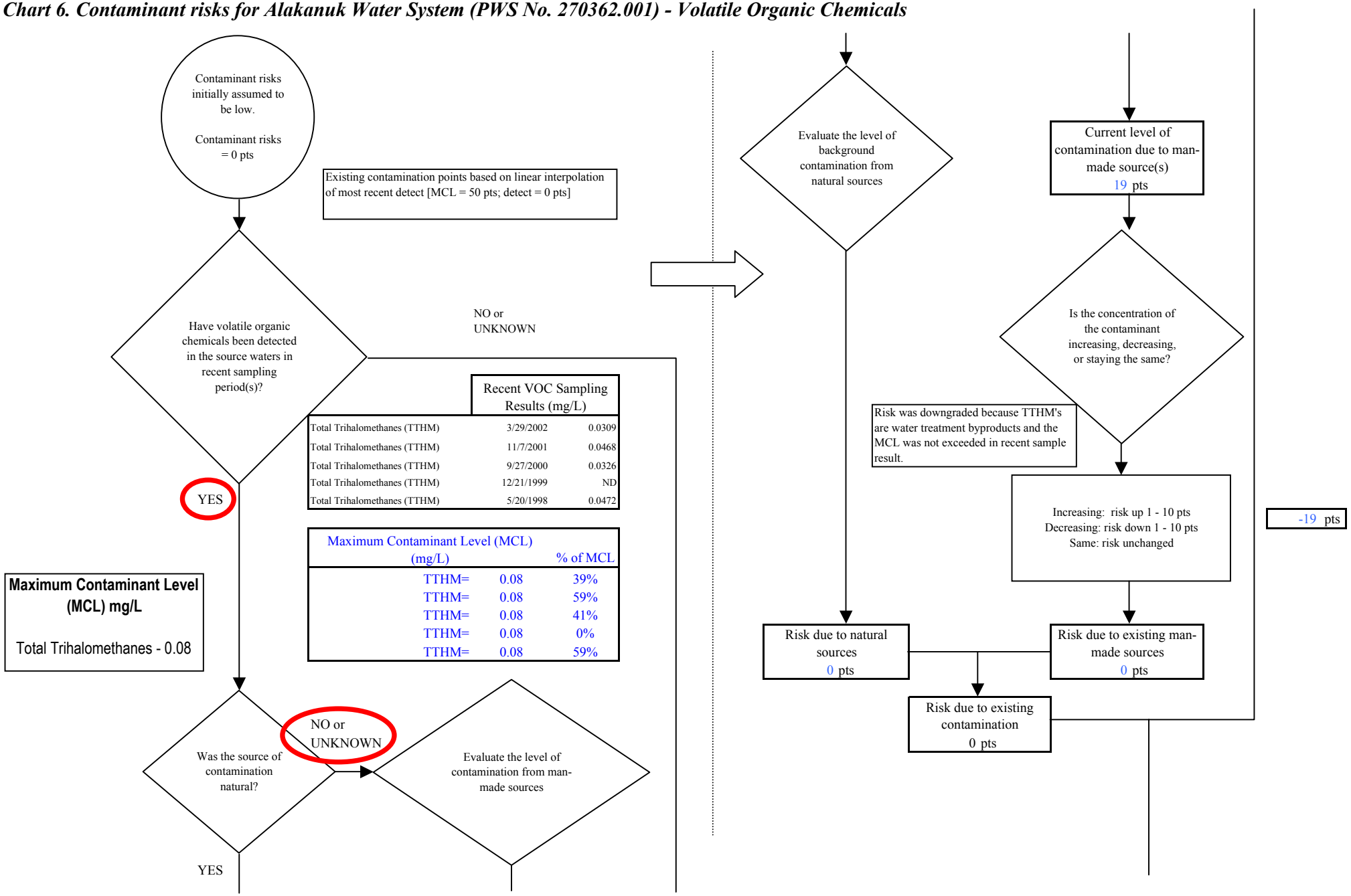


Chart 6. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Volatile Organic Chemicals

+ 50 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A and B? (see Risk Matrix below)

Risk Levels for VOC Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	2	0	2
High(s)	0	0	0
Medium(s)	0		0
Low(s)	58		58

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

Matrix Score 50

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

Initial assessment of risk posed by potential sources of contamination = 50 pts

Are any significant VOC sources in Zone A?

NO

Risk unchanged

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 4 for inventory.

YES

Increase risk 1 - 10 pts

+ 10 pts

Chart 6. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Volatile Organic Chemicals

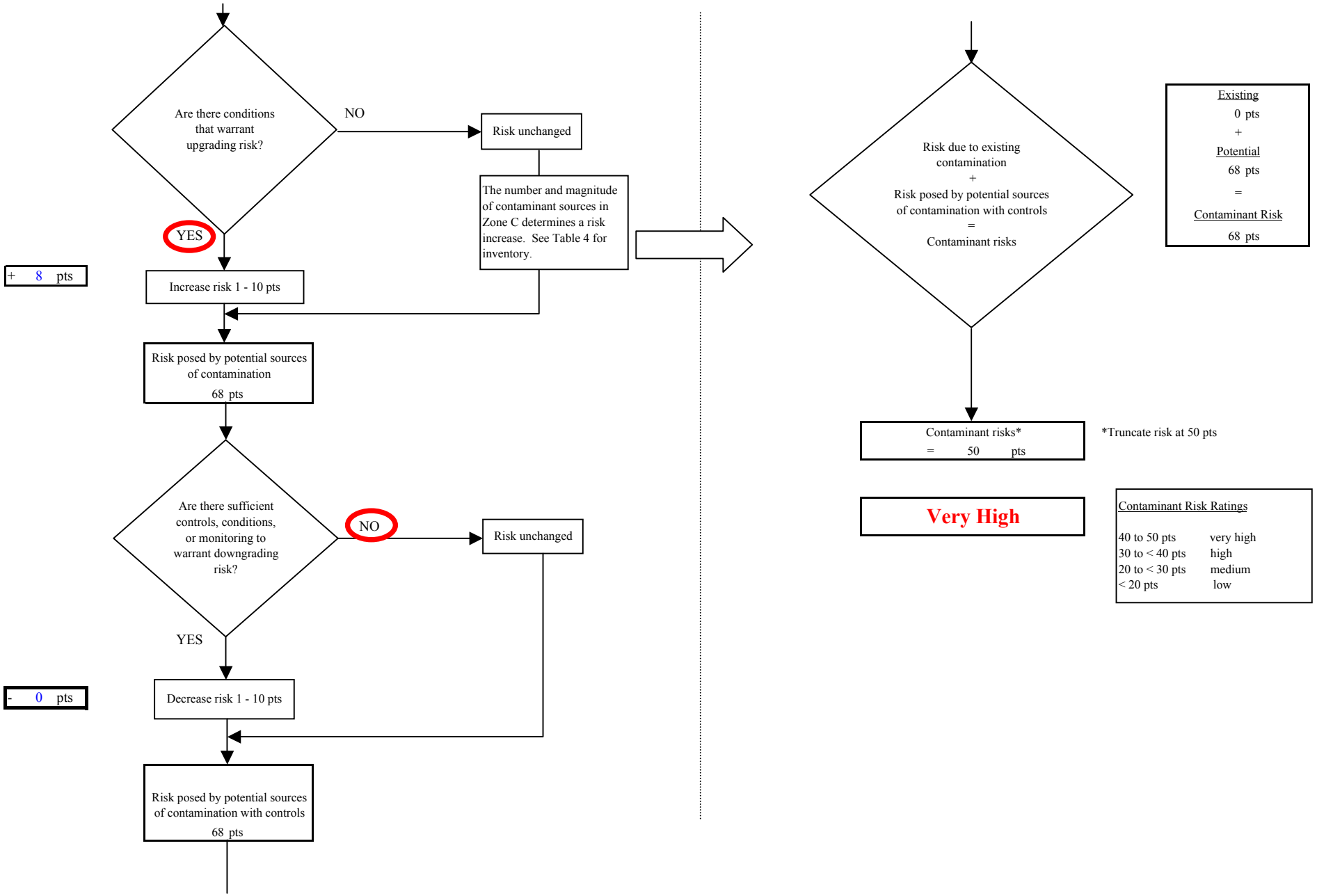


Chart 7. Vulnerability analysis for Alakanuk Water System (PWS No. 270362.001) - Volatile Organic Chemicals

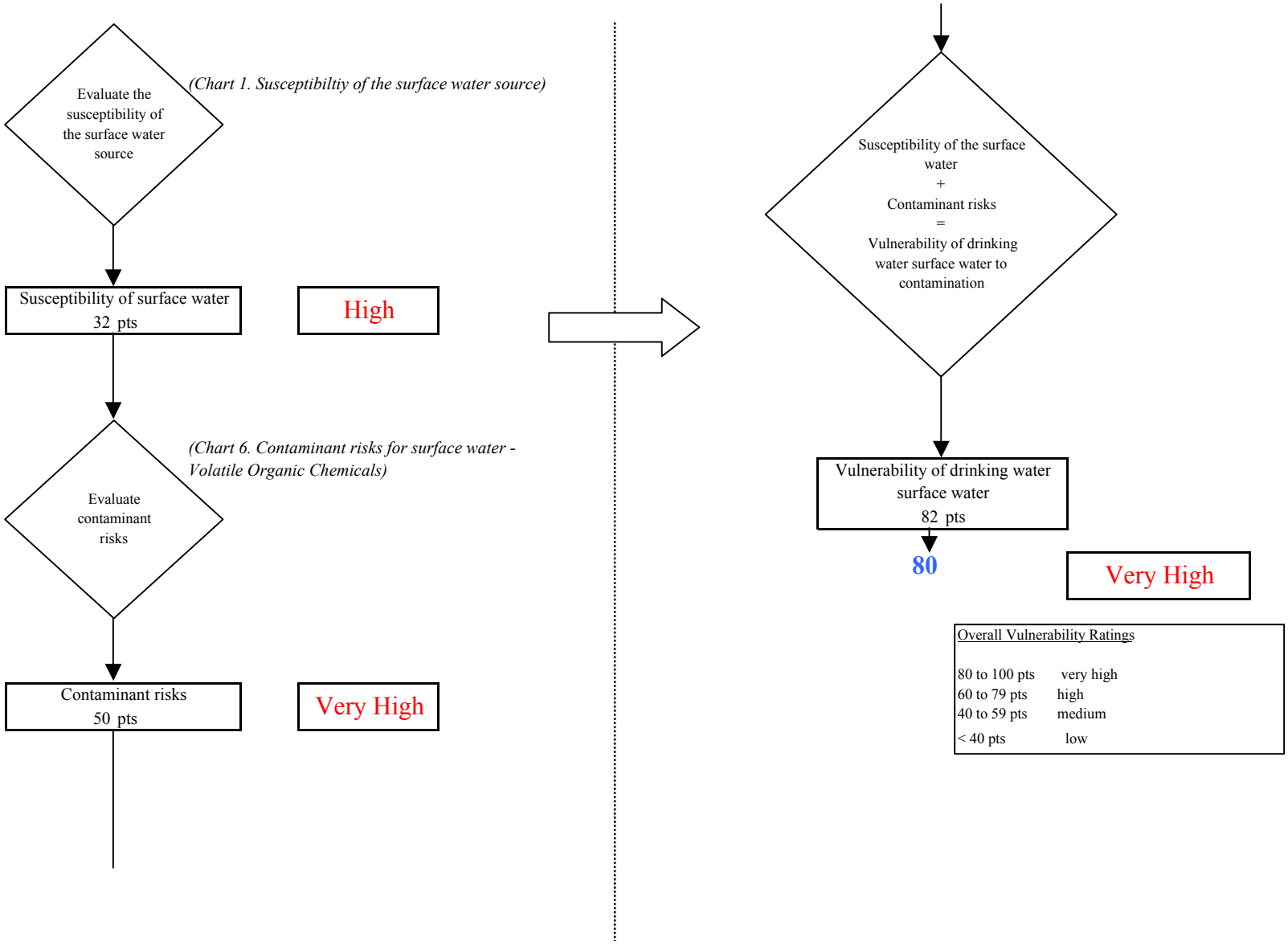


Chart 8. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

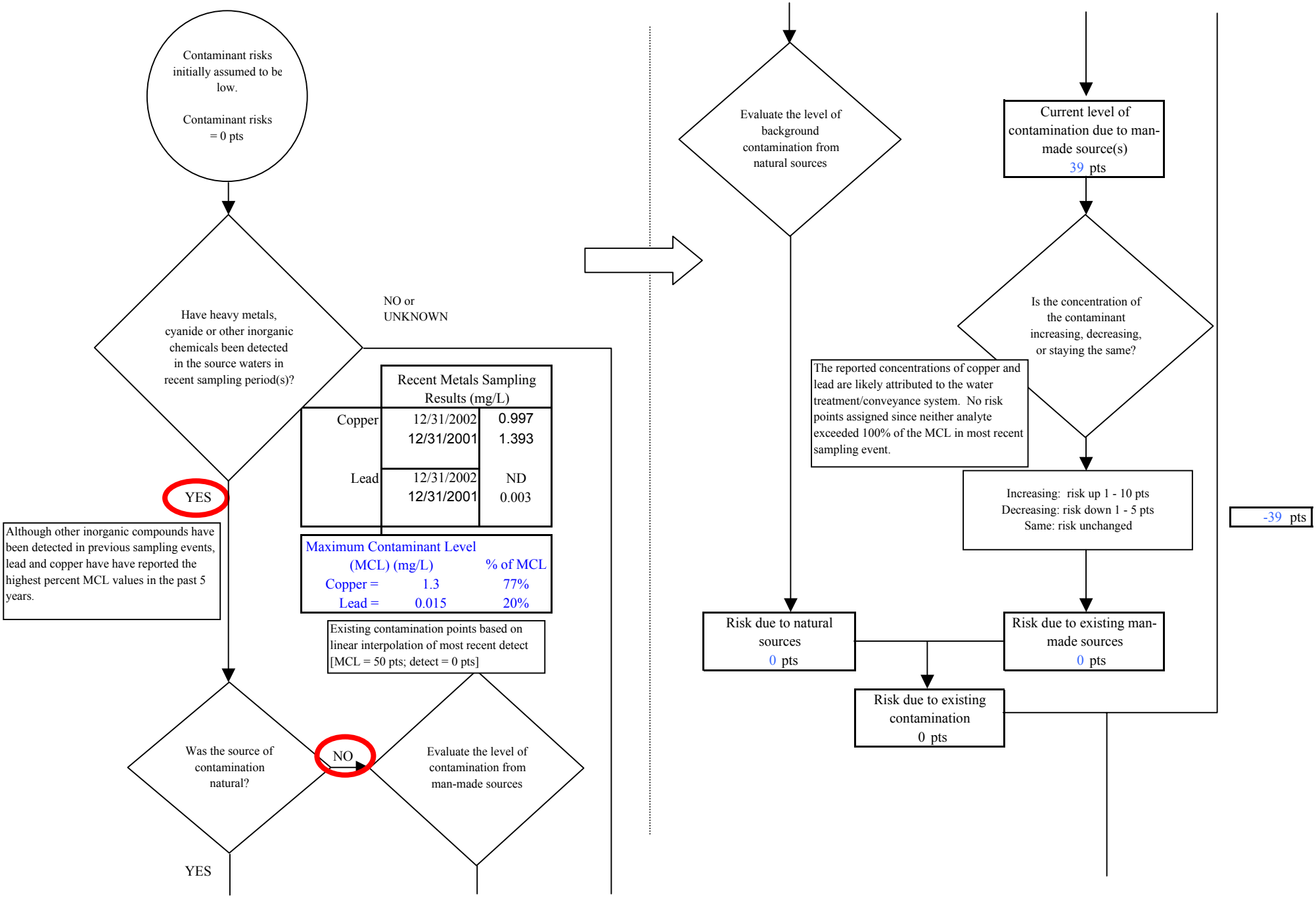
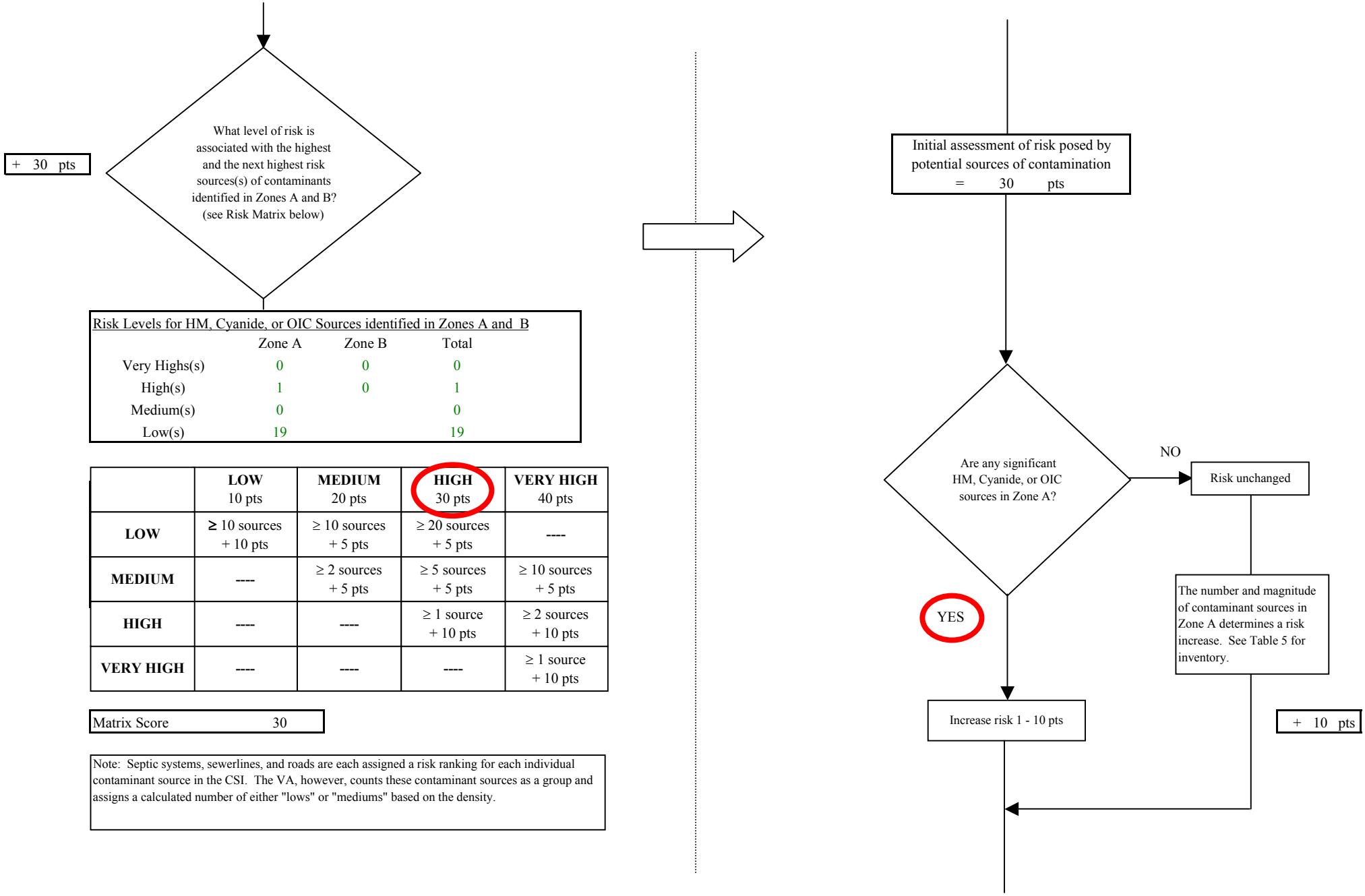


Chart 8. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals



Risk Levels for HM, Cyanide, or OIC Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0		0
Low(s)	19		19

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

Matrix Score 30

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

Chart 8. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

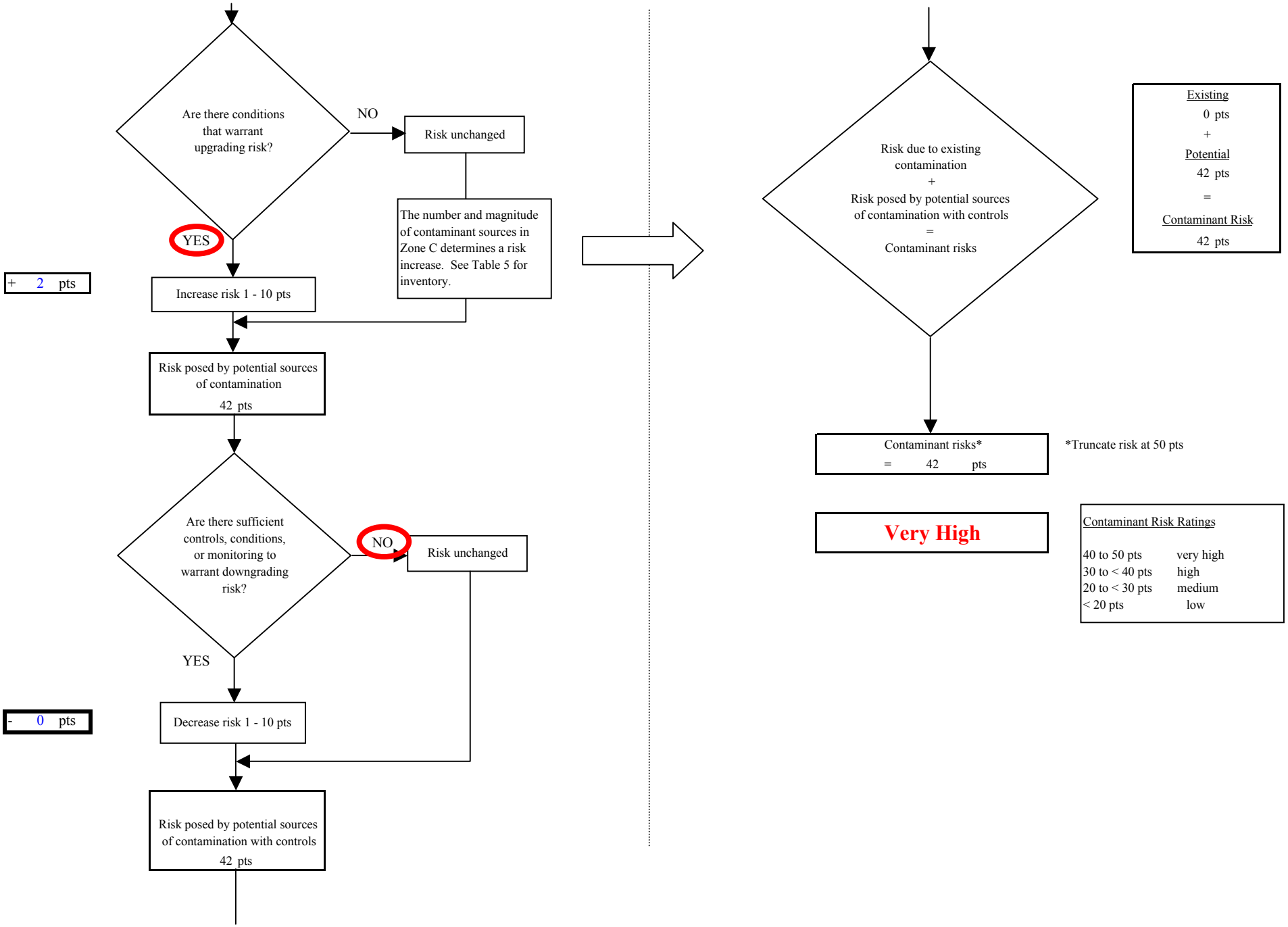


Chart 9. Vulnerability analysis for Alakanuk Water System (PWS No. 270362.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

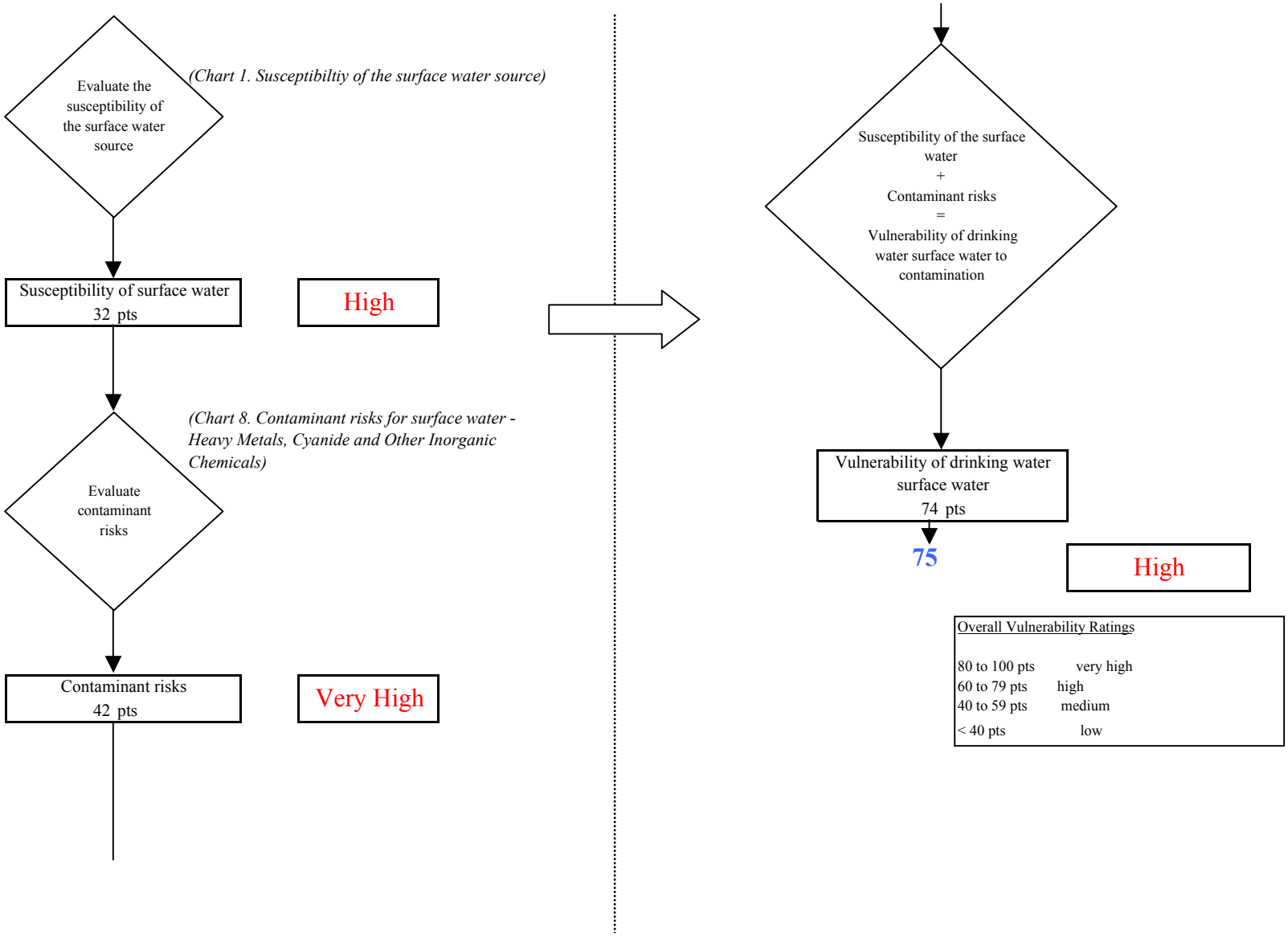


Chart 10. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Synthetic Organic Chemicals

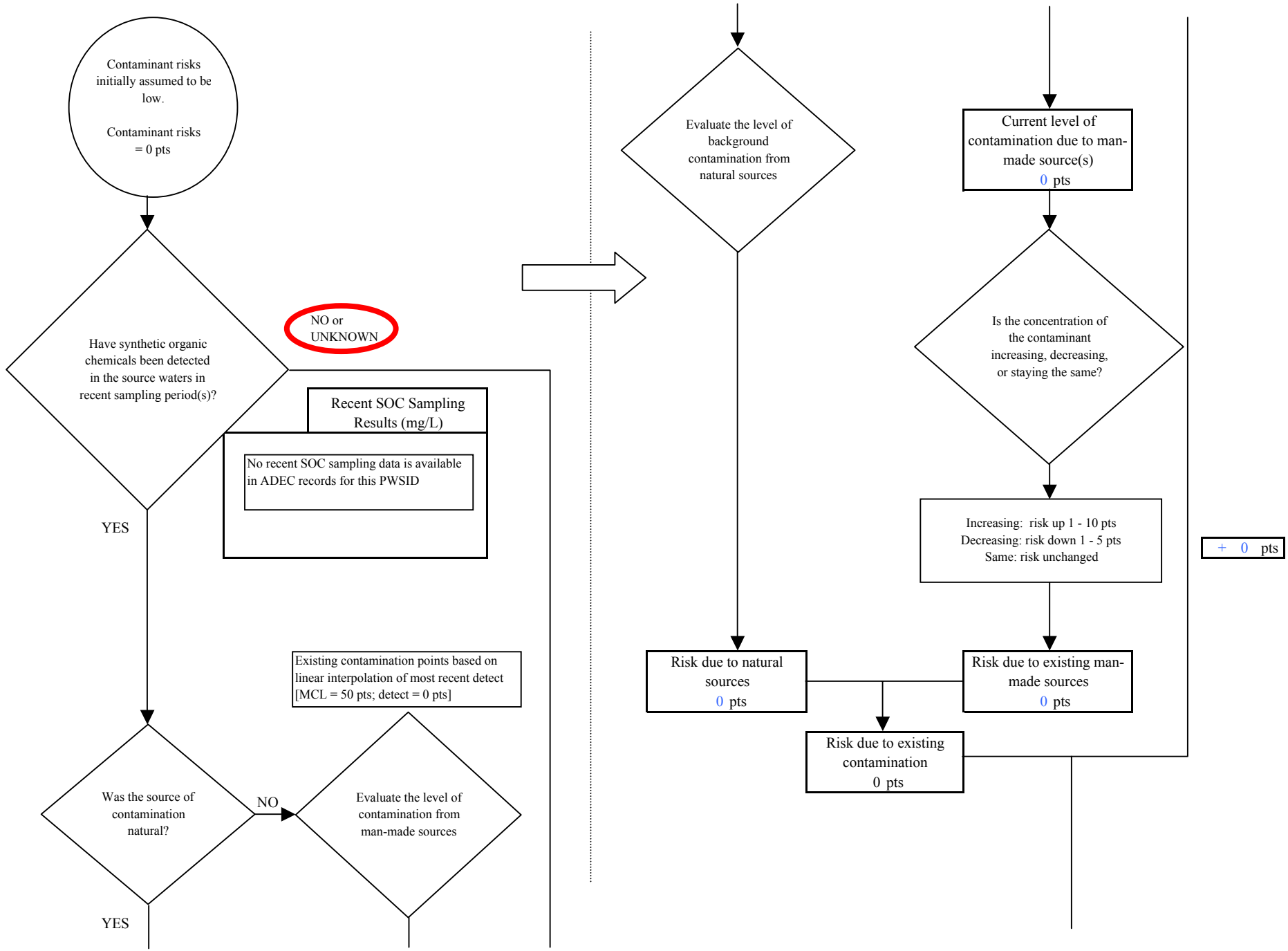
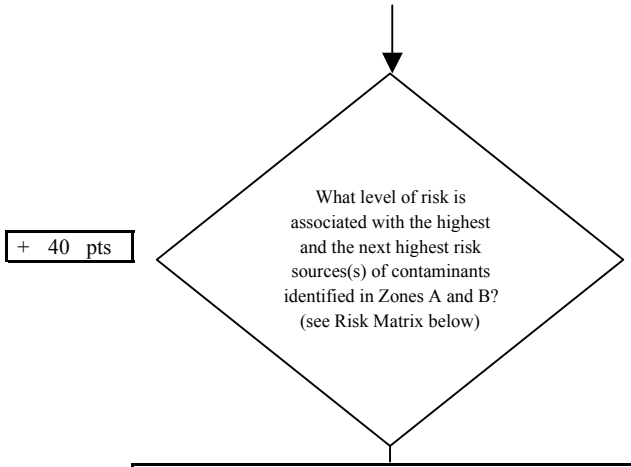


Chart 10. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Synthetic Organic Chemicals



+ 40 pts

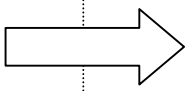
Risk Levels for SOC Sources identified in Zones A and C

	Zone A	Zone B	Total
Very Highs(s)	1	0	1
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	5	0	5

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

Matrix Score 40

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



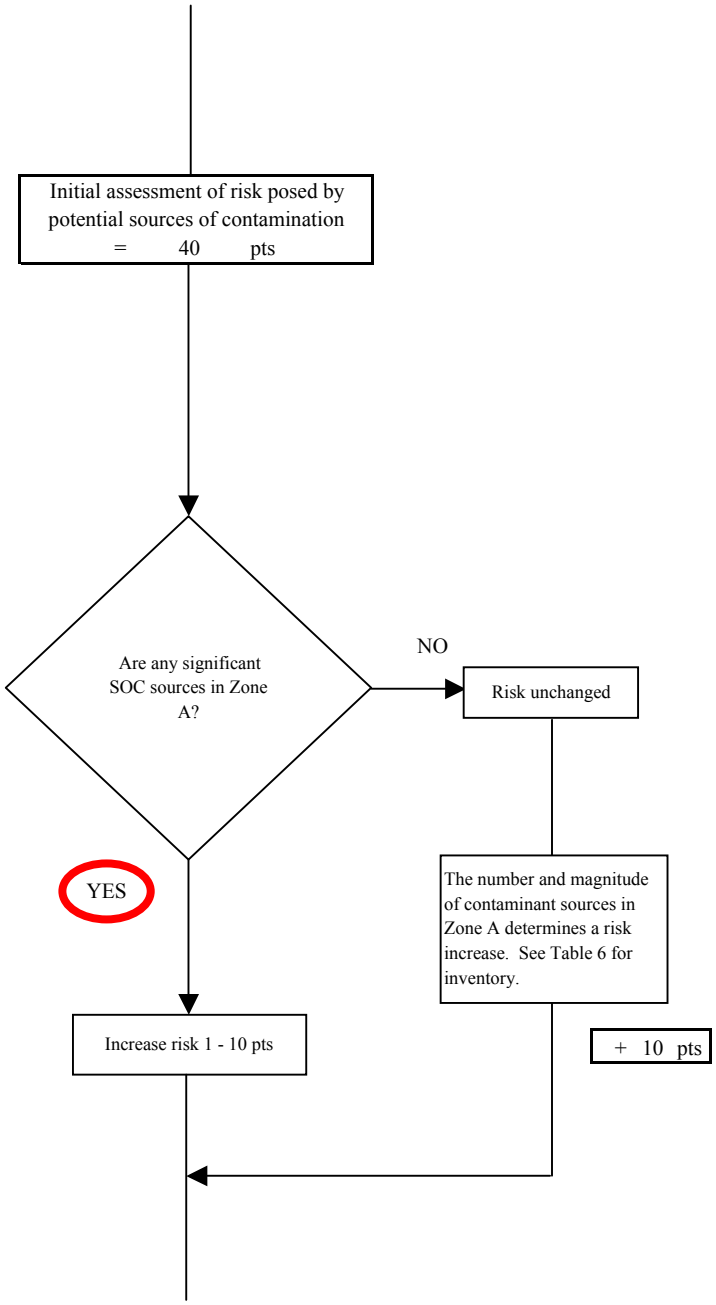


Chart 10. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Synthetic Organic Chemicals

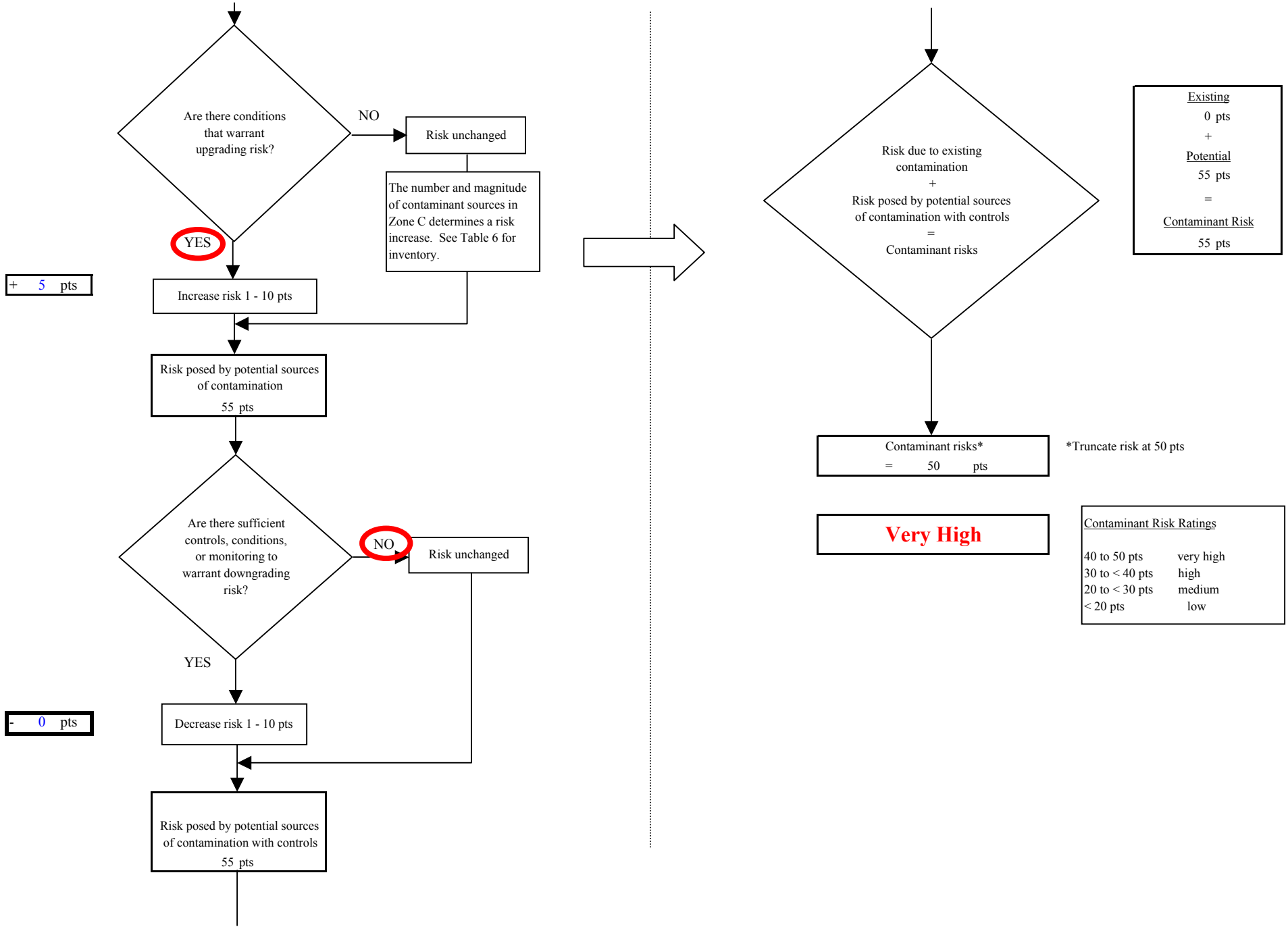


Chart 11. Vulnerability analysis for Alakanuk Water System (PWS No. 270362.001) - Synthetic Organic Chemicals

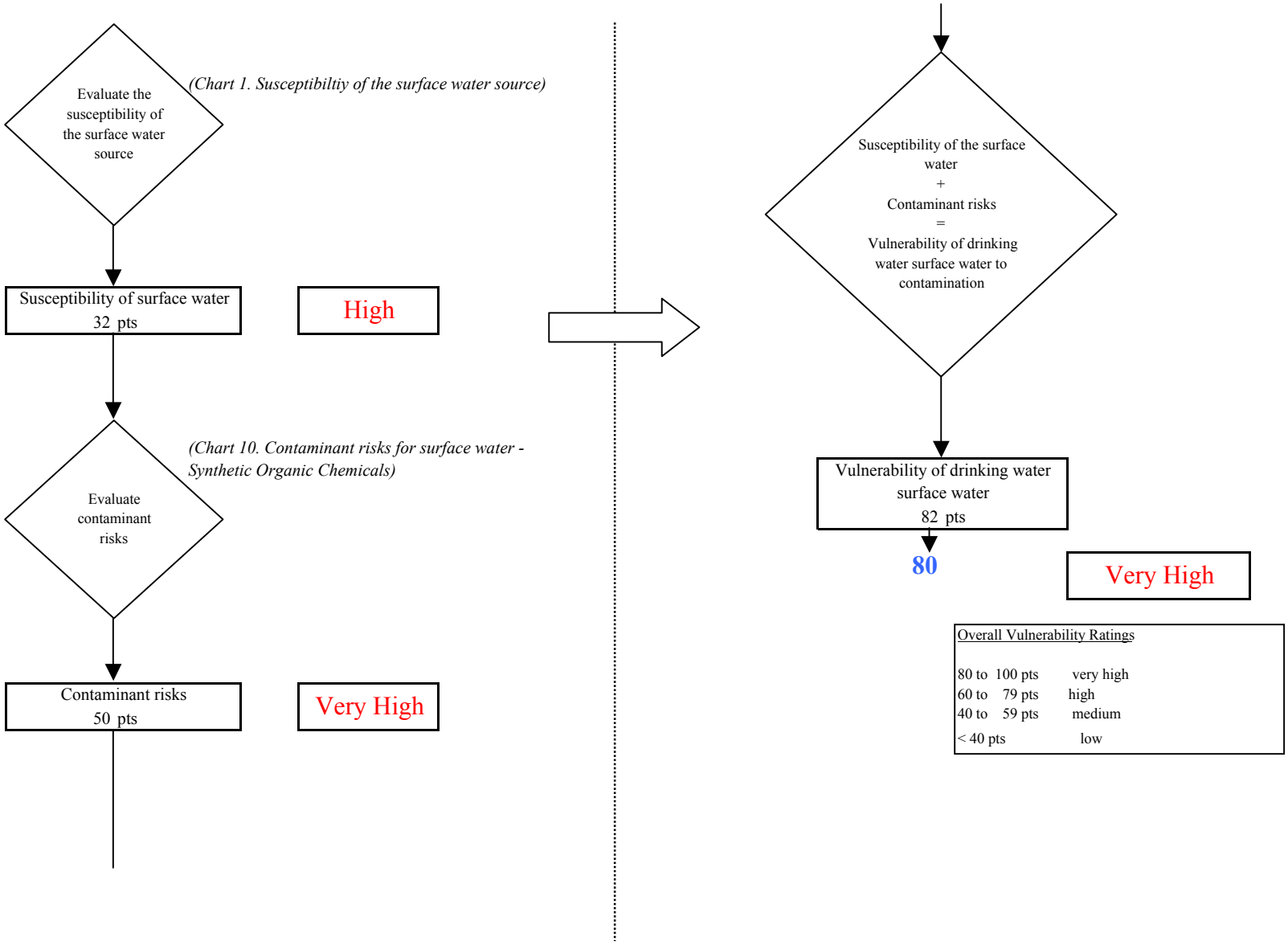


Chart 12. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Other Organic Chemicals

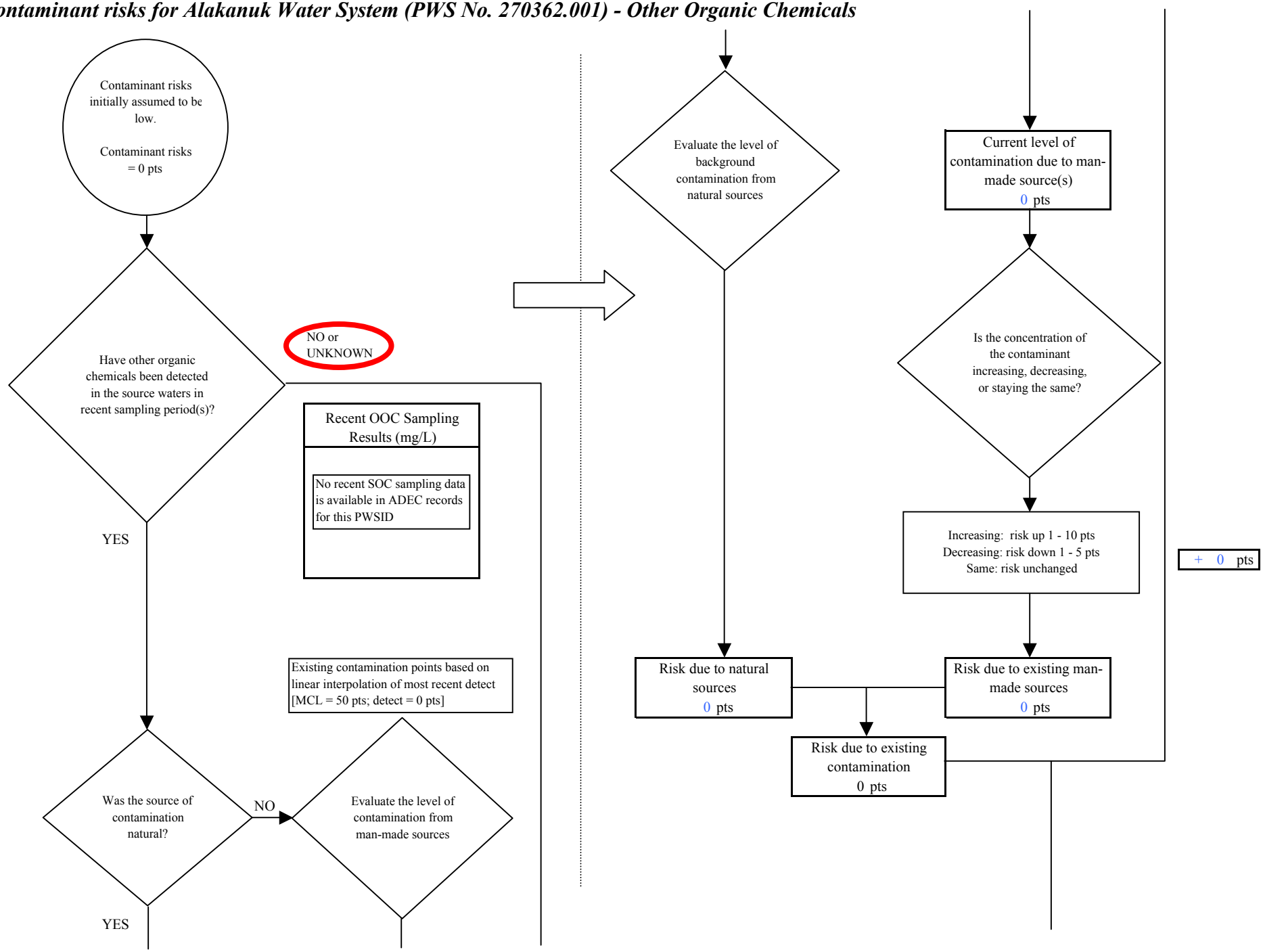
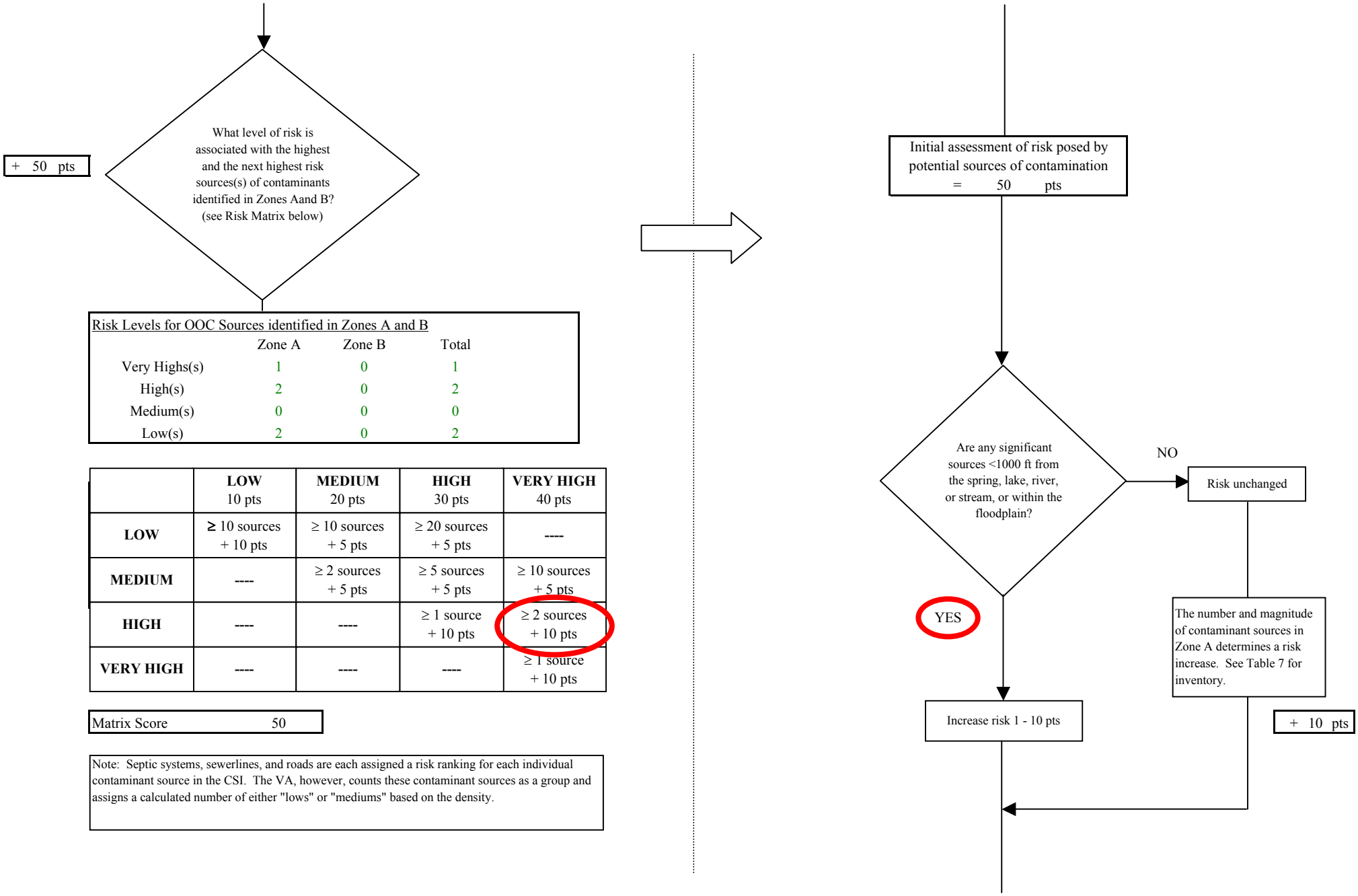


Chart 12. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Other Organic Chemicals



Risk Levels for OOC Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	1	0	1
High(s)	2	0	2
Medium(s)	0	0	0
Low(s)	2	0	2

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

Matrix Score 50

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

Chart 12. Contaminant risks for Alakanuk Water System (PWS No. 270362.001) - Other Organic Chemicals

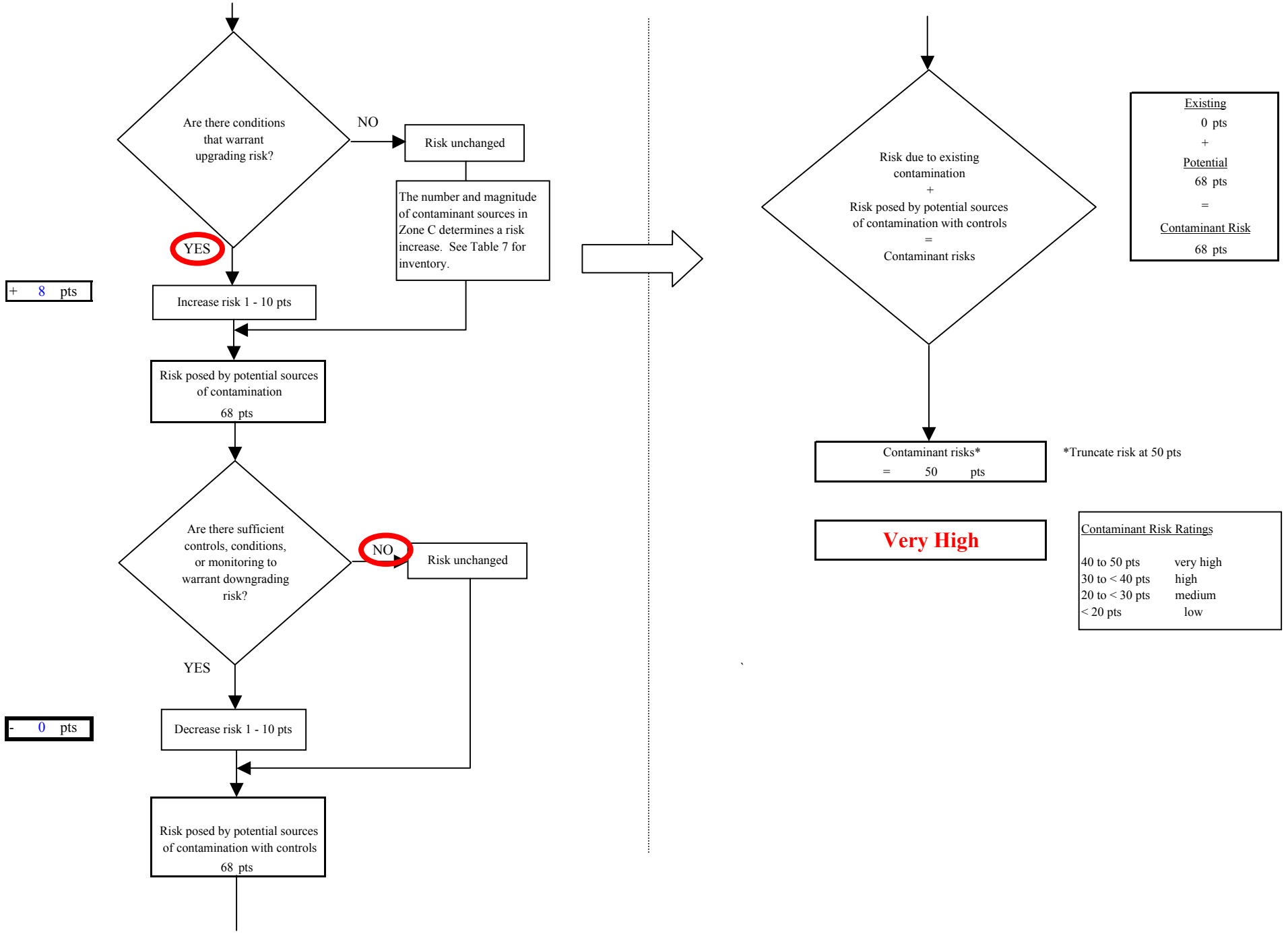


Chart 13. Vulnerability analysis for Alakanuk Water System (PWS No. 270362.001) - Other Organic Chemicals