

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
the Kobuk Village
Drinking Water System,
Kobuk, Alaska

PWSID # 340565.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1332
Alaska Department of Environmental Conservation

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

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

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Source Water Assessment for Kobuk Village Public Water System Source of Public Drinking Water, Kobuk, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Kobuk Village Public Water System (PWS) has two wells. The well (PWS No. 340565.001) has been used as a drinking water source since it was drilled in October of 1978. This report is exclusively limited to PWS # 340565.001.

The well is a Class A (community and non-transient non-community) water system located on the north bank of the Kobuk River in Kobuk, Alaska. Available records indicate that the system has a 100,000 gallon storage tank and that the drinking water source is treated with calcium hypochlorite. This system operates year round and serves approximately 93 residents through 38 service connections. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **Very High** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: fuel tanks, bulk fuel facilities, pipelines, a landfill, and water treatment facility. A detailed inventory can be found in Table 1 of Appendix B. These identified potential and existing sources of contamination are considered 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 well received a vulnerability rating of **Very High** for bacteria and viruses, nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

PUBLIC DRINKING WATER SYSTEM

The Kobuk Village PWS well is a Class A (community/non-transient/non-community) public water system. The system is located on the north bank of the Kobuk River, in Kobuk, Alaska (Sec. 03, T017N, R009W, Fairbanks Meridian, see Map A of

Appendix A). The community of Kobuk is located about 7 miles northeast of Shungnak and 128 air miles northeast of Kotzebue. The community has a population of 125 (ADCED, 2003). Total annual precipitation in Kobuk is 17 inches, including approximately 56 inches of snowfall. Temperatures can be as extreme as -68 to 90°F.

The community of Kobuk obtains most of their water supply from a piped water system. Outhouses and honeybuckets are used for sewage disposal (ADCED, 2003). Kobuk residents rely on the Kobuk Valley Electric Co-op for electricity, which is purchased from AVEC over the Kobuk-Shungnak intertie. Residents dispose of refuse at the community landfill.

According to information supplied by ADEC for the Kobuk Village PWS, the depth of the well is 30 feet below the ground surface. Based on available well construction details, it is assumed that the well is screened in an unconfined aquifer. The well is located within a floodplain.

Information acquired from a October 2000 sanitary survey for the PWS 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 not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The thickness of seasonally thawed ground is much less where tundra vegetation has not been disturbed. Thawed sandy gravel is found at the base of the bluff along the Kobuk River. Soil in and around the Kiana area consist primarily of sandy silt and generally well-sorted floodplain, terrace, and alluvial fan deposits associated with streams and rivers. The soil contains few masses of ice (Indian Health Services, 1986).

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 Kobuk Village 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 Kobuk Village PWS was determined using an analytical calculation and includes Zones A 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 Kobuk Village PWS 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, and
- 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 7 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 Kobuk Village PWS's water well is completed 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	25	Very High
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	50	Very 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	50	Very High
Synthetic Organic Chemicals	50	Very High
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	100	Very High
Nitrates and Nitrites	100	Very High
Volatile Organic Chemicals	100	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	100	Very High
Synthetic Organic Chemicals	100	Very High
Other Organic Chemicals	100	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 sewage lagoon and landfill located in Zone A, and the presence of bacteria and viruses in recent sampling events. Numerous other potential contaminant sources are also found within the protection area (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, 2002). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

A positive bacteria count has been reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). A positive sample on 12/5/2002 was followed by a confirmation sample on 12/18/2002. 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 landfill in Zone A. Numerous other potential contaminant sources are also found within the protection area (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 not been detected in recent sampling events. 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.

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 a bulk fuel facility in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

Recent sampling results indicated low levels of Total Trihalomethanes (TTHM's). TTHM's are generally not an indication of source water conditions as they are a byproduct of water treatment. Risk points were not assigned due to the TTHM's not exceeding the MCL of 0.08 mg/L (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Other possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, and roads. See Table 4 in Appendix B for a complete listing.

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 **Very High**. The risk is primarily attributed to the presence of copper, lead and arsenic in recent sampling events and the presence of a landfill in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 5 – Appendix B).

Based on review of recent sampling records for this PWS, moderate levels of copper, lead and arsenic have been detected; however have not exceeded their MCLs of 1.3, .015 and .05 mg/L, respectively (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The reported concentrations of copper and lead are likely attributed to the water treatment/conveyance system.

According to the EPA “Arsenic occurs naturally in rocks and soil, water, air, and plants and animals. It can be further released into the environment through natural activities such as volcanic action, erosion of

rocks, and forest fires, or through human actions. Approximately 90 percent of industrial arsenic in the U.S. is currently used as a wood preservative, but arsenic is also used in paints, dyes, metals, drugs, soaps, and semi-conductors. Agricultural applications, mining, and smelting also contribute to arsenic releases in the environment.” (EPA, 2001) Studies have linked long-term exposure to arsenic in drinking water to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Non-cancer effects of ingesting arsenic include cardiovascular, pulmonary, immunological, neurological, and endocrine (e.g., diabetes) effects. Short-term exposure to high doses of arsenic can cause other adverse health effects, but such effects are unlikely to occur from U.S. public water supplies that are in compliance with the previous arsenic standard of 50 ppb. (EPA, 2001)

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 **Very High**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Very High**. The risk is primarily attributed to a landfill 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 Kobuk Village PWS (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 **Very High**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill in Zone A. Several 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 Kobuk Village PWS (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 Kobuk 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.

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APPENDIX A

Drinking Water Protection Area Location Map (Map A)

APPENDIX B

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

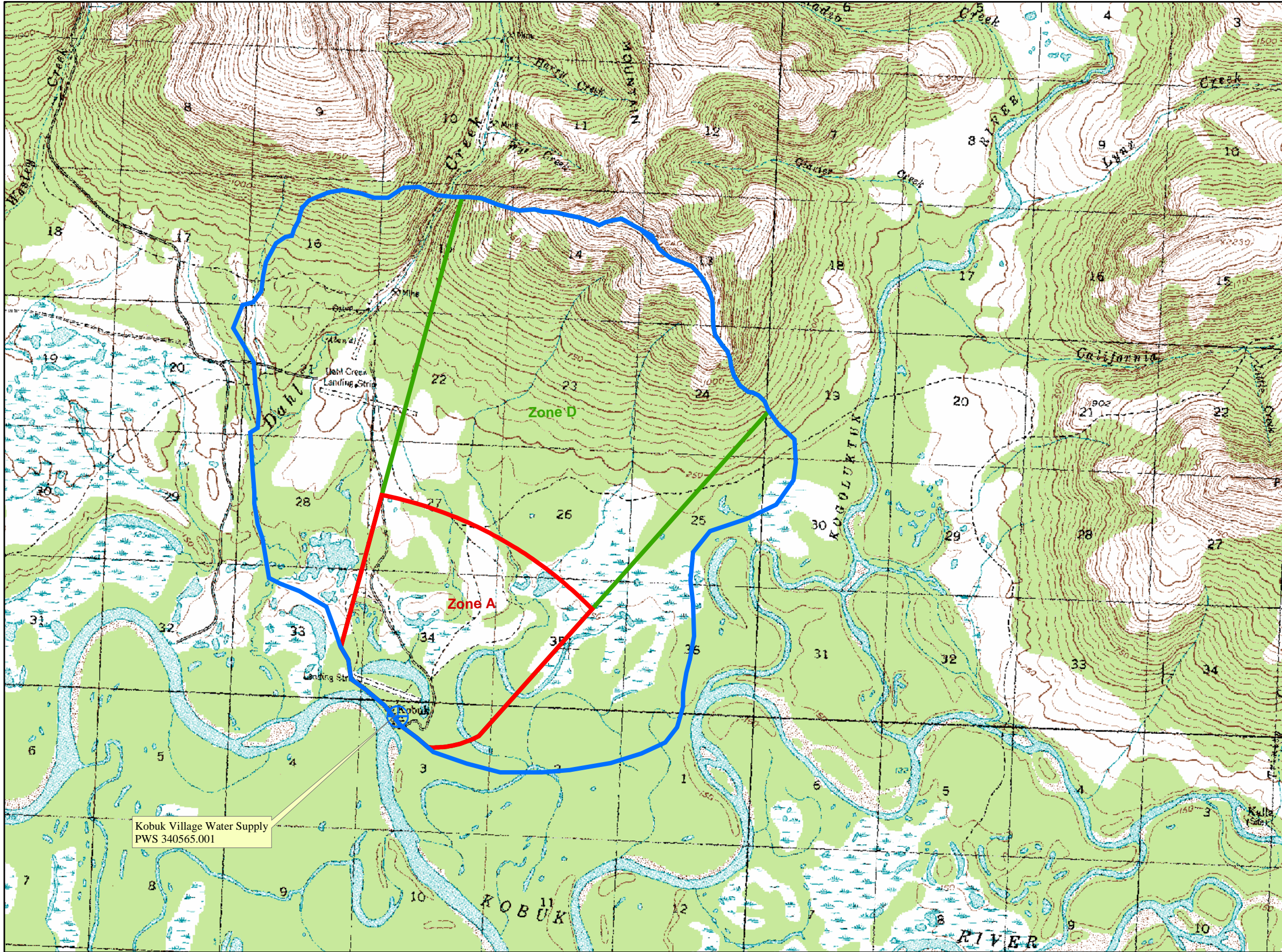
APPENDIX C

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

APPENDIX D

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



Public Water Well System for PWS #340565.001 Kobuk Village Water System




LEGEND

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

Transportation

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

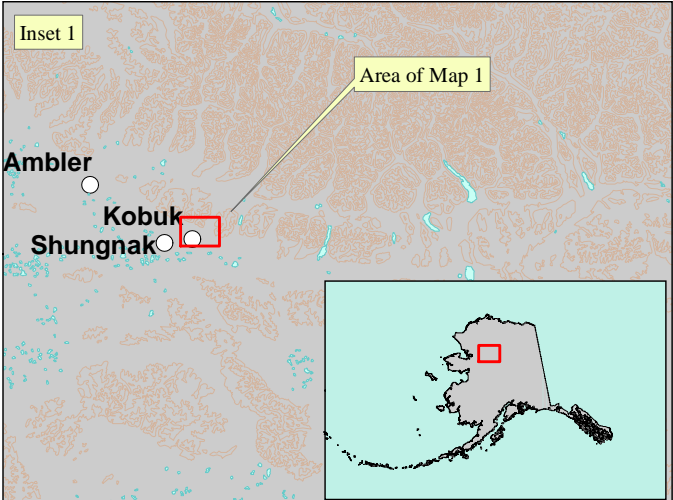
Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
 Zone D Protection Area–10 Years Travel Time or
 Watershed Boundary

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.



Kobuk Village Water Supply
PWS 340565.001
Appendix A Map A

Table 1

**Contaminant Source Inventory for
Kobuk Village Water Supply**

PWSID 340565.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Laundromats without dry cleaning	C22	C22-01	A	C	Washeteria
Motor /motor vehicle repair shops	C31	C31-01	A	C	Airport Service and Maintenance Shop
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	C	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	C	Lift Station-North
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	C	Assume 35 or less honeybucket pits/outhouses in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	C	Landfill/Incinerator
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assume 14 or less aboveground residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	C	Washeteria
Tanks, diesel (above ground)	T06	T06-01	A	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	Kobuk Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	C	Kobuk Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	C	Principal Housing
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	C	GCI Phone Module
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	C	Baptist Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	C	Friends Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	C	Community Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	C	City of Kobuk Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	C	IRA Office Bldg.
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	C	VPSO
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	C	Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	C	GCI

<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>
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	C	City
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	C	Elementary School
Cemeteries	X01	X01-01	A	C	Cemetery1
Cemeteries	X01	X01-02	A	C	Cemetery2
Petroleum product bulk station/terminals	X11	X11-01	A	C	School Fuel Tanks
Airports	X14	X14-01	A	C	Kobuk Airport
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 1 - 20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	C	Kobuk Health Clinic
Airports	X14	X14-02	D	C	Dahl Creek Landing Strip

Table 2

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Bacteria and Viruses*

PWSID 340565.001

<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>
Laundromats without dry cleaning	C22	C22-01	A	Low	C	Washeteria
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	Lift Station-North
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 35 or less honeybucket pits/outhouses in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Landfill/Incinerator
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1 - 20 roads in Zone A
Medical/veterinary facilities (doctor or dentist office, hospitals, nursing homes)	X40	X40-01	A	Medium	C	Kobuk Health Clinic

Table 3

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Nitrates/Nitrites*

PWSID 340565.001

<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>
Laundromats without dry cleaning	C22	C22-01	A	Low	C	Washeteria
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	Lift Station-North
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 35 or less honeybucket pits/outhouses in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Landfill/Incinerator
Cemeteries	X01	X01-01	A	Medium	C	Cemetery1
Cemeteries	X01	X01-02	A	Medium	C	Cemetery2
Airports	X14	X14-01	A	Low	C	Kobuk Airport
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1 - 20 roads in Zone A
Medical/veterinary facilities (doctor or dentist office, hospitals, nursing homes)	X40	X40-01	A	Low	C	Kobuk Health Clinic

Table 4

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Volatile Organic Chemicals*

PWSID 340565.001

<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>
Laundromats without dry cleaning	C22	C22-01	A	Low	C	Washeteria
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	C	Airport Service and Maintenance Shop
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Lift Station-North
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 35 or less honeybucket pits/outhouses in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Landfill/Incinerator
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 14 or less aboveground residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	Washeteria
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Kobuk Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Kobuk Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	Principal Housing
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	GCI Phone Module
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	Baptist Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	Friends Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	Community Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	City of Kobuk Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	IRA Office Bldg.
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	C	VPSO
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	C	Post Office

Table 4 (continued)

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Volatile Organic Chemicals*

PWSID 340565.001

<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>
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	C	GCI
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	Low	C	City
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	Low	C	Elementary School
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	School Fuel Tanks
Airports	X14	X14-01	A	High	C	Kobuk Airport
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	Kobuk Health Clinic
Airports	X14	X14-02	D	High	C	Dahl Creek Landing Strip

Table 5

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

PWSID 340565.001

<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>
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	C	Airport Service and Maintenance Shop
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Lift Station-North
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 35 or less honeybucket pits/outhouses in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	High	C	Landfill/Incinerator
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	Kobuk Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Kobuk Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	C	Principal Housing
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	C	GCI Phone Module
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	Baptist Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	Friends Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	Community Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	C	City of Kobuk Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	IRA Office Bldg.
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	C	VPSO
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	C	Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	C	GCI
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	Low	C	City
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	Low	C	Elementary School
Cemeteries	X01	X01-01	A	Low	C	Cemetery1

Table 5 (continued)

**Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals**

PWSID 340565.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Cemeteries	X01	X01-02	A	Low	C	Cemetery2
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	School Fuel Tanks
Airports	X14	X14-01	A	Low	C	Kobuk Airport
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1 - 20 roads in Zone A
Medical/veterinary facilities (doctor or dentist office, hospitals, nursing homes)	X40	X40-01	A	Low	C	Kobuk Health Clinic

Table 6

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Synthetic Organic Chemicals*

PWSID 340565.001

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	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Lift Station-North
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Landfill/Incinerator
Cemeteries	X01	X01-01	A	Medium	C	Cemetery1
Cemeteries	X01	X01-02	A	Medium	C	Cemetery2
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	School Fuel Tanks
Airports	X14	X14-01	A	Medium	C	Kobuk Airport
Medical/veterinary facilities (doctor or dentist office, hospitals, nursing homes)	X40	X40-01	A	Low	C	Kobuk Health Clinic

Table 7

*Contaminant Source Inventory and Risk Ranking for
Kobuk Village Water Supply
Sources of Other Organic Chemicals*

PWSID 340565.001

<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>
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	C	Airport Service and Maintenance Shop
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	Sewage Lagoon
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Lift Station-North
Landfills (municipal; Class III)	D51	D51-01	A	Very High	C	Landfill/Incinerator
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	School Fuel Tanks
Airports	X14	X14-01	A	Medium	C	Kobuk Airport
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1 - 20 roads in Zone A

Public Water Well System for PWS #340565.001 Kobuk Village Water System
Sources of Potential and Existing Contamination

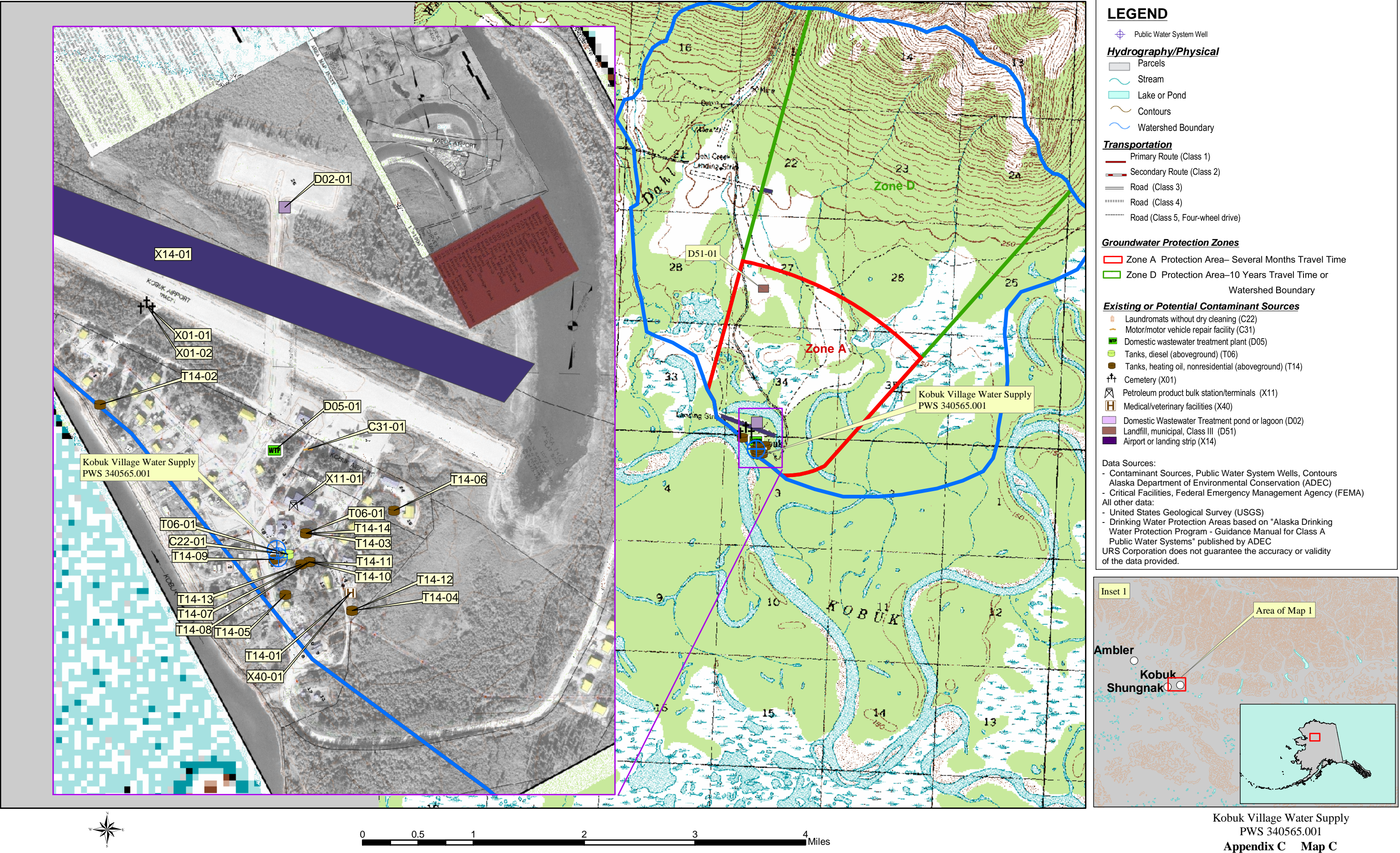


Chart 1. Susceptibility of the wellhead - Kobuk Village Water System (PWS No. 340565.001)

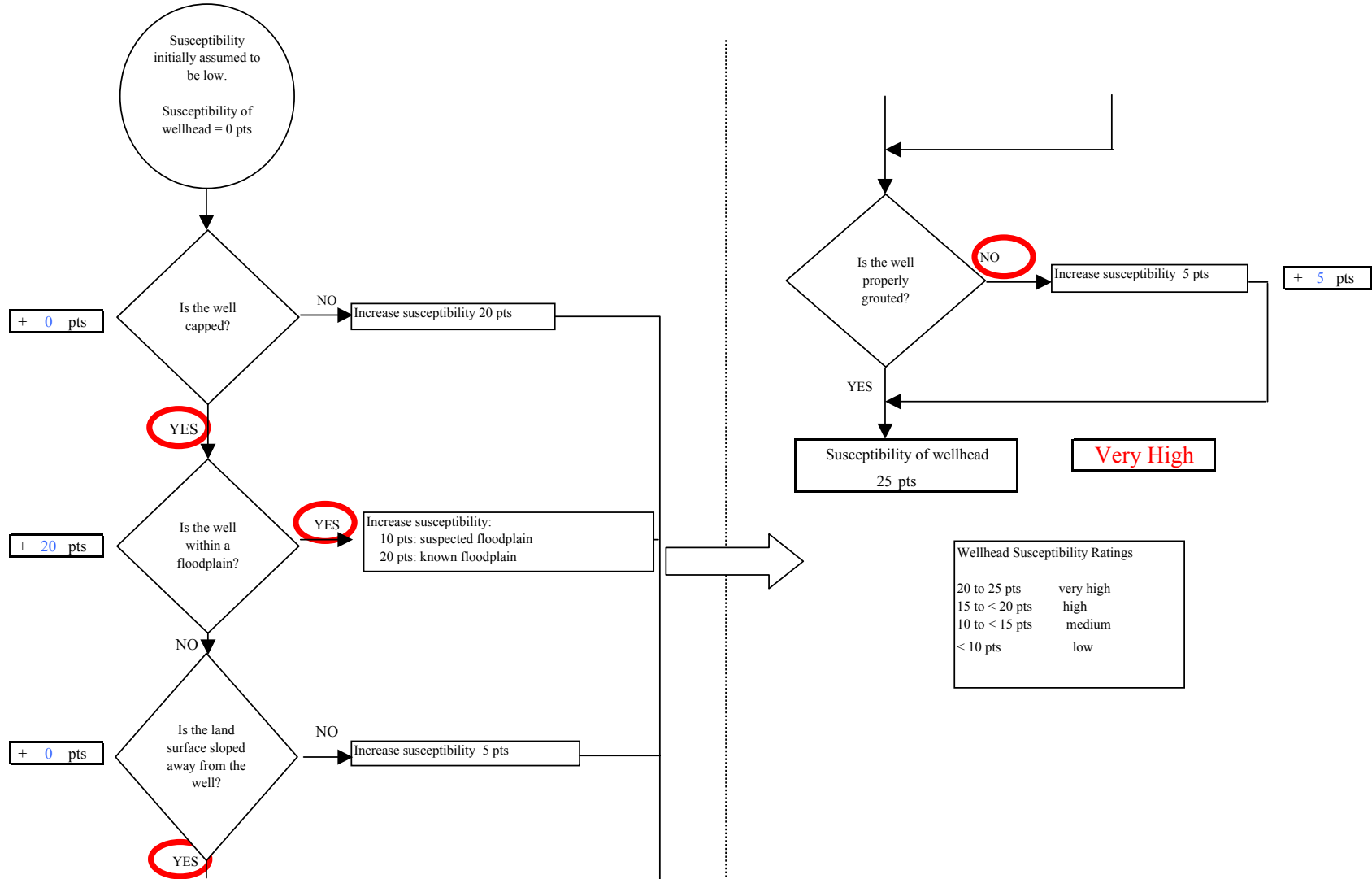


Chart 2. Susceptibility of the aquifer Kobuk Village Water System (PWS No. 340565.001)

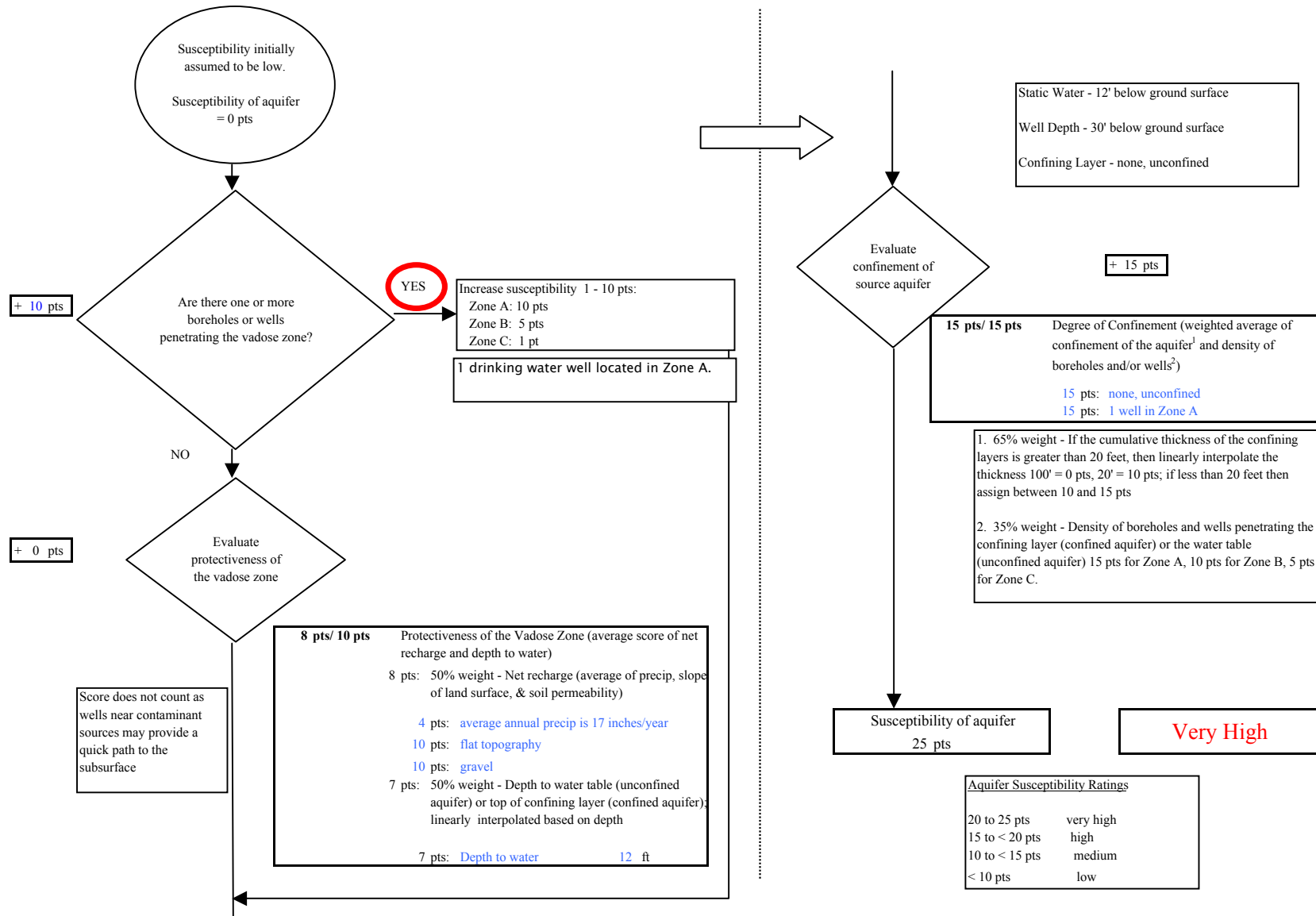


Chart 3. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Bacteria & Viruses

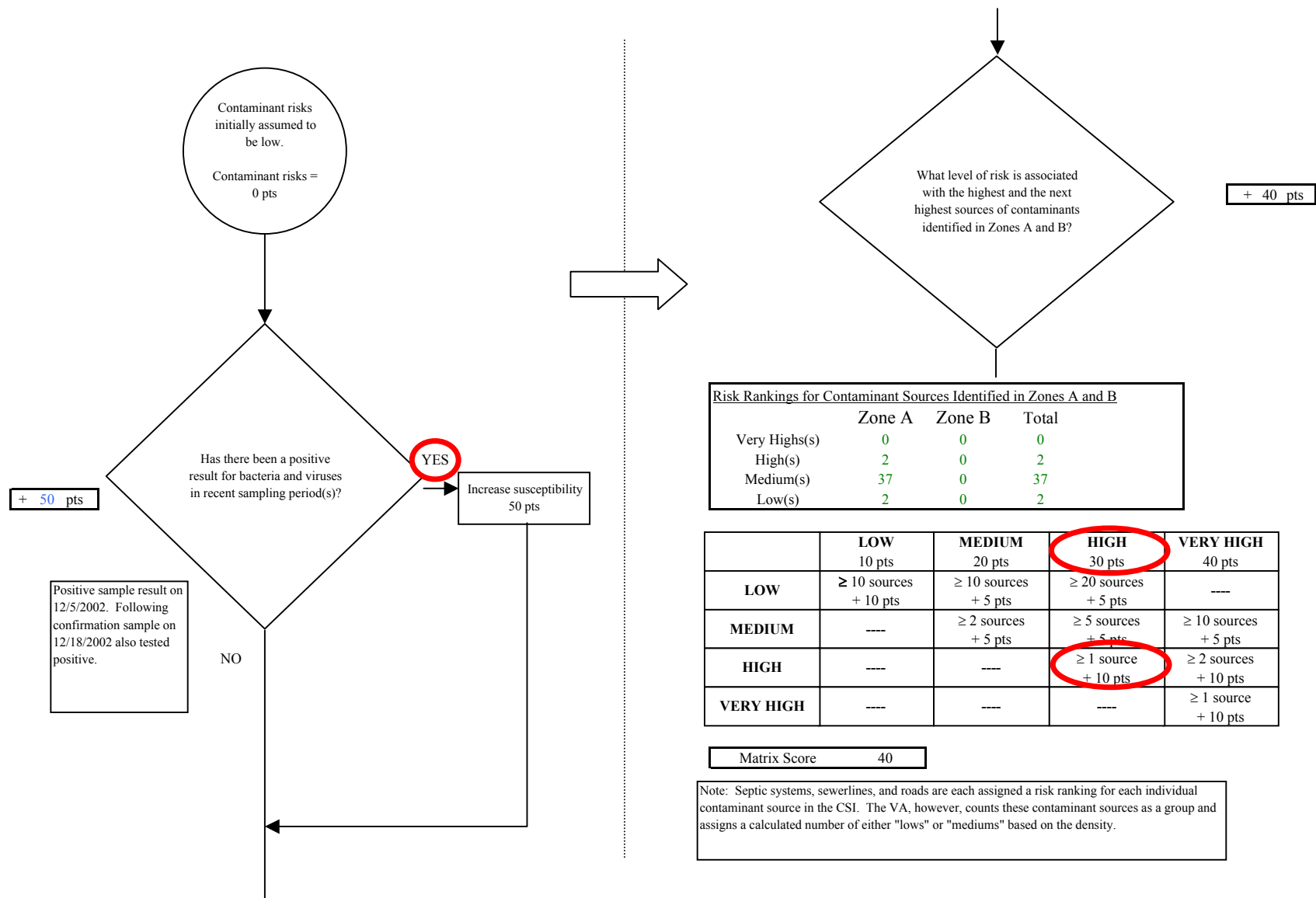


Chart 3. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Bacteria & Viruses

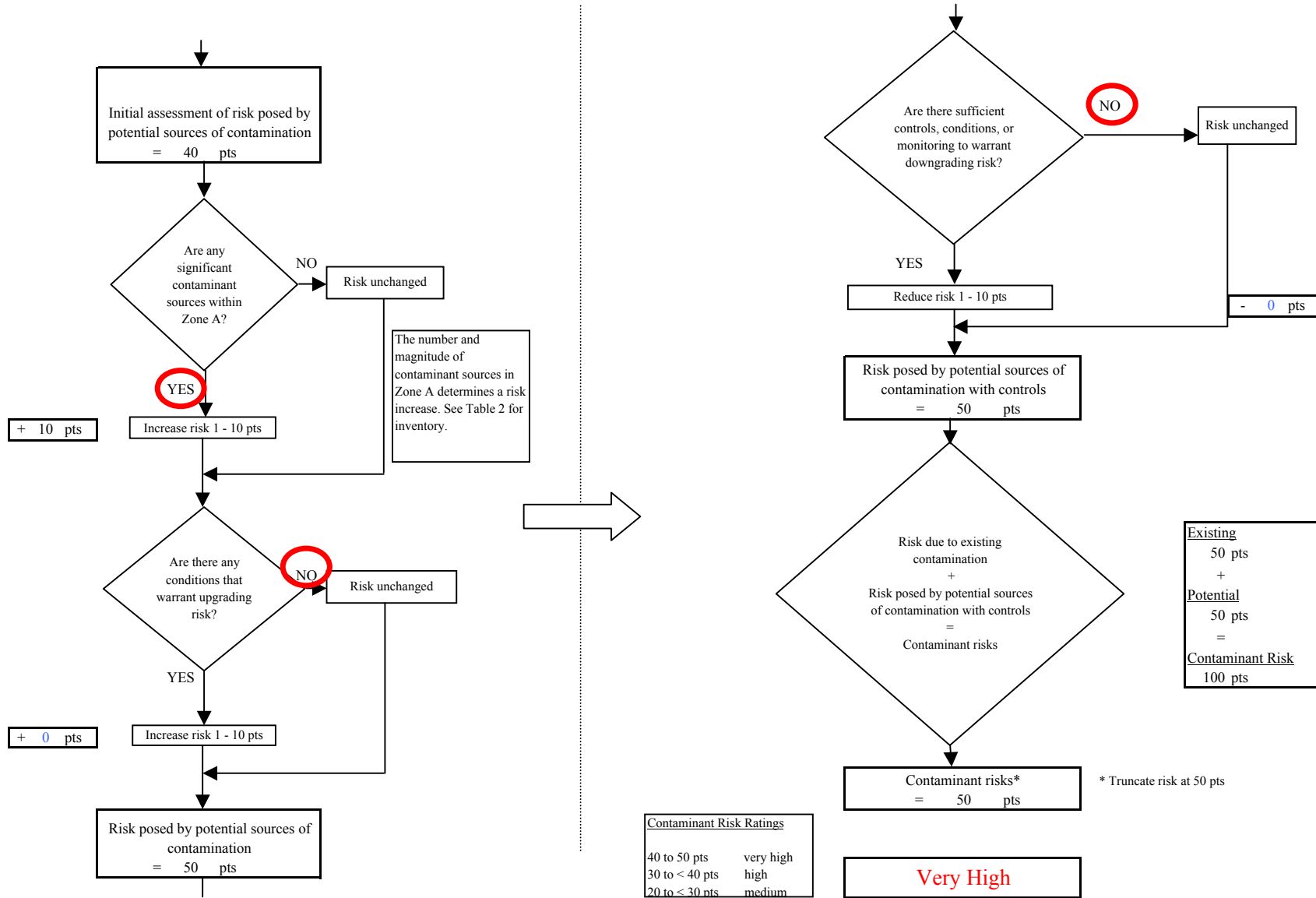


Chart 4. Vulnerability analysis for Kobuk Village Water System (PWS No. 340565.001) - Bacteria & Viruses

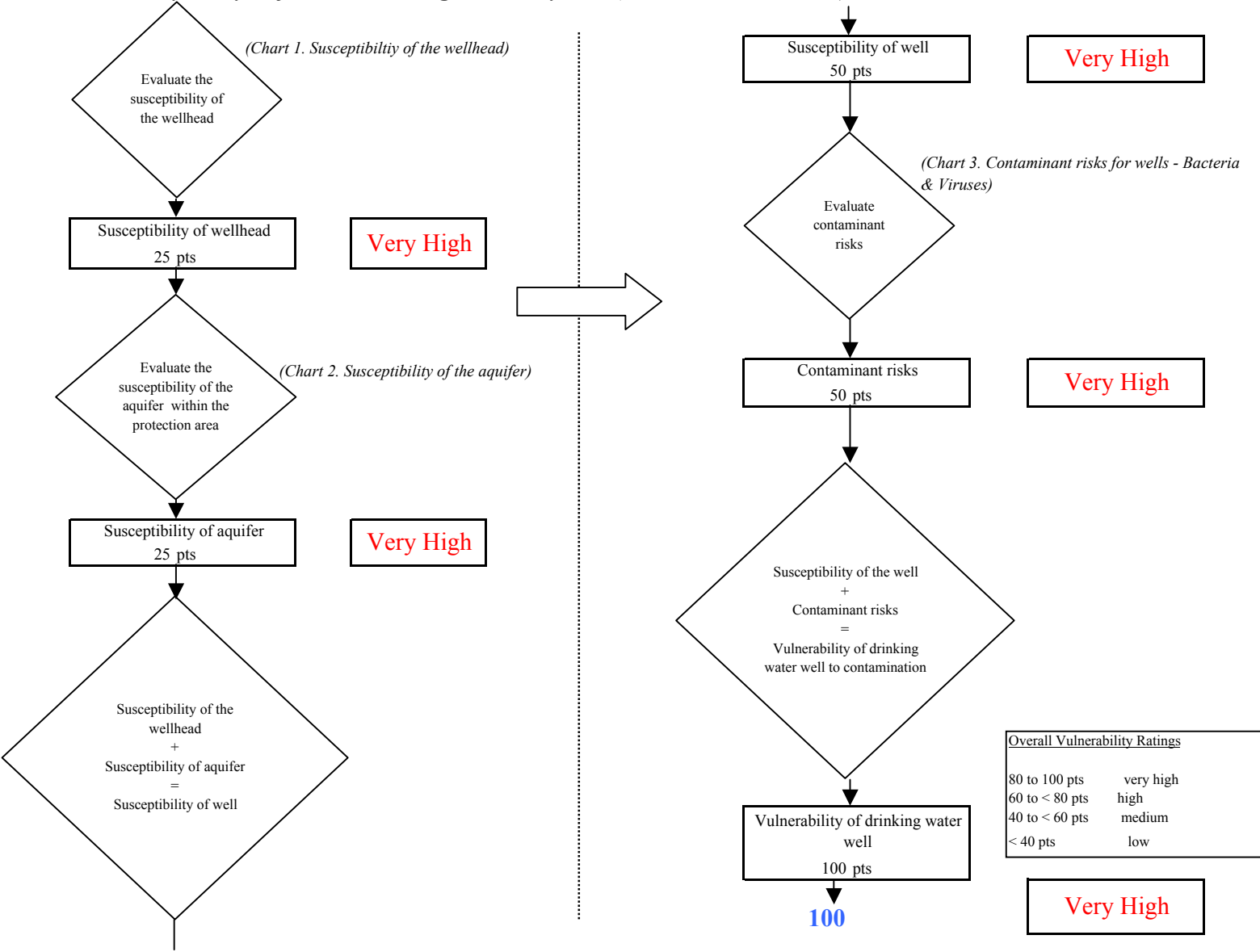


Chart 5. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Nitrates and Nitrites

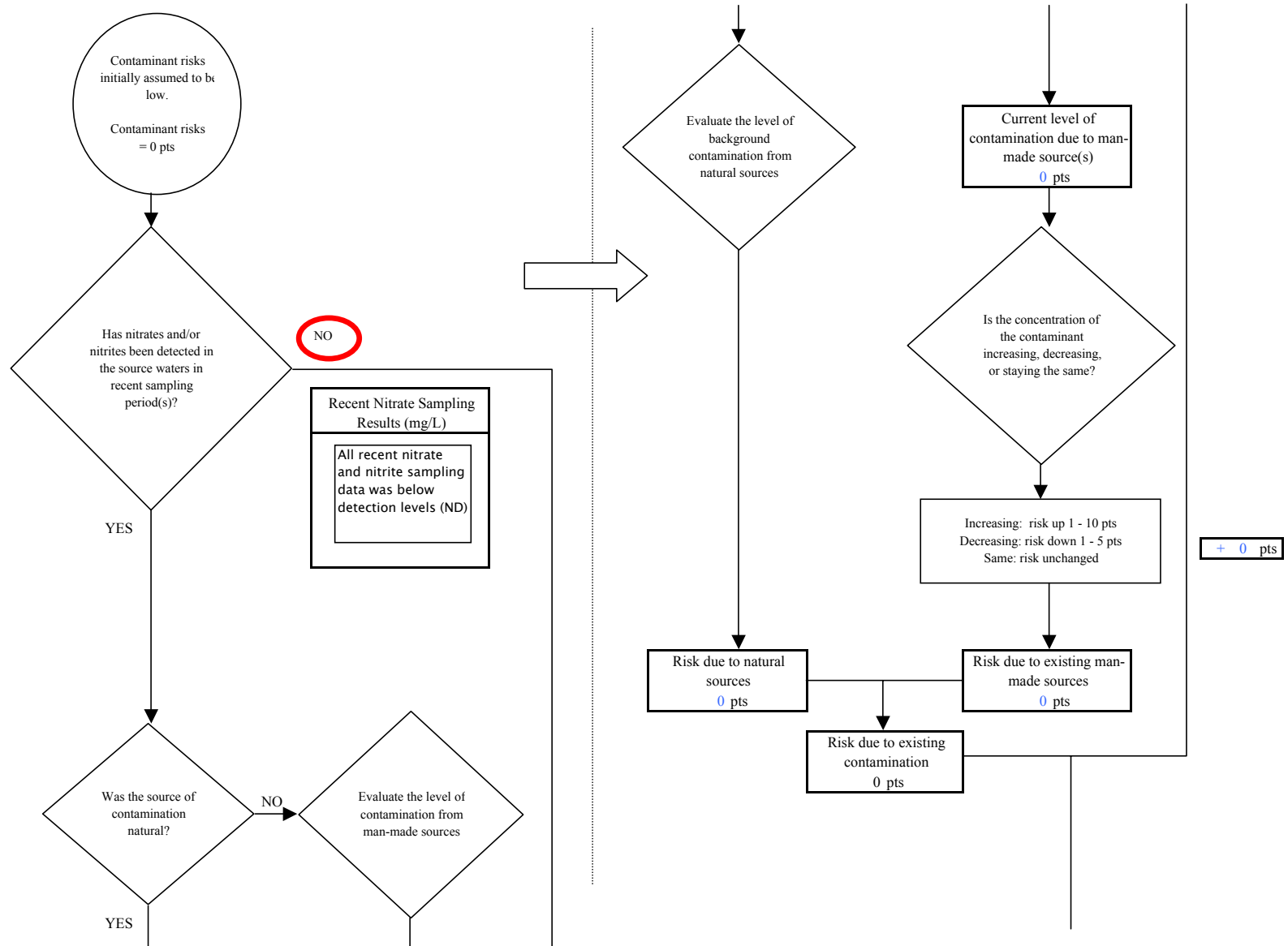


Chart 5. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Nitrates and Nitrites

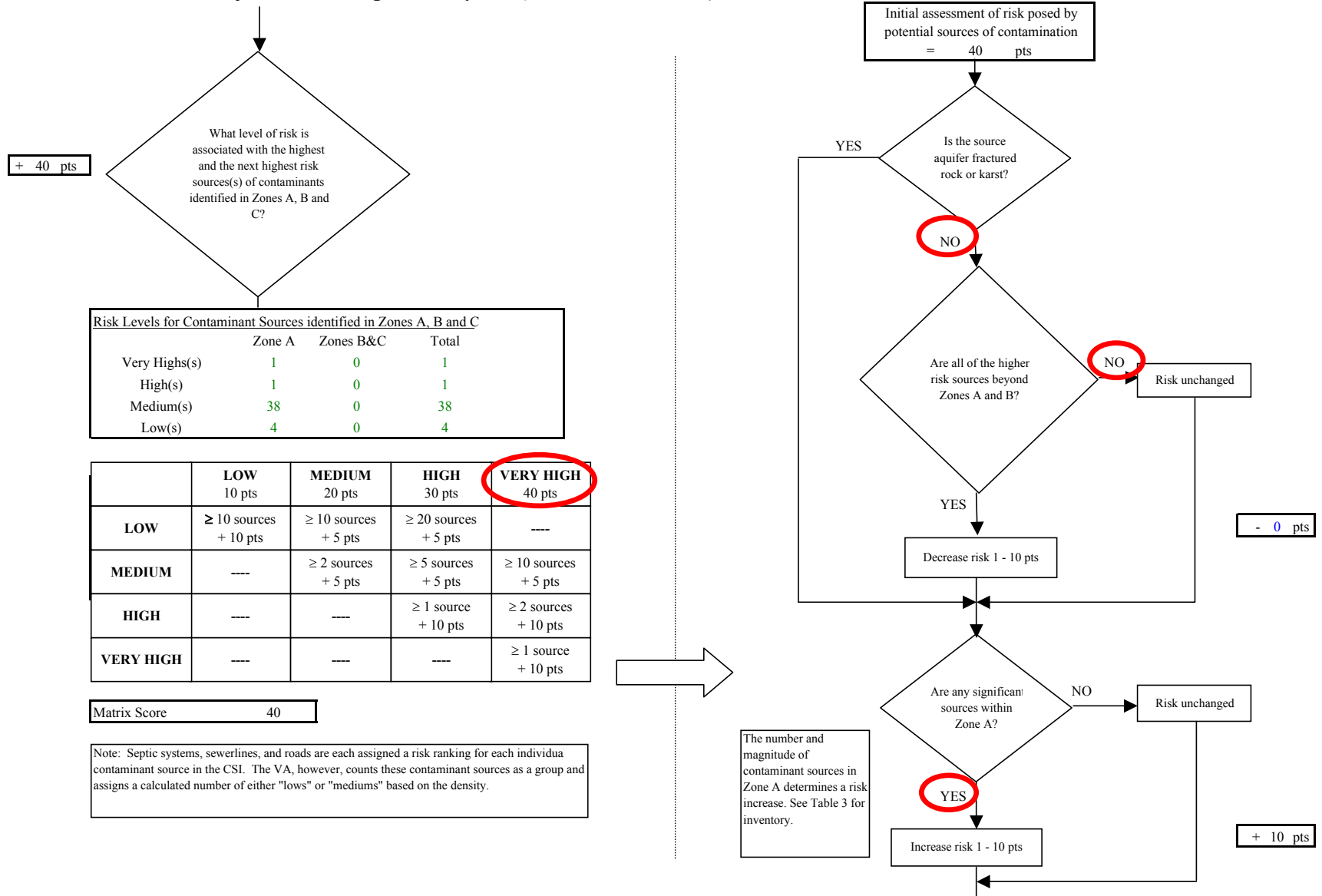


Chart 5. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Nitrates and Nitrites

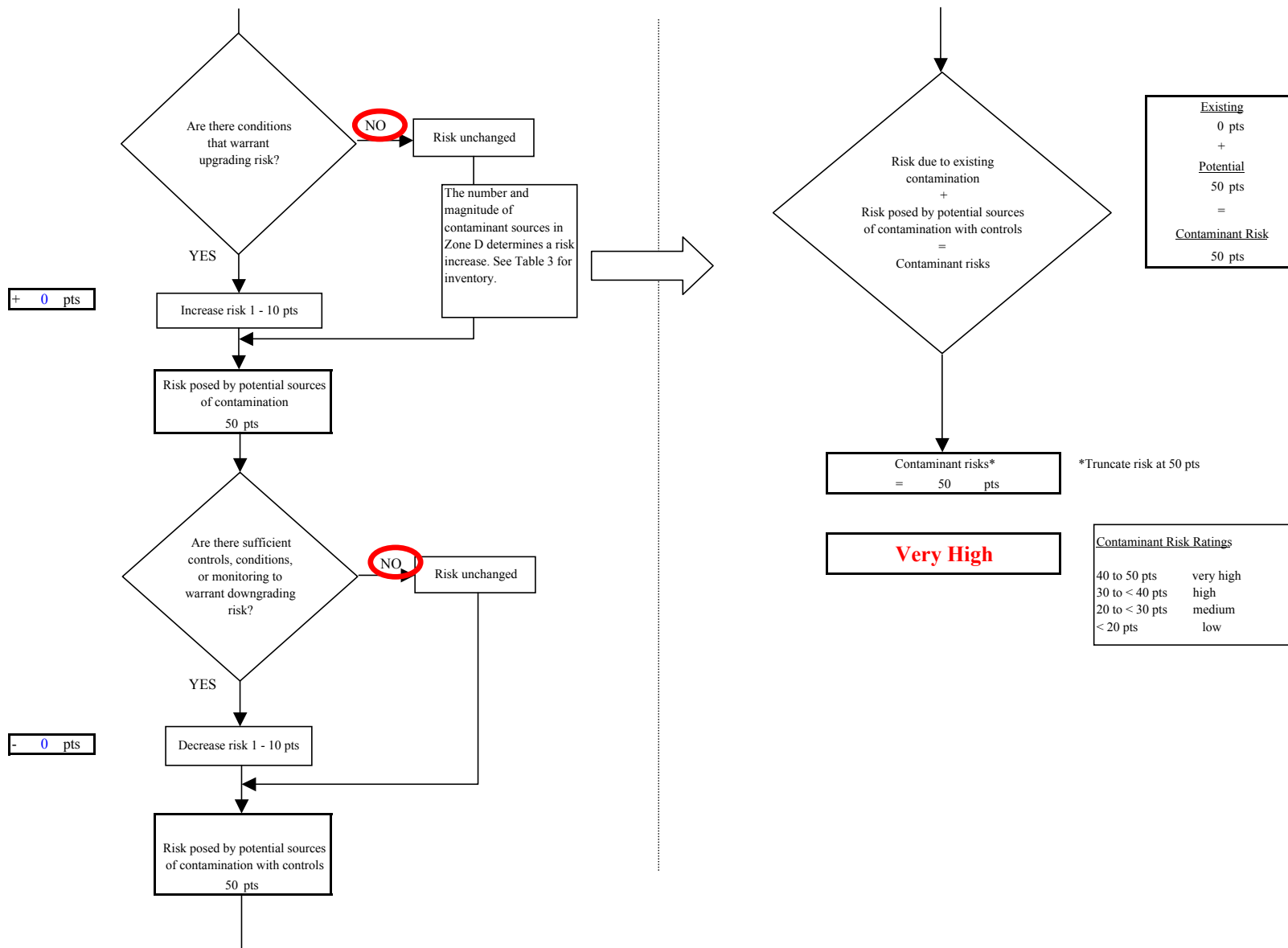


Chart 6. Vulnerability analysis for Kobuk Village Water System (PWS No. 340565.001) - Nitrates and Nitrites

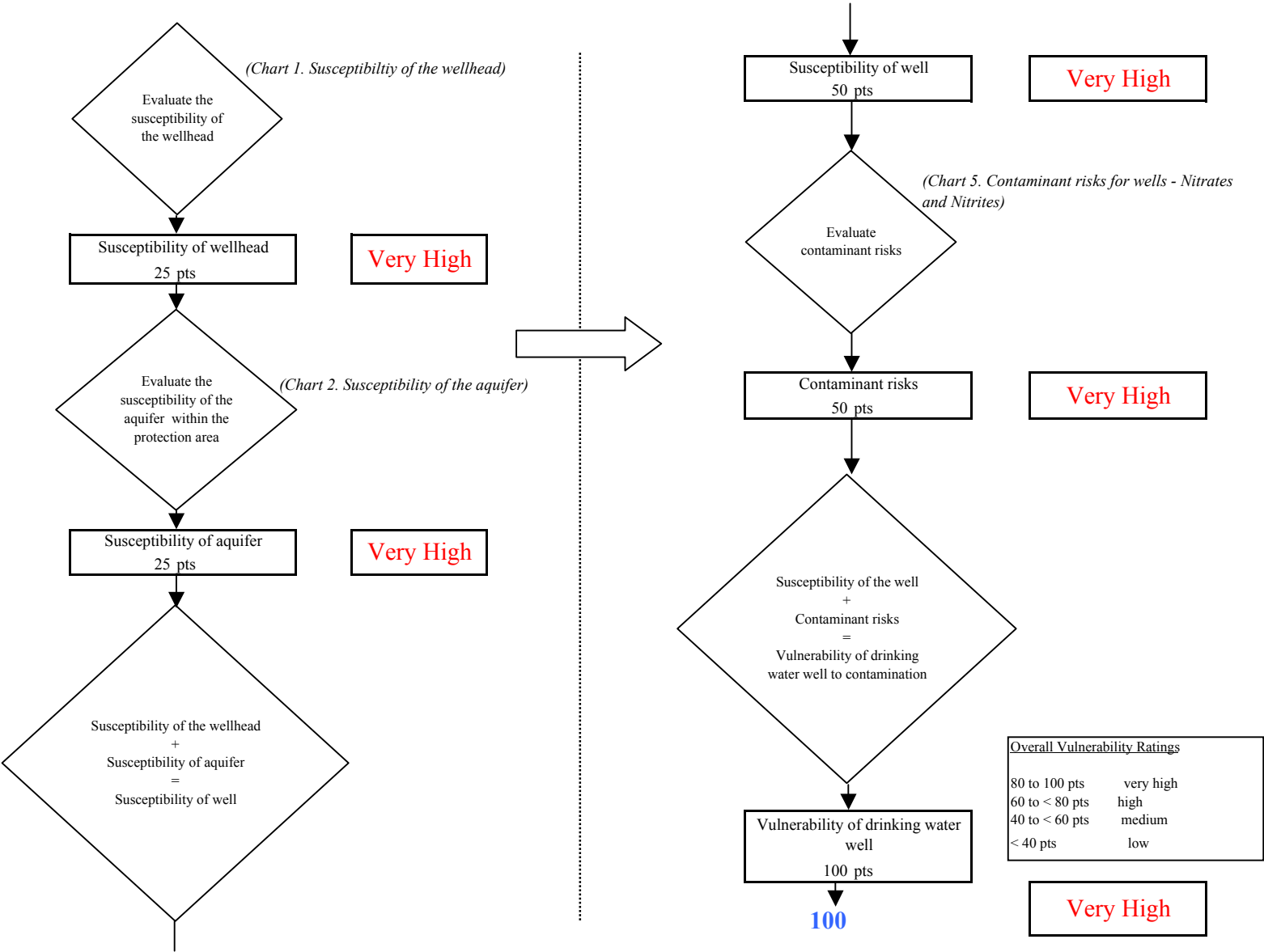


Chart 7. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Volatile Organic Chemicals

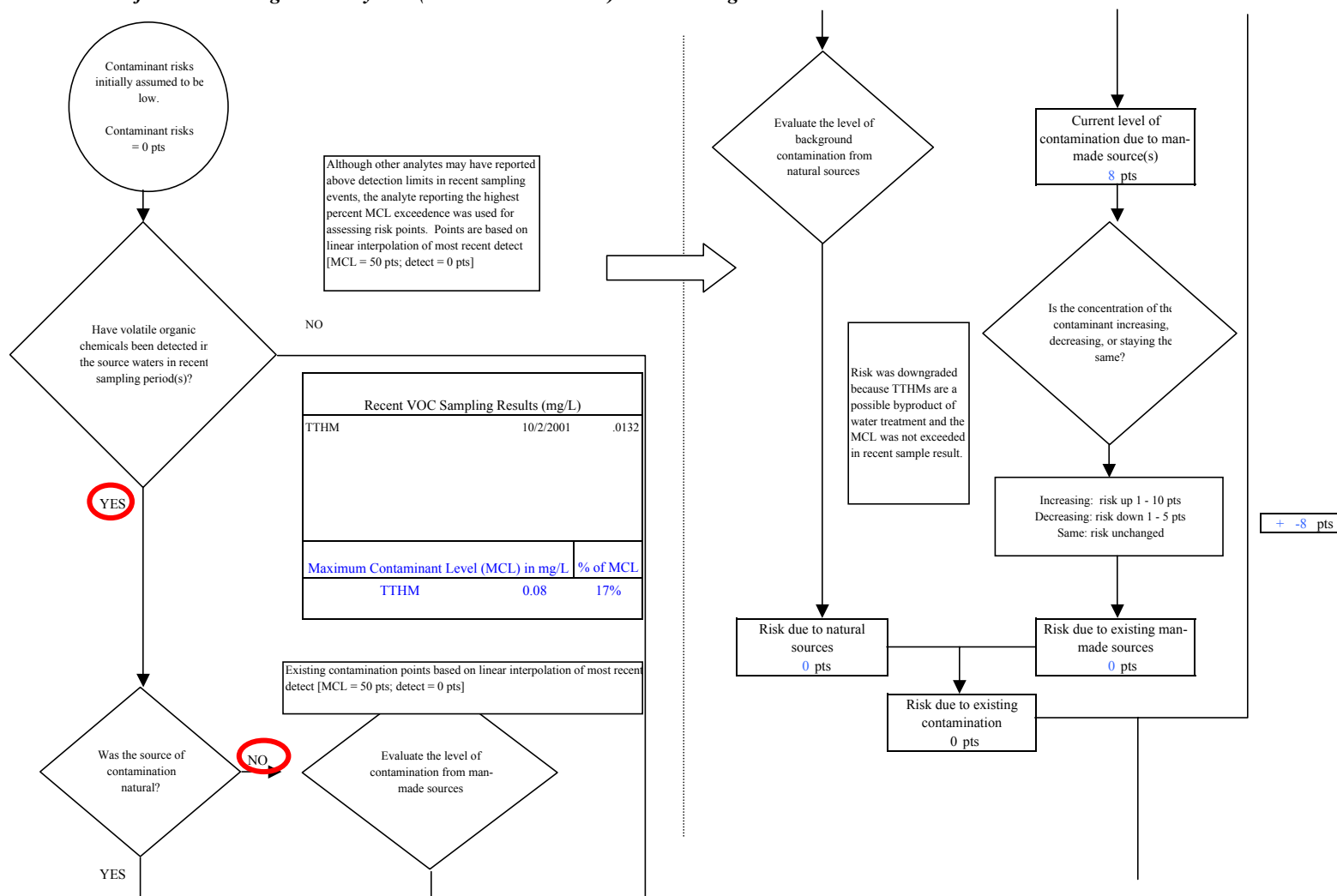


Chart 7. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Volatile Organic Chemicals

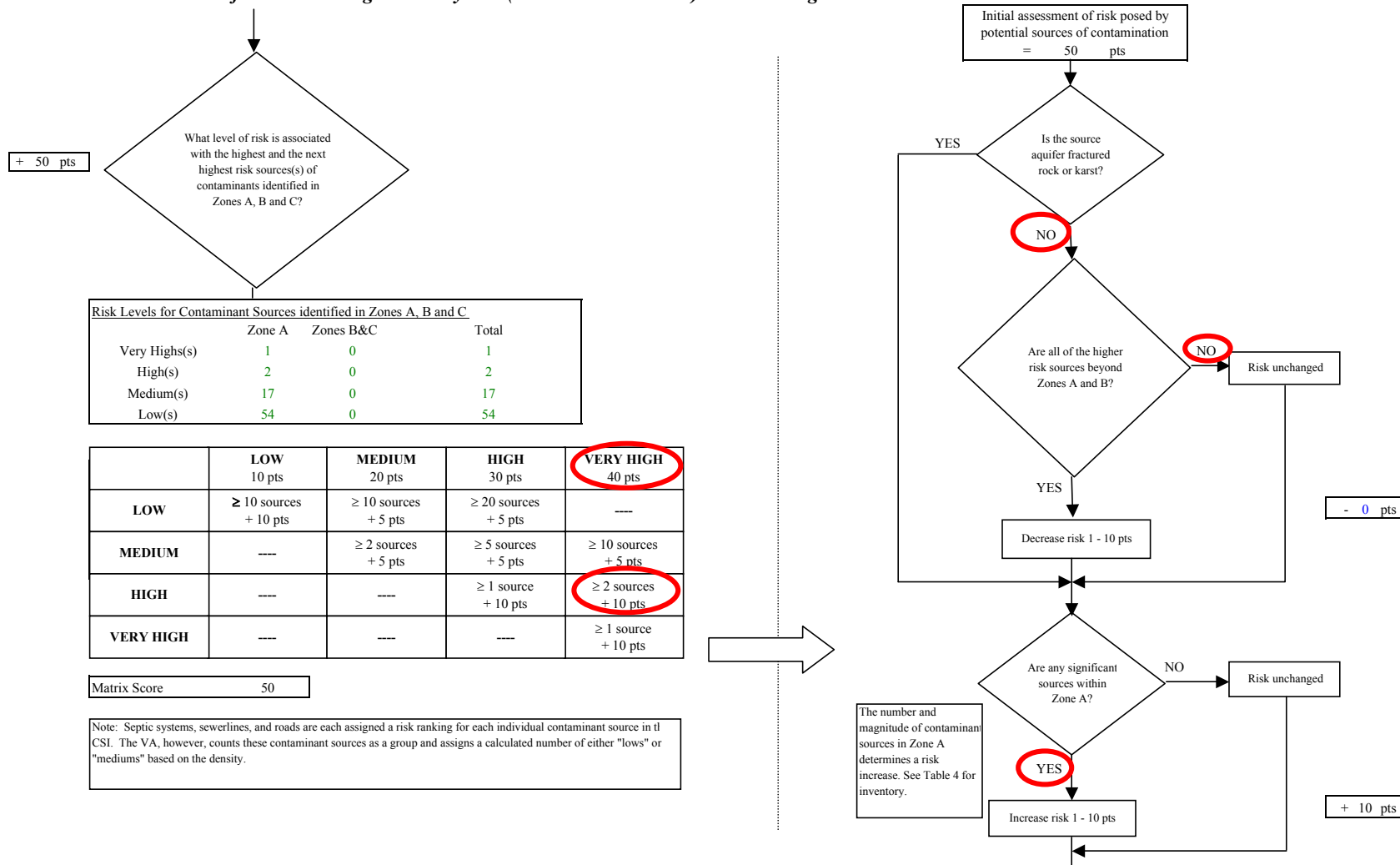


Chart 7. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Volatile Organic Chemicals

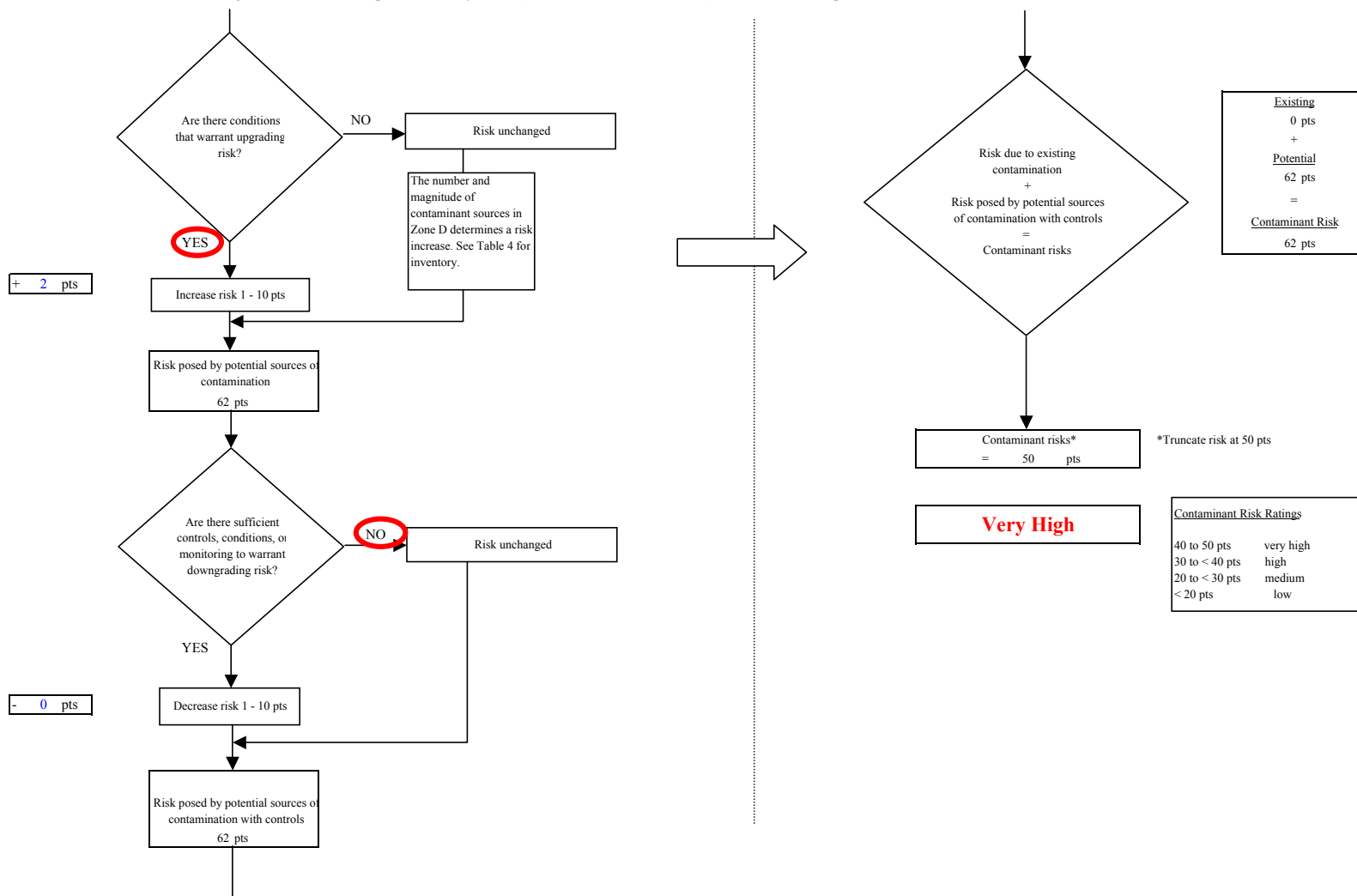


Chart 8. Vulnerability analysis for Kobuk Village Water System (PWS No. 340565.001) - Volatile Organic Chemicals

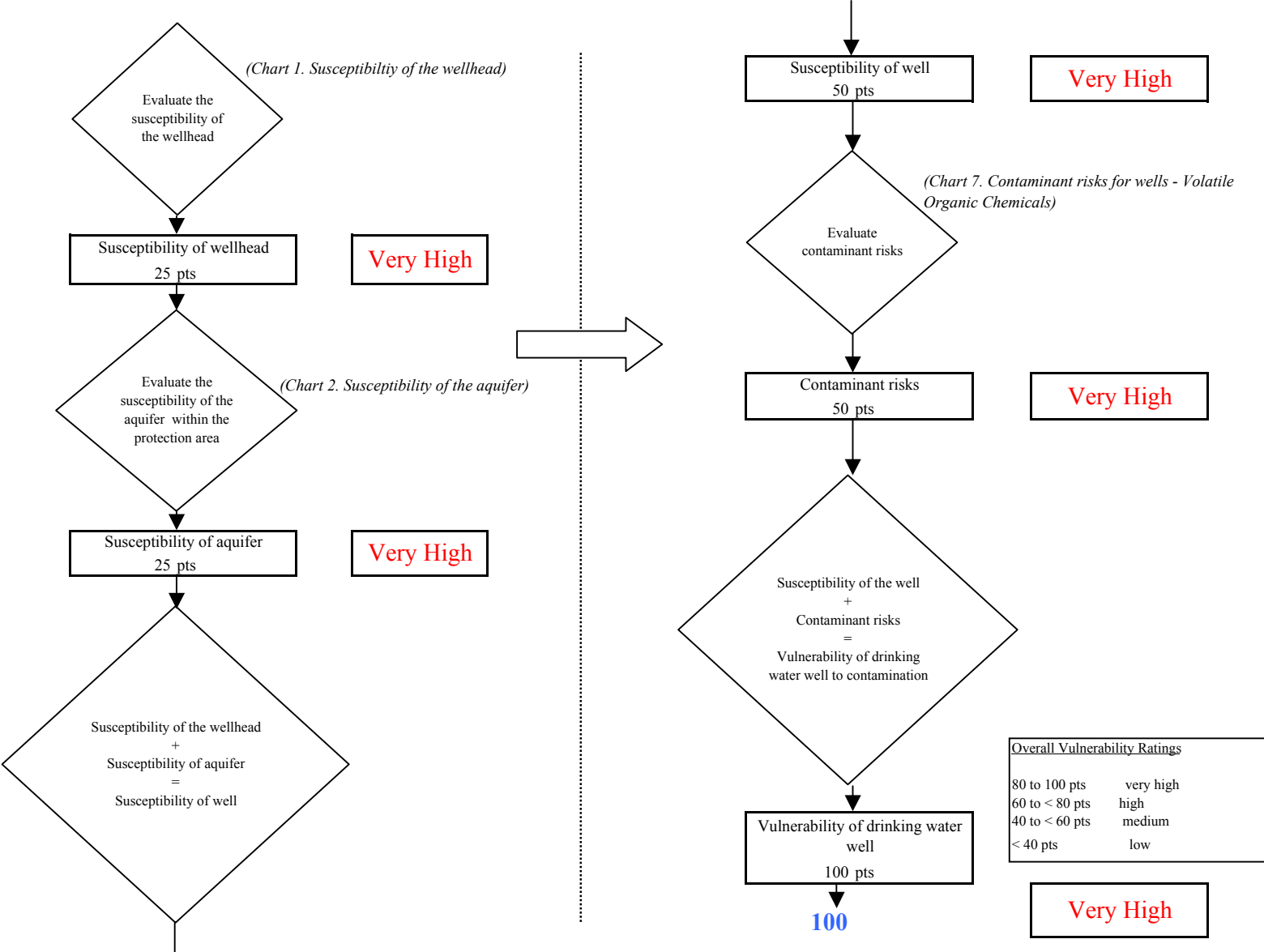


Chart 9. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

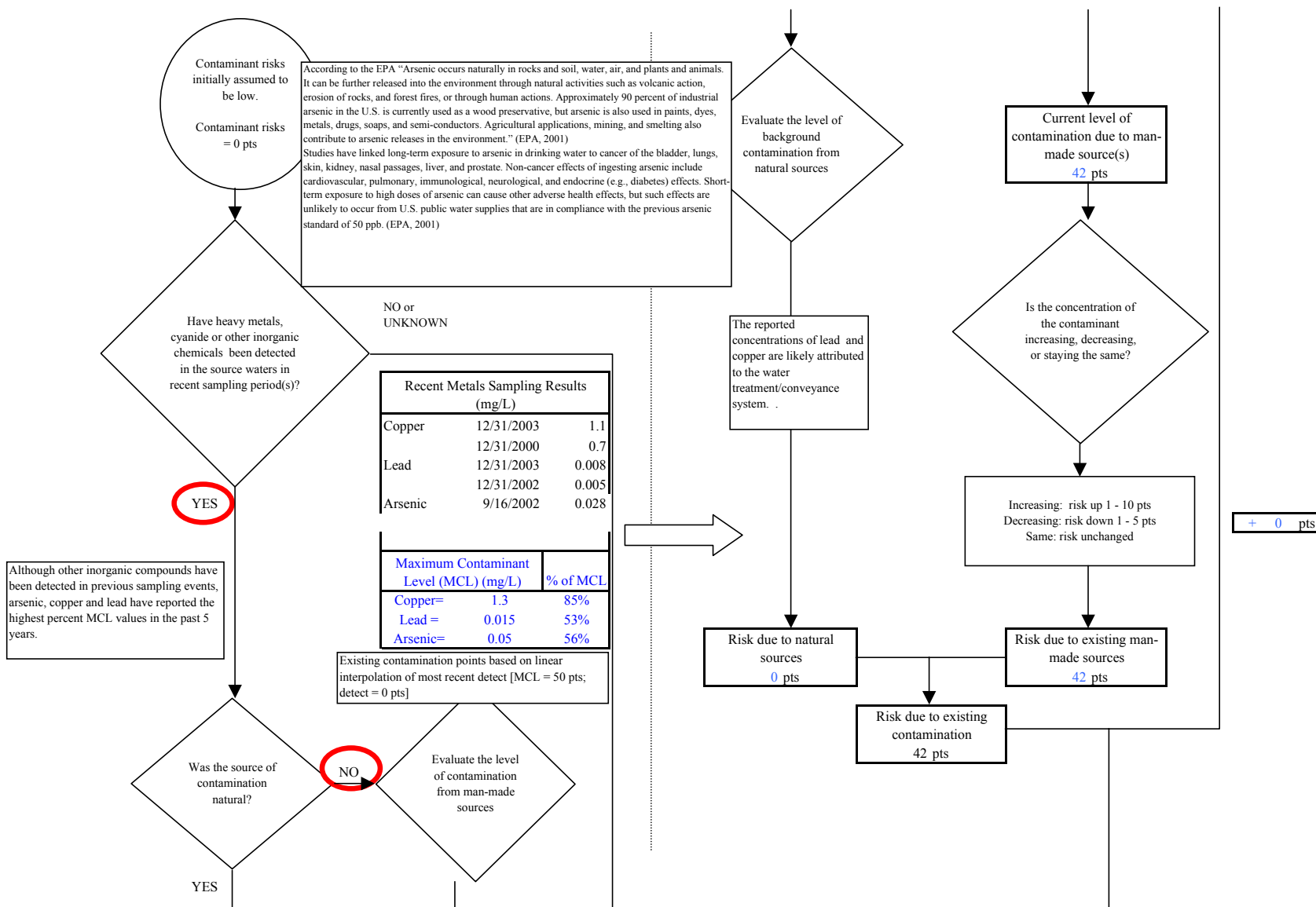


Chart 9. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

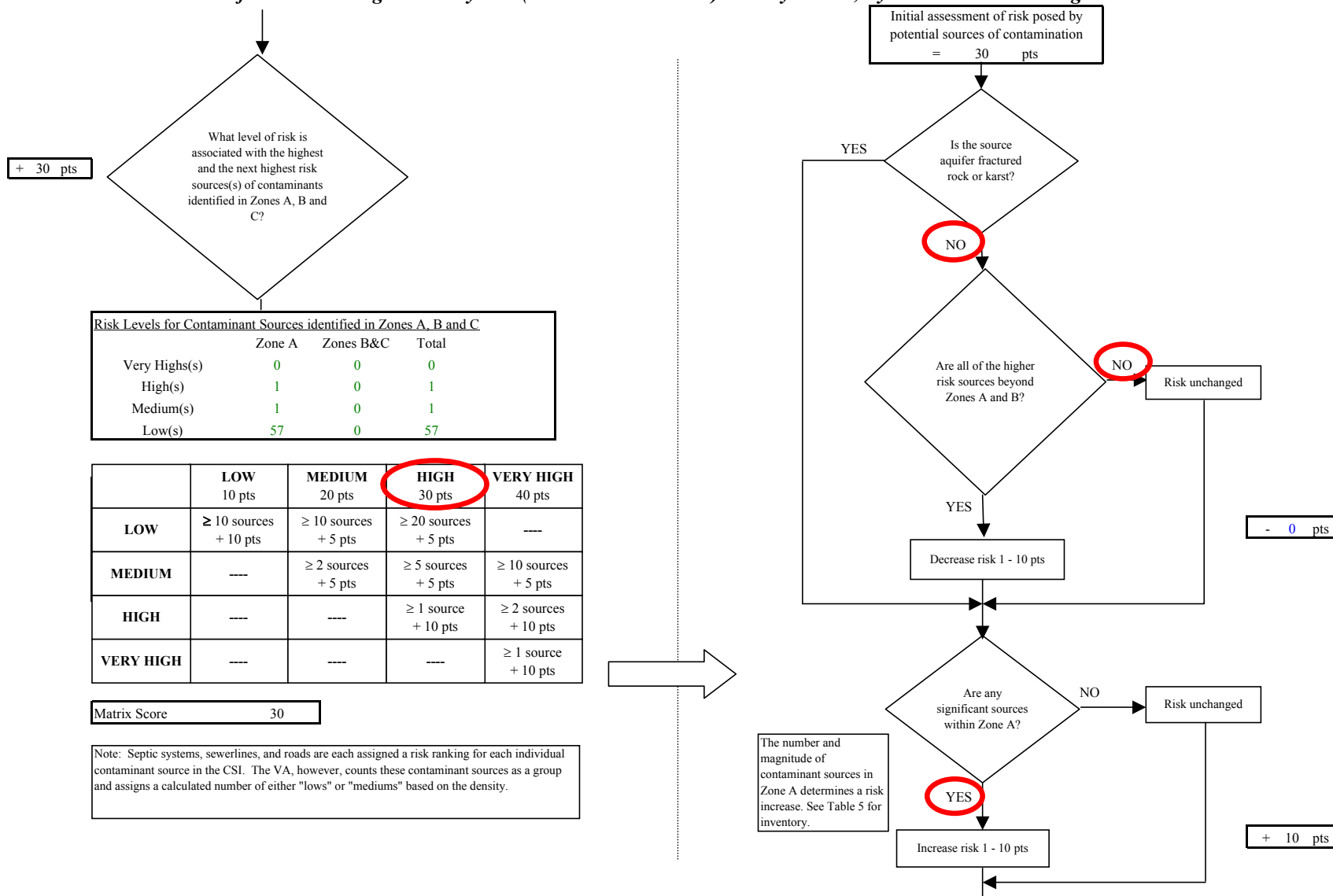


Chart 9. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

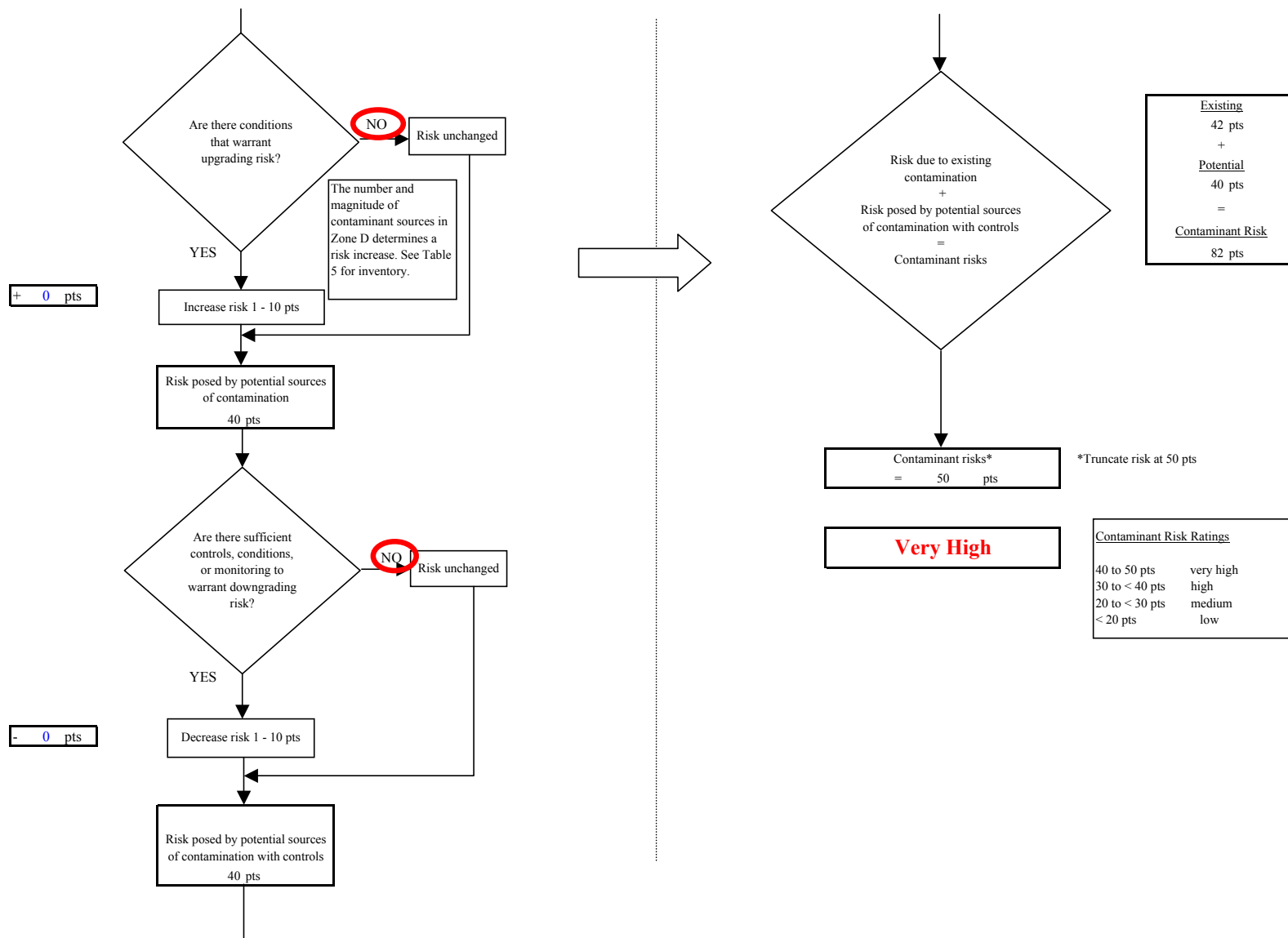


Chart 10. Vulnerability analysis for Kobuk Village Water System (PWS No. 340565.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

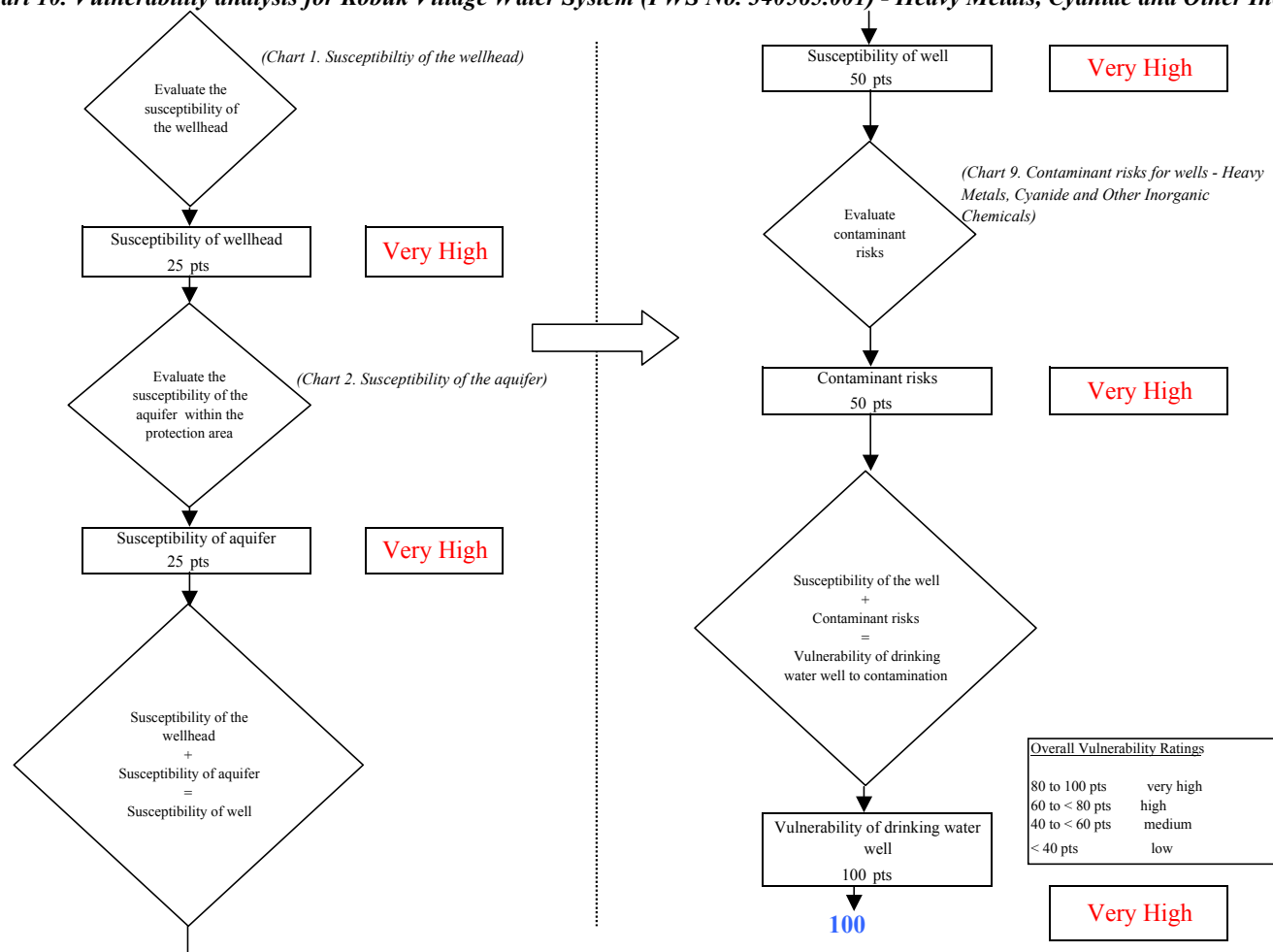


Chart 11. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Synthetic Organic Chemicals

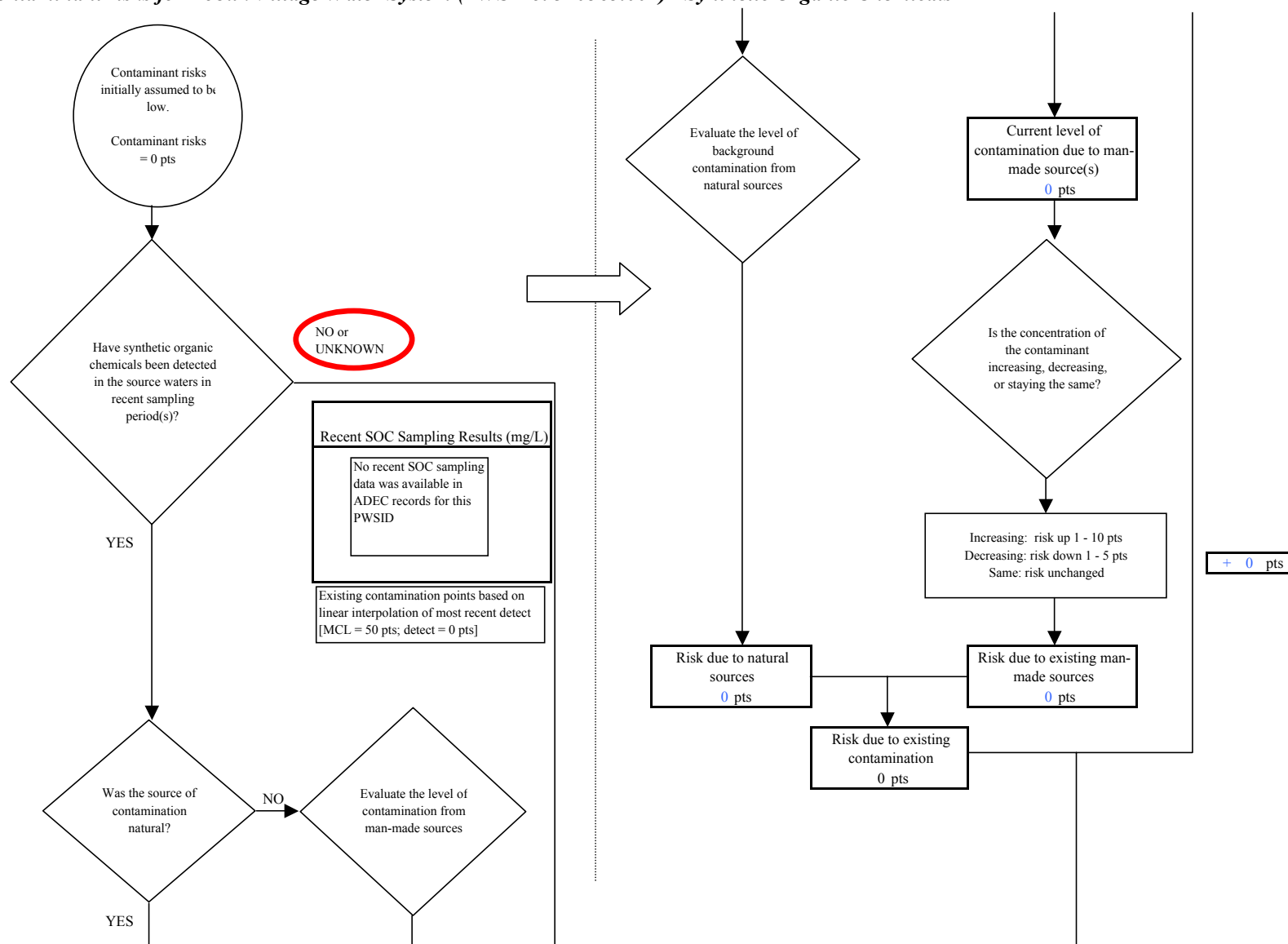


Chart 11. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Synthetic Organic Chemicals

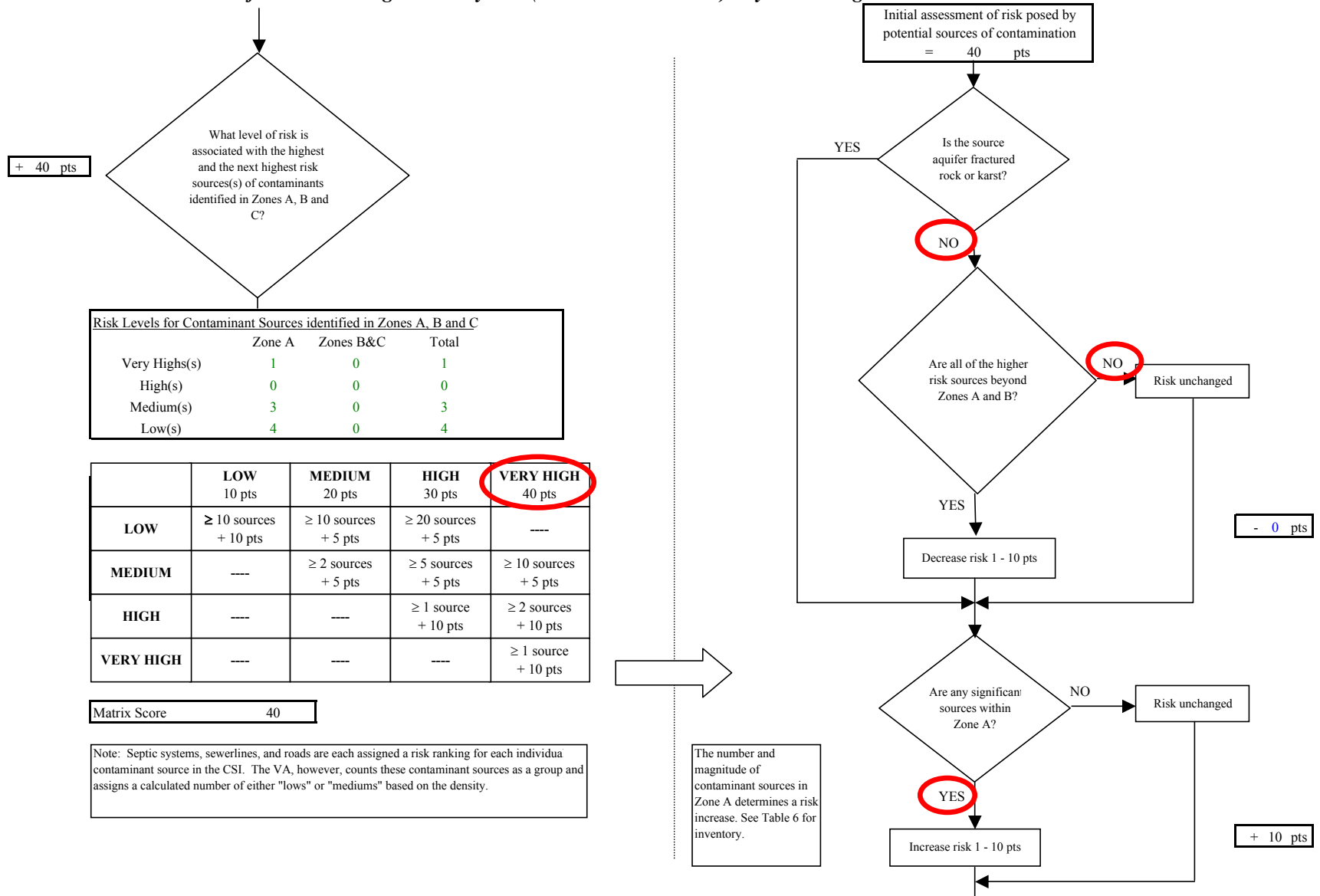


Chart 11. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Synthetic Organic Chemicals

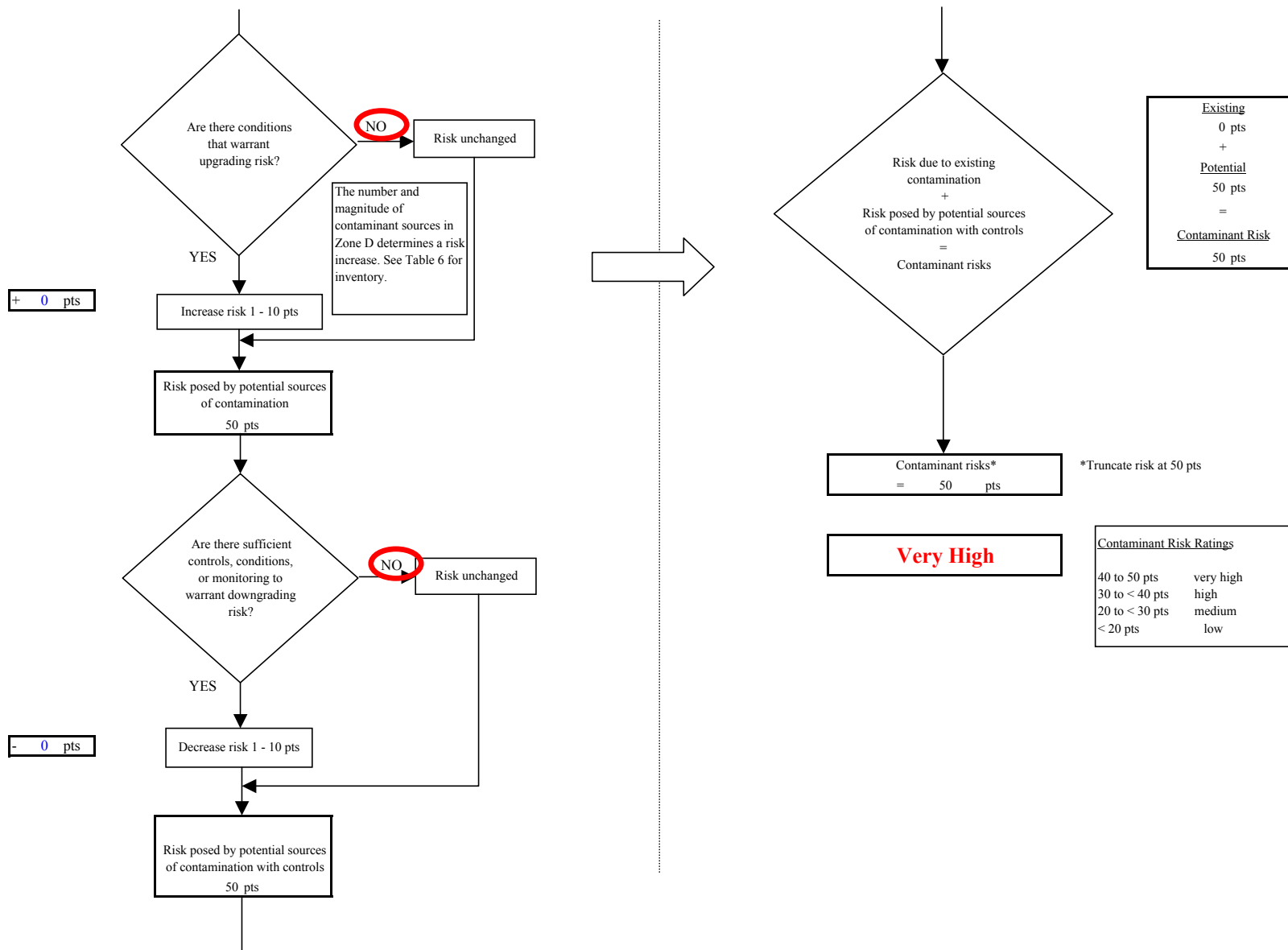


Chart 12. Vulnerability analysis for Kobuk Village Water System (PWS No. 340565.001) - Synthetic Organic Chemicals

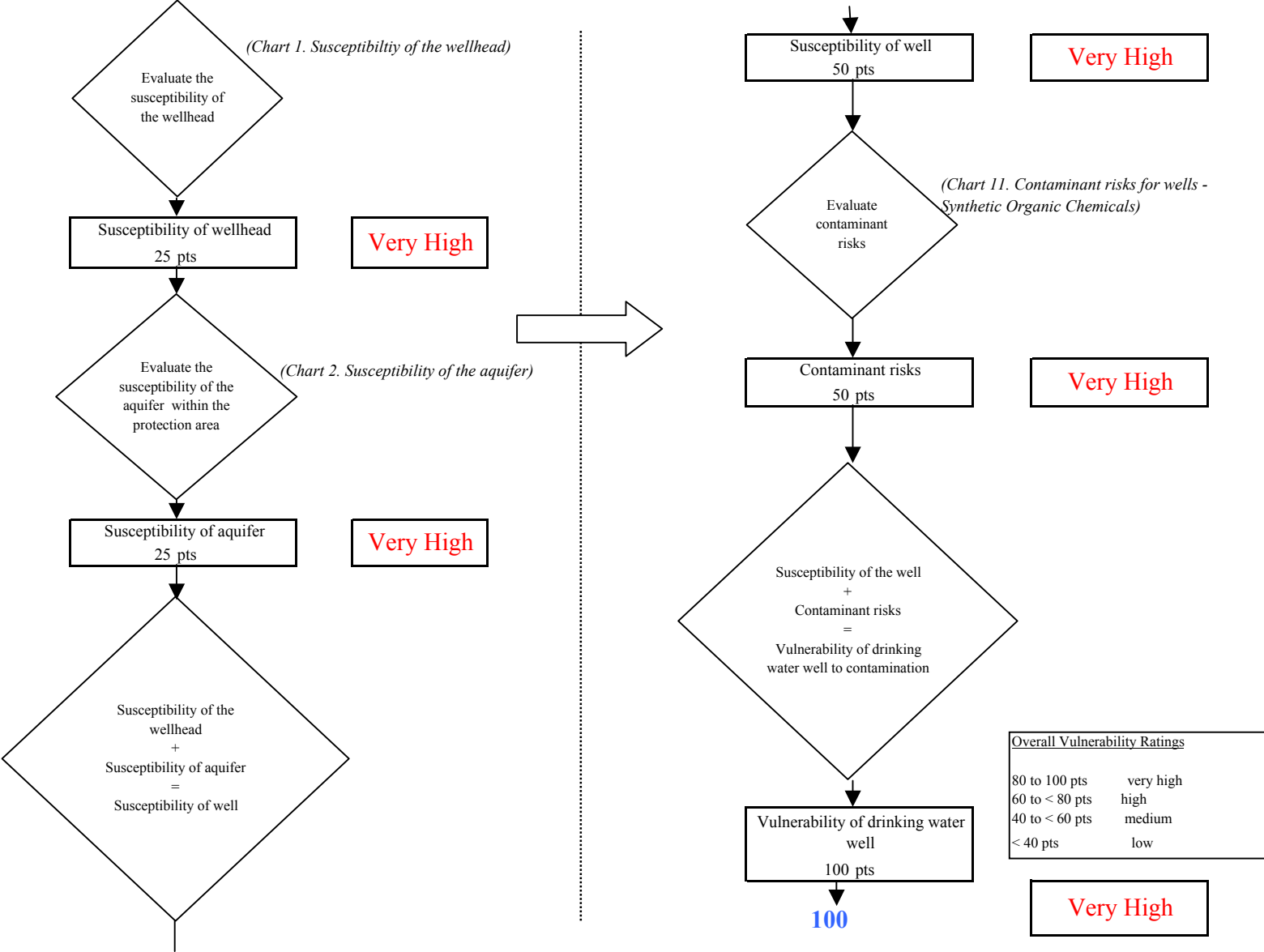


Chart 13. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Other Organic Chemicals

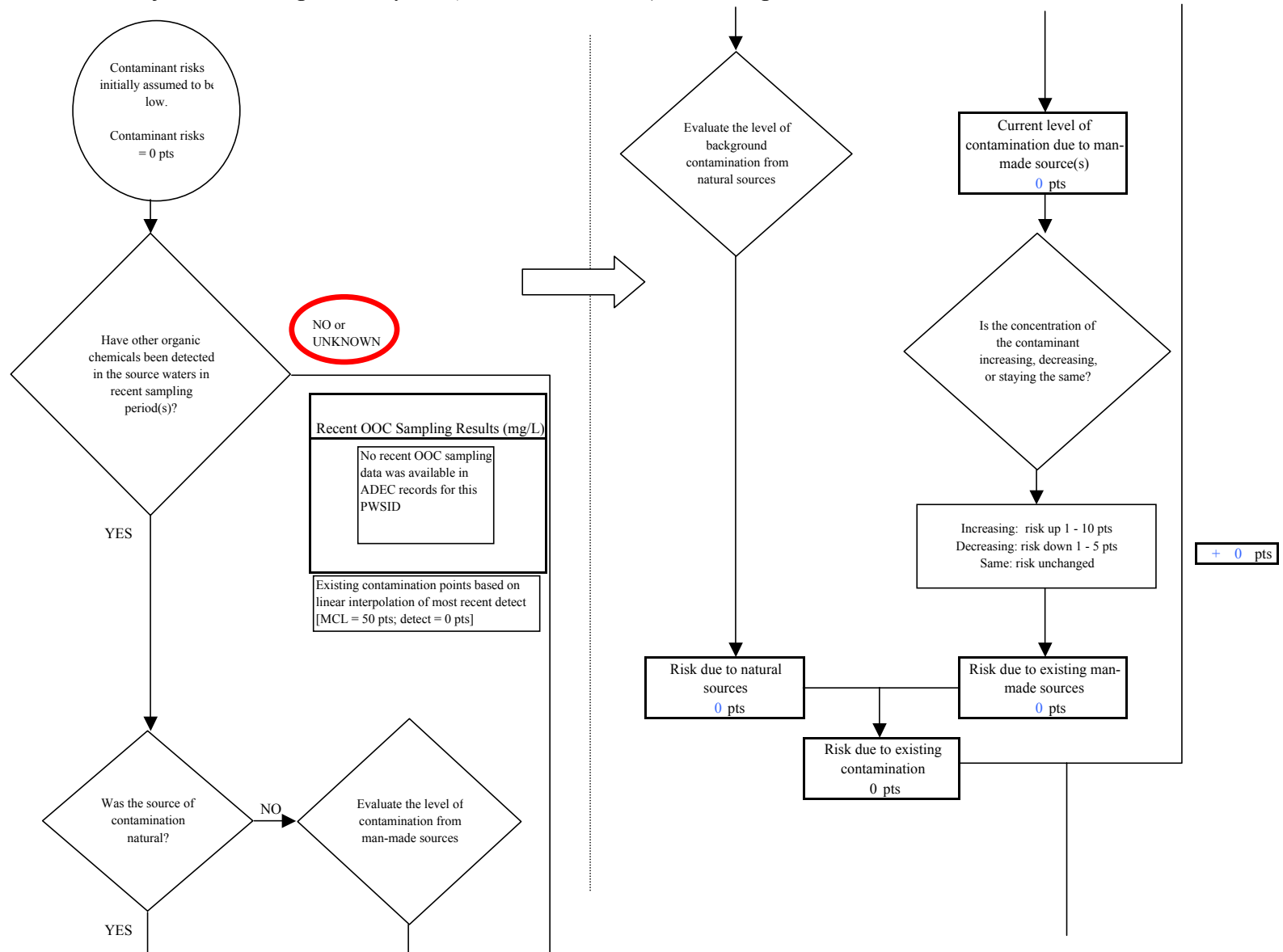


Chart 13. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Other Organic Chemicals

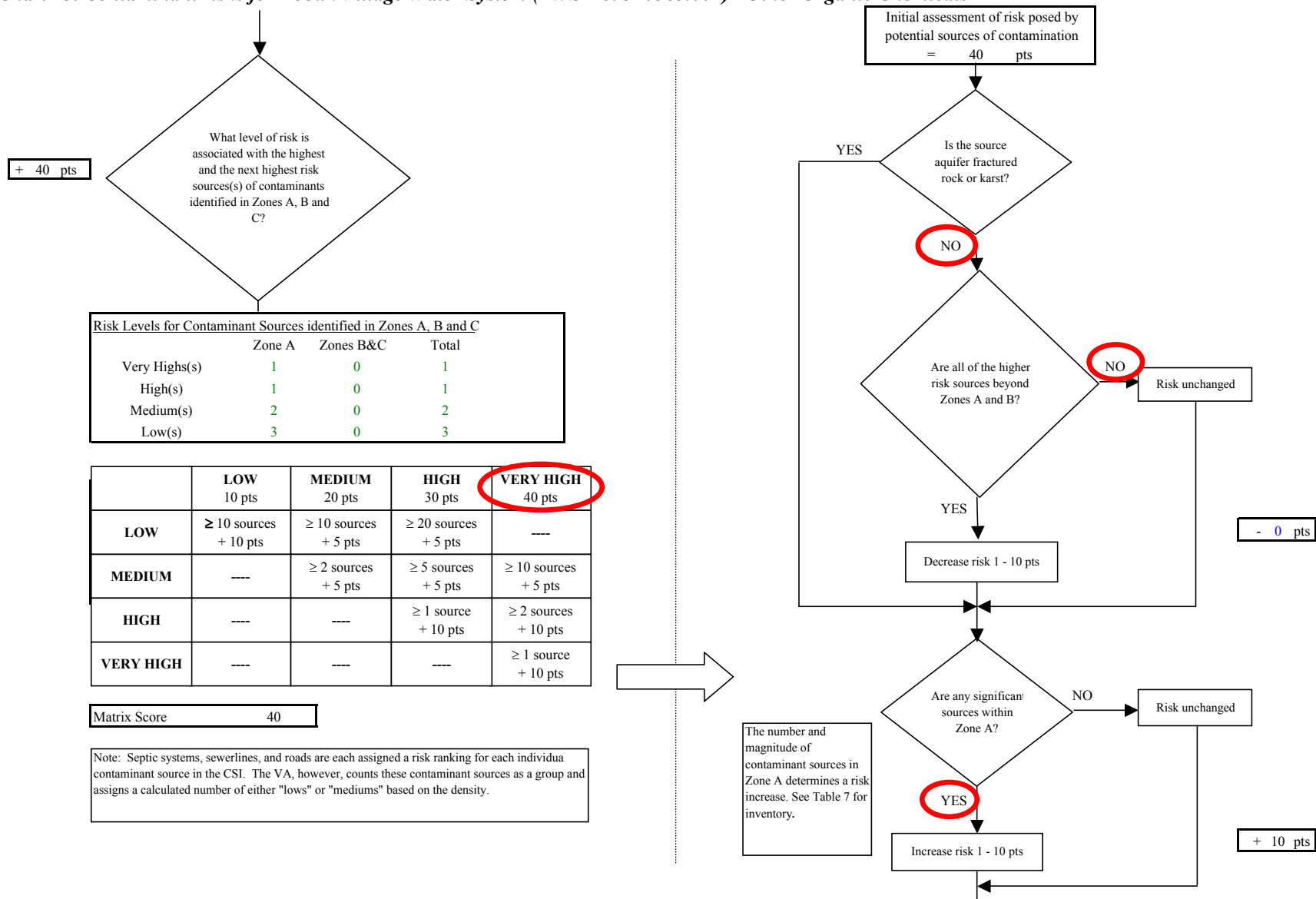


Chart 13. Contaminant risks for Kobuk Village Water System (PWS No. 340565.001) - Other Organic Chemicals

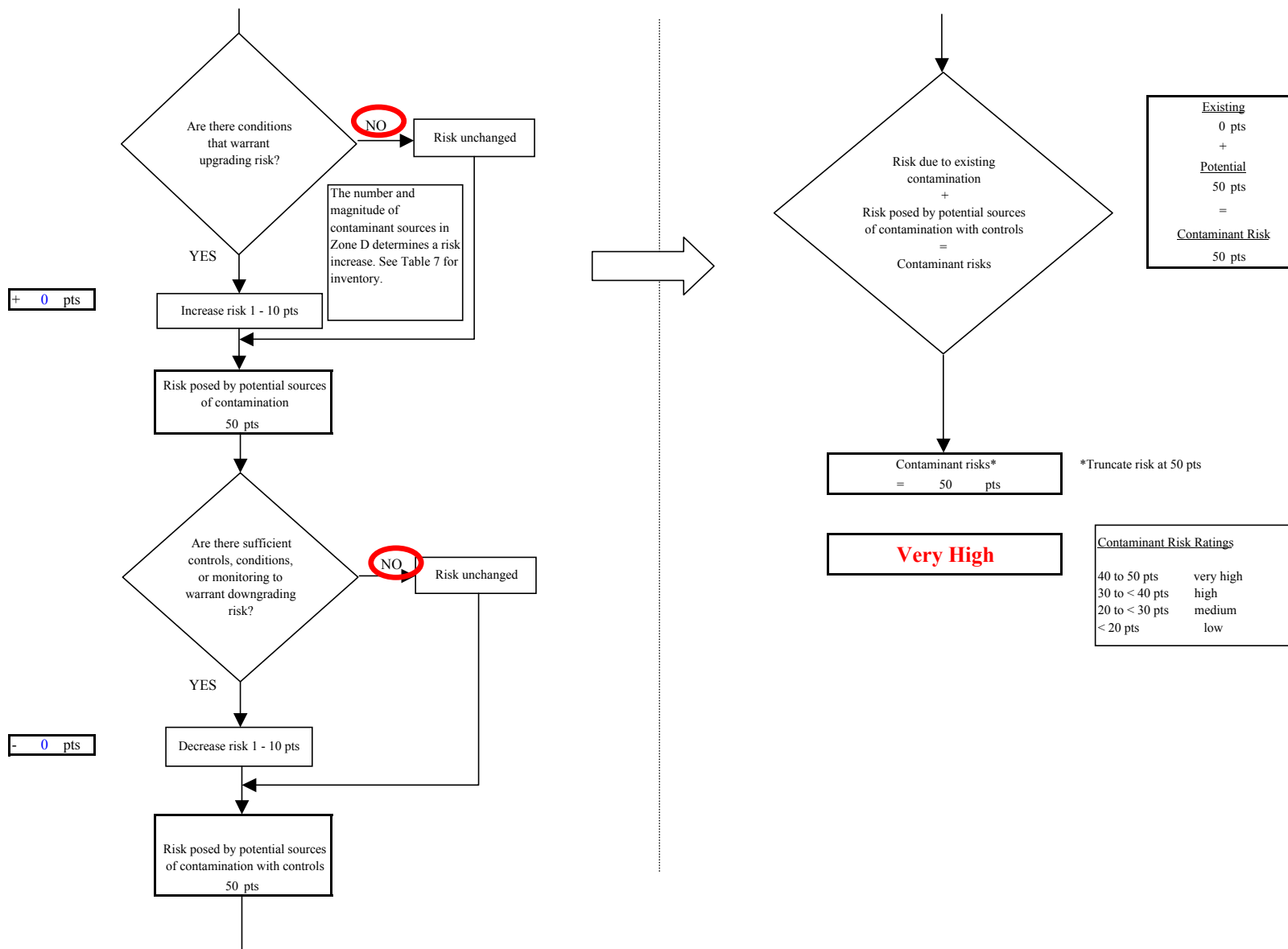


Chart 14. Vulnerability analysis for Kobuk Village Water System (PWS No. 340565.001) - Other Organic Chemicals

