



Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Donlin Creek Camp
Drinking Water System,
Crooked Creek, Alaska

PWSID # 271983.001

May 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1146
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 Donlin Creek Camp Source of Public Drinking Water, Crooked Creek, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Donlin Creek Camp has one Public Water System (PWS) well. The well (PWS No. 271983.001) has been used as a drinking water source since it was drilled in 1996.

The well is a Class A (community and non-transient non-community) water system located approximately 12 air miles north of the Kuskokwim River, near the village of Crooked Creek, Alaska. It is unknown if there is secondary storage of drinking water, and it appears that the untreated drinking water source is derived directly from the wellhead. This system operates year round and serves approximately 80 residents. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produce a **High** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: a domestic wastewater treatment plant disposal pond/lagoon, aboveground fuel tanks, and roads. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

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

PUBLIC DRINKING WATER SYSTEM

The Donlin Creek Camp well is a Class A (community/non-transient/non-community) public water system. The system is located approximately 12 air miles north of the Kuskokwim River, near the village of Crooked Creek, Alaska (Sec. 3, T22N,

R49W, Seward Meridian; see Map A of Appendix A). Crooked Creek is located on the north bank of the Kuskokwim River, at its junction with Crooked Creek. The community lies in the Kilbuck-Kuskokwim Mountains, 50 miles northeast of Aniak, 141 miles northeast of Bethel, and 275 miles west of Anchorage. The community has a population of 146 (ADCED, 2003). Average annual precipitation in Crooked Creek is 17 inches, including approximately 85 inches of snowfall. Temperatures range from -59 to 94°F.

The community of Crooked Creek obtains most of their water supply from a community well. All households lack plumbing, and residents use honey buckets (ADCED, 2003). Crooked Creek receives electrical power from the Middle Kuskokwim Electric Cooperative. Power generating facilities are fueled by diesel. Refuse is collected by individuals and transported to the landfill (ADCED, 2003).

According to information supplied by ADEC for the Donlin Creek Camp PWS, the depth of the primary water well is 530 feet below the ground surface, and the well is screened in an unconfined aquifer. The well is not located within a floodplain.

A sanitary survey was not available through the ADEC; therefore, it is unknown if 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. A well construction log indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The community divides itself into three villages: upper, middle and lower. The main village is located in the Kilbuck-Kuskokwim Mountains, immediately upstream from the confluence of Crooked Creek with the Kuskokwim River. The hills rise sharply, just 60 yards from the riverbank. Soils information is limited; however, it appears that silts and silty sands overlie silty gravel and talus. Bedrock appears to be

close to the surface. Permafrost is reported to exist at a depth of about 20 feet, and the active layer is approximately 4 feet deep (U.S. Department of Health, et al, 1982).

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 Donlin Creek Camp 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 Donlin Creek Camp PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

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

For the basis of all Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile organic chemicals,
- Heavy metals, cyanide and other inorganic chemicals,
- Synthetic organic chemicals,
- Other organic chemicals.

The sources are displayed on Map C of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a “potential” or “existing” source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

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

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B

because of their short life span. Only “Very High” and “High” rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well. Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF THE DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains fourteen charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Chart 4 contains the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

A score for the Natural Susceptibility is reached by considering the properties of the well and the aquifer.

$$\begin{aligned}
 & \text{Susceptibility of the Wellhead (0 – 25 Points)} \\
 & \quad \text{(Chart 1 of Appendix D)} \\
 & \quad + \\
 & \text{Susceptibility of the Aquifer (0 – 25 Points)} \\
 & \quad \text{(Chart 2 of Appendix D)} \\
 & \quad =
 \end{aligned}$$

**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 Donlin Creek Camp’s water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	13	Medium
Natural Susceptibility	33	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	40	Very High
Nitrates and/or Nitrites	41	Very High
Volatile Organic Chemicals	35	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	13	Low
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	12	Low

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

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

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	75	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	70	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	50	Medium
Synthetic Organic Chemicals	45	Medium
Other Organic Chemicals	45	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of a domestic wastewater treatment plant disposal pond/lagoon in Zone A (see Table 2 – Appendix B).

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

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **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 domestic wastewater treatment plant disposal pond/lagoon in Zone A (see Table 3 – Appendix B).

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

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **High**. The risk is primarily attributed to the presence of aboveground fuel tanks in Zone A. Several other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

All recent sampling data for VOCs were below detection levels for the Donlin Creek Camp (See

Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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

Heavy Metals, Cyanide and Other Inorganic Chemicals

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

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

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Medium**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Low**. The risk is primarily attributed to the presence of a domestic wastewater treatment plant disposal pond/lagoon in Zone A (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Donlin Creek Camp (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Medium**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Low**. The risk is primarily attributed to the presence of a domestic wastewater treatment plant disposal pond/lagoon and roads in Zone A (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for the Donlin Creek Camp (See Chart 13 –

Contaminant Risks for Other Organic Chemicals in Appendix D).

After combining the contaminant risk for other organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Medium**.

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the Donlin Creek Camp and the community of Crooked Creek 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.

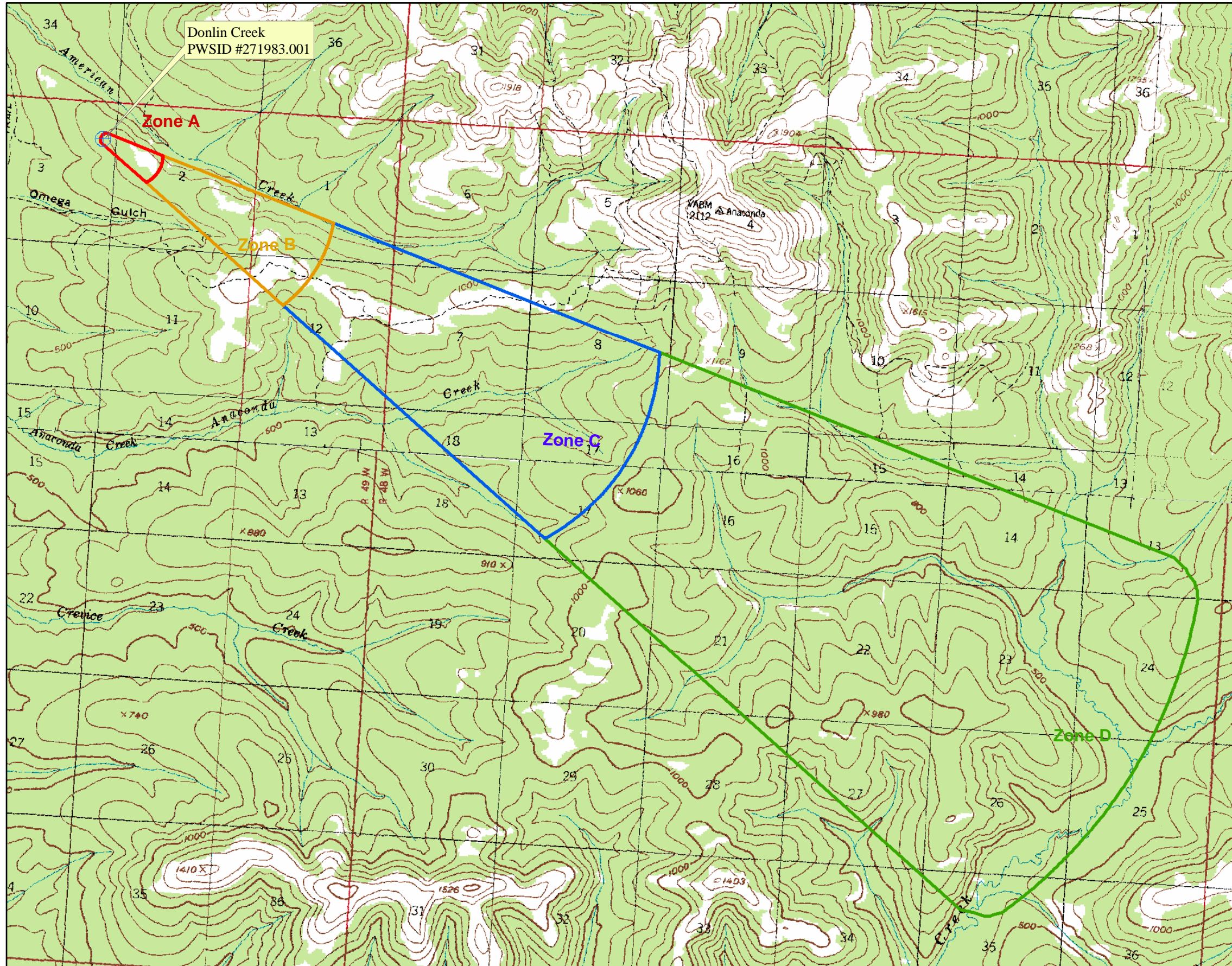
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APPENDIX A

Drinking Water Protection Area Location Map (Map A)

Public Water Well System for PWS #271983.001 Donlin Creek



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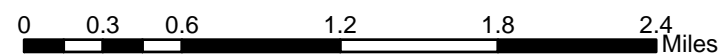
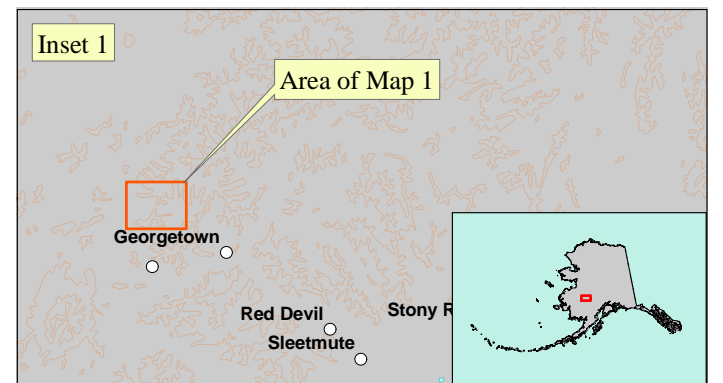
- Public Water System Well
- Groundwater Protection Zones**
- Zone A – Several Months Travel Time
- Zone B – Less Than 2 Years Travel Time
- Zone C – Less Than 5 Years Travel Time
- Zone D – Less Than 10 Years Travel Time

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours

Data Sources:
 - Contaminant Sources, Public Water System Wells, Contours
 - Alaska Department of Environmental Conservation (ADEC)
 - Critical Facilities, Federal Emergency Management Agency (FEMA)
 All other data:
 - United States Geological Survey (USGS)
 - Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class A Public Water Systems" published by ADEC

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



APPENDIX B

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

Table 1

**Contaminant Source Inventory for
Donlin Creek**

PWSID 271983.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	C	
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assume 3 or less residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	C	
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 1-20 roads in Zone A

*Contaminant Source Inventory and Risk Ranking for
Donlin Creek
Sources of Bacteria and Viruses*

PWSID 271983.001

Table 2

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A

*Contaminant Source Inventory and Risk Ranking for
Donlin Creek
Sources of Nitrates/Nitrites*

PWSID 271983.001

Table 3

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A

*Contaminant Source Inventory and Risk Ranking for
Donlin Creek
Sources of Volatile Organic Chemicals*

PWSID 271983.001

Table 4

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 3 or less residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A

*Contaminant Source Inventory and Risk Ranking for
Donlin Creek*

PWSID 271983.001

Table 5

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A

*Contaminant Source Inventory and Risk Ranking for
Donlin Creek
Sources of Synthetic Organic Chemicals*

PWSID 271983.001

Table 6

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	

*Contaminant Source Inventory and Risk Ranking for
Donlin Creek
Sources of Other Organic Chemicals*

PWSID 271983.001

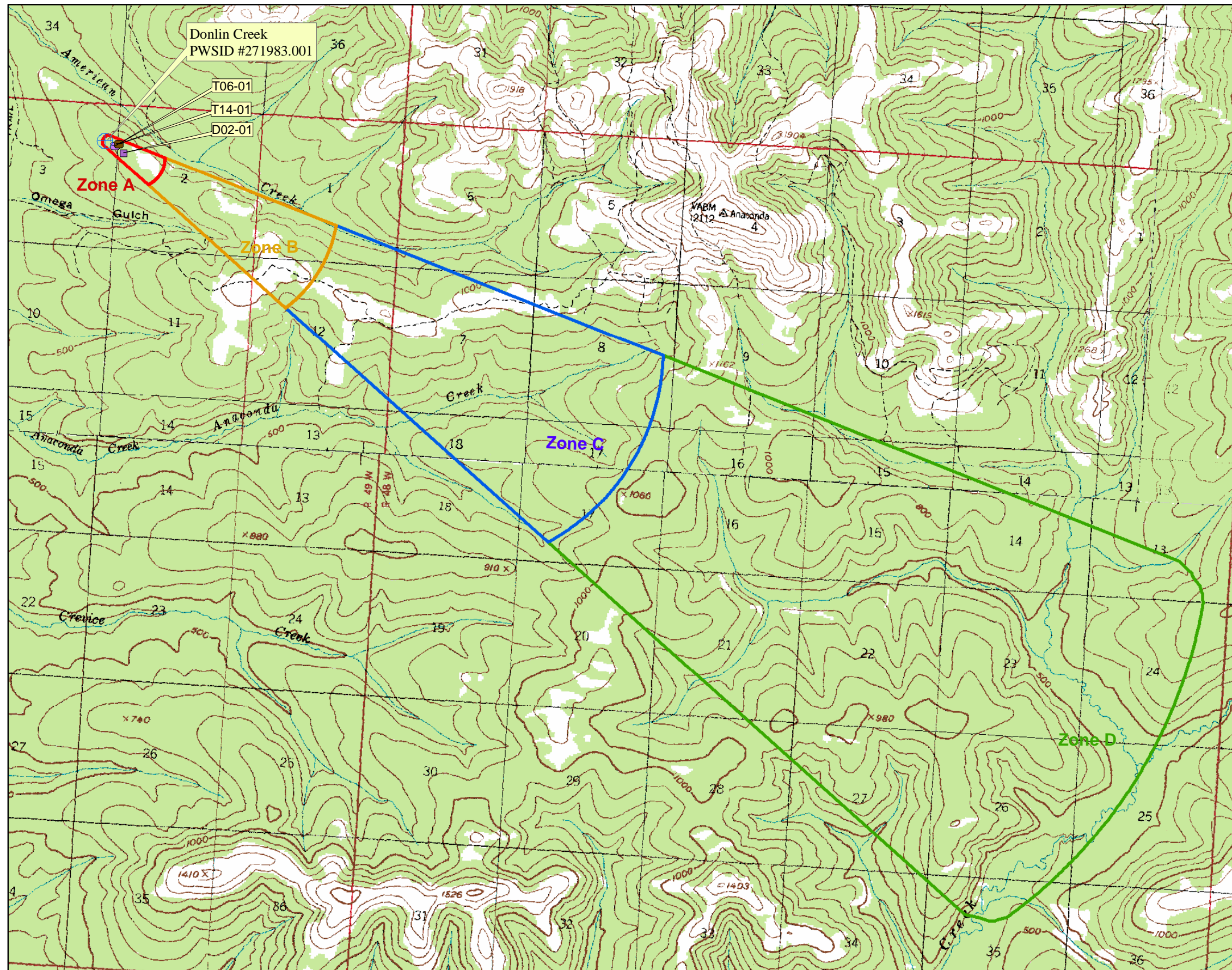
Table 7

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Map Number</i>	<i>Comments</i>
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A

APPENDIX C

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

Public Water Well System for PWS #271983.001 Donlin Creek
Showing Potential and Existing Sources of Contamination

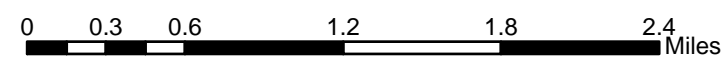
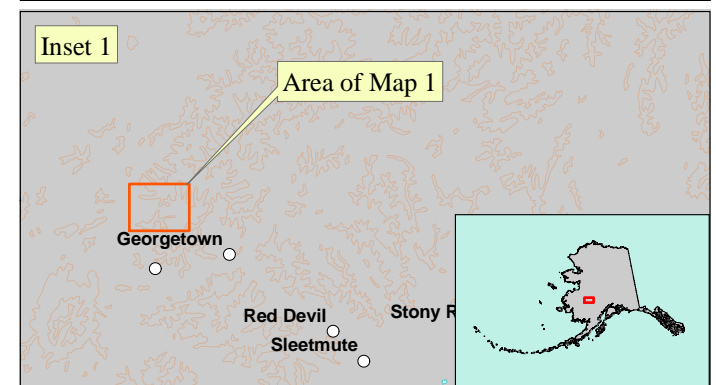


LEGEND

- Public Water System Well
- Groundwater Protection Zones**
 - Zone A – Several Months Travel Time
 - Zone B – Less Than 2 Years Travel Time
 - Zone C – Less Than 5 Years Travel Time
 - Zone D – Less Than 10 Years Travel Time
- Hydrography/Physical**
 - Parcels
 - Stream
 - Lake or Pond
 - Contours
- Existing or Potential Contaminant Sources**
 - Tanks, diesel (aboveground) (T06)
 - Tanks, heating oil, nonresidential (aboveground) (T14)
 - Domestic wastewater treatment plant disposal pond/lagoon (D02)

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.



APPENDIX D

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

Chart 1. Susceptibility of the wellhead - Donlin Creek (PWS No.271983.001)

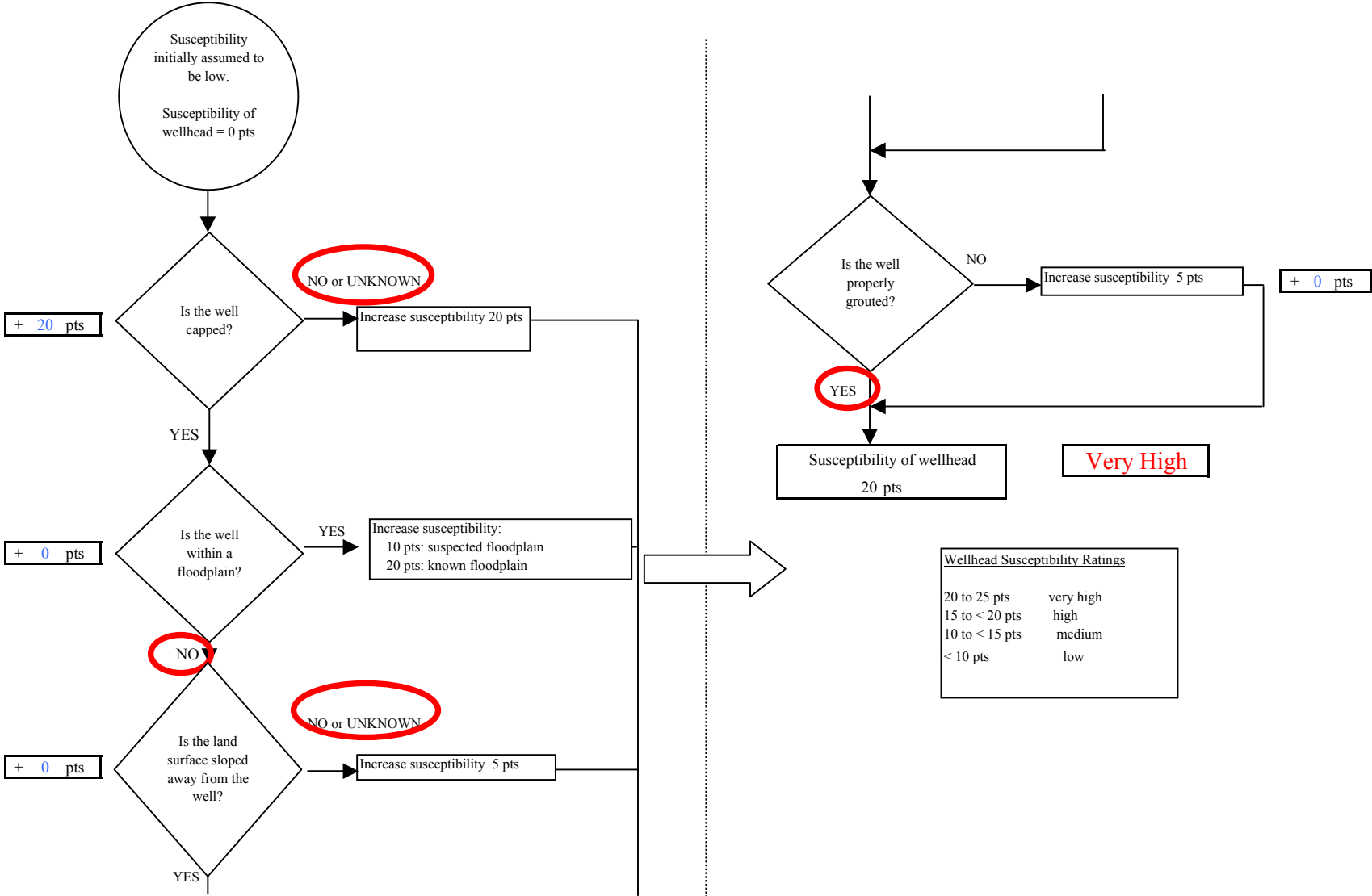


Chart 2. Susceptibility of the aquifer Donlin Creek (PWS No.271983.001)

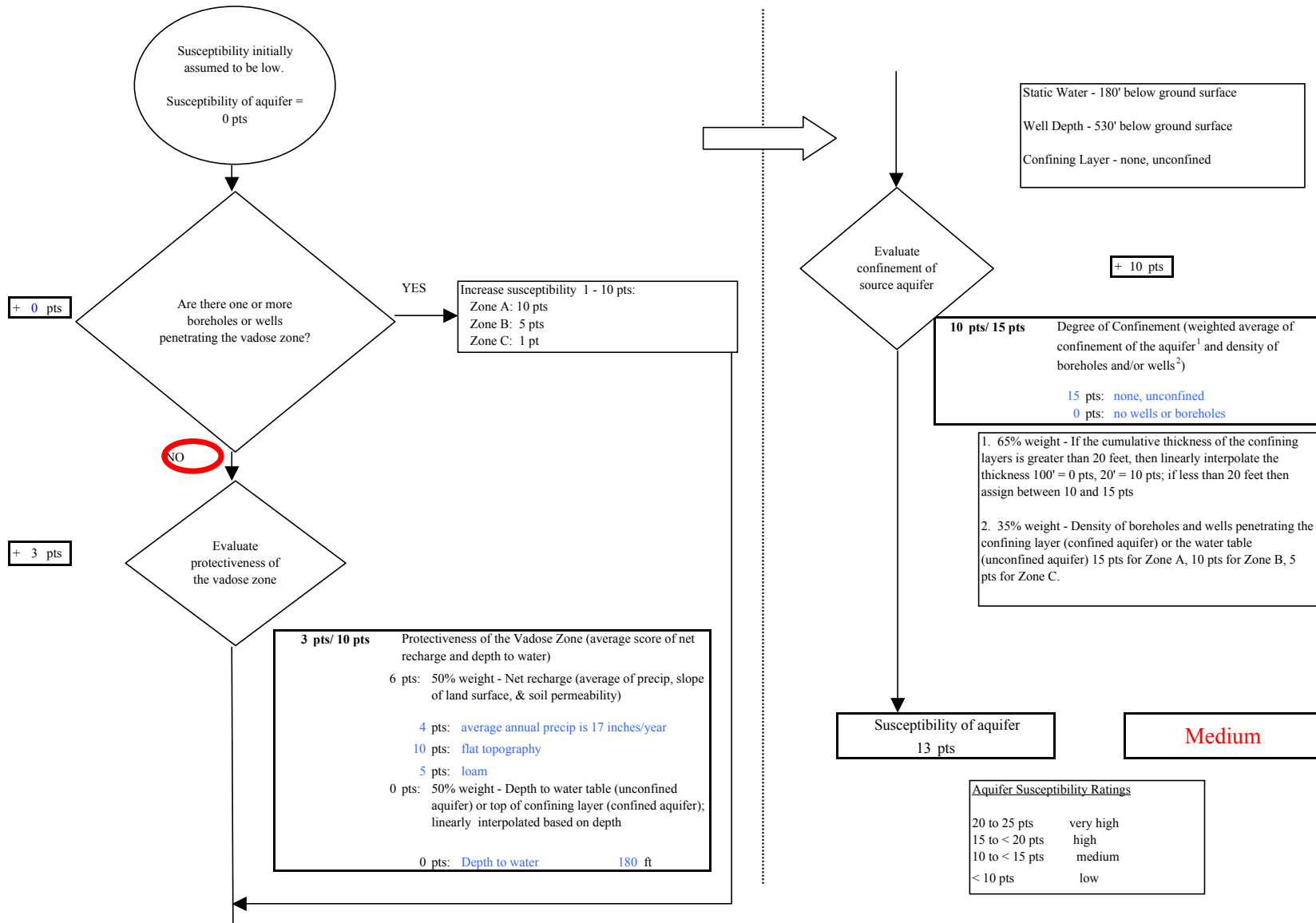


Chart 3. Contaminant risks for Donlin Creek (PWS No.271983.001) - Bacteria & Viruses

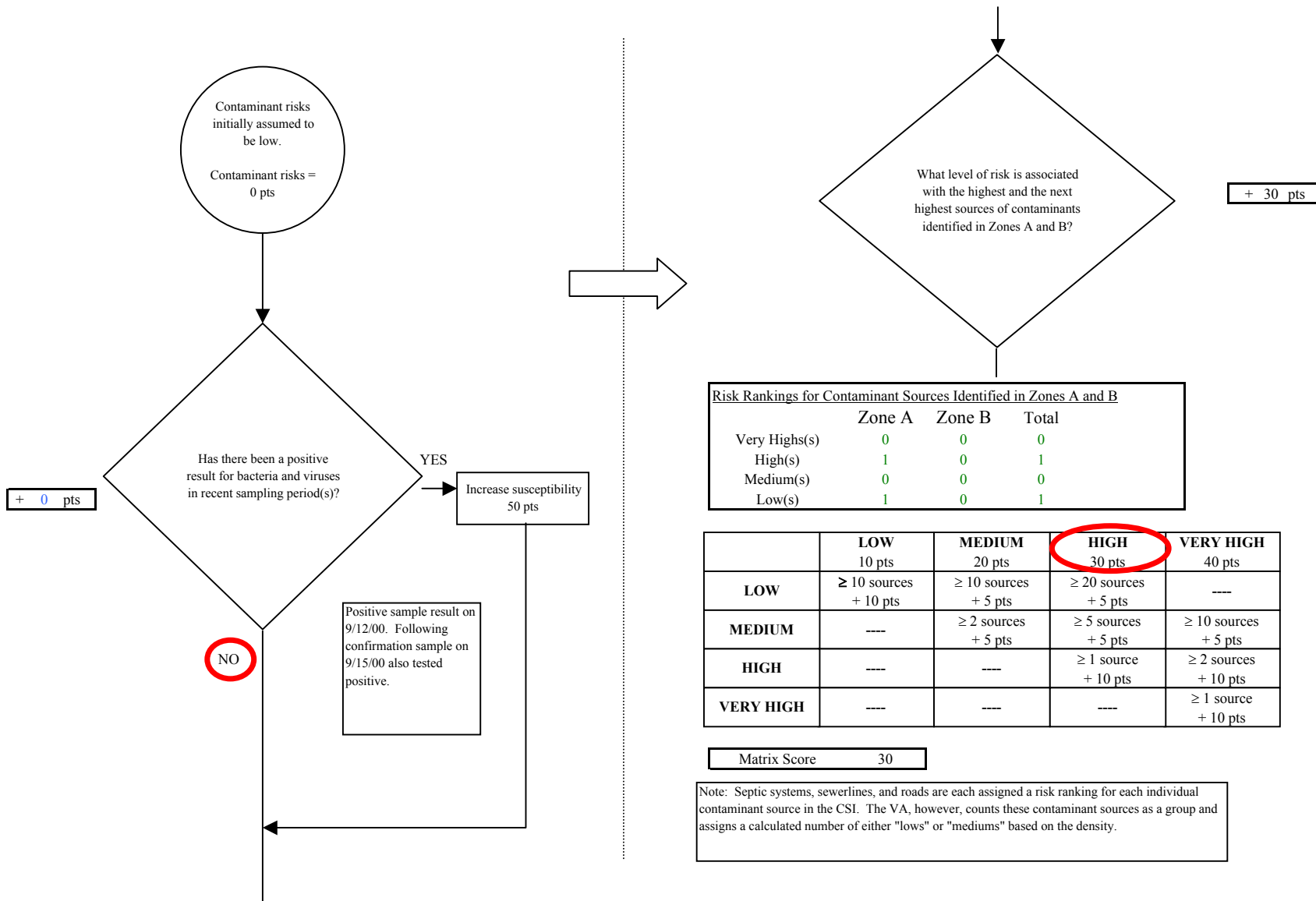


Chart 3. Contaminant risks for Donlin Creek (PWS No.271983.001) - Bacteria & Viruses

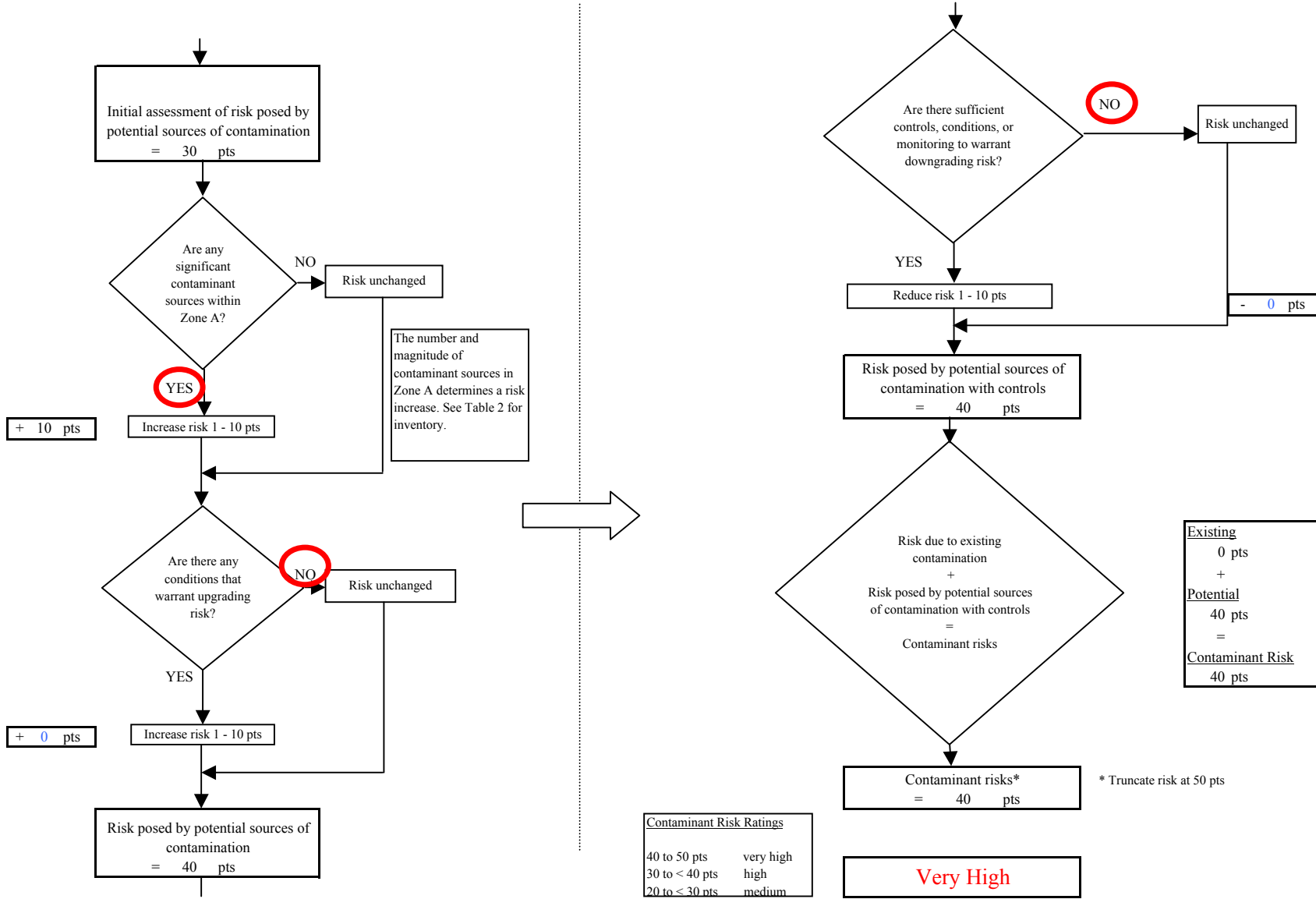


Chart 4. Vulnerability analysis for Donlin Creek (PWS No.271983.001) - Bacteria & Viruses

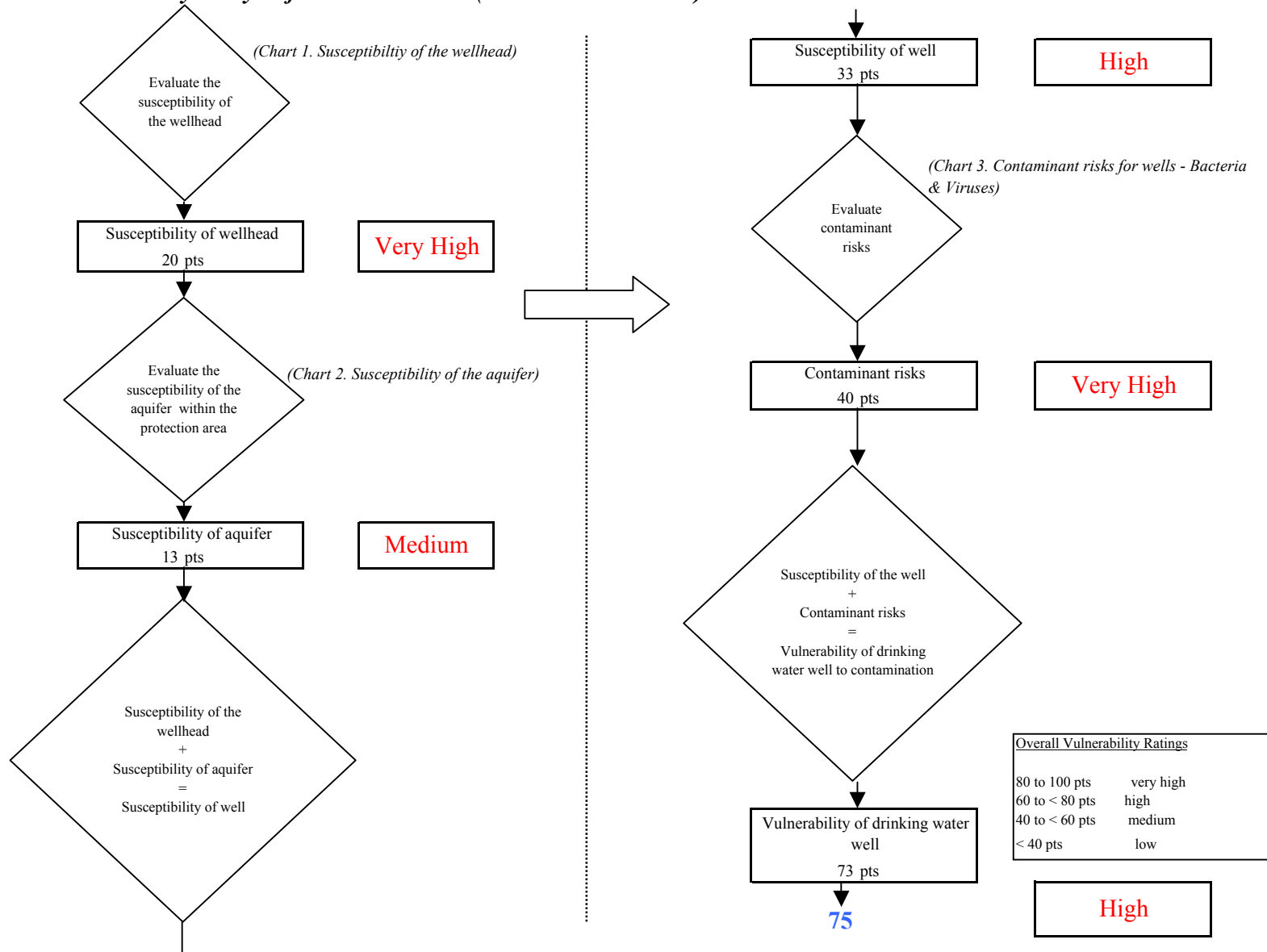


Chart 5. Contaminant risks for Donlin Creek (PWS No.271983.001) - Nitrates and Nitrites

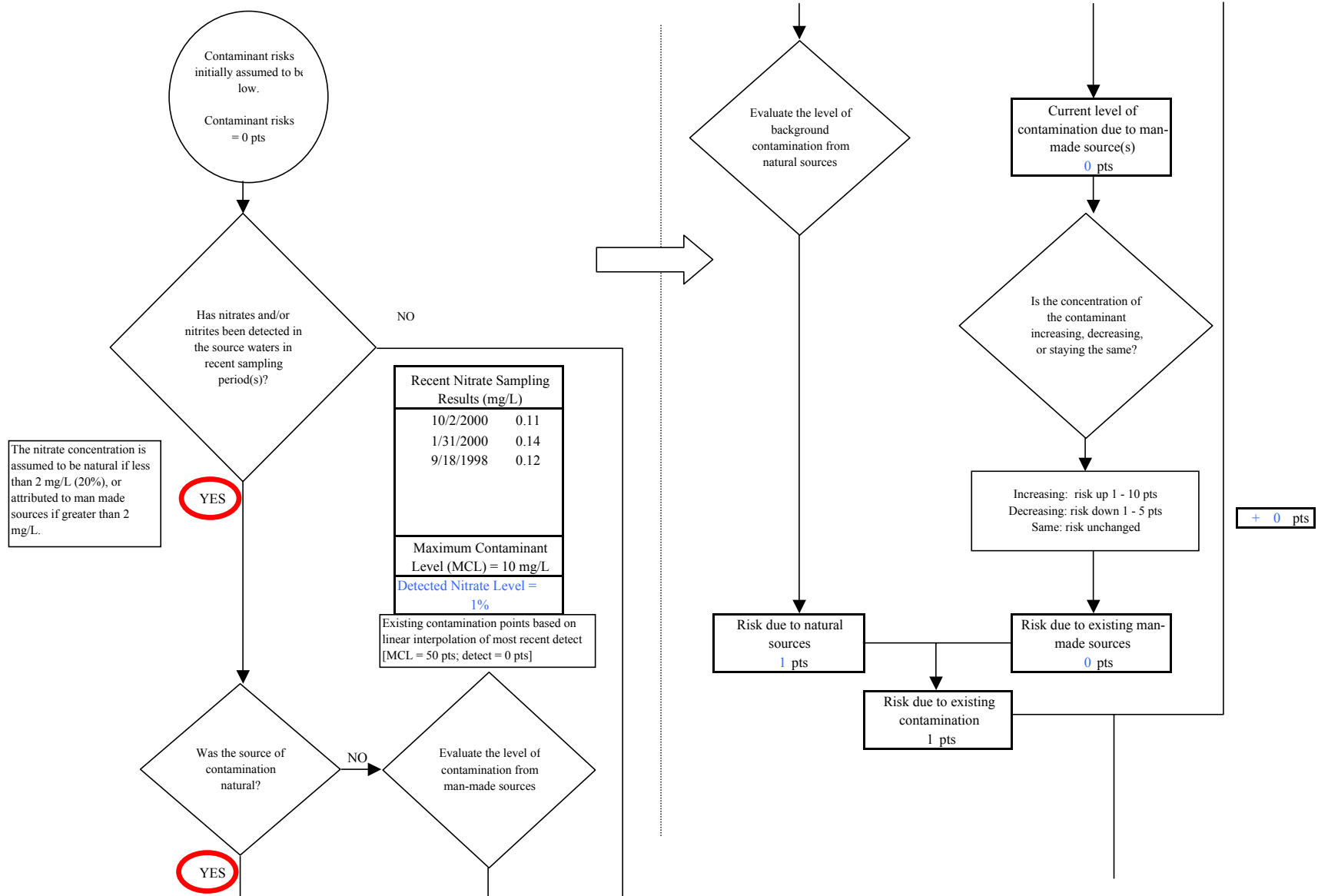


Chart 5. Contaminant risks for Donlin Creek (PWS No.271983.001) - Nitrates and Nitrites

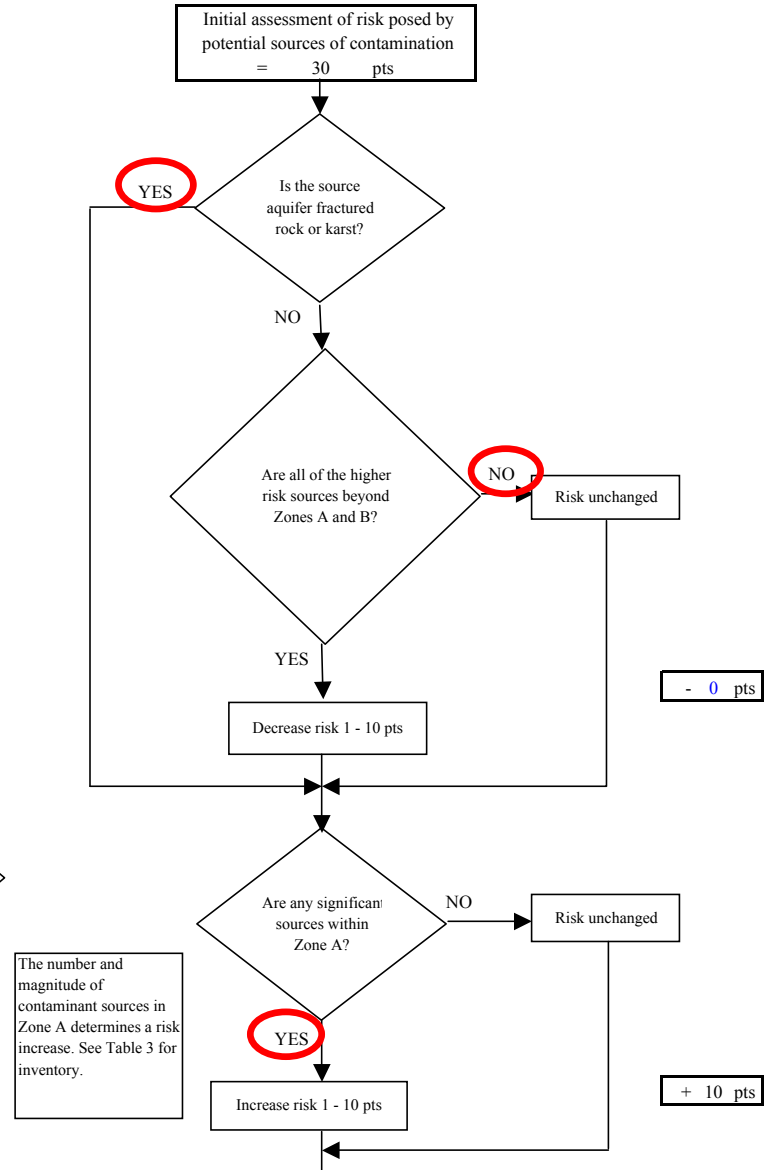
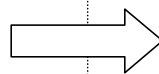
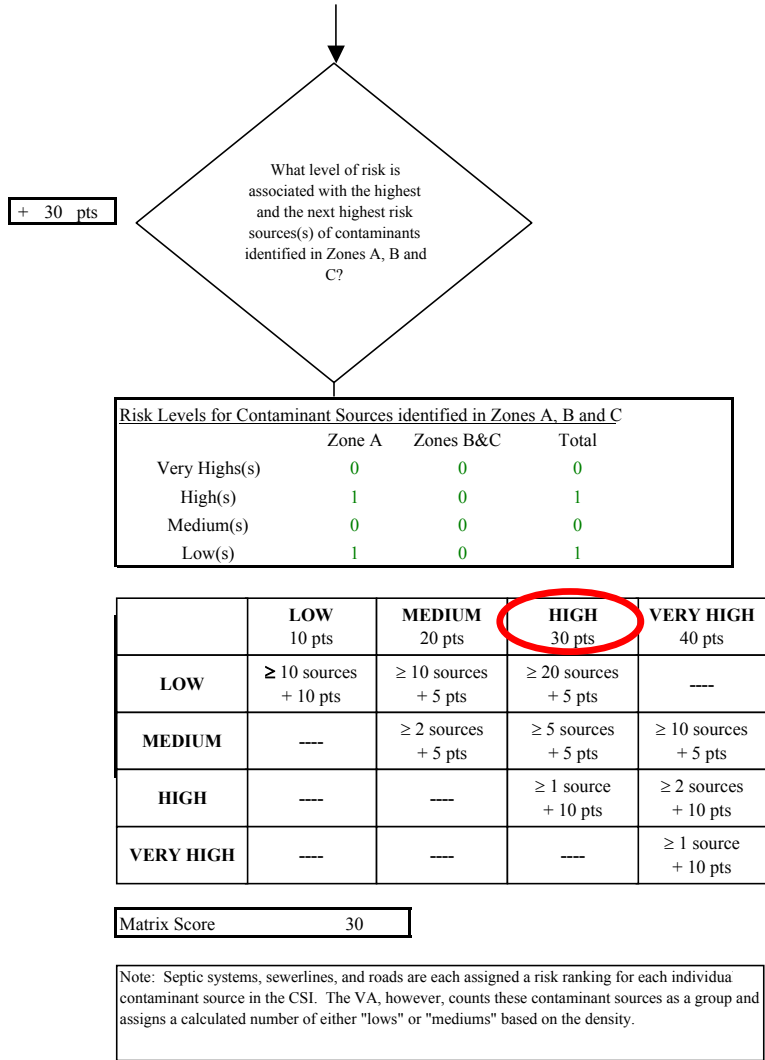


Chart 5. Contaminant risks for Donlin Creek (PWS No.271983.001) - Nitrates and Nitrites

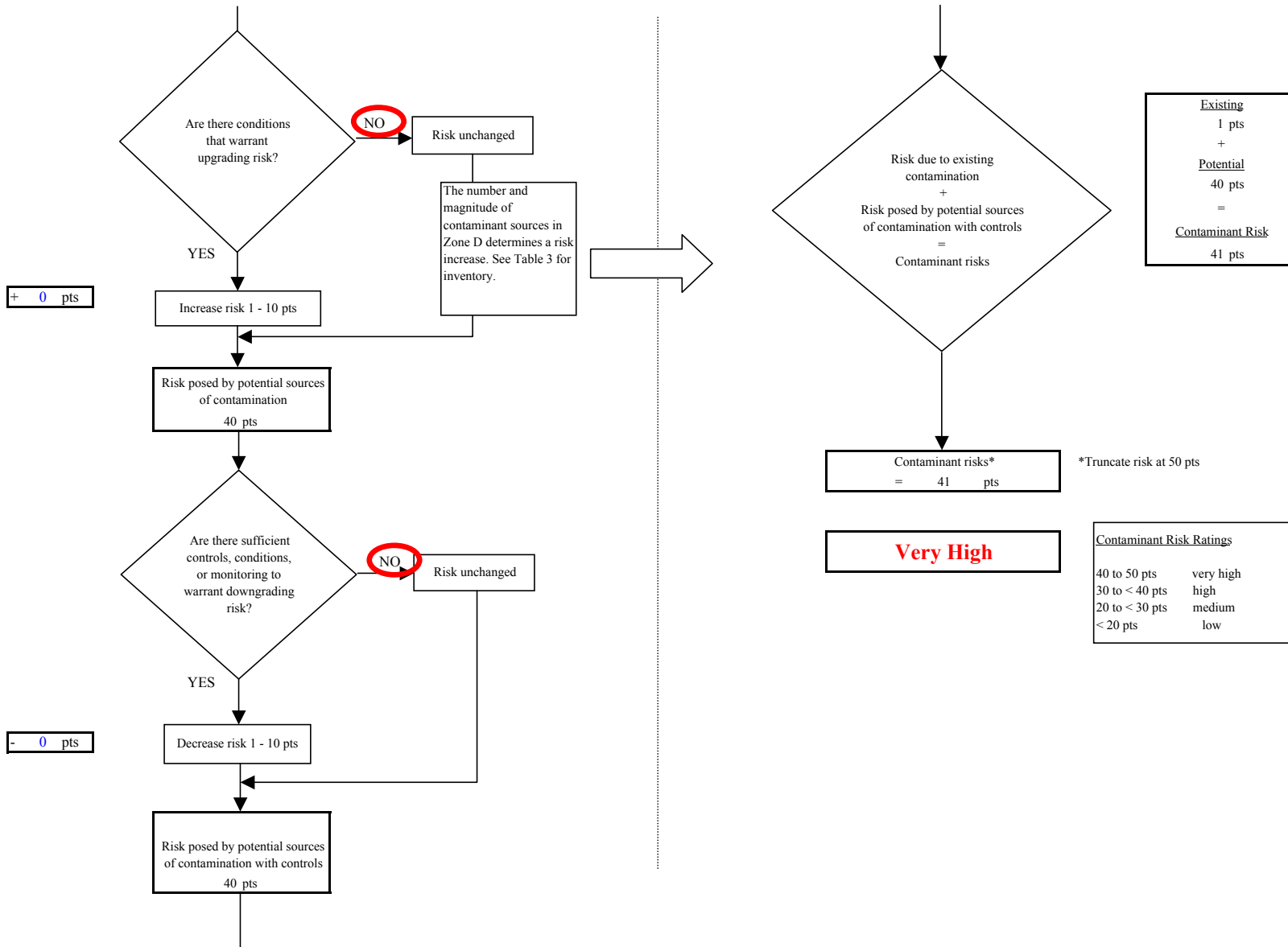


Chart 6. Vulnerability analysis for Donlin Creek (PWS No.271983.001) - Nitrates and Nitrites

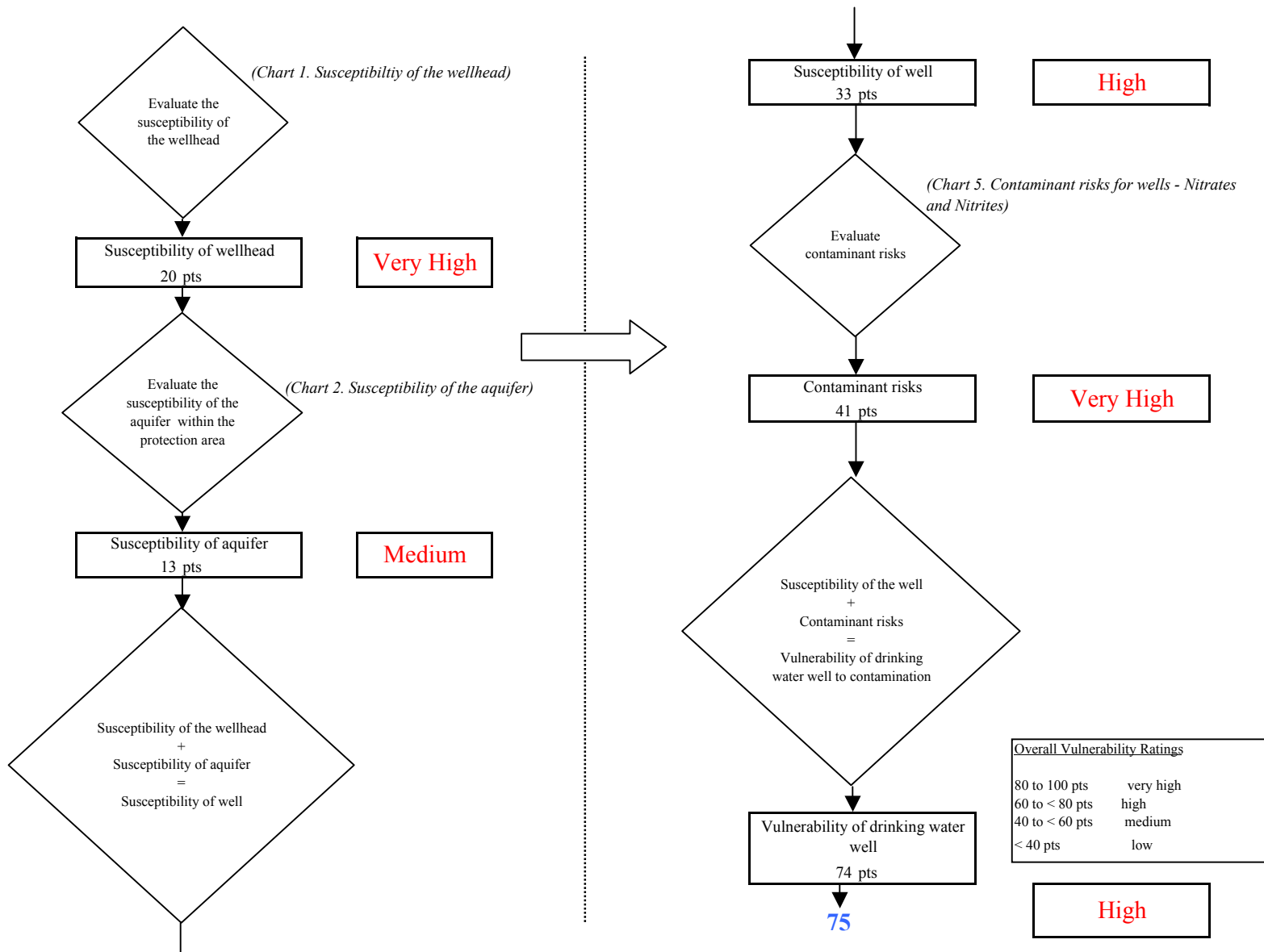


Chart 7. Contaminant risks for Donlin Creek (PWS No.271983.001) - Volatile Organic Chemicals

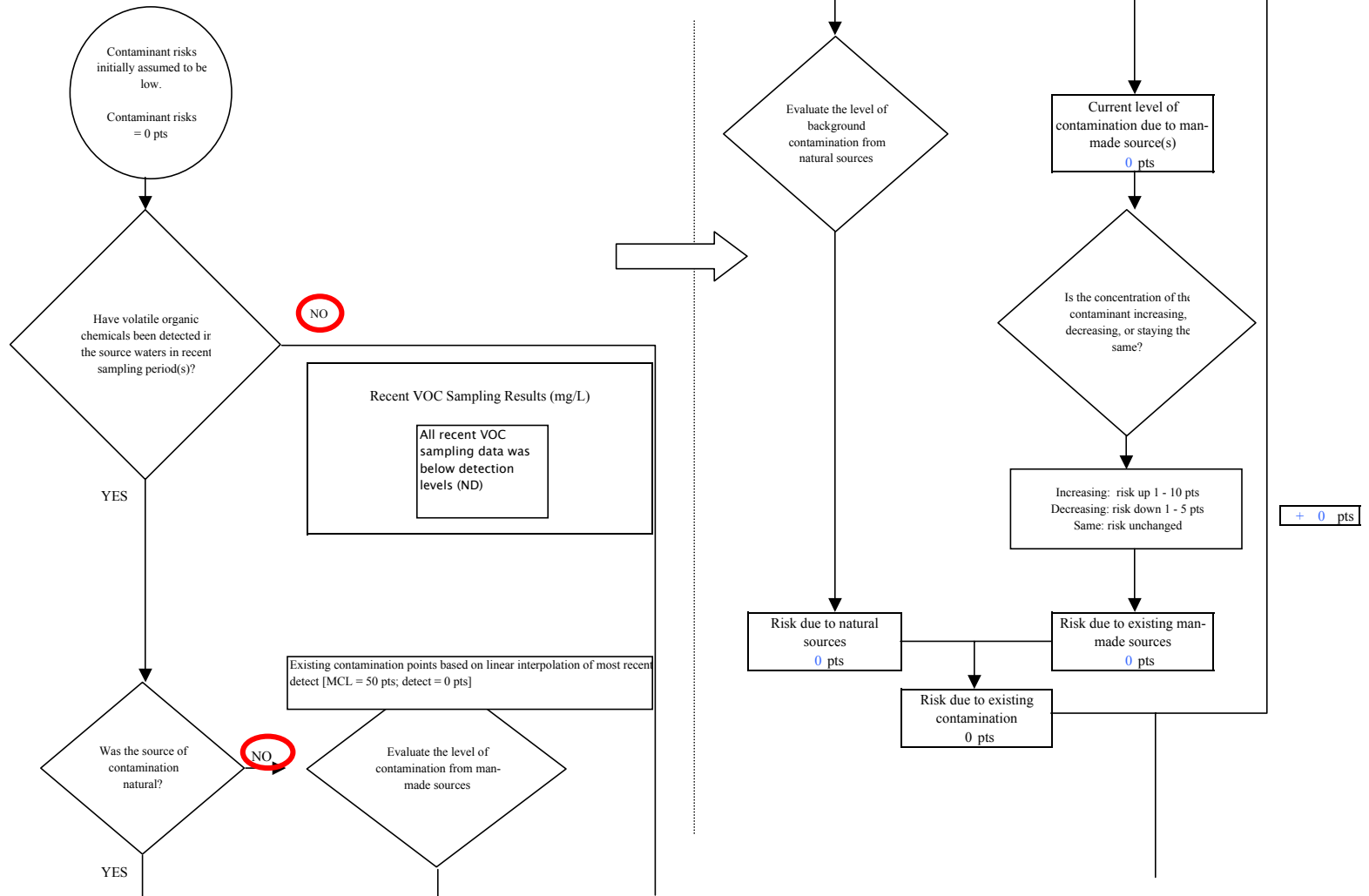


Chart 7. Contaminant risks for Donlin Creek (PWS No.271983.001) - Volatile Organic Chemicals

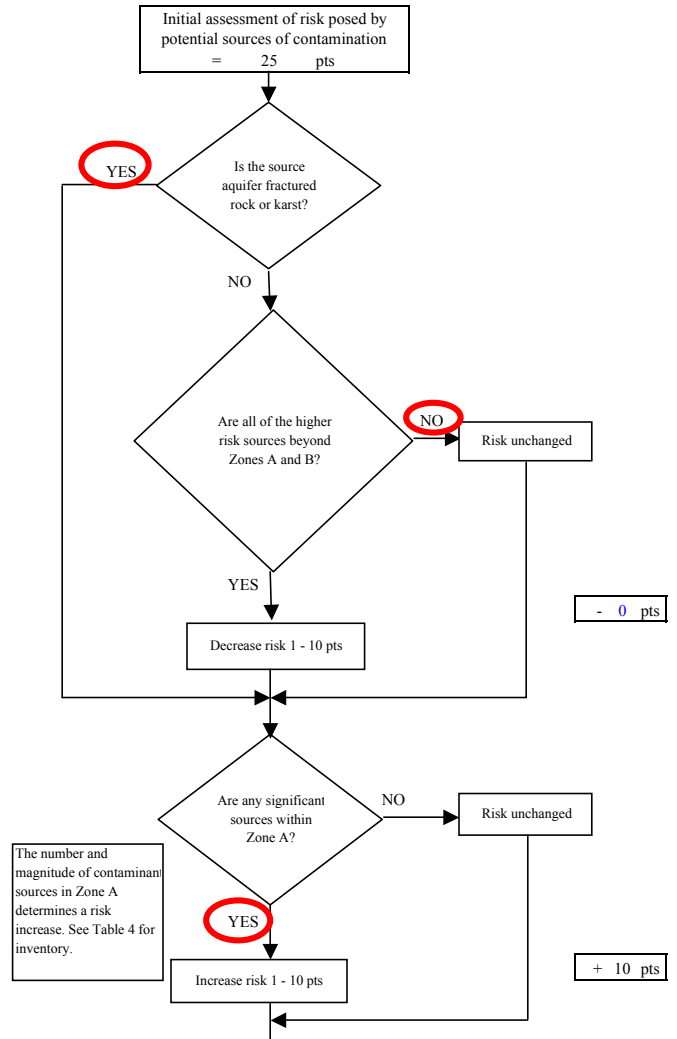
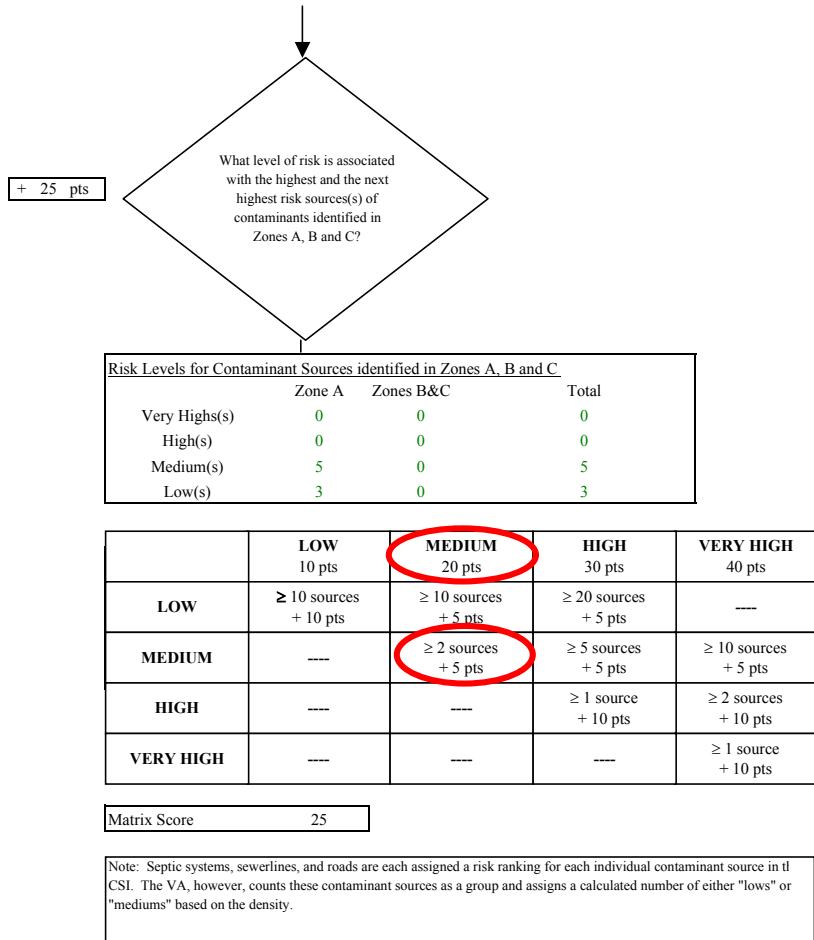


Chart 7. Contaminant risks for Donlin Creek (PWS No.271983.001) - Volatile Organic Chemicals

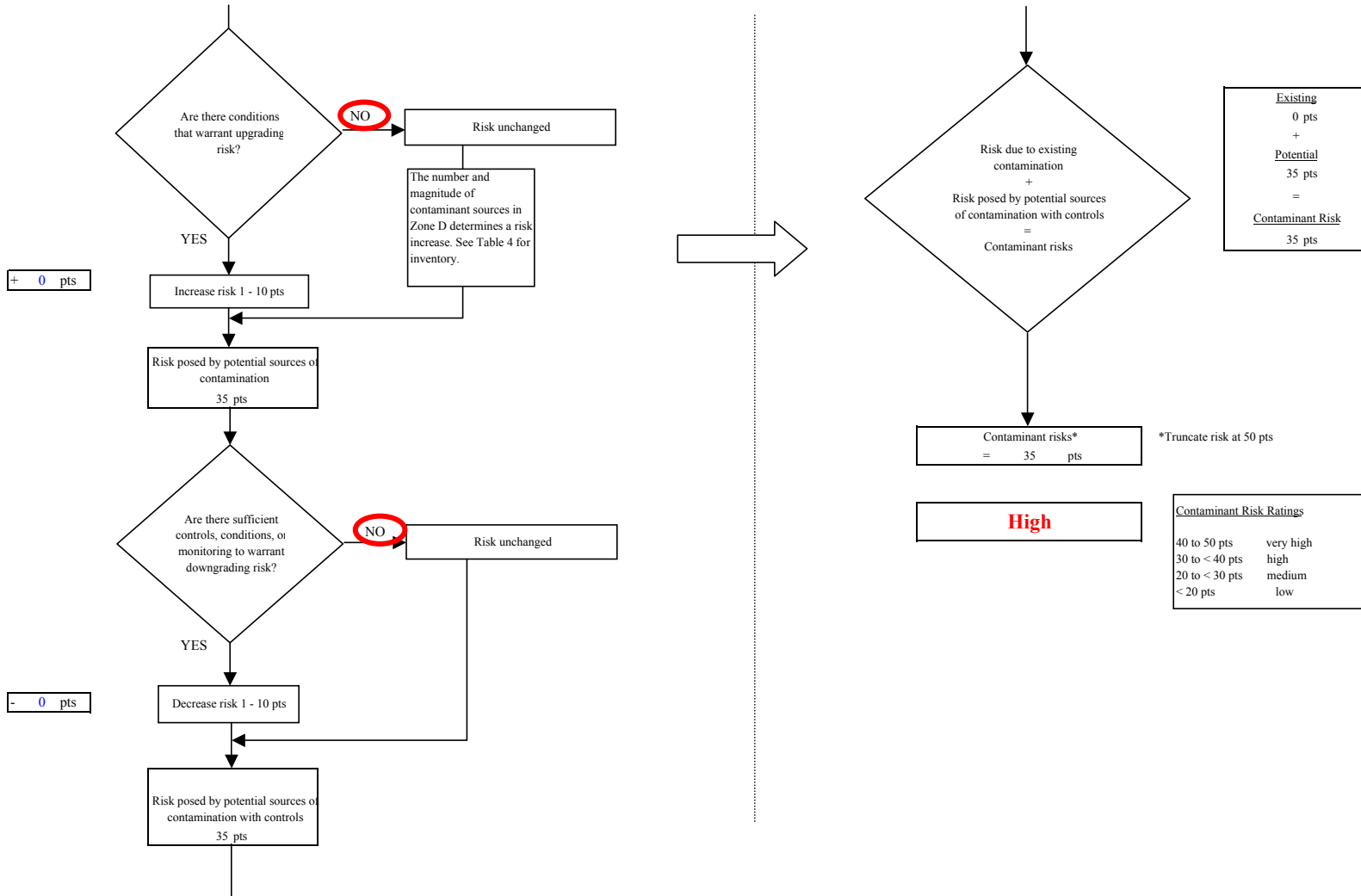


Chart 8. Vulnerability analysis for Donlin Creek (PWS No.271983.001) - Volatile Organic Chemicals

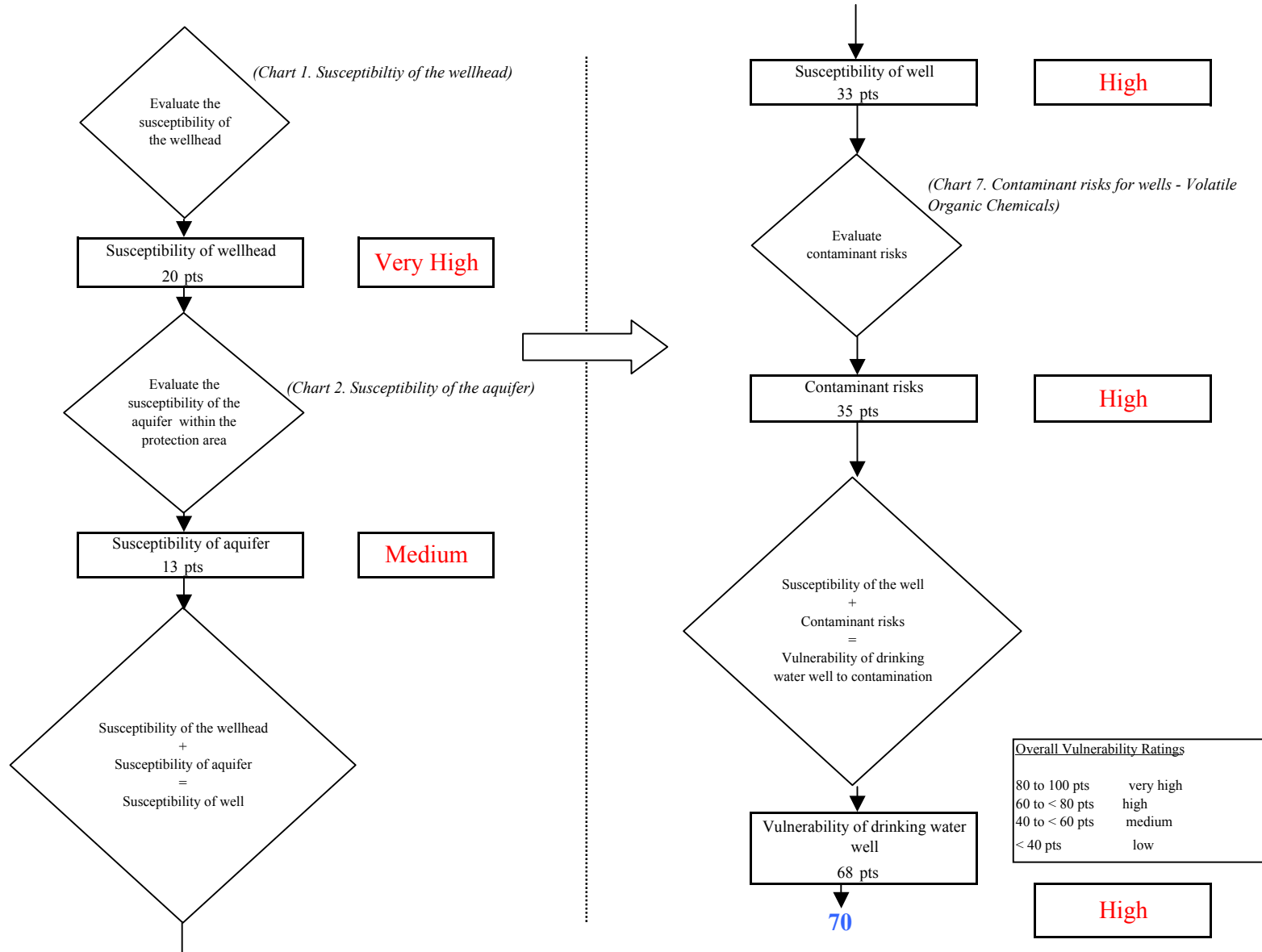


Chart 9. Contaminant risks for Donlin Creek (PWS No.271983.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

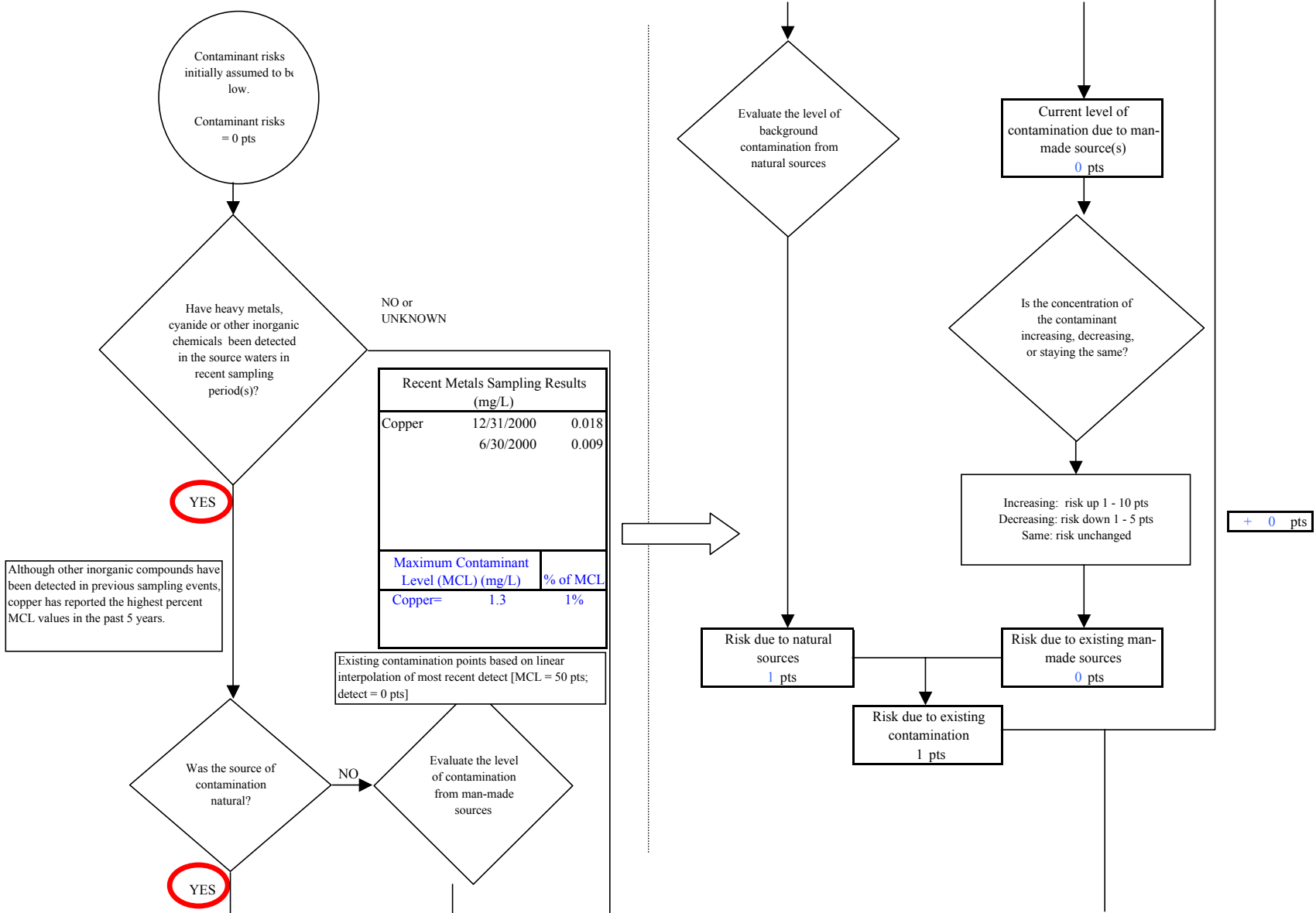


Chart 9. Contaminant risks for Donlin Creek (PWS No.271983.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

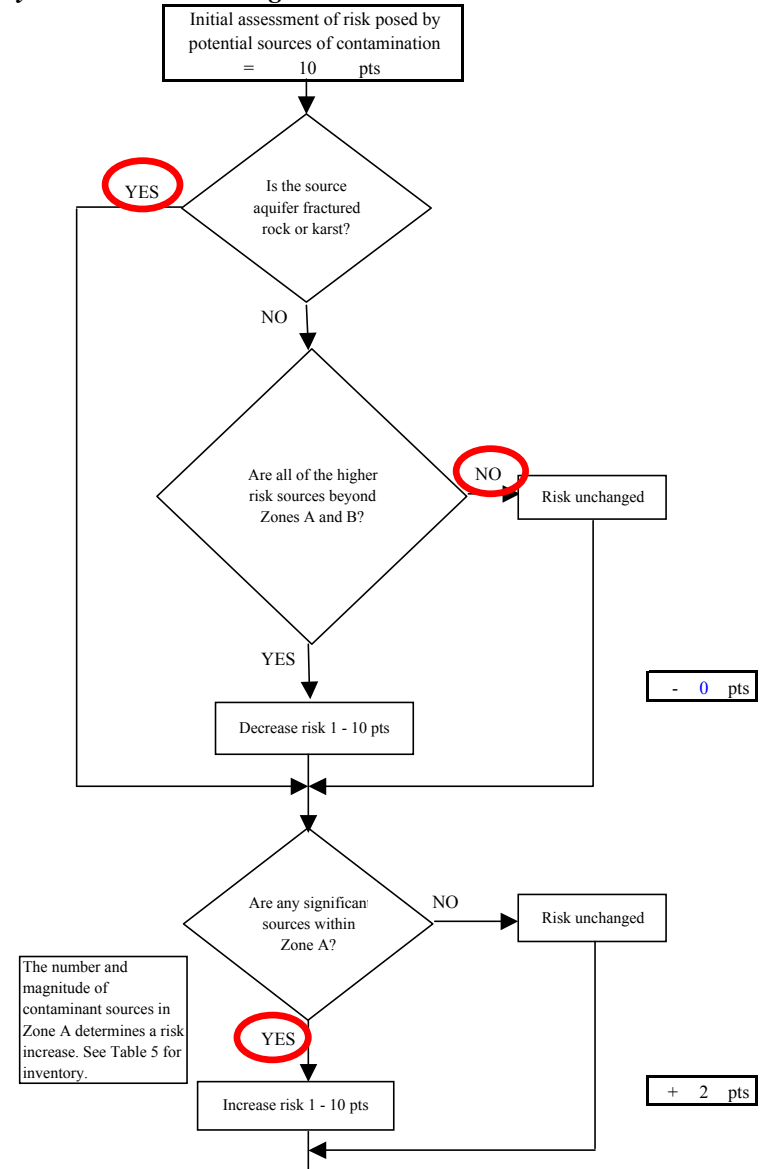
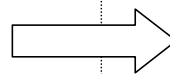
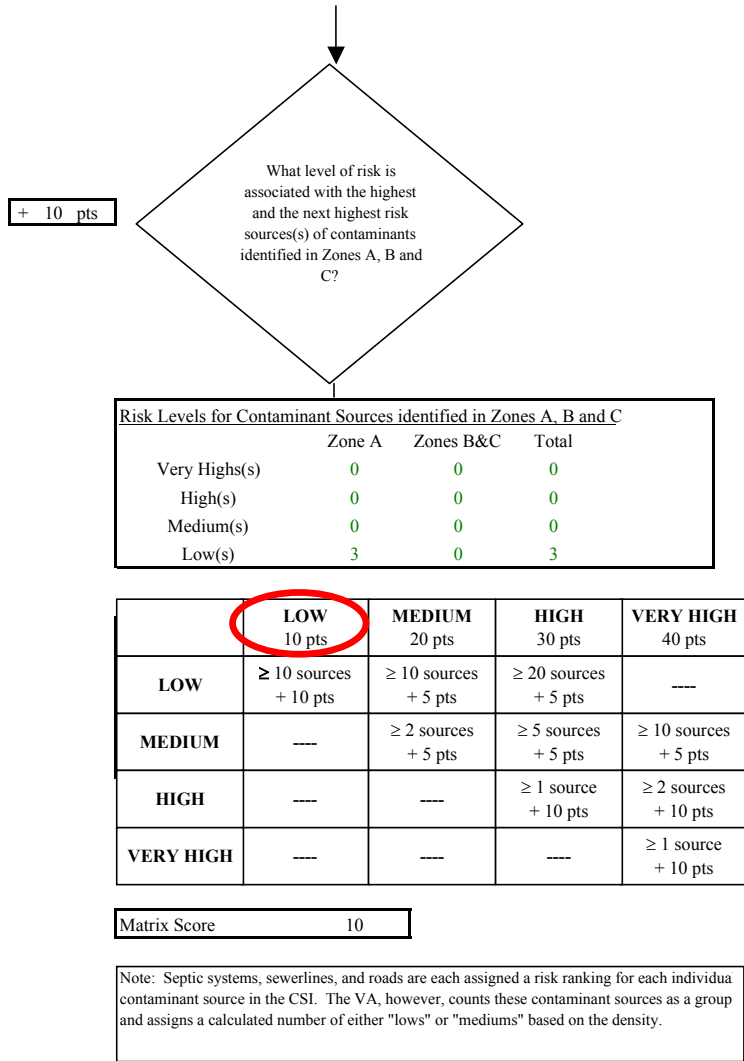


Chart 9. Contaminant risks for Donlin Creek (PWS No.271983.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

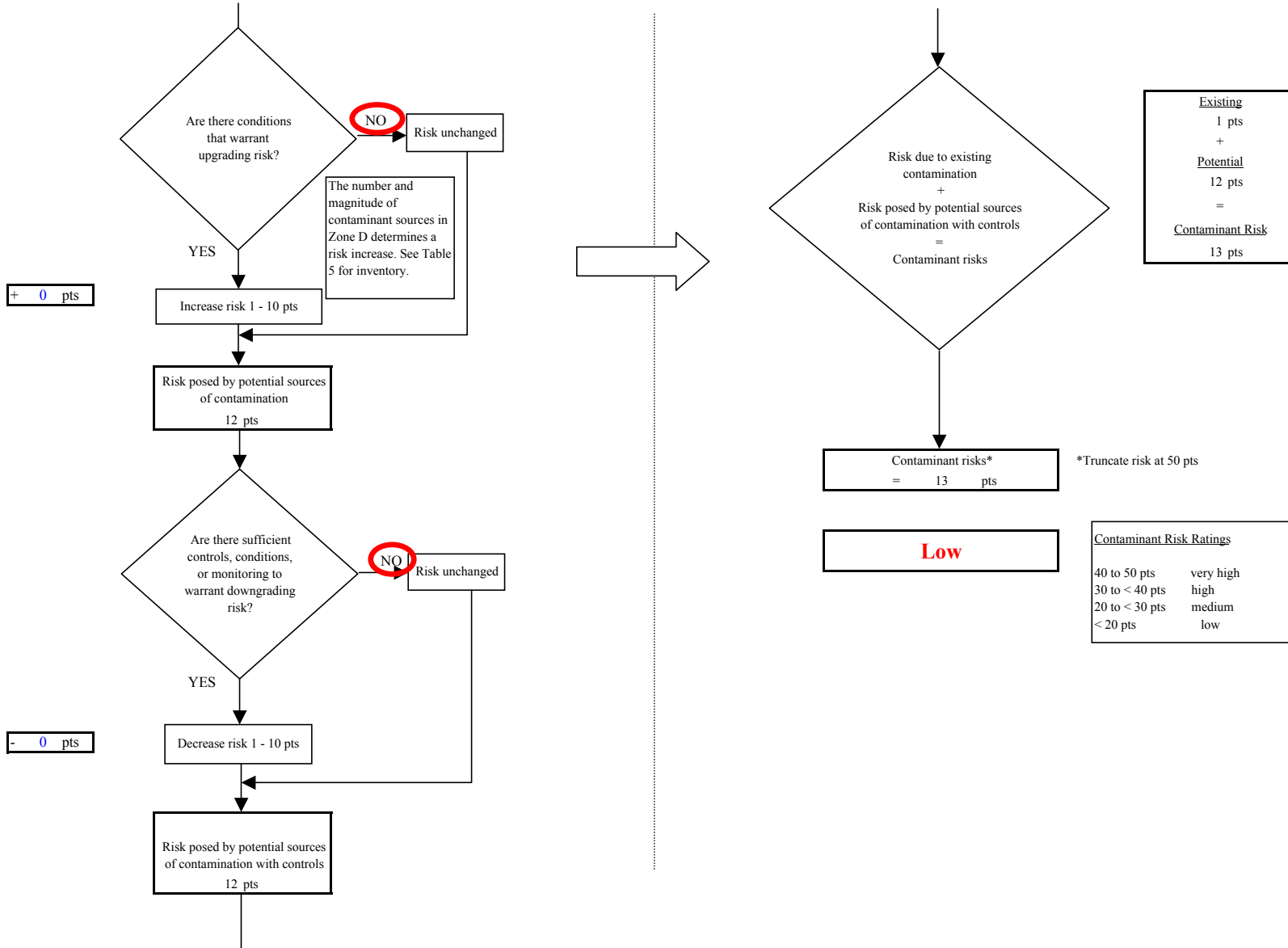


Chart 10. Vulnerability analysis for Donlin Creek (PWS No.271983.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

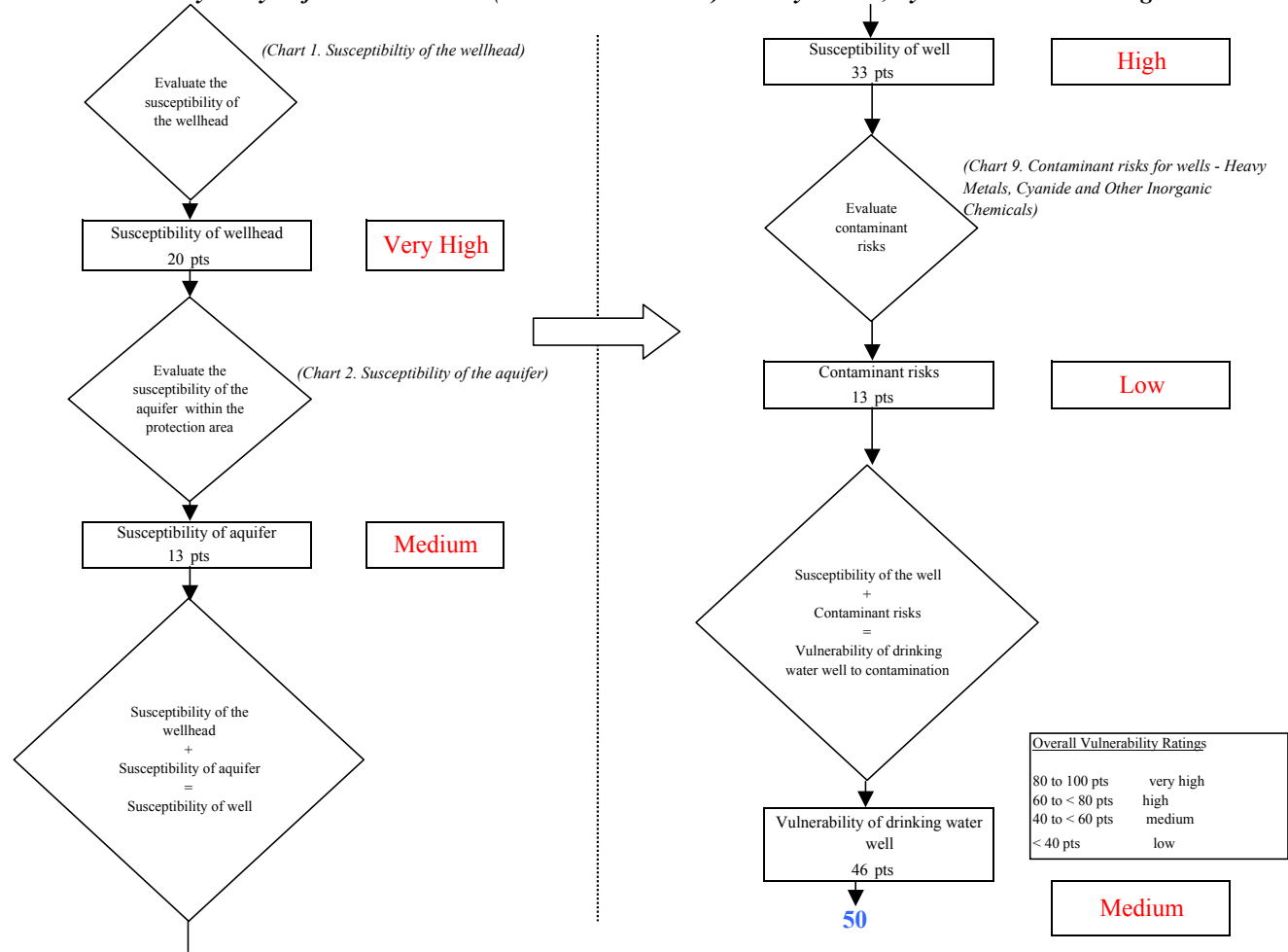


Chart 11. Contaminant risks for Donlin Creek (PWS No.271983.001) - Synthetic Organic Chemicals

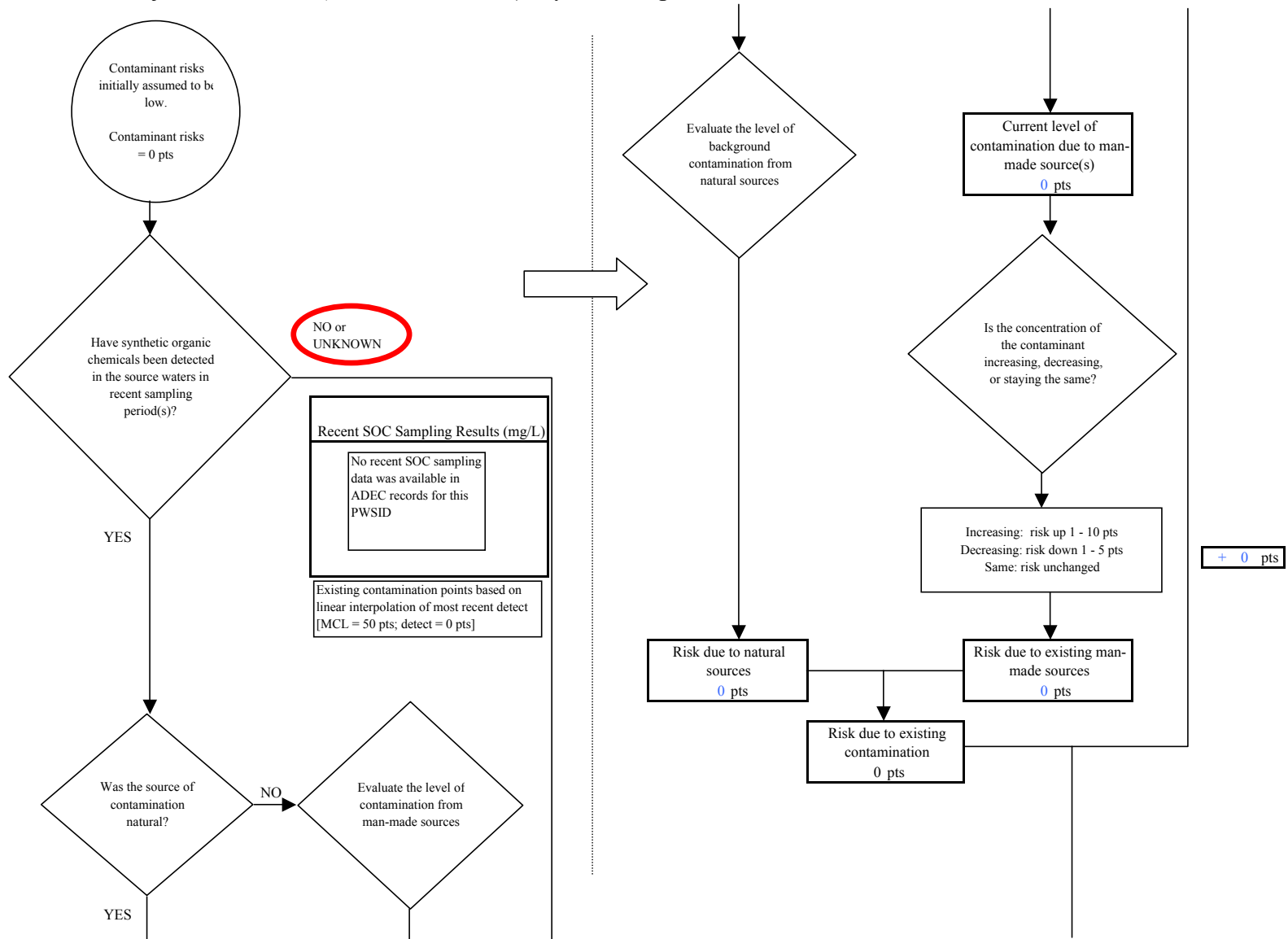


Chart 11. Contaminant risks for Donlin Creek (PWS No.271983.001) - Synthetic Organic Chemicals

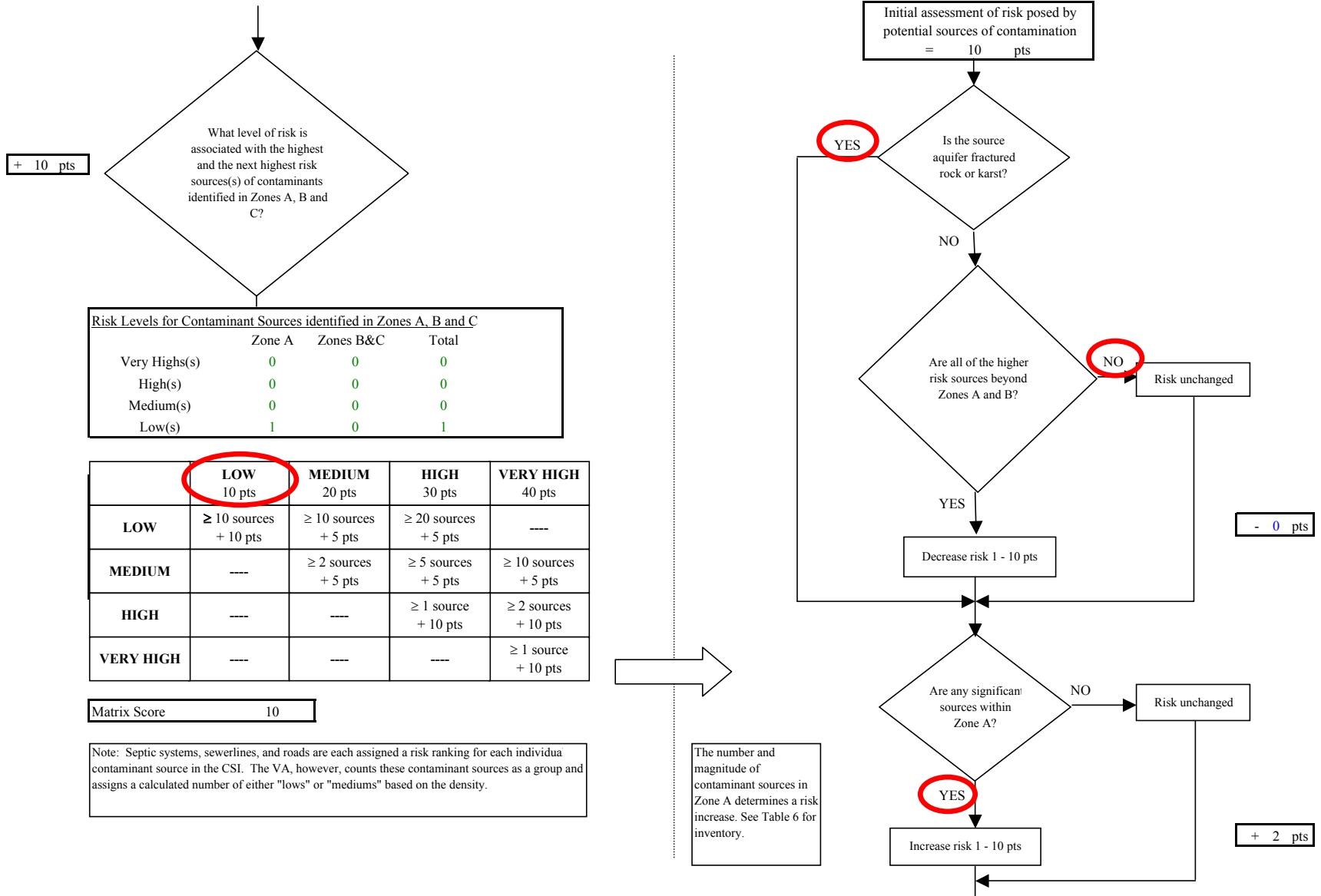


Chart 11. Contaminant risks for Donlin Creek (PWS No.271983.001) - Synthetic Organic Chemicals

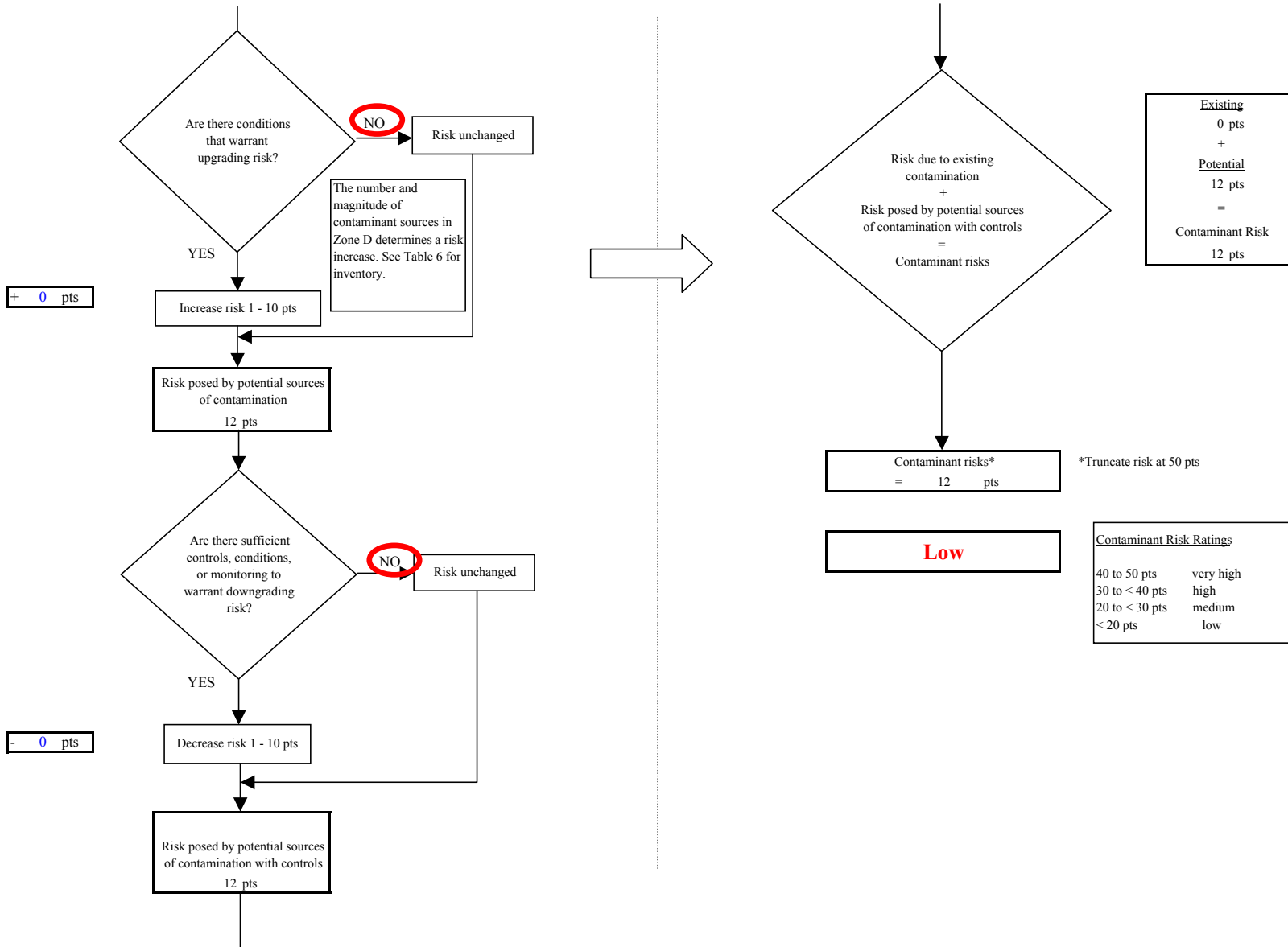


Chart 12. Vulnerability analysis for Donlin Creek (PWS No.271983.001) - Synthetic Organic Chemicals

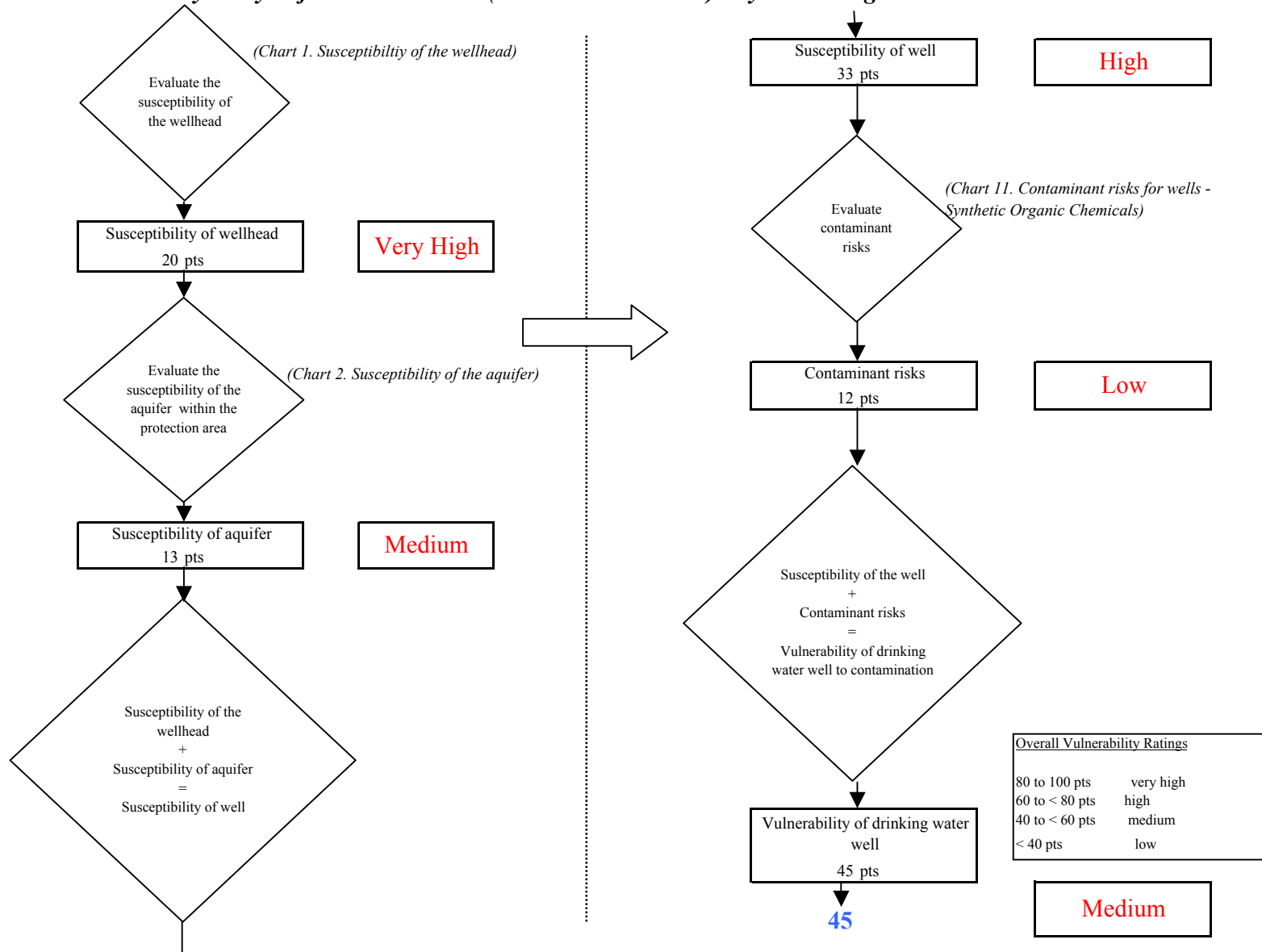


Chart 13. Contaminant risks for Donlin Creek (PWS No.271983.001) - Other Organic Chemicals

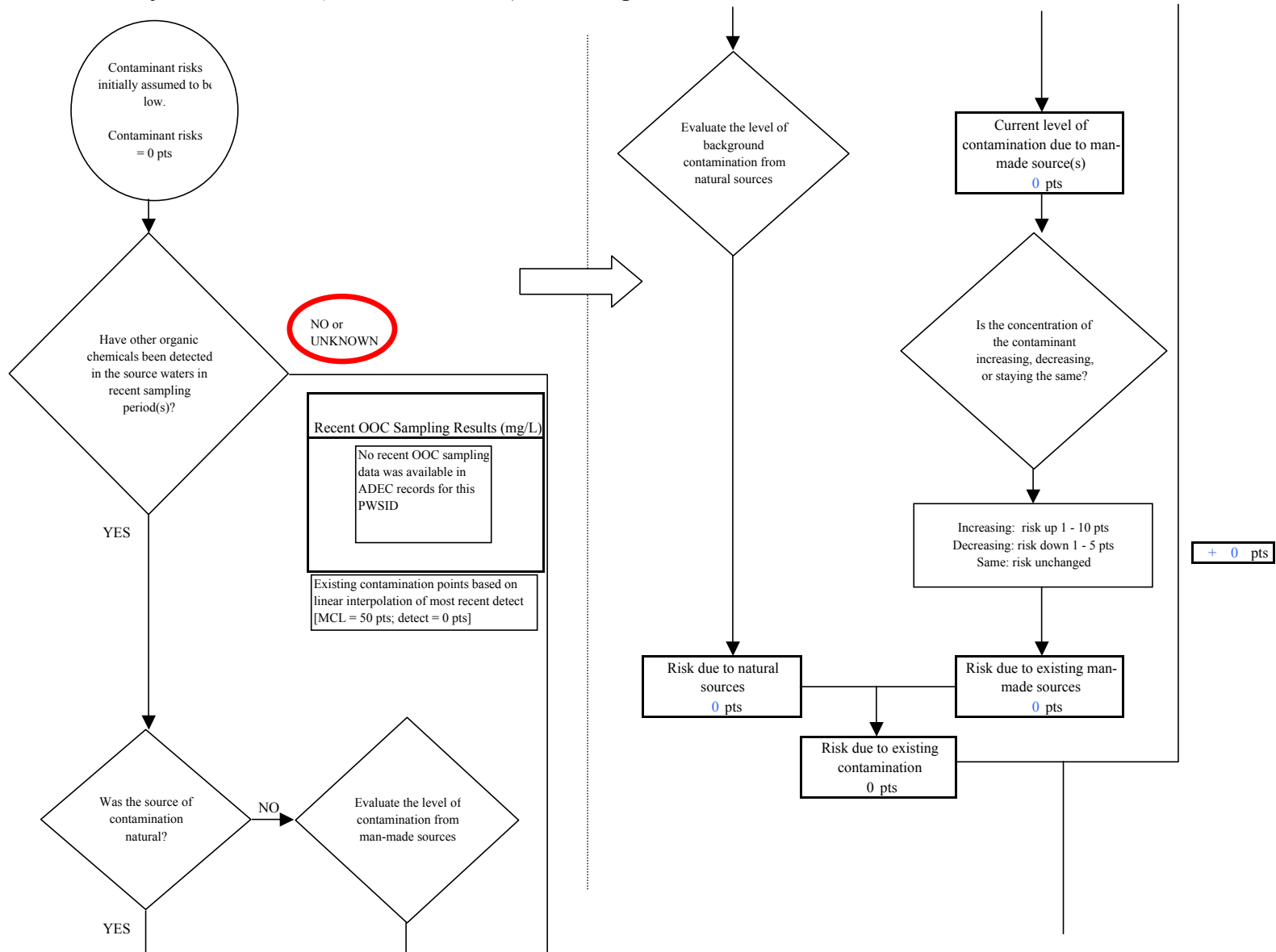


Chart 13. Contaminant risks for Donlin Creek (PWS No.271983.001) - Other Organic Chemicals

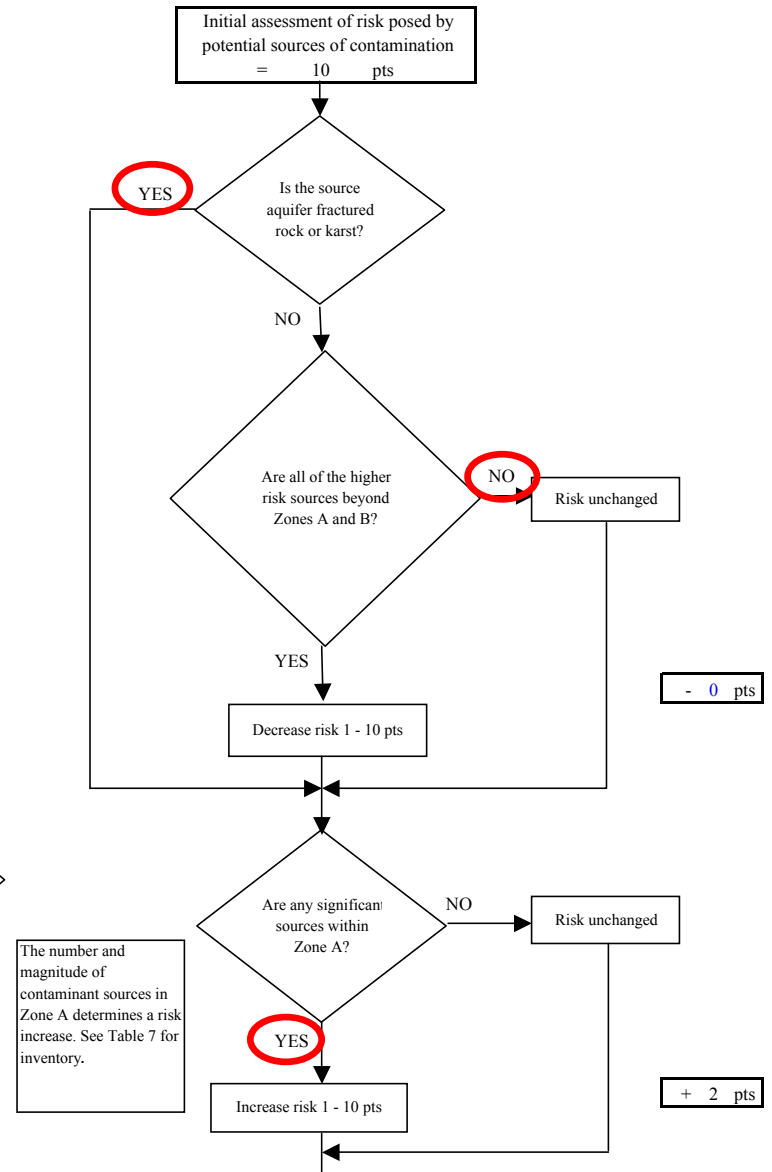
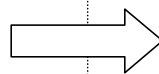
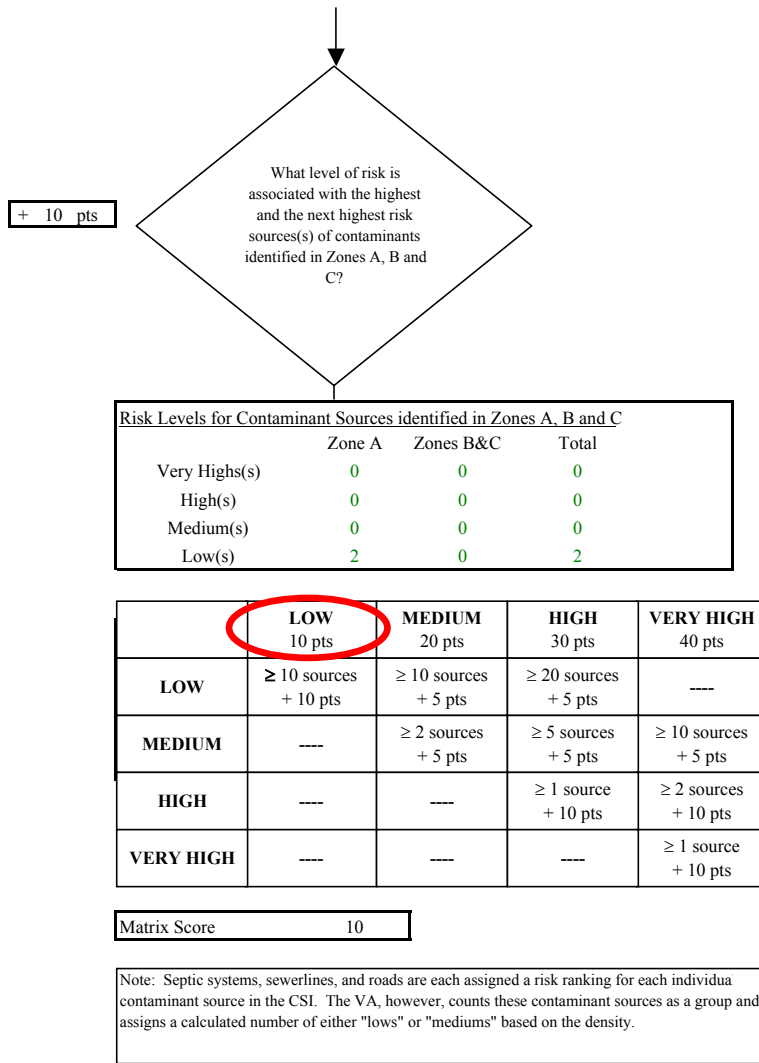


Chart 13. Contaminant risks for Donlin Creek (PWS No.271983.001) - Other Organic Chemicals

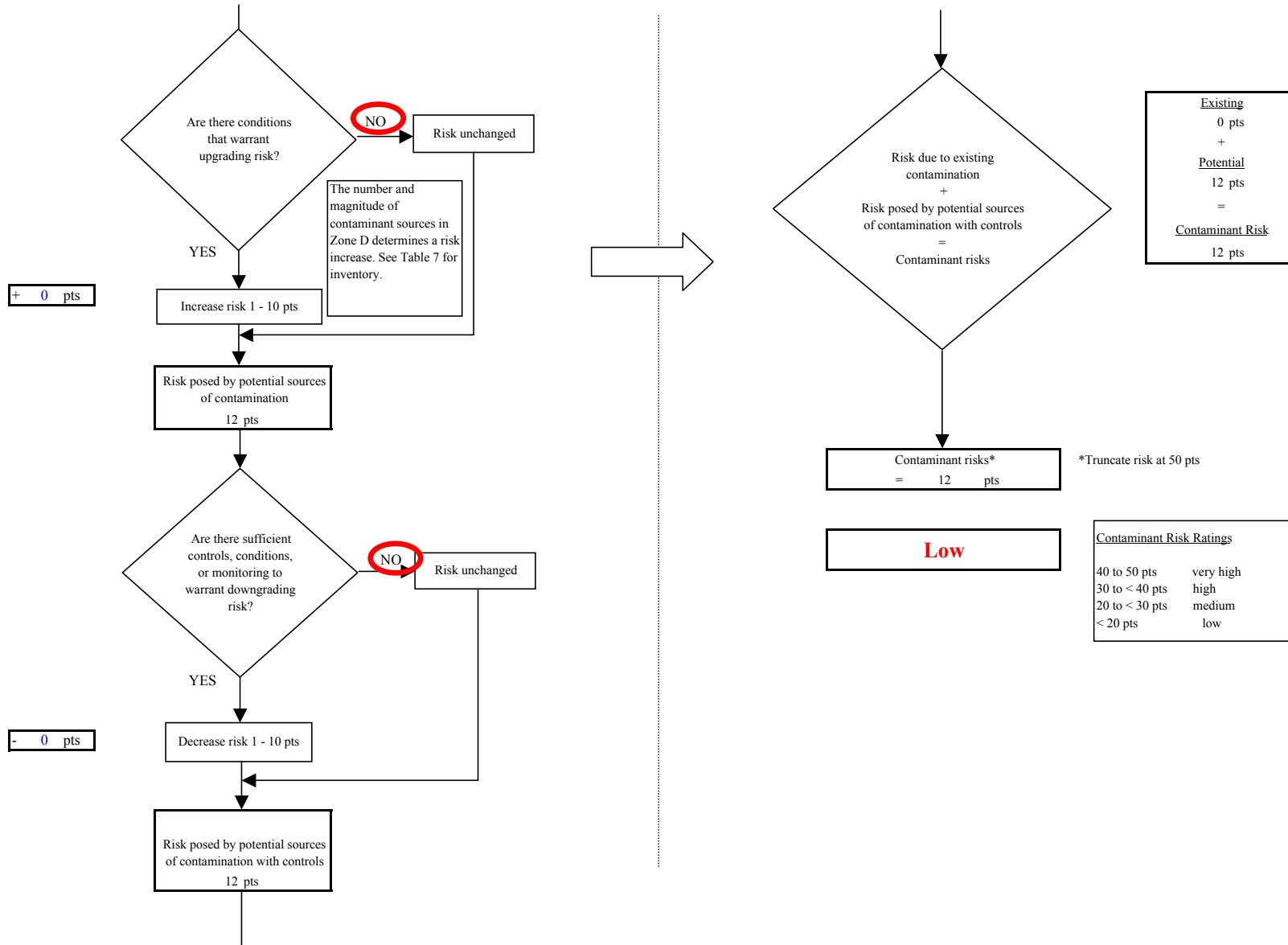


Chart 14. Vulnerability analysis for Donlin Creek (PWS No.271983.001) - Other Organic Chemicals

