# Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Nikiski Trailer Court Drinking Water System,
Nikiski area, Alaska
PWSID 241088.001

December 2003

DRINKING WATER PROTECTION PROGRAM REPORT Report 1278
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 Nikiski Trailer Court Source of Public Drinking Water, Nikiski area, Alaska

**Drinking Water Protection Program**
**Alaska Department of Environmental Conservation**

## EXECUTIVE SUMMARY

The public water system for Nikiski Trailer Court is a Class A (community) water system consisting of one well. The Nikiski Trailer Court is located off of the Kenai Spur Highway on Nikiski Avenue. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produces a **Low** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for the Nikiski Trailer Court public drinking water source include: large capacity septic systems, residential septic systems, and highways and roads. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals, inorganic chemicals, synthetic organic chemicals and other organic chemicals. Overall, the public water source for the Nikiski Trailer Court received a vulnerability rating of **High** for bacteria/viruses and nitrates/nitrites and **Low** for inorganic chemicals, volatile organic chemicals, synthetic organic chemicals and other organic chemicals.

## NIKISKI TRAILER COURT PUBLIC DRINKING WATER SYSTEM

The Nikiski Trailer Court public water system (PWS) is a Class A (community) water system. The system consists of one well located off of the Kenai Spur Highway on Nikiski Avenue. (See Map 1 of Appendix A). Nikiski is part of the Kenai Peninsula Borough, which is located directly south of the city of Anchorage (Please see the inset of Map 1 in Appendix A for location). The borough encompasses 25,600 square miles, of which only 15,700 square miles is land.

The Kenai Peninsula is broken into two distinct geographic areas; the Kenai Mountains and the Kenai Lowlands. Nikiski and its surrounding communities are located in the Kenai Lowlands. Communities located within the Kenai Lowlands include Sterling, Soldotna, Kenai, Nikiski, Clam Gulch, Ninilchik, and Homer.

The Kenai Peninsula area topography varies from about 3,000 feet to 5,000 feet above sea level in the Kenai Mountains, the highest point being about 6,400 feet above sea level. The Kenai Peninsula is dotted with many lakes and small streams, including three large lakes (Kenai Lake, Skilak Lake, and Tustemena Lake) and two substantial rivers (Kenai River, and Kasilof River) (USGS 1915).

The Nikiski Trailer Court water system is located within the Kenai Lowlands, which is a sub-province of the Cook Inlet-Susitna Lowland physiographic region. The Kenai Lowland is a glaciated coastal shelf situated west of the northeast-trending Kenai Mountains. Approximately 100 miles long, the coastal shelf is bordered on the west by Cook Inlet, on the east by Kenai Mountains, on the north by Turnagain Arm, and on the south by the Caribou Hills and Kachemak Bay. The following summary of regional geology and hydrogeology is based on studies by Bailey and Hogan (1995); Freethey and Scully (1980); Glass (1996); Hartman, et al. (1972); and Karlstrom (1964).

The Kenai Lowland is underlain by bedrock. Tertiary sedimentary bedrock is more than 500 feet below the city of Kenai airport, but is exposed along beach cliffs and road cuts near the southwest end of the lowland. Unconsolidated surficial deposits of Quaternary age include coastal deposits, glaciolacustrine deposits, glaciofluvial deposits, glacial moraine deposits, and periglacial wind deposits. Unconsolidated Quaternary cover on the lowlands generally thickens from south to North being thin or absent in the Homer area, and over 750 feet thick near Nikiski.

The most significant groundwater resources of the Kenai Lowlands are contained in Quarternary coarse-grained sands and gravels. Flood plain, river terrace and other alluvial deposits are common aquifer materials in the area, and are characterized by high rates of recharge, and large saturated thicknesses. Other favorable materials include proglacial lake and associated river deposits and glacial outwash deposits consisting of meltwater sorted sand and gravel material. Unsorted glacial moraine and drift deposits generally have poor groundwater yields, as do discontinuous layers of confining clays and silt that are common throughout the unconsolidated materials. The relatively thicker sequence of unconsolidated sediments in the northern portions of the Kenai Lowlands locally hosts thicker, more extensive clay aquitards and multiple aquifers.

The Kenai Peninsula area has a central water system, however, many homes and businesses in the area rely on individual wells for their water supply. Most of these wells are deep with depths between 50 and 200 feet. Static water levels in many of these wells are between 10 and 30 feet below the surface. Although groundwater quality can vary significantly in short distance, groundwater supplies are abundant in the area.

According to the most recent sanitary survey (1/3/2002) the depth of the well is 136 feet below ground surface (bgs). No well log is available; however studies in the area indicate that the well is completed in a confined aquifer.

The Sanitary Survey indicates that the well was not properly sealed. However, the owner/operator has stated that this has been corrected. A properly installed sanitary seal may provide protection against contaminant from entering the source waters at the casing.

The well is not located in a floodplain and the land is sloped away from the well providing adequate surface water drainage. Records indicate that the well is not grouted. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year round and serves up to 150 residents, 10 non-residents through 83 service connections.
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## NIKISKI TRAILER COURT 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 Nikiski Trailer Court. 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 APublic 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 2 years time-of-travel |
| C | Less than 5 years time-of-travel |
| D | Less than 10 years time-of-travel |

The DWPA for the Nikiski Trailer Court was determined using an analytical calculation and includes Zone A, B, C, and D (See Map 1 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 Nikiski Trailer Court 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 1 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, and volatile organic chemicals.

**VULNERABILITY OF NIKISKI TRAILER COURT 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 eight 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. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile 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 well for Nikiski Trailer Court is completed in a confined aquifer setting. Studies and well logs in the area indicate a confining layer exists approximately from 100-125 feet. This confining layer may provide a protective barrier from the movement of contaminants in the subsurface. However, wells penetrating the confining layer may provide a quick path for contaminants to enter the confining aquifer. Table 2 shows the Susceptibility scores and ratings for the Nikiski Trailer Court.

**Table 2. Susceptibility**

| | **Score** | **Rating** |
|---|---|---|
| Susceptibility of the Wellhead | 5 | Low |
| Susceptibility of the Aquifer | 14 | Medium |
| Natural Susceptibility | 19 | Low |

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 | 35 | Low |
| Heavy Metals, Cyanide, and Other Inorganic Chemicals | 50 | Very High |
| 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:

Natural Susceptibility (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 (0 – 100) and ratings for each of the three categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

**Table 4. Overall Vulnerability**

| Category | Score | Rating |
|---|---|---|
| Bacteria and Viruses | 70 | High |
| Nitrates and Nitrites | 70 | High |
| Volatile Organic Chemicals | 14 | Low |
| Heavy Metals, Cyanide, and Other Inorganic Chemicals | 70 | High |
| Synthetic Organic Chemicals | 30 | Low |
| Other Organic Chemicals | 30 | Low |

**Bacteria and Viruses**

The large capacity septic systems and residential septic systems in the protection area represent the greatest risk for bacteria and viruses to the drinking water well.

Only a small amount of bacteria and viruses are required to endanger public health. Coli forms are found naturally in the environment and although they aren't necessarily a health threat, it is an indicator of other potentially harmful bacteria in the water, more specifically, fecal coli forms and E. coli which only come from human and animal fecal waste (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Sampling has not detected bacteria within source waters.

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 large capacity septic systems and residential septic systems in the protection area also represent the greatest risk to to nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Recent samplings have detected nitrates at 2% of the Maximum Contaminant Level (MCL) of 10 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. Though existing nitrate contamination was detected at the site, the data indicates that nitrate concentrations are safe with respect to human health.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination is very high.

**Volatile Organic Chemicals**

The roads, residential areas and motor vehicle waste disposal wells represent the greatest identified risk for volatile organic chemical contamination to the well.

Approximately 20% residents in the area typically heat their homes with various types of on-site fuel sources, including propane and heating oil stored in aboveground or underground storage tanks. Although this report does not address heating oil tanks (unless their location is known), they can pose a risk of volatile organic chemical contamination to drinking water sources. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Secondary containment around the tank and regular system maintenance can help prevent many of these harmful fuel leaks and help protect the drinking water supply.

Volatile Organic Chemicals have not been detected within source waters. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is medium.

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

The large capacity septic system, residential septic system, roads and residential areas present the greatest risk for inorganic chemicals to the well.

Samplings of inorganic chemicals have detected arsenic and barium, at levels below their respective maximum contaminant levels (MCLs). Arsenic was detected at the greatest concentration with respect to its MCL (0.008 mg/L or 80%). In greater quantities, arsenic is known to cause skin damage, problems with circulatory systems, and may create an increased risk of developing cancer (EPA, 2002).

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 large capacity septic system, residential septic systems, and residential areas represent the greatest risk for synthetic organic chemicals to the well.

Synthetic organic chemicals have not been sampled for in this water system.

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

**Other Organic Chemicals**

The large capacity septic system, residential septic systems, residential areas and roads represents the greatest risk for other organic chemicals to the well.

Other organic chemicals have not been sampled for in this water system.

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

# ACKNOWLEDGMENT

Source Water Assessments in the Nikiski area were jointly prepared by ADEC-Drinking Water Protection Program and URS Corporation. The Drinking Water Protection Program would like to thank URS Corporation for their efforts in researching the area.

# APPENDIX A

## Nikiski Trailer Court
## Drinking Water Protection Area Location Map
## (Map 1)

# Map 1- Nikiski Trailer Court Drinking Water Protection Area

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Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

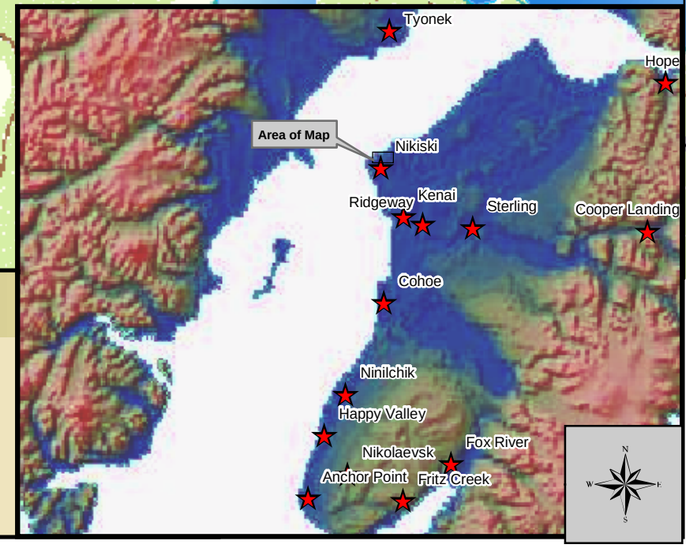
0 1,300 2,600 Feet

1:15,600

Data Sources:
Kenai Borough: Roads and parcels
USGS-63,360 topo map and hillshade
Potential Sources of Contamination: ADEC

**Legend**

- Class A Public Water System
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Zone D Protection Area
- Kenai_land_use
- Roads
- Water
- Rivers and Streams



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# APPENDIX B

## Contaminant Source Inventory and Risk Ranking for Nikiski Trailer Court (Tables 1-7)

***Table 1***

# *Contaminant Source Inventory for* ***Nikiski Village Trailer Court***

***PWSID 241088.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Map Number* | *Comments* |
|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | 2 | |
| Residential Areas | R01 | R01-01 | A | 2 | Zone A has approxiamtely 55 residential acres |
| Highways and roads, dirt/gravel | X24 | X24-01-3 | A | 2 | Zone A has 3 roads |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | 2 | |
| Residential Areas | R01 | R01-02 | B | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | 2 | Zone B has 4 residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-03 | C | 2 | |
| Residential Areas | R01 | R01-03 | C | 2 | Zone C has 108 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-05-9 | C | 2 | Zone C has 4residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | D | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-05 | D | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-06 | D | 2 | |
| Injection wells (Class V) Motor Vehicle Waste Disposal Well | D42 | D42-01 | D | 2 | |

***Table 2***

# *Contaminant Source Inventory and Risk Ranking for Nikiski Village Trailer Court Sources of Bacteria and Viruses*

***PWSID 241088.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | High | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | 2 | Zone A has approxiamtely 55 residential acres |
| Highways and roads, dirt/gravel | X24 | X24-01-3 | A | Low | 2 | Zone A has 3 roads |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | High | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | Low | 2 | Zone B has 4 residential septics |

**Table 3**

# *Contaminant Source Inventory and Risk Ranking for Nikiski Village Trailer Court Sources of Nitrates/Nitrites*

**PWSID 241088.001**

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | High | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | 2 | Zone A has approxiamtely 55 residential acres |
| Highways and roads, dirt/gravel | X24 | X24-01-3 | A | Low | 2 | Zone A has 3 roads |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | High | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | Low | 2 | Zone B has 4 residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-03 | C | High | 2 | |
| Residential Areas | R01 | R01-03 | C | Low | 2 | Zone C has 108 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-05-9 | C | Low | 2 | Zone C has 4residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | D | High | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-05 | D | High | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-06 | D | High | 2 | |

***Table 4***

# *Contaminant Source Inventory and Risk Ranking for Nikiski Village Trailer Court Sources of Volatile Organic Chemicals*

***PWSID 241088.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | Low | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | 2 | Zone A has approxiamtely 55 residential acres |
| Highways and roads, dirt/gravel | X24 | X24-01-3 | A | Low | 2 | Zone A has 3 roads |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | Low | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | Low | 2 | Zone B has 4 residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-03 | C | Low | 2 | |
| Residential Areas | R01 | R01-03 | C | Low | 2 | Zone C has 108 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-05-9 | C | Low | 2 | Zone C has 4residential septics |
| Injection wells (Class V) Motor Vehicle Waste Disposal Well | D42 | D42-01 | D | High | 2 | |

**Table 5**

# *Contaminant Source Inventory and Risk Ranking for Nikiski Village Trailer Court*

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

**PWSID 241088.001**

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | Low | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | 2 | Zone A has approxiamtely 55 residential acres |
| Highways and roads, dirt/gravel | X24 | X24-01-3 | A | Low | 2 | Zone A has 3 roads |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | Low | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | Low | 2 | Zone B has 4 residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-03 | C | Low | 2 | |
| Residential Areas | R01 | R01-03 | C | Low | 2 | Zone C has 108 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-05-9 | C | Low | 2 | Zone C has 4residential septics |
| Injection wells (Class V) Motor Vehicle Waste Disposal Well | D42 | D42-01 | D | High | 2 | |

***Table 6***

# *Contaminant Source Inventory and Risk Ranking for Nikiski Village Trailer Court Sources of Synthetic Organic Chemicals*

***PWSID 241088.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | Low | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | 2 | Zone A has approxiamtely 55 residential acres |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | Low | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | Low | 2 | Zone B has 4 residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-03 | C | Low | 2 | |
| Residential Areas | R01 | R01-03 | C | Low | 2 | Zone C has 108 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-05-9 | C | Low | 2 | Zone C has 4residential septics |

***Table 7***

# *Contaminant Source Inventory and Risk Ranking for Nikiski Village Trailer Court Sources of Other Organic Chemicals*

***PWSID 241088.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-01 | A | Low | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | 2 | Zone A has approxiamtely 55 residential acres |
| Highways and roads, dirt/gravel | X24 | X24-01-3 | A | Low | 2 | Zone A has 3 roads |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | B | Low | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | 2 | Zone B has 27 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-01-4 | B | Low | 2 | Zone B has 4 residential septics |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-03 | C | Low | 2 | |
| Residential Areas | R01 | R01-03 | C | Low | 2 | Zone C has 108 residential acres |
| Septic systems (serves one single-family home) | R02 | R02-05-9 | C | Low | 2 | Zone C has 4residential septics |

# APPENDIX C

## Nikiski Trailer Court
## Drinking Water Protection Area
## and Potential and Existing Contaminant Sources
## (Map 2)

# Map 2-Nikiski Trailer Court Potential and Existing Source of Contamination

PWSID: 241088.001

Zone C has
5 roads
4 residential septics
108 residential acres

Zone B has
4 residential septics
4 roads
27 residential acres

Zone A has 3 roads
54 residential acres

Area of Inset

D10-01
D10-02
D10-03
D10-04
D10-05
D10-06
D42-01

Well

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

Feet
0 1,000 2,000
1:14,000

Data Sources:
Kenai Borough: Roads and parcels
Aerial Photo: USGS and Microsoft Terraserver
Potential Sources of Contamination: ADEC

**Legend**

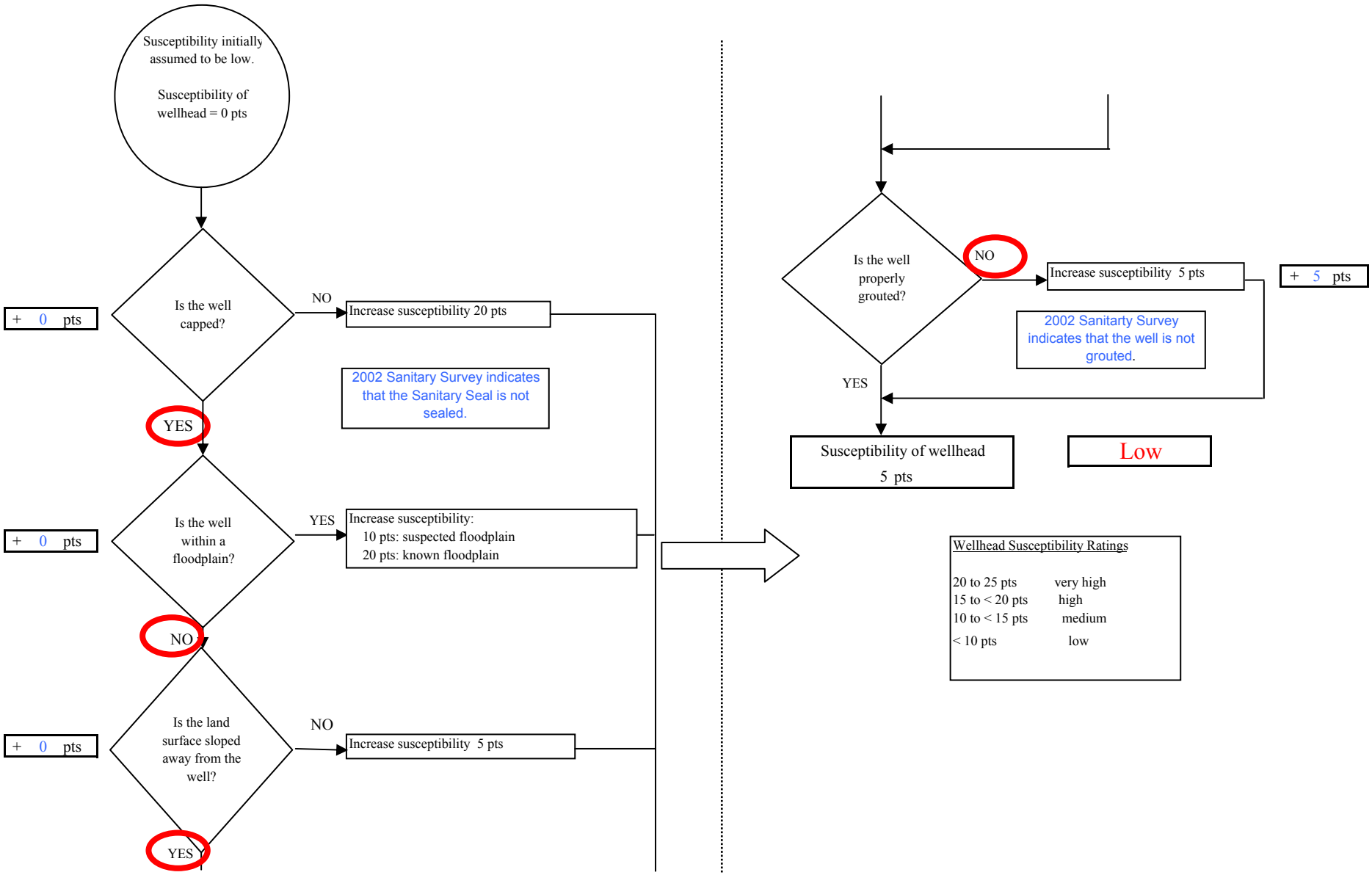
- Class A Public Water System
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Zone D Protection Area
- Residential Areas (R02)
- Roads
- Rivers and Streams
- Water
- Injection wells (Class V) Septic System (Drainfield Disposal Method) (D10)
- Injection wells (Class V) Motor Vehicle Waste Disposal Well (D42)
- Septic systems (serves one single-family home and/or less than 20 people)(R02)

# APPENDIX D

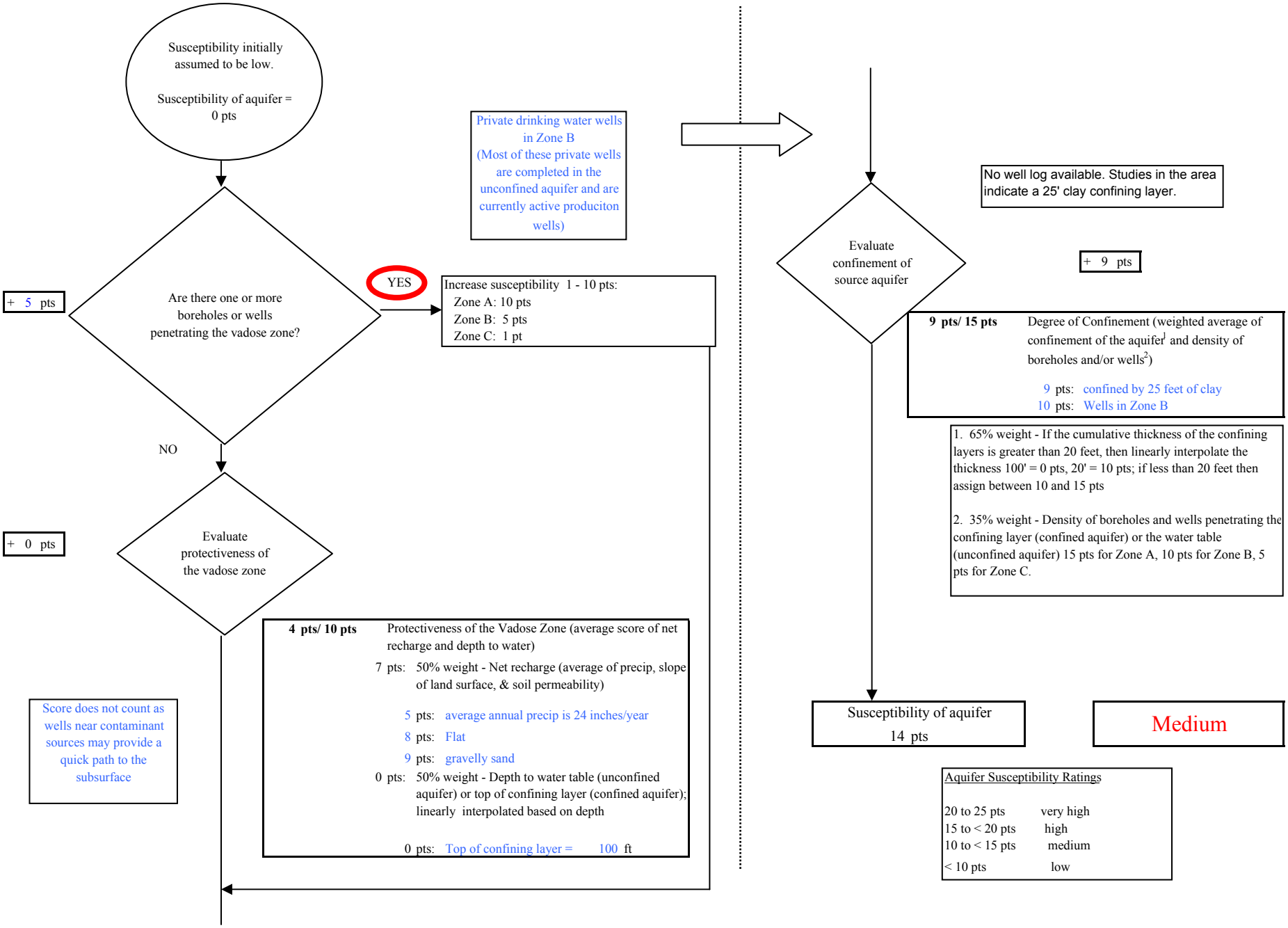
## Vulnerability Analysis for Nikiski Trailer Court Public Drinking Water Source

**(Charts 1-14)**

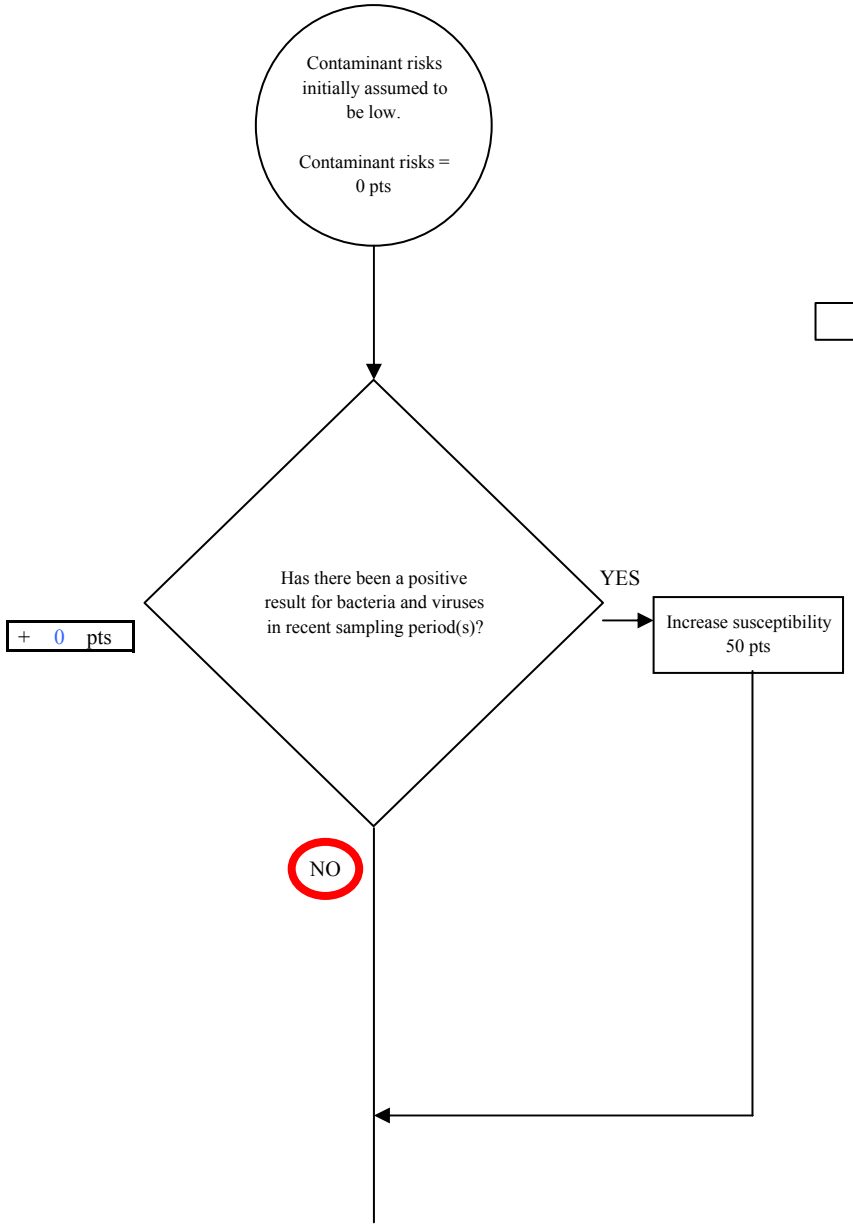
## *Chart 1. Susceptibility of the wellhead - PWSID 241088.001: Nikiski Trailer Court*

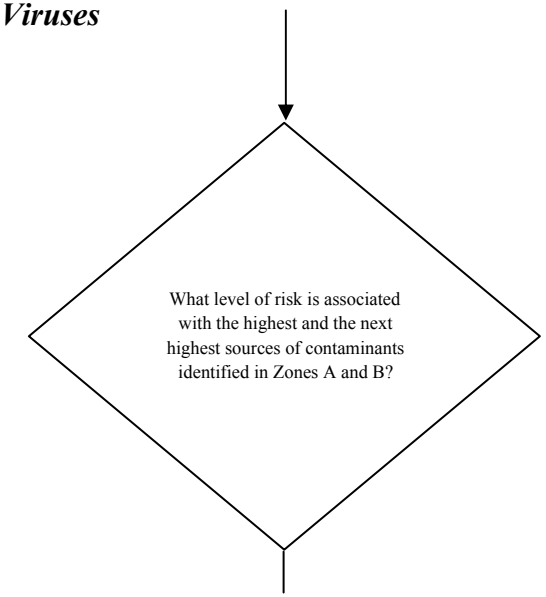


## *Chart 2. Susceptibility of the aquifer - PWSID 241088.001: Nikiski Trailer Court*



## *Chart 3. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Bacteria & Viruses*




+ 40 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

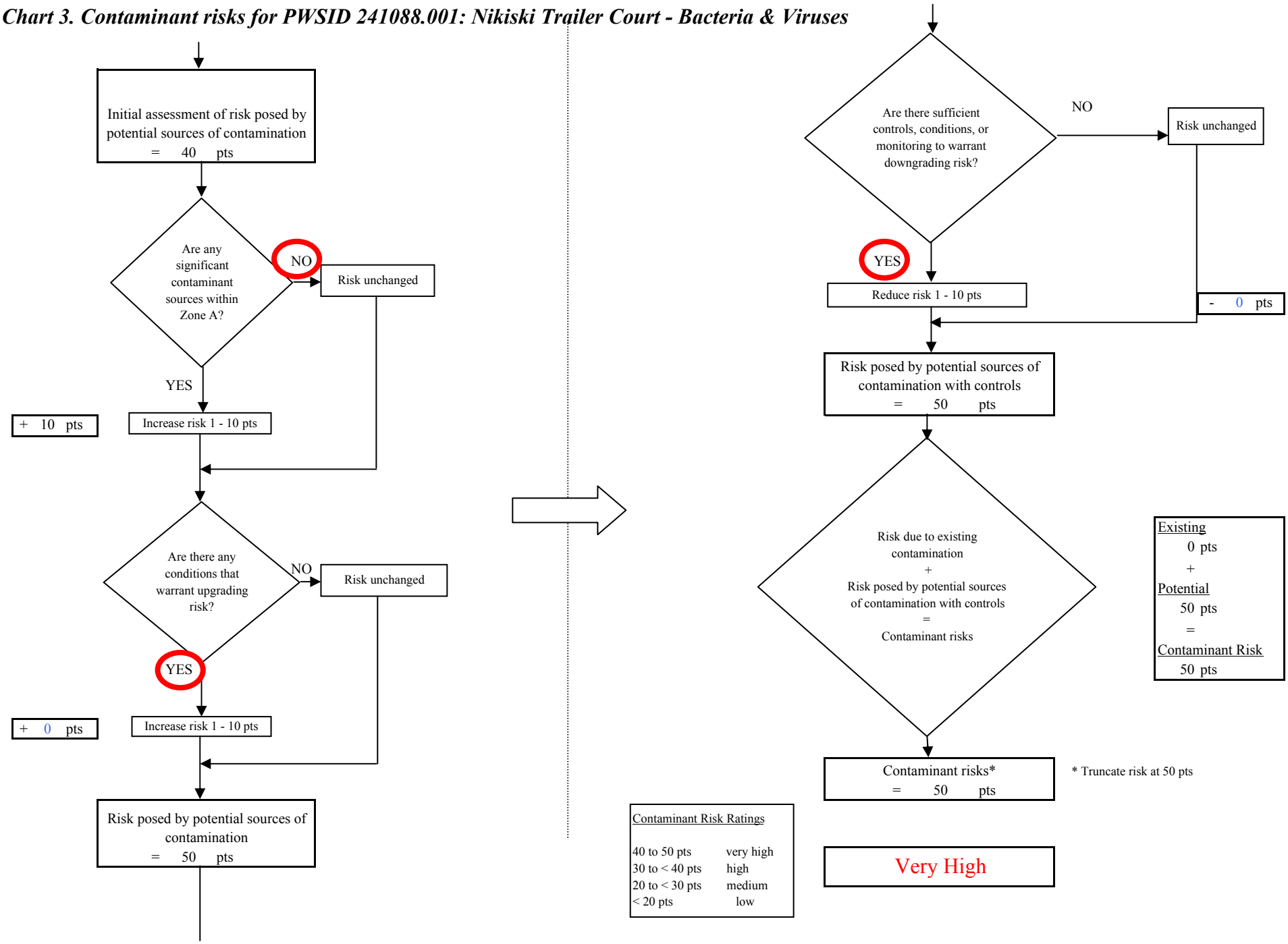
| | Zone A | Zone B | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 1 | 1 | 2 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 3 | 3 | 6 |

| | **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 |

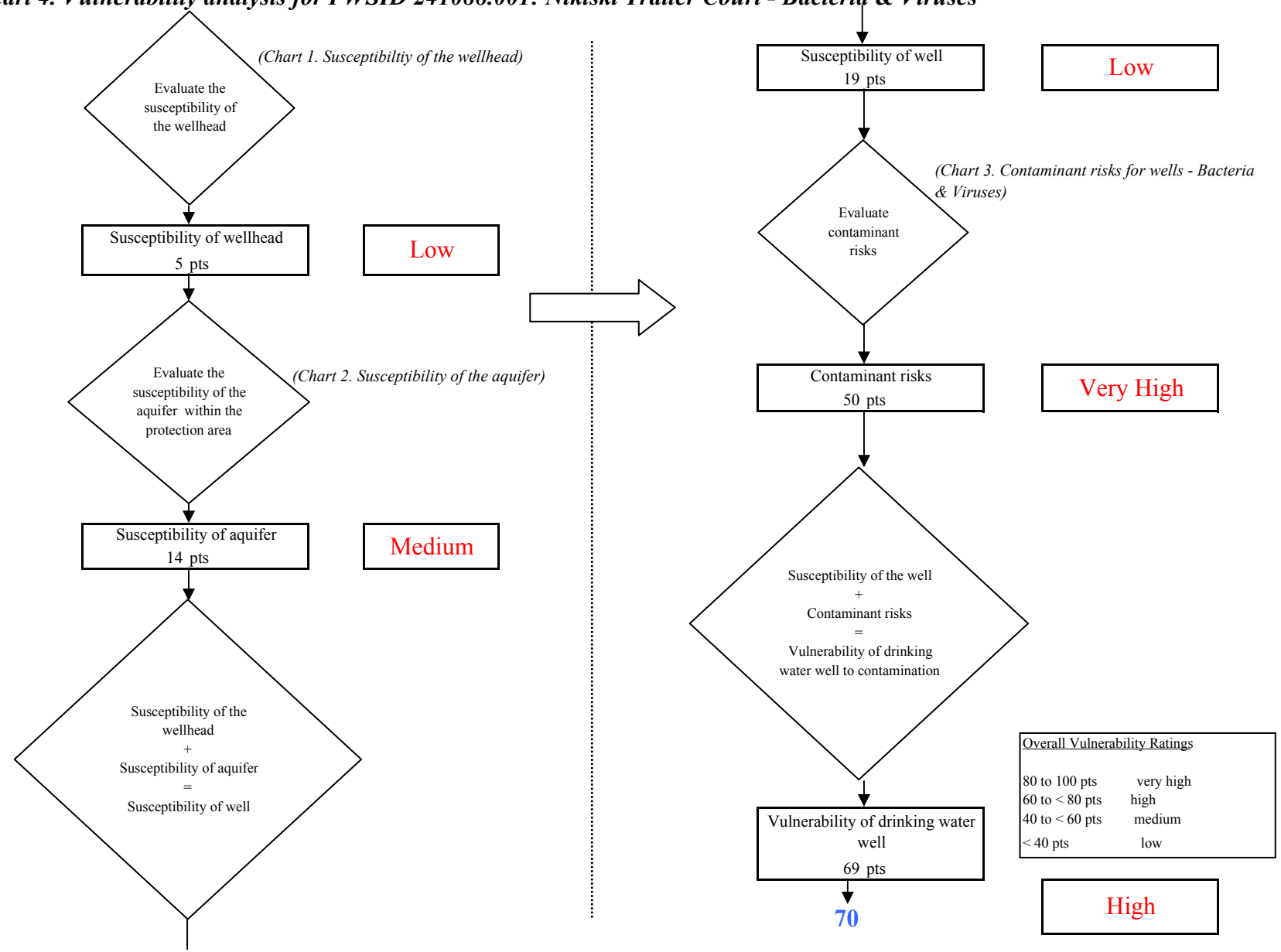
Matrix Score 40

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.

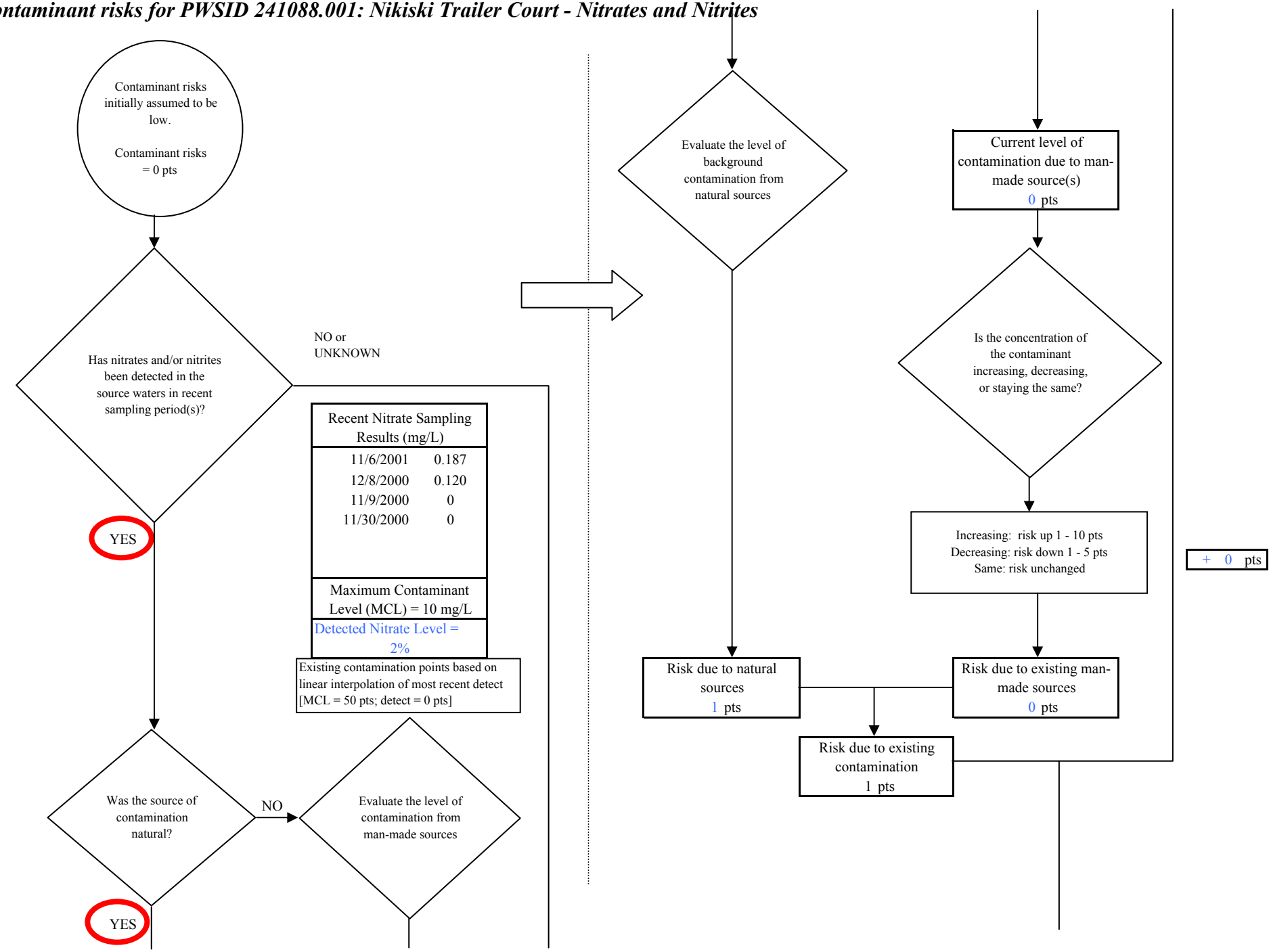
## *Chart 3. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Bacteria & Viruses*



## *Chart 4. Vulnerability analysis for PWSID 241088.001: Nikiski Trailer Court - Bacteria & Viruses*



## *Chart 5. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Nitrates and Nitrites*



## *Chart 5. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - 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, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 1 | 2 | 3 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 3 | 4 | 7 |

| | **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.

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

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

- 0 pts

Decrease risk 1 - 10 pts

Are any significant sources within Zone A?

NO

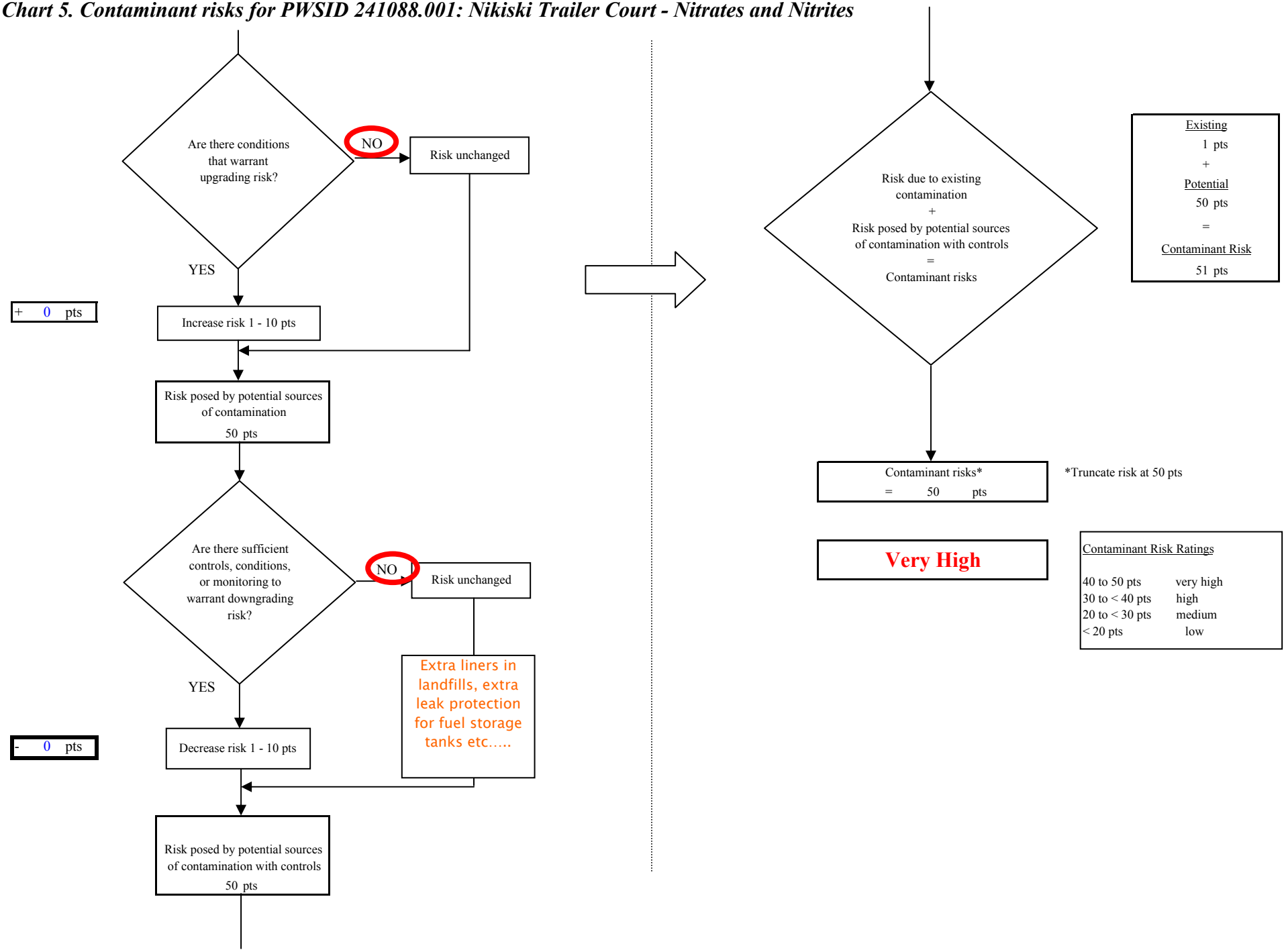
Risk unchanged

YES

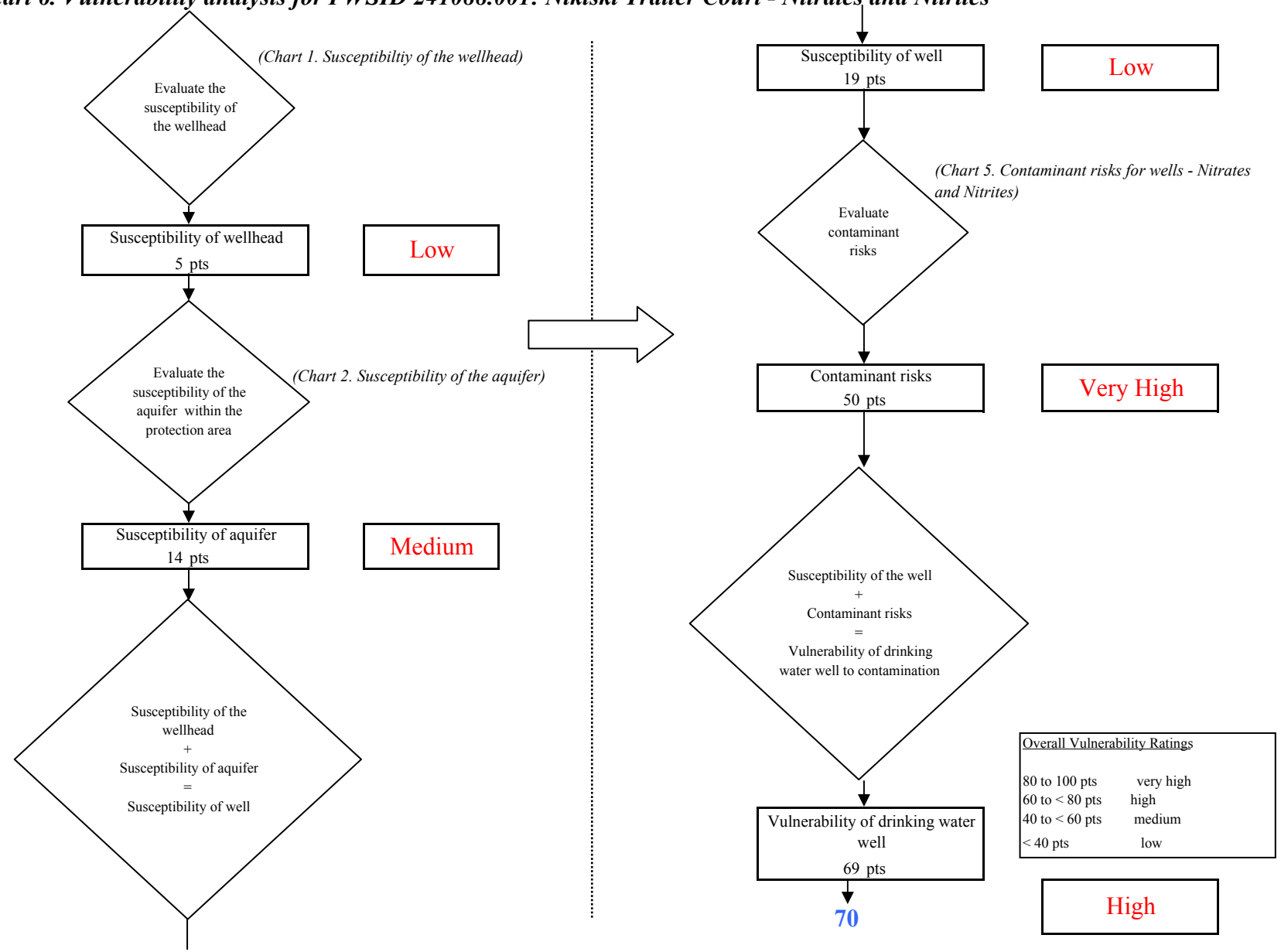
+ 10 pts

Increase risk 1 - 10 pts

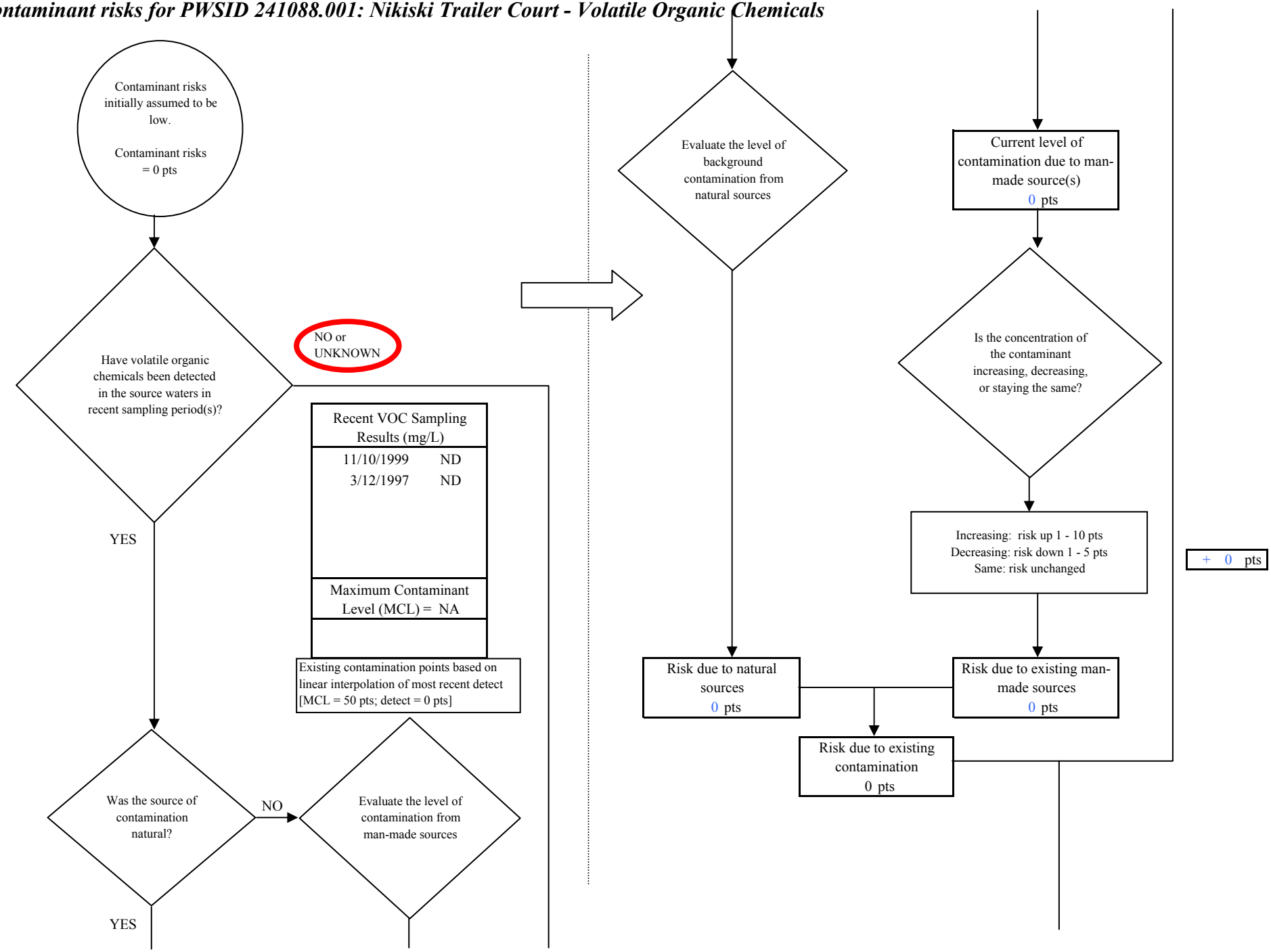
## *Chart 5. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Nitrates and Nitrites*



## *Chart 6. Vulnerability analysis for PWSID 241088.001: Nikiski Trailer Court - Nitrates and Nitrites*



## *Chart 7. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Volatile Organic Chemicals*



## *Chart 7. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Volatile Organic Chemicals*

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 4 | 6 | 10 |

| | **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 10

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 = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

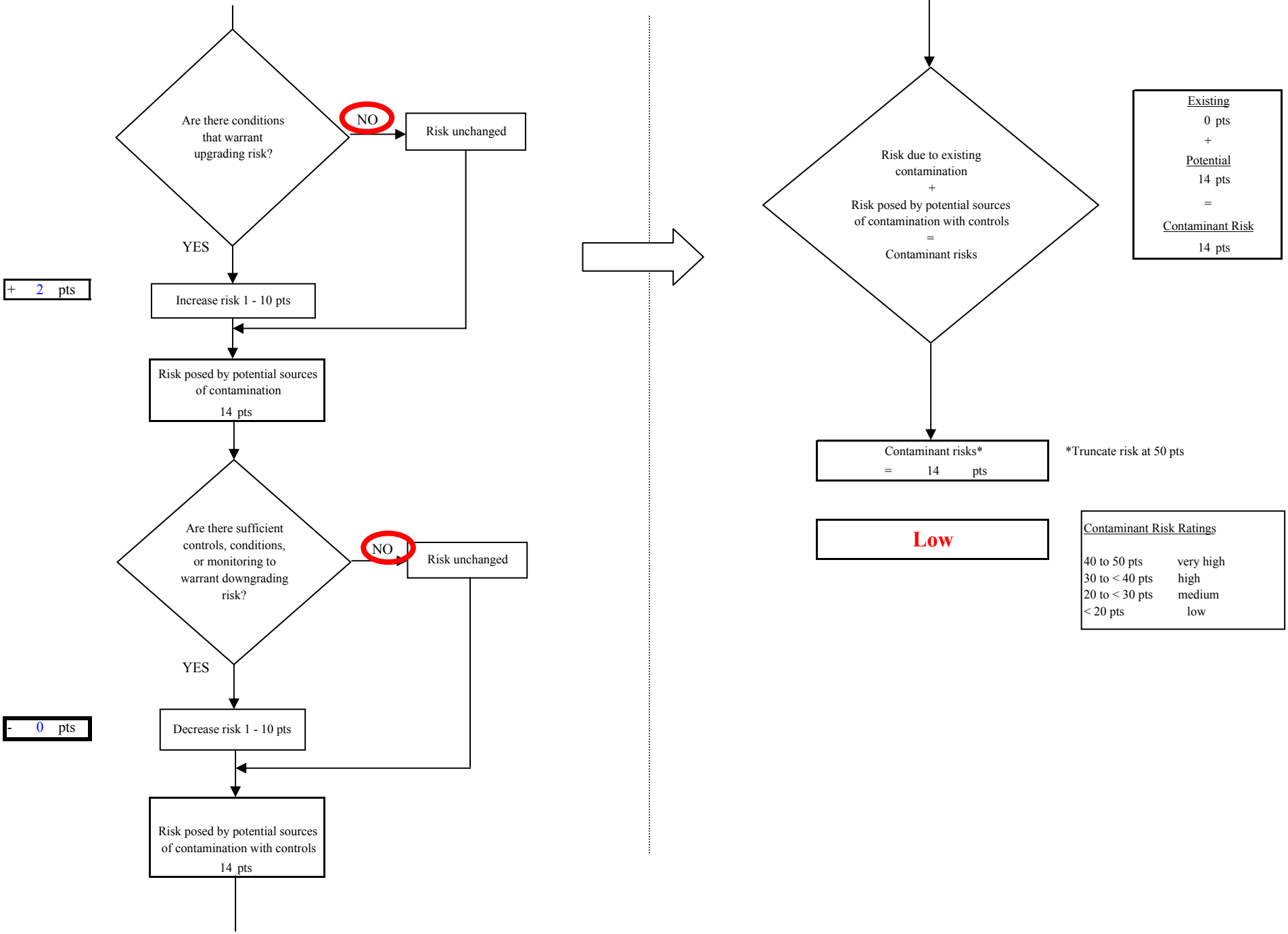
Risk unchanged

YES

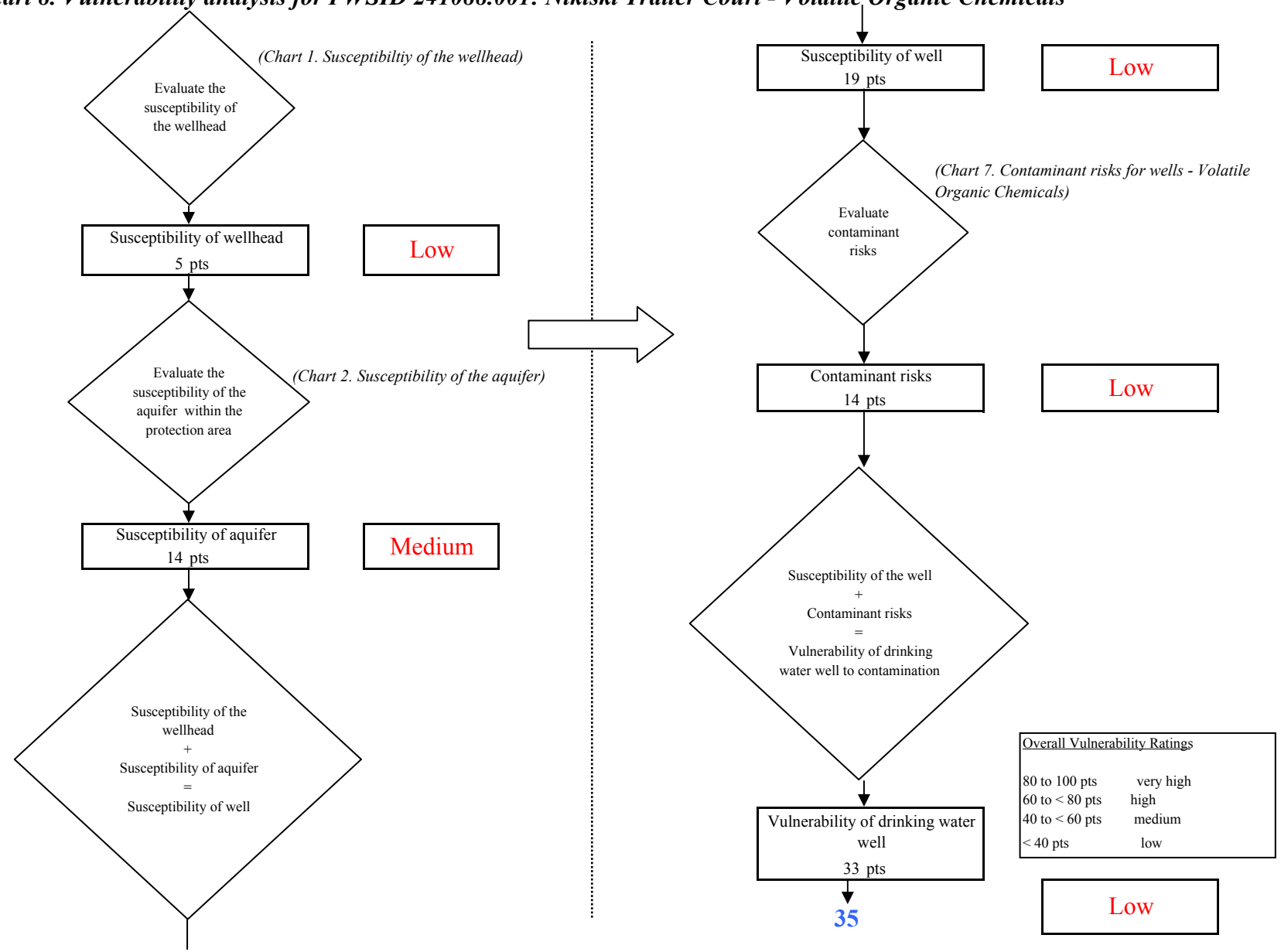
Increase risk 1 - 10 pts

+ 2 pts

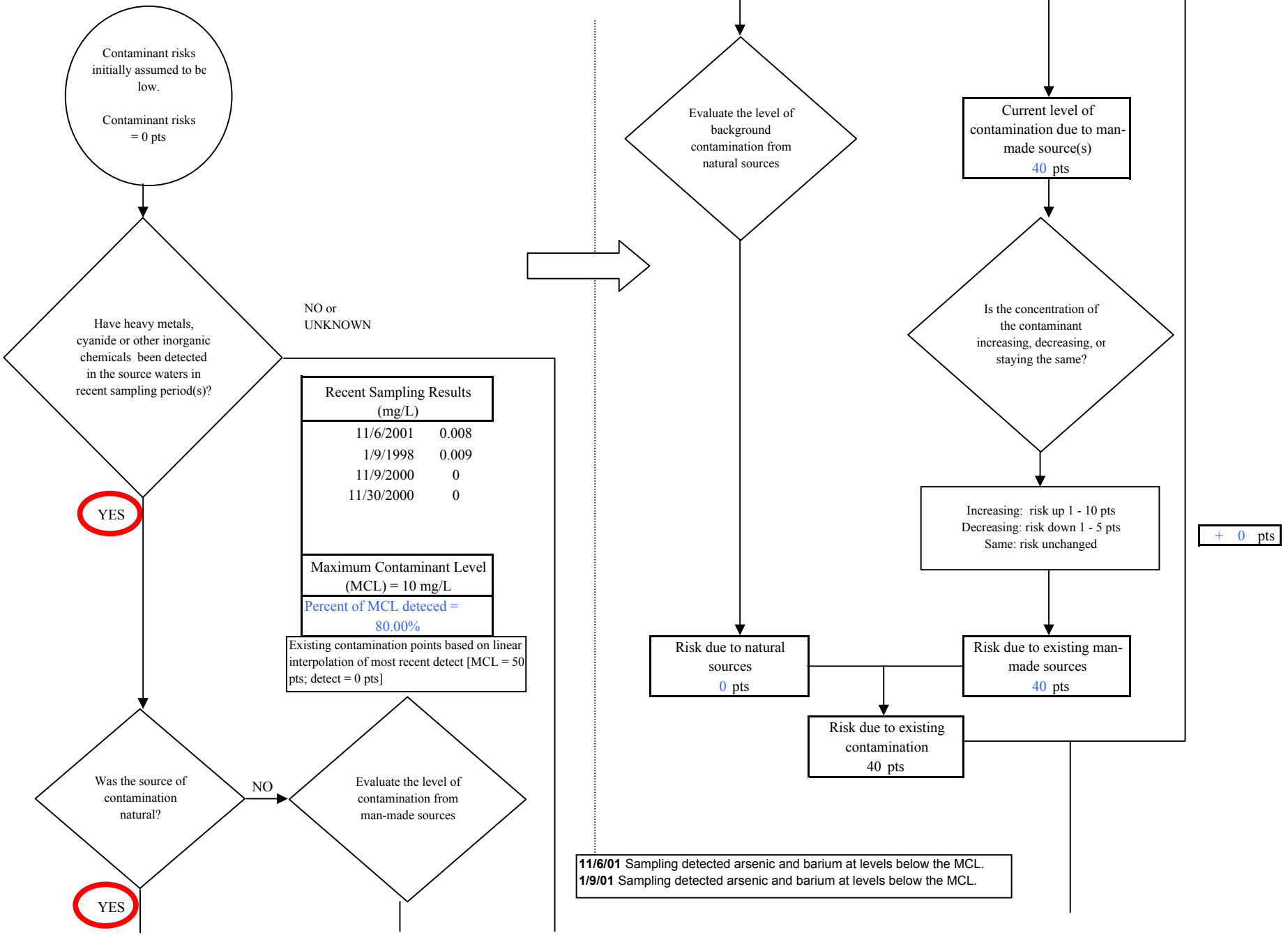
## *Chart 7. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Volatile Organic Chemicals*



## *Chart 8. Vulnerability analysis for PWSID 241088.001: Nikiski Trailer Court - Volatile Organic Chemicals*



## *Chart 9. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Heavy Metals, Cyanide and Other Inorganic Chemicals*



## *Chart 9. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Heavy Metals, Cyanide and Other Inorganic Chemicals*

+ 10 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 3 | 5 | 8 |

| | **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 10

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 = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

## *Chart 9. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Heavy Metals, Cyanide and Other Inorganic Chemicals*

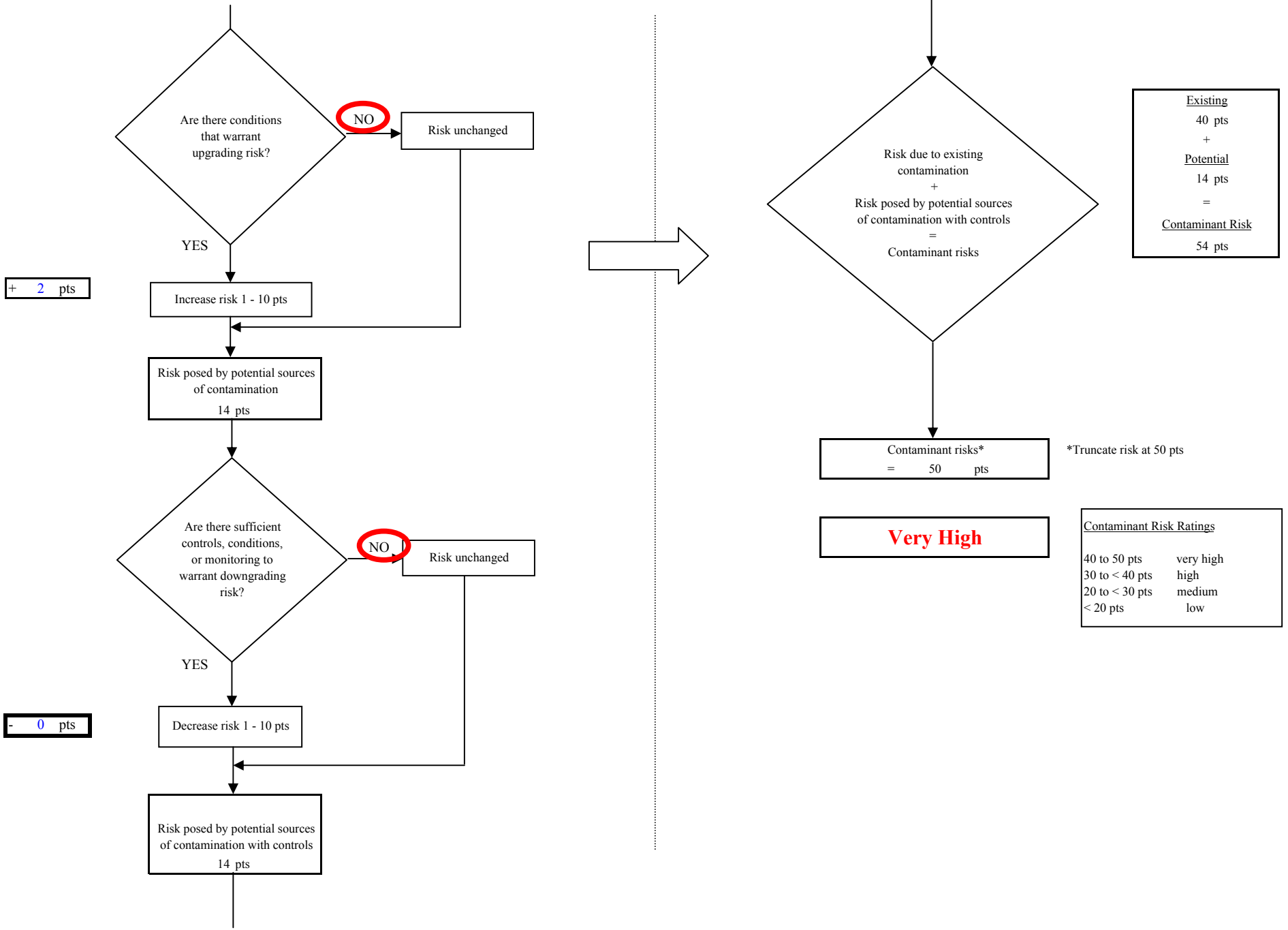
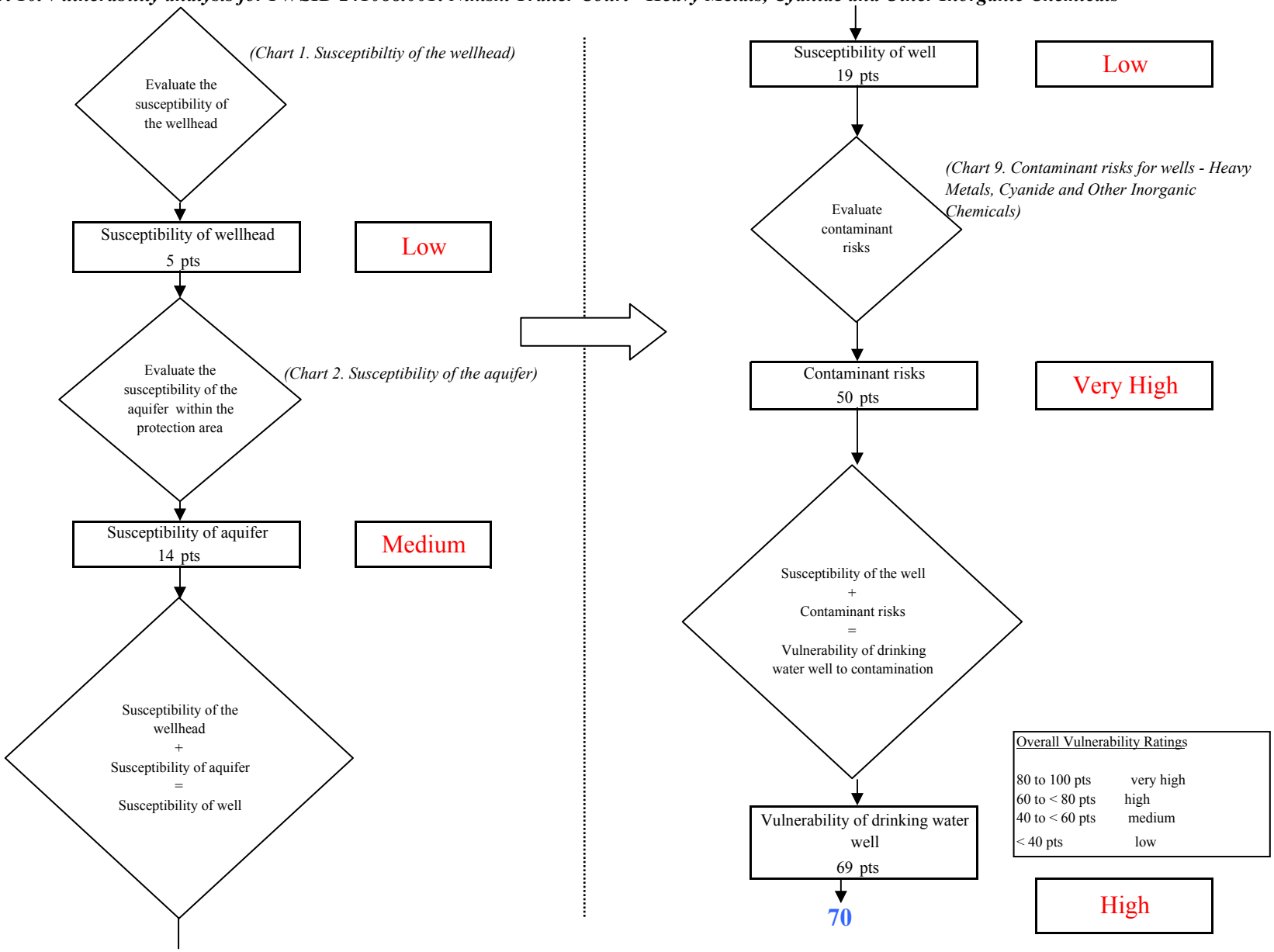
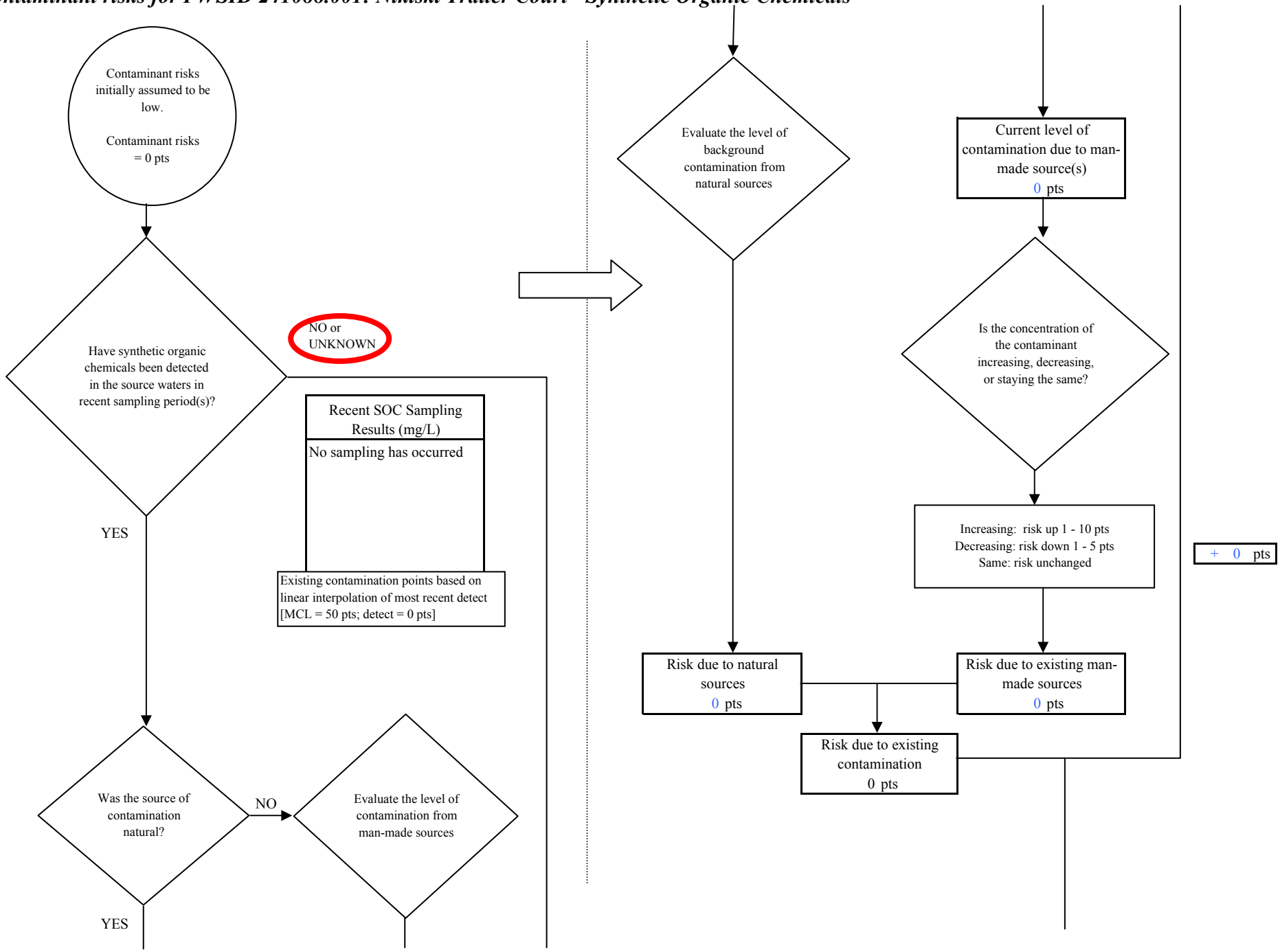


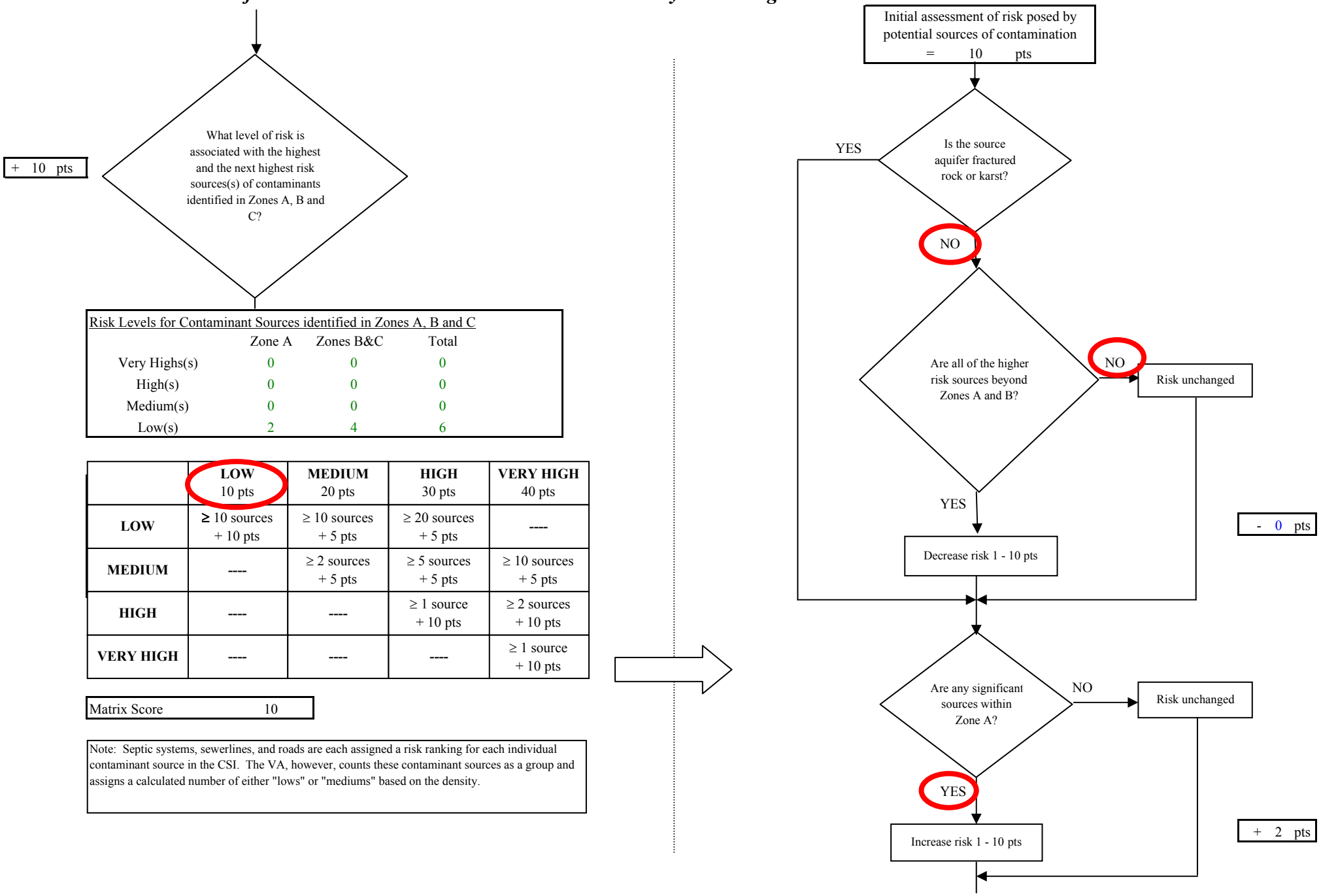
***Chart 10. Vulnerability analysis for PWSID 241088.001: Nikiski Trailer Court - Heavy Metals, Cyanide and Other Inorganic Chemicals***



## *Chart 11. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Synthetic Organic Chemicals*



## *Chart 11. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Synthetic Organic Chemicals*




Risk Levels for Contaminant Sources identified in Zones A, B and C

| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 2 | 4 | 6 |

| | **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 10

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 11. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Synthetic Organic Chemicals*

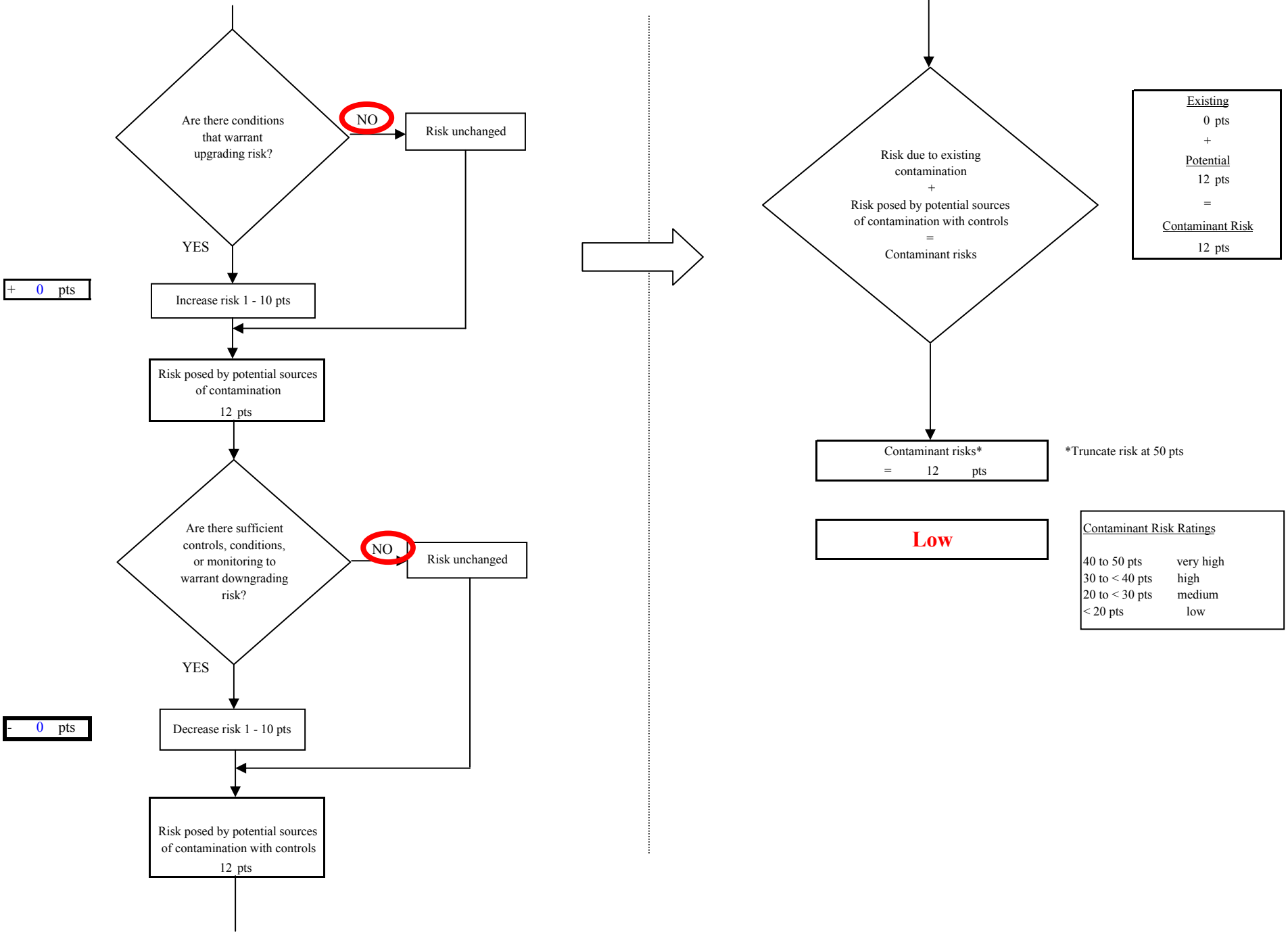
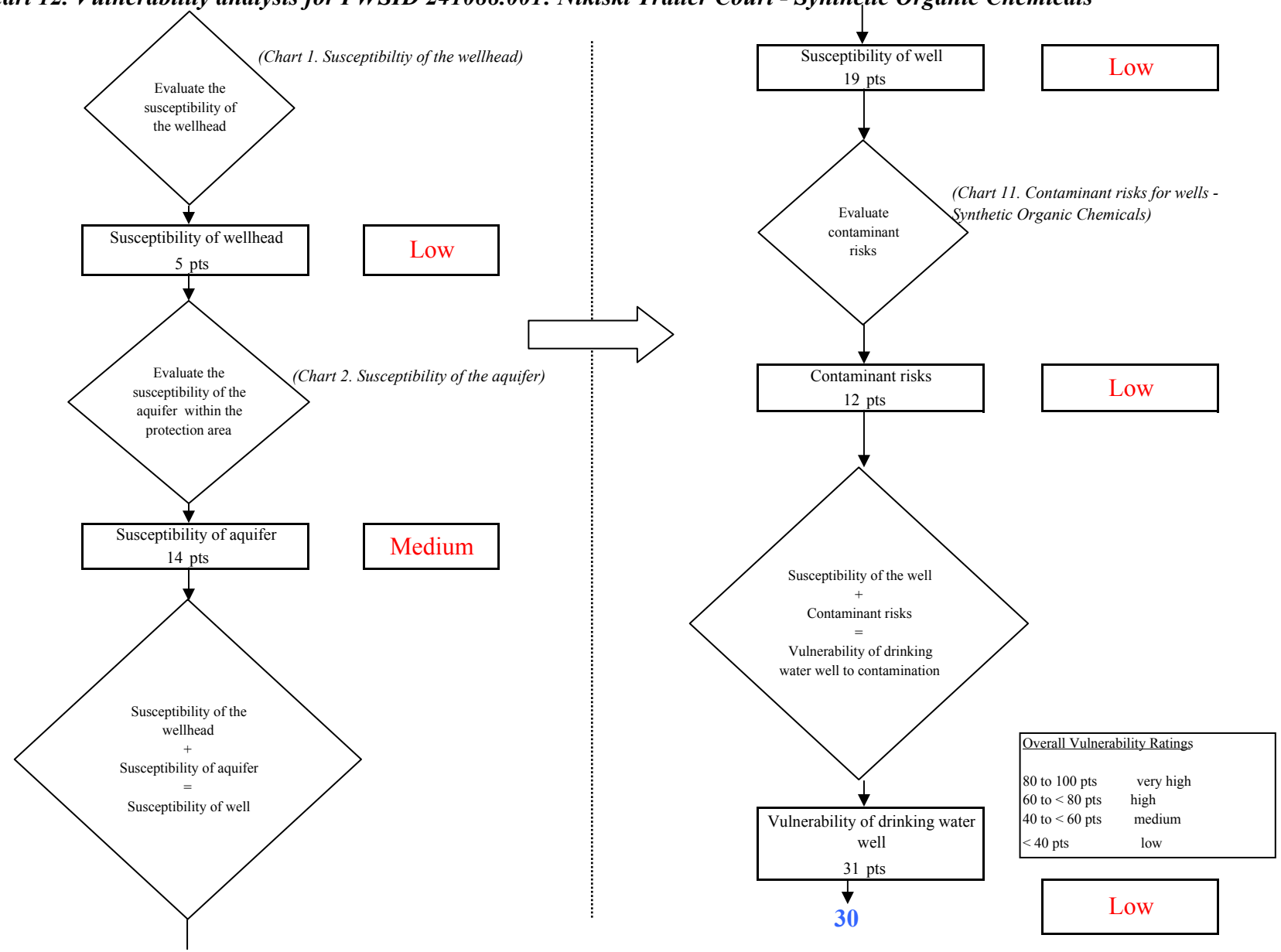
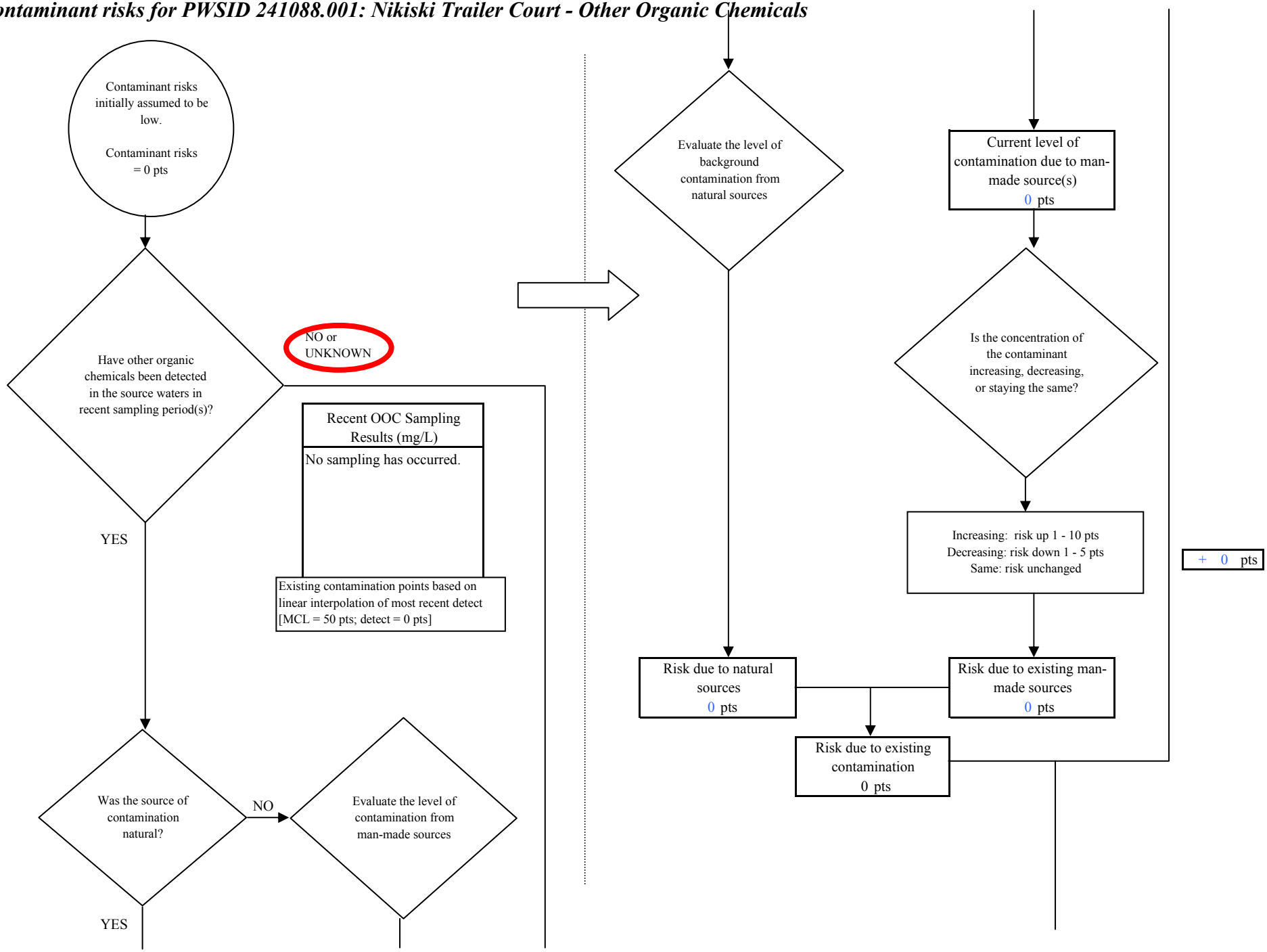


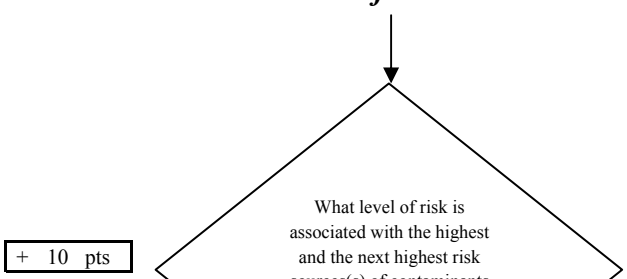
***Chart 12. Vulnerability analysis for PWSID 241088.001: Nikiski Trailer Court - Synthetic Organic Chemicals***



## *Chart 13. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Other Organic Chemicals*



## *Chart 13. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Other Organic Chemicals*




+ 10 pts

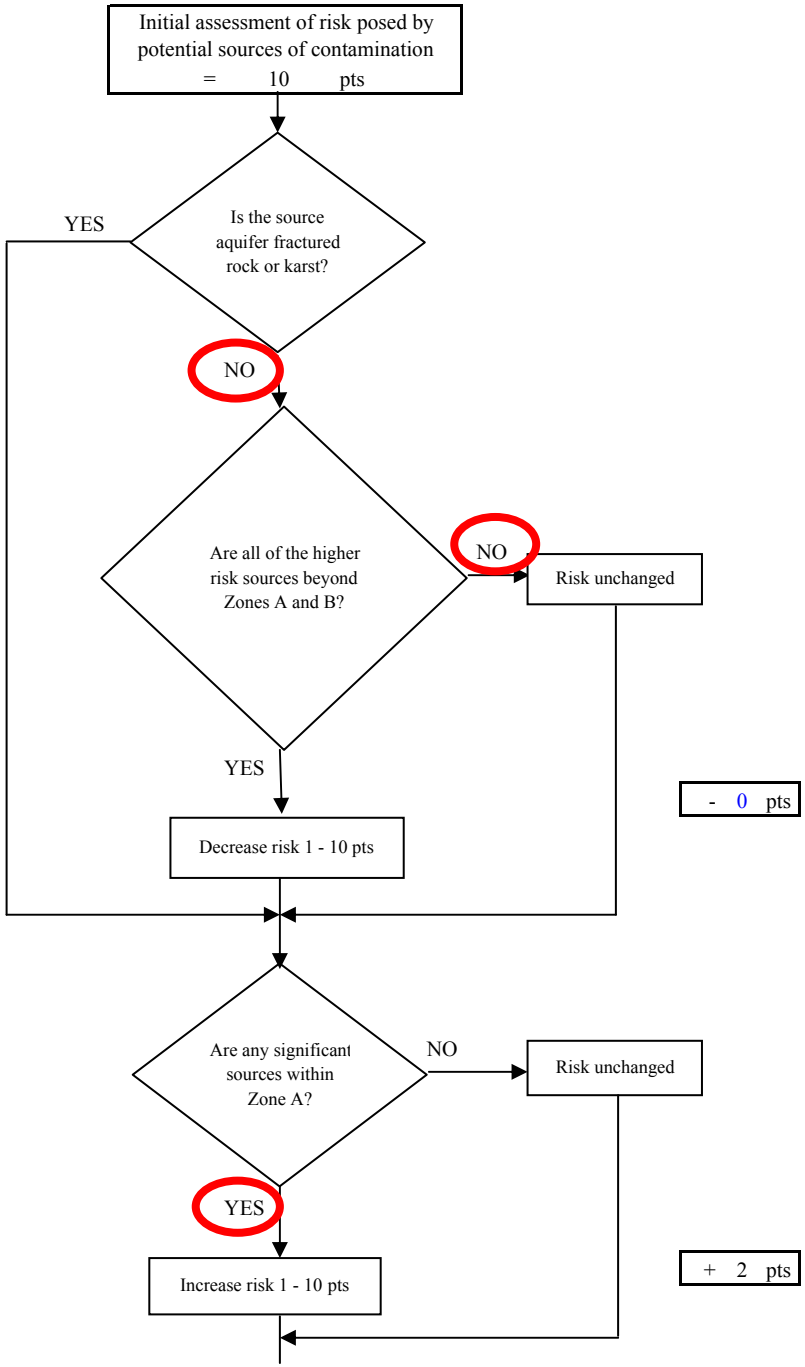
Risk Levels for Contaminant Sources identified in Zones A, B and C

| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 3 | 5 | 8 |

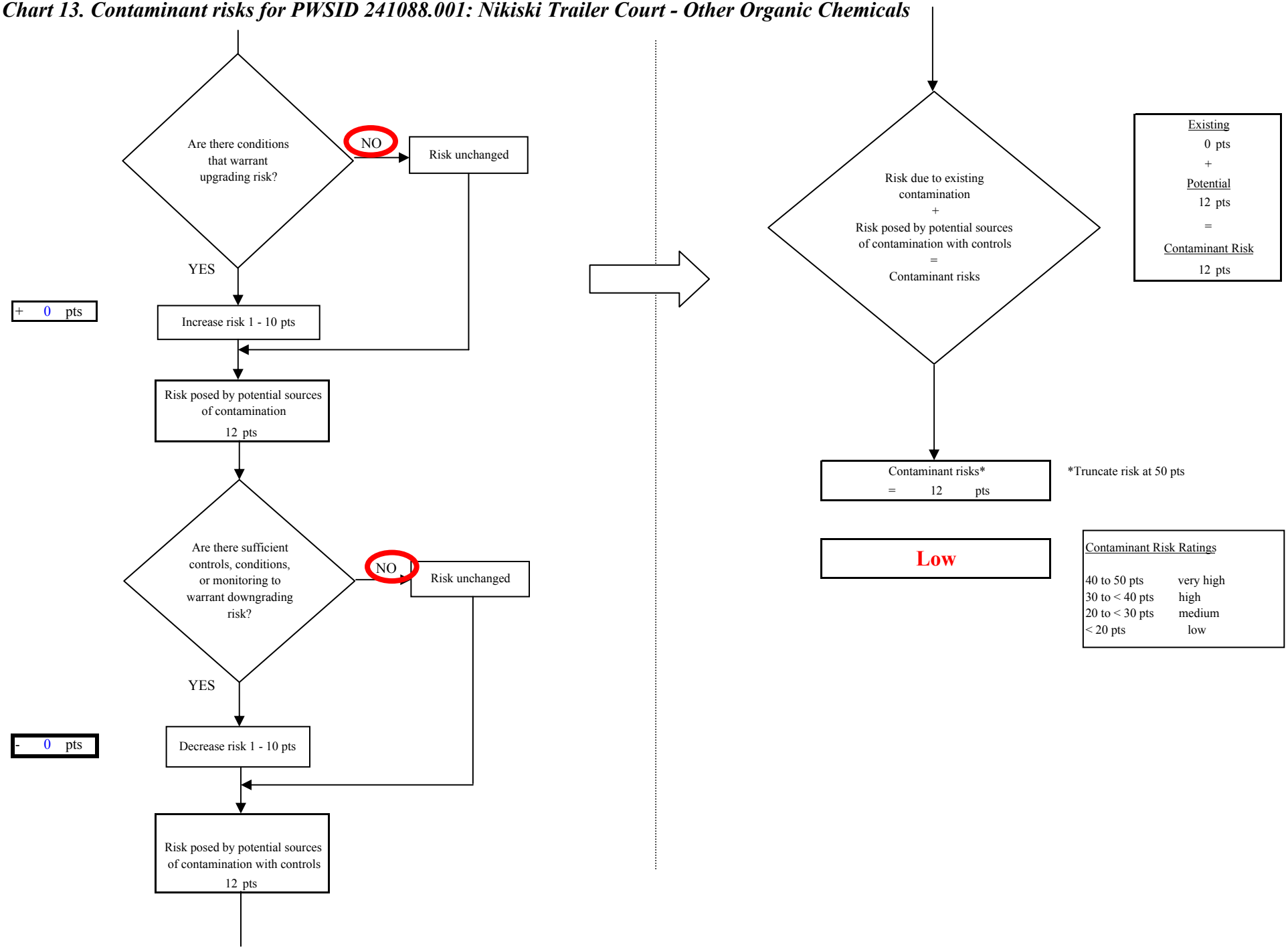
| | **LOW** 10 pts | **MEDIUM** 20 pts | **HIGH** 30 pts | **VERY HIGH** 40 pts |
|---|---|---|---|---|
| **LOW** | ≥ 10 sources + 10 pts | ≥ 10 sources + 5 pts | ≥ 20 sources + 5 pts | ---- |
| **MEDIUM** | ---- | ≥ 2 sources + 5 pts | ≥ 5 sources + 5 pts | ≥ 10 sources + 5 pts |
| **HIGH** | ---- |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

Matrix Score 10

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 13. Contaminant risks for PWSID 241088.001: Nikiski Trailer Court - Other Organic Chemicals*



## *Chart 14. Vulnerability analysis for PWSID 241088.001: Nikiski Trailer Court - Other Organic Chemicals*