

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Bear Creek RV Park
Drinking Water System,
Seward area, Alaska
PWSID 240773.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1567
Alaska Department of Environmental Conservation

Source Water Assessment for Bear Creek RV Park Drinking Water System Seward area, Alaska PWSID 240773.001

June 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1567

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.

CONTENTS

	Page		Page
Executive Summary	1	Inventory of Potential and Existing Contaminant Sources	2
Bear Creek RV Park Public Drinking Water System	1	Ranking of Contaminant Risks	2
Bear Creek RV Park Protection Area	1	Vulnerability of Bear Creek RV Park Drinking Water System	2
	1	References	7

TABLES

TABLE	1. Definition of Zones	2
	2. Susceptibility	3
	3. Contaminant Risks	3
	3. Overall Vulnerability	3

APPENDICES

APPENDIX	<p>A. Bear Creek RV Park Drinking Water Protection Area (Map 1)</p> <p>B. Contaminant Source Inventory for Bear Creek RV Park (Table 1) Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park– Bacteria and Viruses (Table 2) Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park– Nitrates/Nitrites (Table 3) Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park– Volatile Organic Chemicals (Table 4) Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park– Heavy Metals, Cyanide, and Other Inorganic Chemicals (Table 5) Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park– Synthetic Organic Chemicals (Table 6) Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park– Other Organic Chemicals (Table 7)</p> <p>C. Bear Creek RV Park Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)</p> <p>D. Vulnerability Analysis for Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park Public Drinking Water Source (Charts 1 – 14)</p>
----------	---

Source Water Assessment for Bear Creek RV Park Source of Public Drinking Water, Seward area, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Bear Creek RV Park is a Class A (community) water system consisting of one well located off of Bear Lake Road. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produces a **Medium** rating for the natural susceptibility of the well. Identified potential sources of contaminants for the Bear Creek RV Park include: roads, residential septic systems, residential area, campgrounds and large capacity septic systems. These identified potential 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 Bear Creek RV Park received a vulnerability rating of **High** for nitrates/nitrite, **Medium** for bacteria/viruses and volatile organic chemicals and **Low** for inorganic chemicals, synthetic organic chemicals and other organic chemical

BEAR CREEK RV PARK PUBLIC DRINKING WATER SYSTEM

The Bear Creek RV Park public water system (PWS) is a Class A (community) water system. The system consists of one well located off of Bear Lake Road (See Map 1 of Appendix A). The Bear Creek RV Park is part of the Kenai Peninsula Borough, which is located directly south of the city of Anchorage. 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. Kenai 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. Communities located in the Kenai Mountains include: Cooper Landing, Moose Pass and Seward.

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 Tustumena Lake) and two substantial rivers (Kenai River, and Kasilof River) (USGS 1915).

The Bear Creek RV Park water system is located within the Kenai Mountains, in the town of Seward Alaska. Seward lies at the mouth of the Resurrection River at the head of Resurrection Bay, in a valley surrounded by steep mountains to the east and west. Drainage is typically off the mountains towards the Bay

The surface geology of the Seward area is predominantly composed of unconsolidated surficial deposits. These deposits are chiefly of glaciofluvial origin. This alluvium comprises an unconfined aquifer. The exposed rock surrounding Seward is predominantly the Jurassic or Cretaceous Valdez Group. The Valdez Group is comprised of weakly metamorphosed metagraywacke, metasiltstone, and argillite (Tysdal and Case 1979).

The Seward area has a central water system, supplied by nine municipal wells. However, many homes and businesses in the area rely on individual wells for their water supply. Sewage is collected and piped to a secondary treatment lagoon. Almost all homes are fully plumbed (ADCED 2002)

The Sanitary Survey (1999) indicates that the well is 95 feet deep and the wellhead is protected with a sanitary seal. 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. The land surface is sloped away from the casing. Since the well was drilled prior to grouting regulations, it is assumed not to be 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 100 residents and 40 non-residents through 52 service connections.

BEAR CREEK RV PARK 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 Bear Creek RV Park. 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 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 Bear Creek RV Park 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 Bear Creek RV Park 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 BEAR CREEK RV PARK 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

Bear Creek RV Park well is completed in a semi-confined aquifer setting. The well log indicates that the well is 95 feet deep. A possible confining layer exists from 43-61 feet (cemented sand) and silt 61-75 feet (rocky clay). These layers may provide a protective

barrier from the movement of contaminants in the subsurface. However, well logs in the area indicate the confining layer disappears as it approaches the mountains and private wells penetrate the confining layers. Both of which provide a path for potential contaminants to enter the confined aquifer.

Table 2 shows the Susceptibility scores and ratings for the Bear Creek RV Park.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	23	Very High
Natural Susceptibility	28	Medium

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	30	High
Nitrates and/or Nitrites	41	Very High
Volatile Organic Chemicals	23	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	12	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 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	55	Medium
Nitrates and Nitrites	70	High
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	35	Low
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	35	Low

Bacteria and Viruses

Roads, residential area, residential septic systems, campgrounds and large capacity septic systems represent the greatest risk for bacteria and viruses to this drinkingwater 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 or viruses 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 medium.

Nitrates and Nitrites

Roads, residential area, residential septic systems, campgrounds and large capacity septic systems represent the greatest risk to nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for the Bear Creek RV Park well indicates that nitrate concentrations have ranged from 0.0 mg/l to 0.18 mg/l. The reported nitrate concentrations suggest that the nitrate concentrations are attributed to natural sources. 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. The most recent nitrate level detected was 2% (0.18 mg/L) 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, recent 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 nitrate and nitrite contamination is high.

Volatile Organic Chemicals

Roads, residential septic systems, residential areas, camping areas and large capacity septic systems represent the greatest identified risk for volatile organic chemical contamination to the well.

Many 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.

Recent sampling for volatile organic chemicals on 4/19/99 detected very low levels of toluene. The levels detected were 0.00025 mg/l or < 1% of the Maximum Contaminant Level of 0.5 mg/l. Though existing volatile organic chemical contamination was detected at the site, recent data indicates that the water is safe with respect to human health.

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

Roads, residential septic systems, residential areas and large capacity septic systems represent the greatest risk for inorganic chemicals to the well.

Inorganic chemicals have not been detected in source water.

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 low.

Synthetic Organic Chemicals

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

Synthetic organic chemicals have not been detected in source water. The system currently has an SOC waiver and is not required to sample.

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 low.

Other Organic Chemicals

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

Other organic chemicals have not been detected. The system currently has an OOC waiver and is not required to sample.

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 low.

REFERENCES

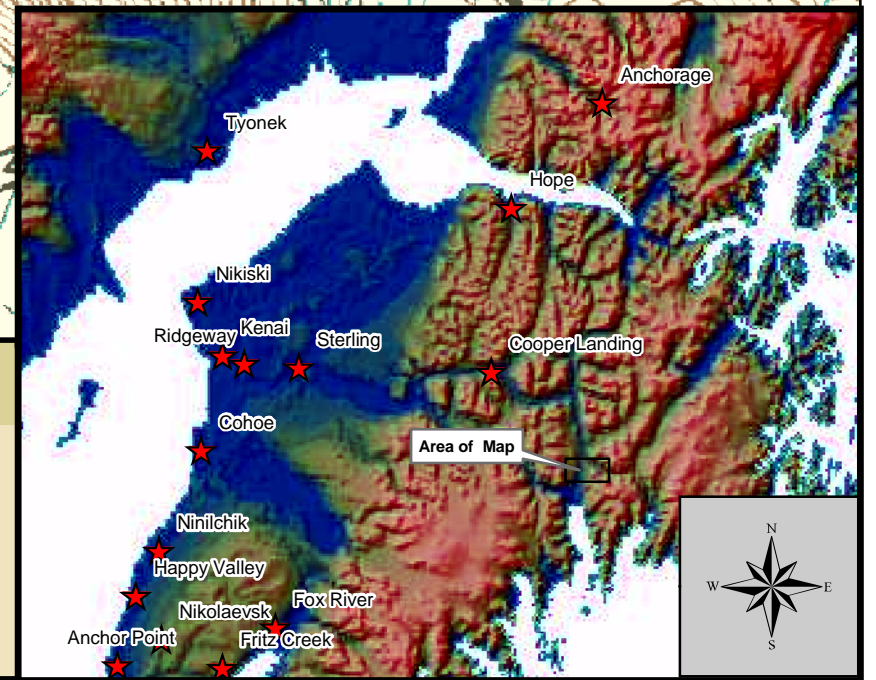
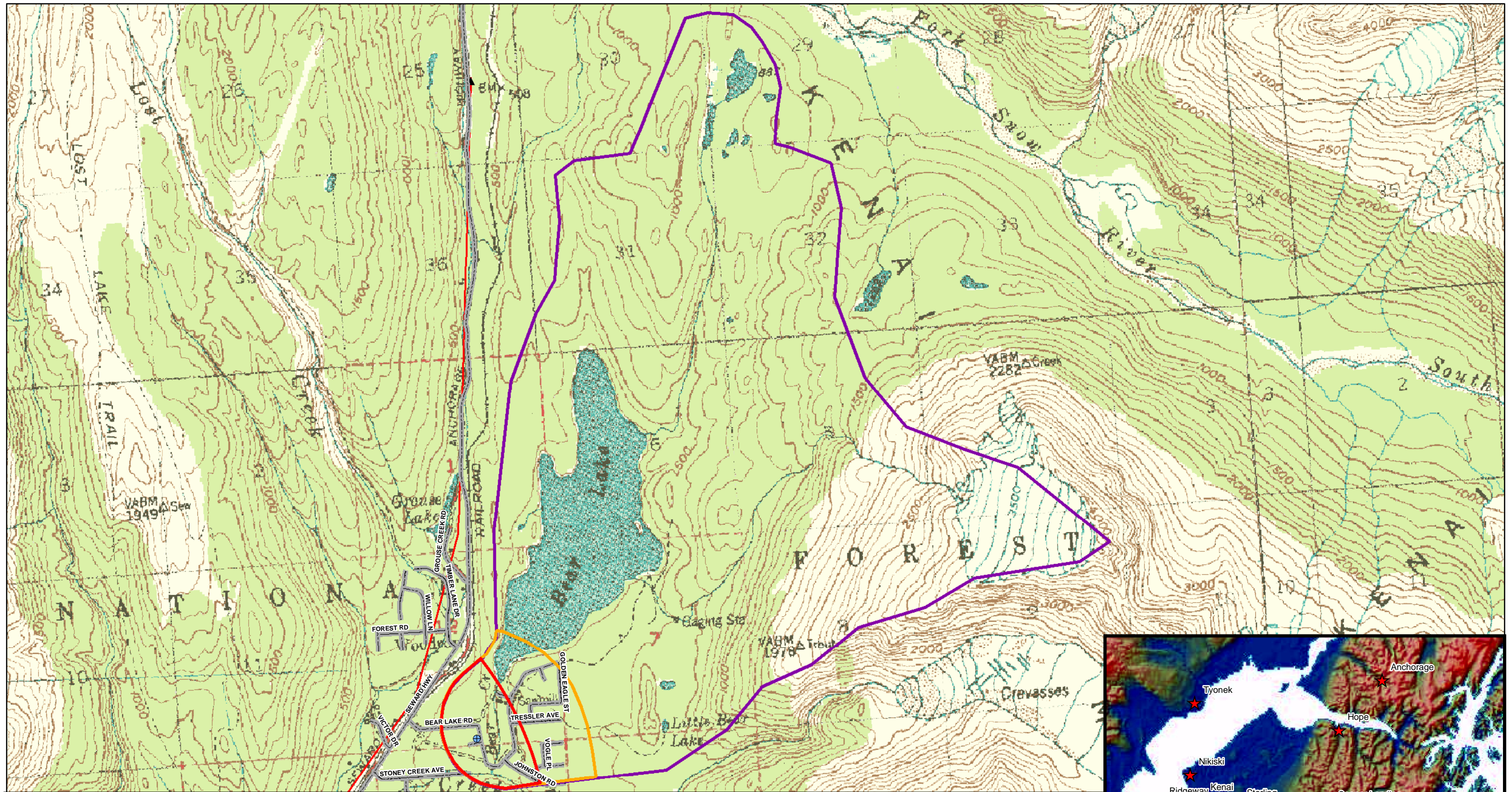
- Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.
- Alaska Department of Environmental Conservation, Contaminated Sites Database, 2003 [WWW database], URL http://www.state.ak.us/dec/dspar/csites/cs_search.htm
- Alaska Department of Environmental Conservation, Leaking Underground Storage Tank Database, 2003 [WWW database], URL http://www.dec.state.ak.us/spar/stp/ust/search/fac_search.asp
- Freeze, R. A., and Cherry, J.A. 1979, *Groundwater*, Prentice-Hall, Englewood Cliffs, New Jersey
- Glass, Roy, L. 1996 *Groundwater Conditions and Quality in the Western Part of the Kenai Peninsula, Southcentral Alaska*. U.S. Geological Survey Open File Report 94-466, prepared in cooperation with the Alaska Department of Natural Resources, Kenai Peninsula Borough, and Kenai Soil and Water Conservation District.
- Martin, G.C., Johnson, B.L., and Grant, 1915, *Geology and mineral resources of Kenai Peninsula, Alaska*: US Geological Survey Bulletin 587, 243 p., maps.
- Tysdal, R.G., and Case, J.E., 1979, *Geologic Map of the Seward and Blying Sound Quadrangles, Alaska*, United States Geological Survey, Reston, Virginia.
- United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL <http://www.epa.gov/safewater/mcl.html>.

ACKNOWLEDGMENT

Source Water Assessments in the Seward area were jointly prepared by ADEC-Drinking Water Protection Program and Ecology and Environment (E & E Inc.). The Drinking Water Protection Program would like to thank Ecology and Environment (E & E Inc.) for their efforts in researching the area.

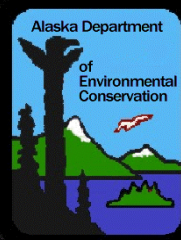
APPENDIX A

Bear Creek RV Park Drinking Water Protection Area Location Map (Map 1)



Map 1-Bear Creek RV Park-Drinking Water Protection Area

PWSID: 240773.001

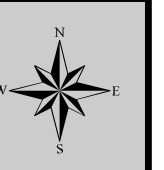


0 6001,200 2,400 Feet

1:29,932

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
	Roads
	Rivers and Streams
	Water



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Bear Creek RV Park (Tables 1-7)

Table 1

**Contaminant Source Inventory for
Bear Creek Mobile Home RV Park**

PWSID 240773.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Residential Areas	R01	R01-1	A	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	2	Zone A has 29 residential septics
Highways and roads, paved (cement or asphalt)	X20	X20-1-6	A	2	Zone A has 6 roads identified.
Campgrounds and RV Parks	X35	X35-01	A	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	2	Zone B has 46 residential septics
Highways and roads, paved (cement or asphalt)	X20	X20-7-12	B	2	Zone B has 5 roads identified.
Residential Areas	R01	R01-3	C	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	2	Zone C has 2 residential septics

Table 2

Contaminant Source Inventory and Risk Ranking for
Bear Creek Mobile Home RV Park
Sources of Bacteria and Viruses

PWSID 240773.001

<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>
Residential Areas	R01	R01-1	A	Low	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	Low	2	Zone A has 29 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-1-6	A	Low	2	Zone A has 6 roads identified.
Campgrounds and RV Parks	X35	X35-01	A	Low	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	High	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	Low	2	Zone B has 46 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-7-12	B	Low	2	Zone B has 5 roads identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	Low	2	Zone C has 2 residential septic

Table 3

*Contaminant Source Inventory and Risk Ranking for
 Bear Creek Mobile Home RV Park
 Sources of Nitrates/Nitrites*

PWSID 240773.001

<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>
Residential Areas	R01	R01-1	A	Low	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	Low	2	Zone A has 29 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-1-6	A	Low	2	Zone A has 6 roads identified.
Campgrounds and RV Parks	X35	X35-01	A	Low	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	High	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	Low	2	Zone B has 46 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-7-12	B	Low	2	Zone B has 5 roads identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	Low	2	Zone C has 2 residential septic

Table 4

*Contaminant Source Inventory and Risk Ranking for
Bear Creek Mobile Home RV Park
Sources of Volatile Organic Chemicals*

PWSID 240773.001

<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>
Residential Areas	R01	R01-1	A	Low	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	Low	2	Zone A has 29 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-1-6	A	Low	2	Zone A has 6 roads identified.
Campgrounds and RV Parks	X35	X35-01	A	Low	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	Low	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	Low	2	Zone B has 46 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-7-12	B	Low	2	Zone B has 5 roads identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	Low	2	Zone C has 2 residential septic

Table 5

*Contaminant Source Inventory and Risk Ranking for
Bear Creek Mobile Home RV Park
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

PWSID 240773.001

<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>
Residential Areas	R01	R01-1	A	Low	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	Low	2	Zone A has 29 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-1-6	A	Low	2	Zone A has 6 roads identified.
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	Low	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	Low	2	Zone B has 46 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-7-12	B	Low	2	Zone B has 5 roads identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	Low	2	Zone C has 2 residential septic

Table 6

*Contaminant Source Inventory and Risk Ranking for
Bear Creek Mobile Home RV Park
Sources of Synthetic Organic Chemicals*

PWSID 240773.001

<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>
Residential Areas	R01	R01-1	A	Low	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	Low	2	Zone A has 29 residential septic
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	Low	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	Low	2	Zone B has 46 residential septic
Residential Areas	R01	R01-3	C	Low	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	Low	2	Zone C has 2 residential septic

Table 7

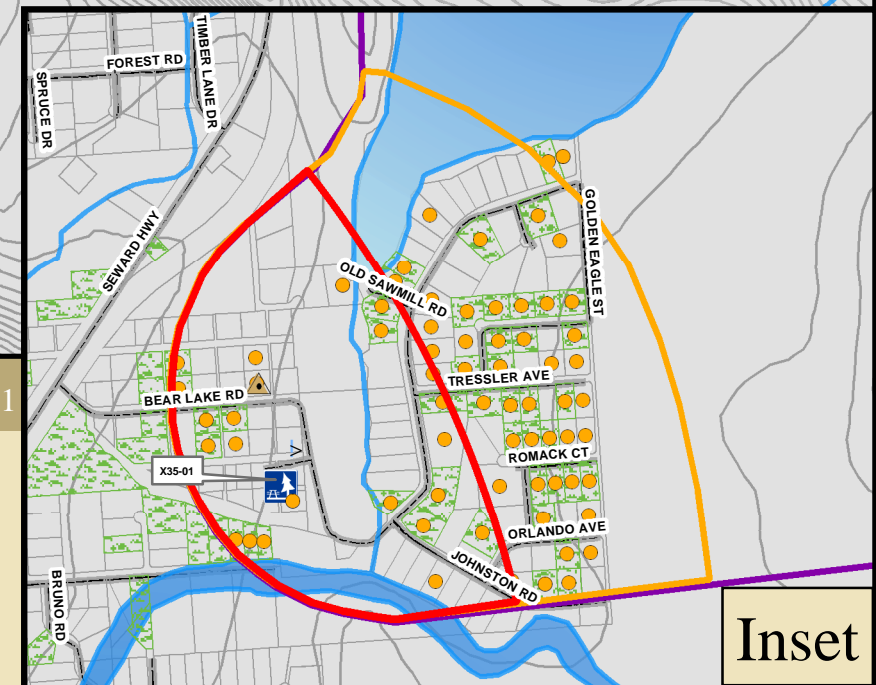
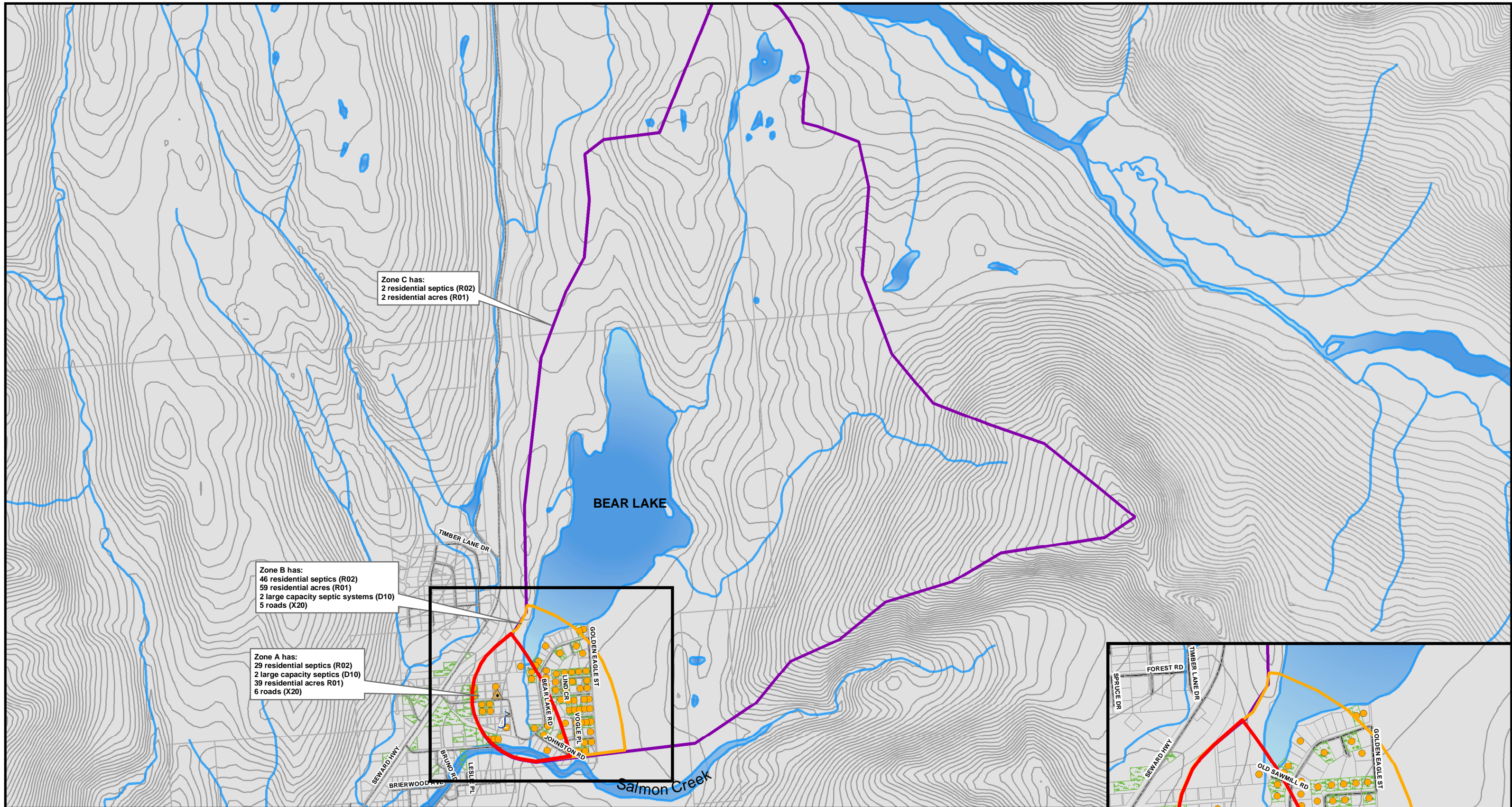
*Contaminant Source Inventory and Risk Ranking for
Bear Creek Mobile Home RV Park
Sources of Other Organic Chemicals*

PWSID 240773.001

<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>
Residential Areas	R01	R01-1	A	Low	2	Zone A has 46 residential acres
Septic systems (serves one single-family home)	R02	R02-1-29	A	Low	2	Zone A has 29 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-1-6	A	Low	2	Zone A has 6 roads identified.
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	B	Low	2	Zone B has 2 large capacity septic tanks
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Residential Areas	R01	R01-2	B	Low	2	Zone B has 59 residential acres
Septic systems (serves one single-family home)	R02	R02-30-75	B	Low	2	Zone B has 46 residential septic
Highways and roads, paved (cement or asphalt)	X20	X20-7-12	B	Low	2	Zone B has 5 roads identified.
Residential Areas	R01	R01-3	C	Low	2	Zone C has 2 residential acres
Septic systems (serves one single-family home)	R02	R02-76-77	C	Low	2	Zone C has 2 residential septic

APPENDIX C

Bear Creek RV Park Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2-Bear Creek RV Park: Potential and Existing Sources of Contamination

PWSID: 240773.001

Alaska Department of Environmental Conservation
Alaska Drinking Water Protection Program

0 2,580 5,160 Feet
1:30,218

Data Sources:
Roads and parcels: Kenai Borough
Potential Sources of Contamination: ADEC

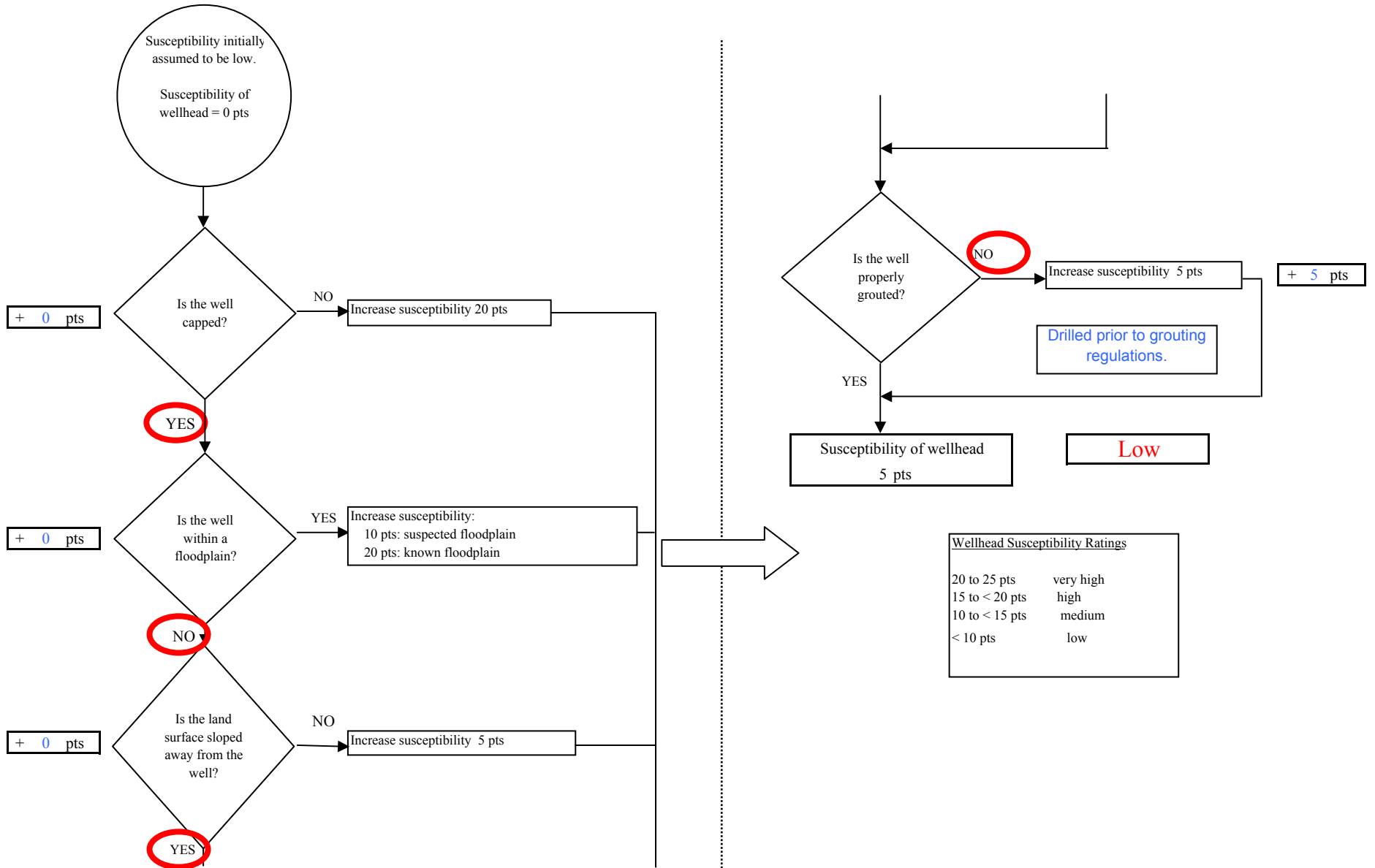
- > Class A Public Water System
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Parcels
- Roads
- Campgrounds and RV Parks (X35)
- Injection wells (Class V) Septic System (Drainfield Disposal Method) (D10)
- Septic systems (serves one single-family home and/or less than 20 people)(R02)
- Residential Area (R02)
- Rivers and Streams
- Water
- Elevation Contours (20m)

Inset

APPENDIX D

Vulnerability Analysis for Bear Creek RV Park Public Drinking Water Source (Charts 1-14)

Chart 1. Susceptibility of the wellhead - Bear Creek RV Park PWSID 240773.001



Wellhead Susceptibility Ratings	
20 to 25 pts	very high
15 to < 20 pts	high
10 to < 15 pts	medium
< 10 pts	low

Chart 2. Susceptibility of the aquifer - Bear Creek RV Park PWSID 240773.001

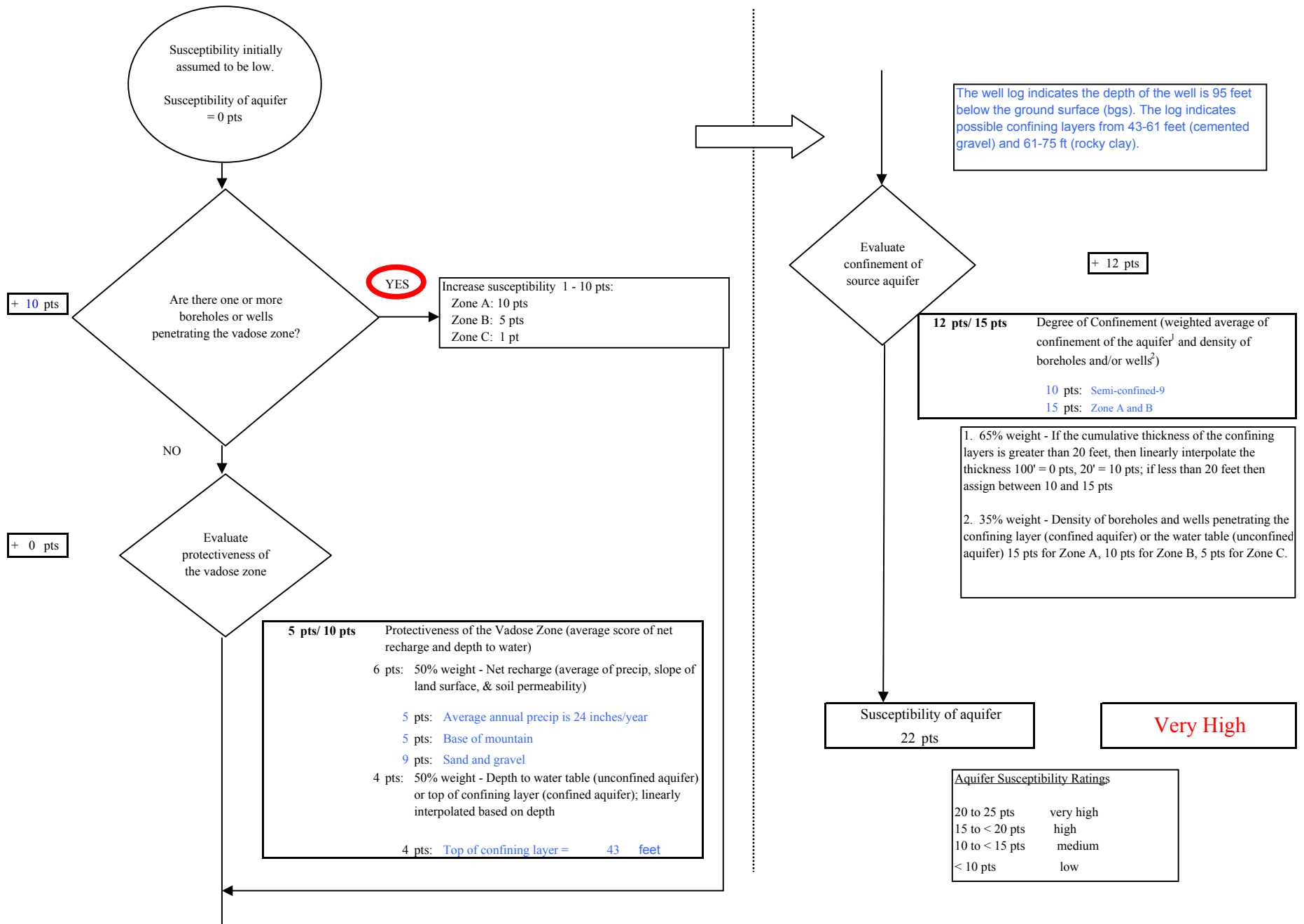
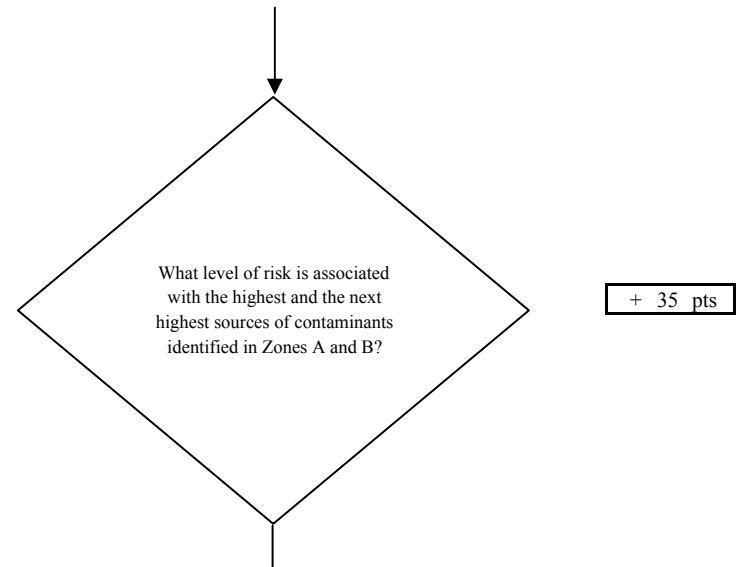
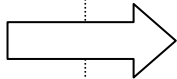
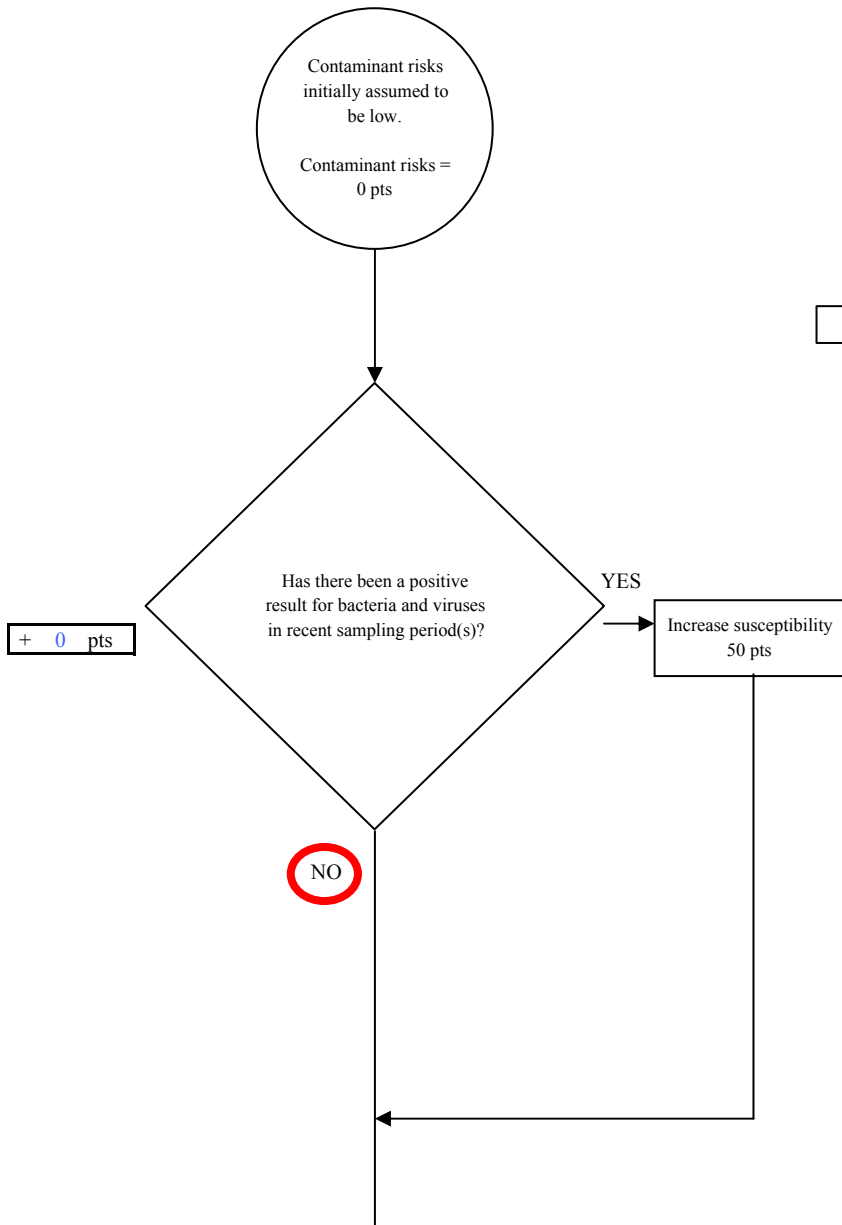


Chart 3. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Bacteria & Viruses



Risk Rankings for Contaminant Sources Identified in Zones A and B			
	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	0	1	1
Medium(s)	0	0	0
Low(s)	32	8	40

	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 35

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 Bear Creek RV Park PWSID 240773.001 - Bacteria & Viruses

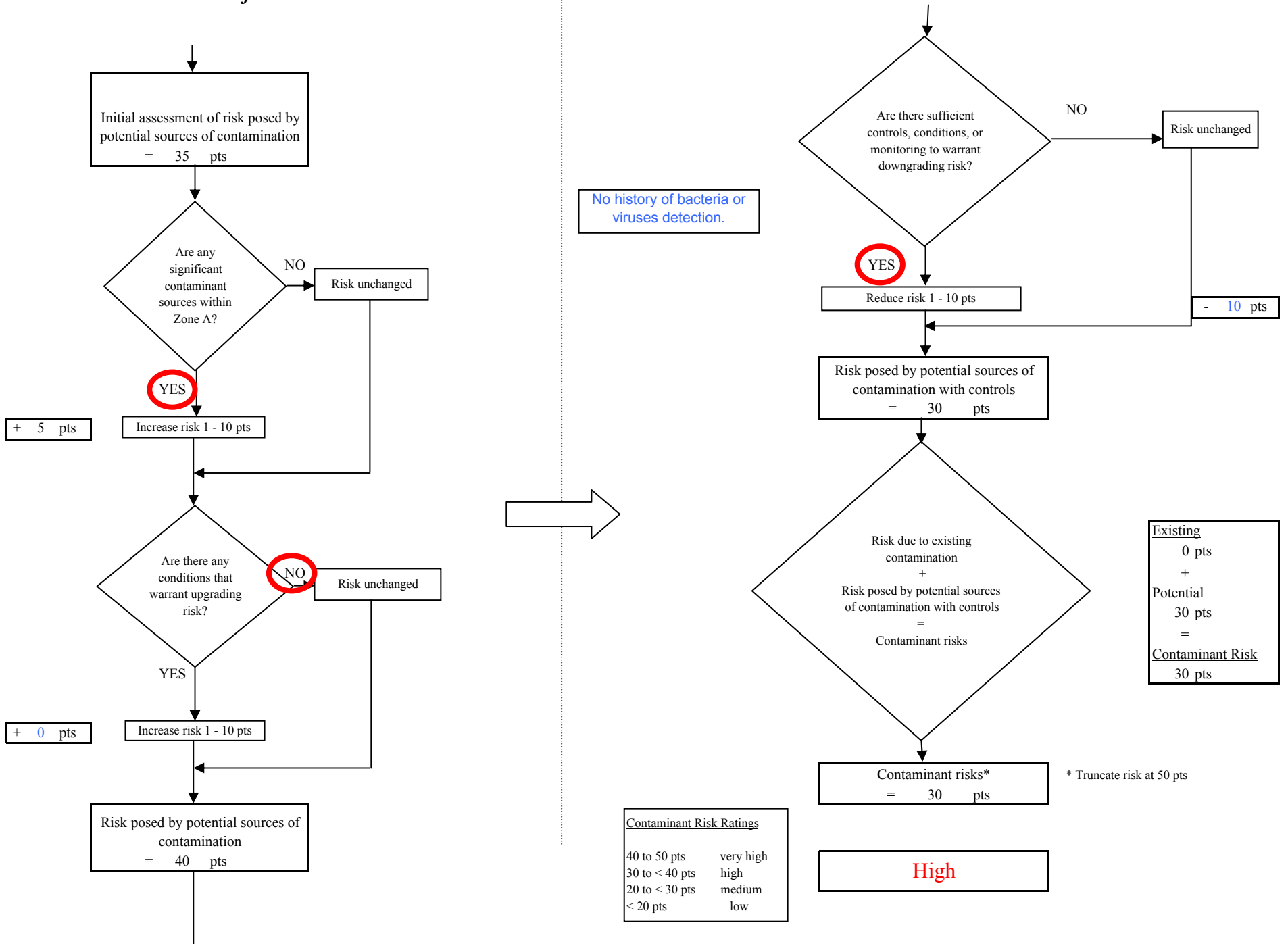


Chart 4. Vulnerability analysis for Bear Creek RV Park PWSID 240773.001 - Bacteria & Viruses

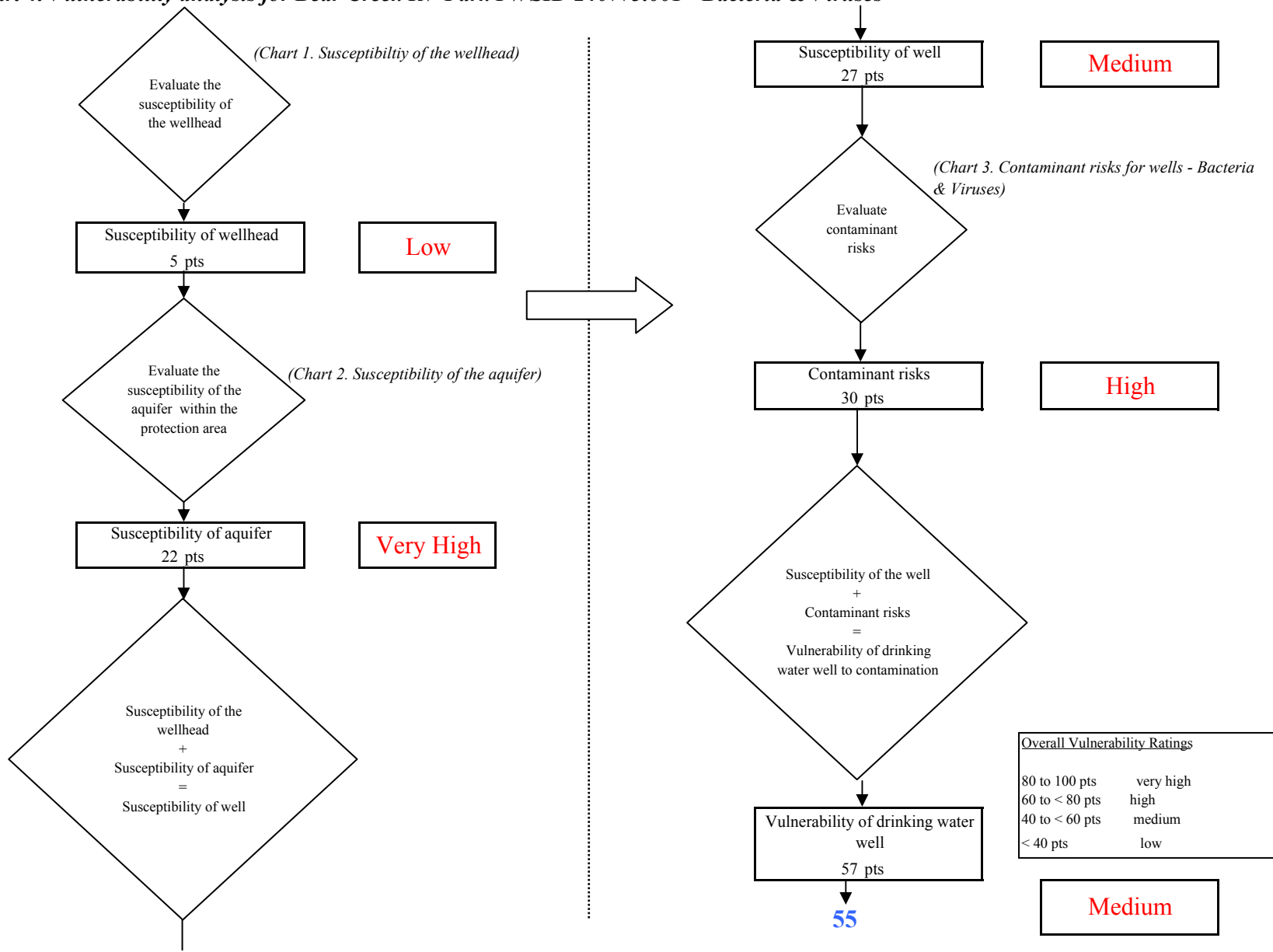


Chart 5. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Nitrates and Nitrites

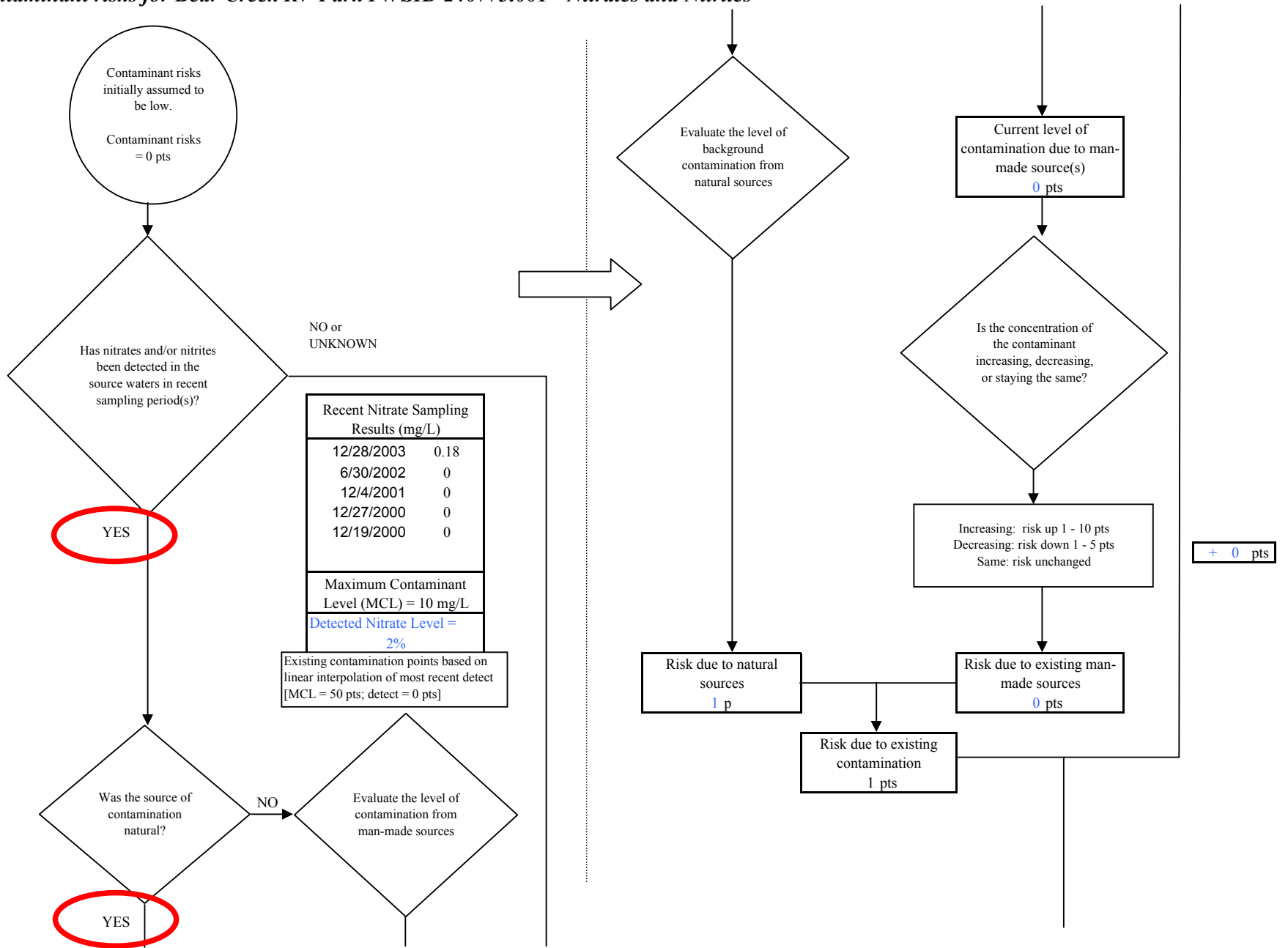


Chart 5. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Nitrates and Nitrites

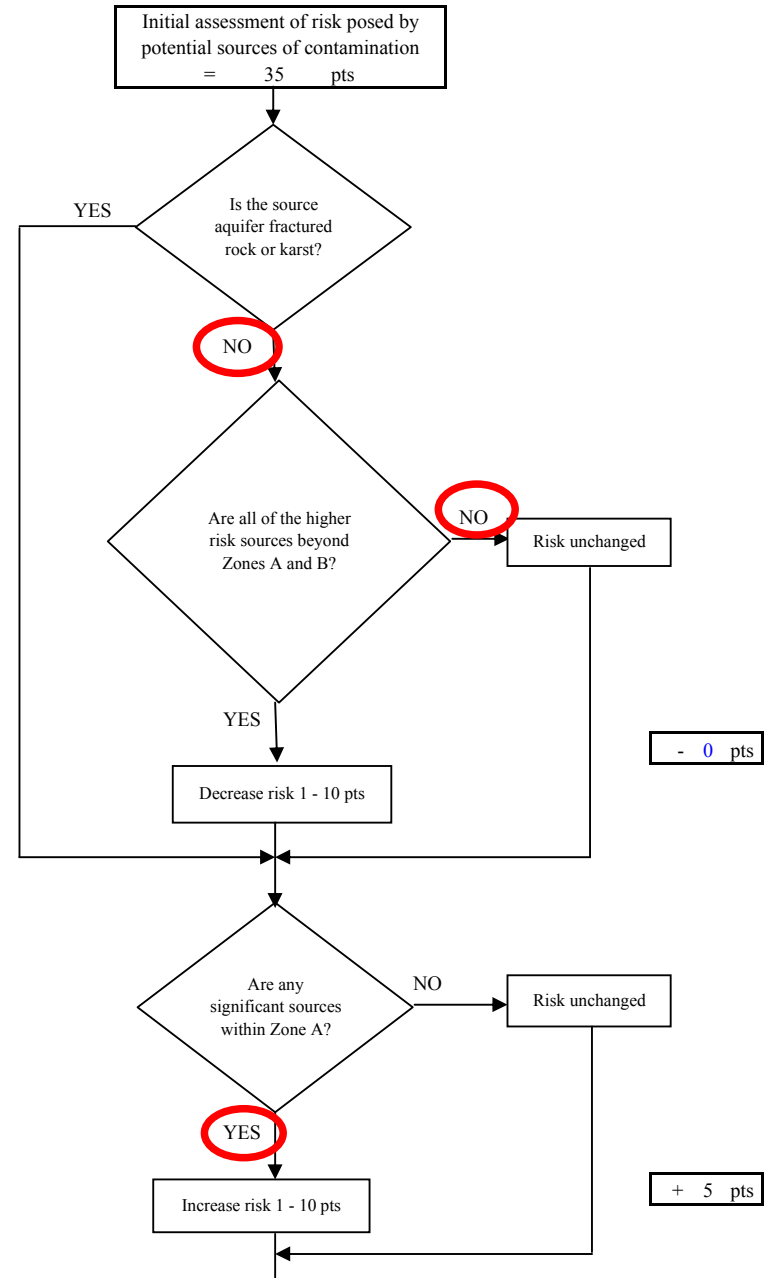
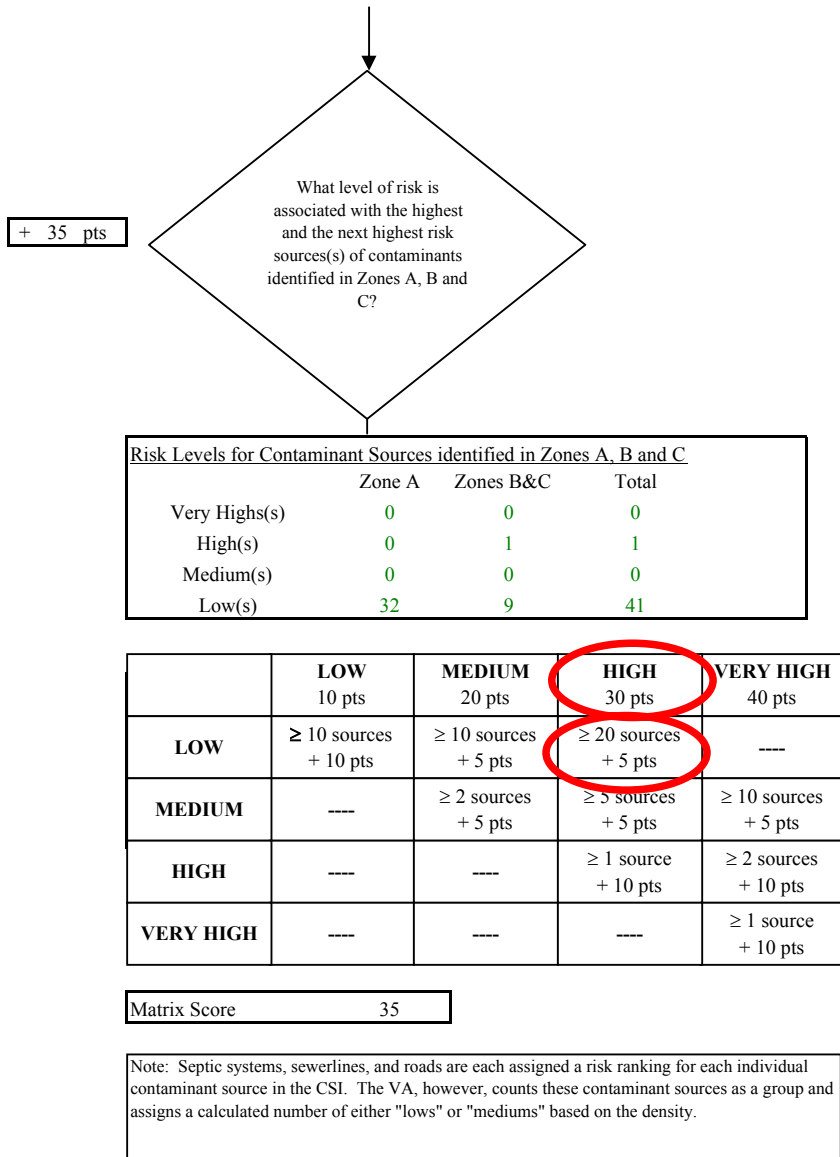


Chart 5. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Nitrates and Nitrites

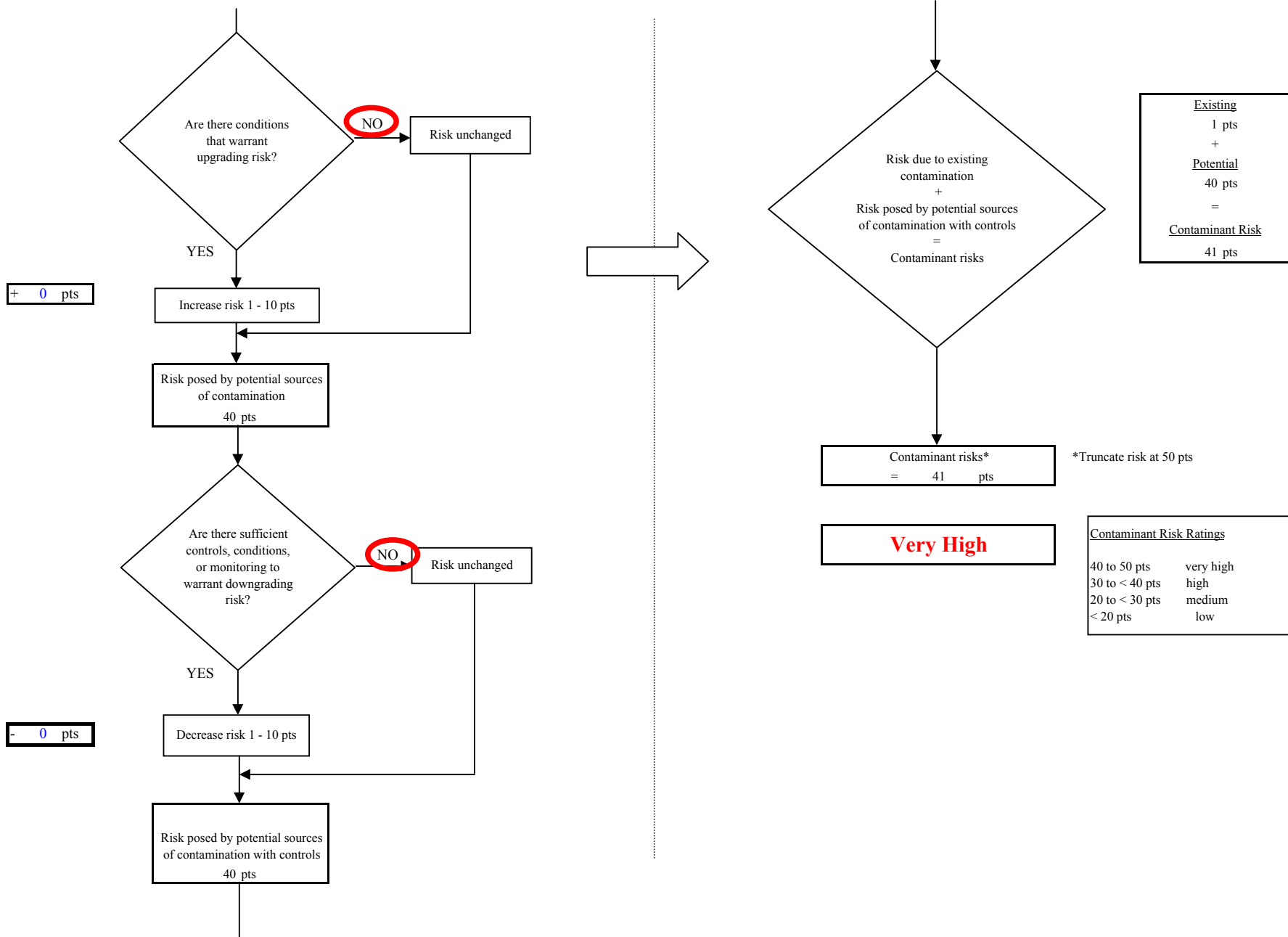


Chart 6. Vulnerability analysis for Bear Creek RV Park PWSID 240773.001 - Nitrates and Nitrites

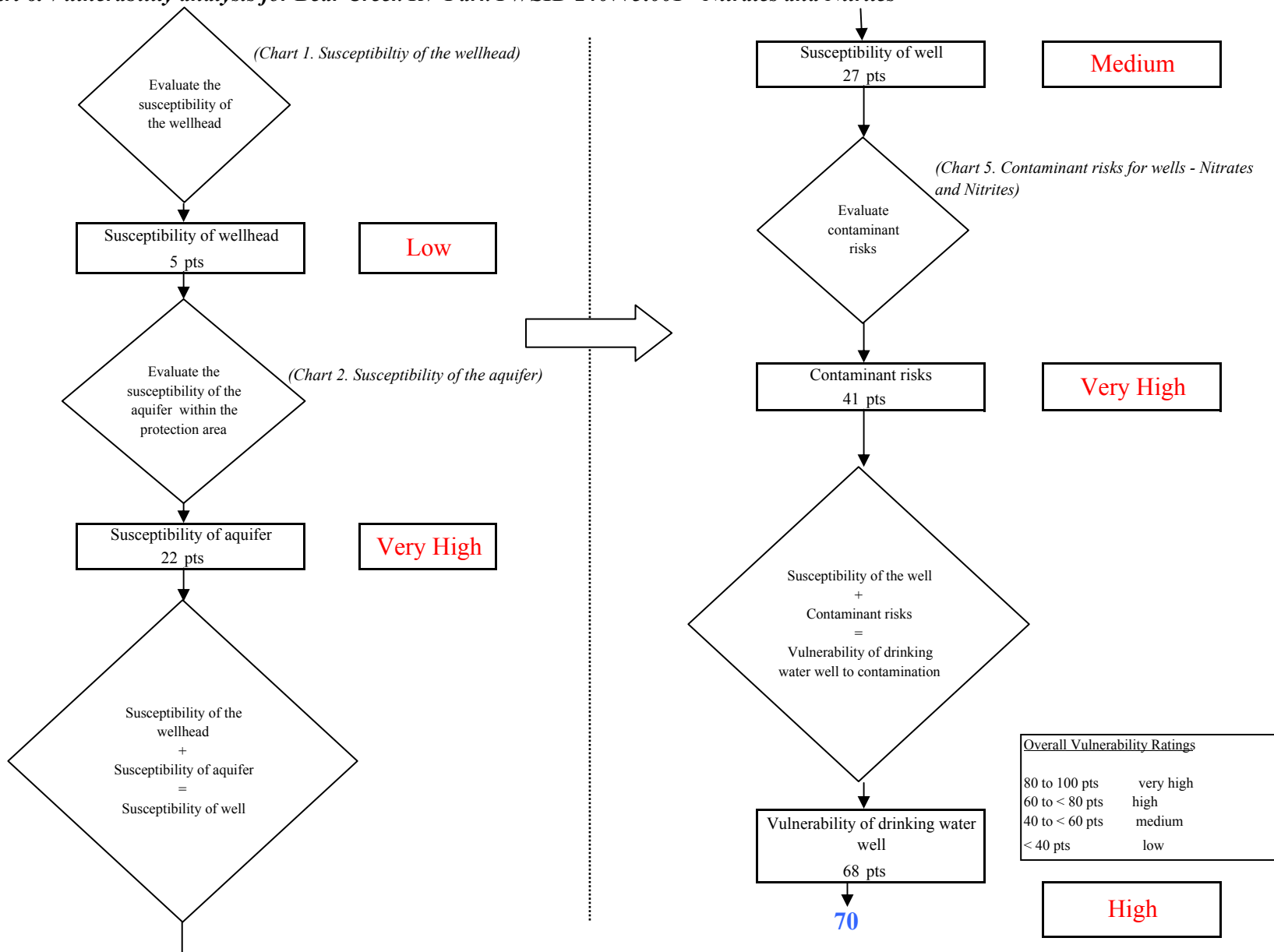


Chart 7. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Volatile Organic Chemicals

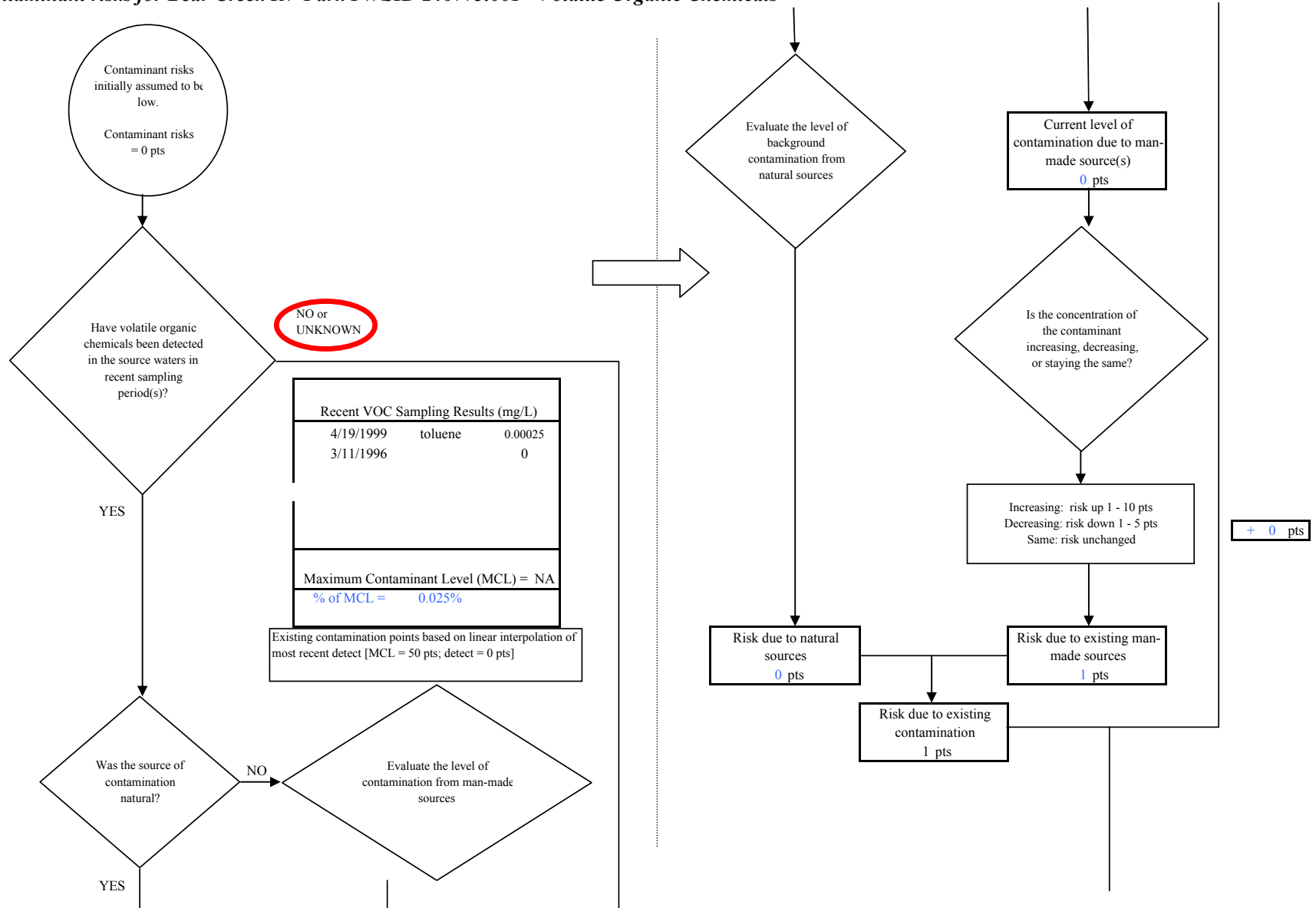


Chart 7. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Volatile Organic Chemicals

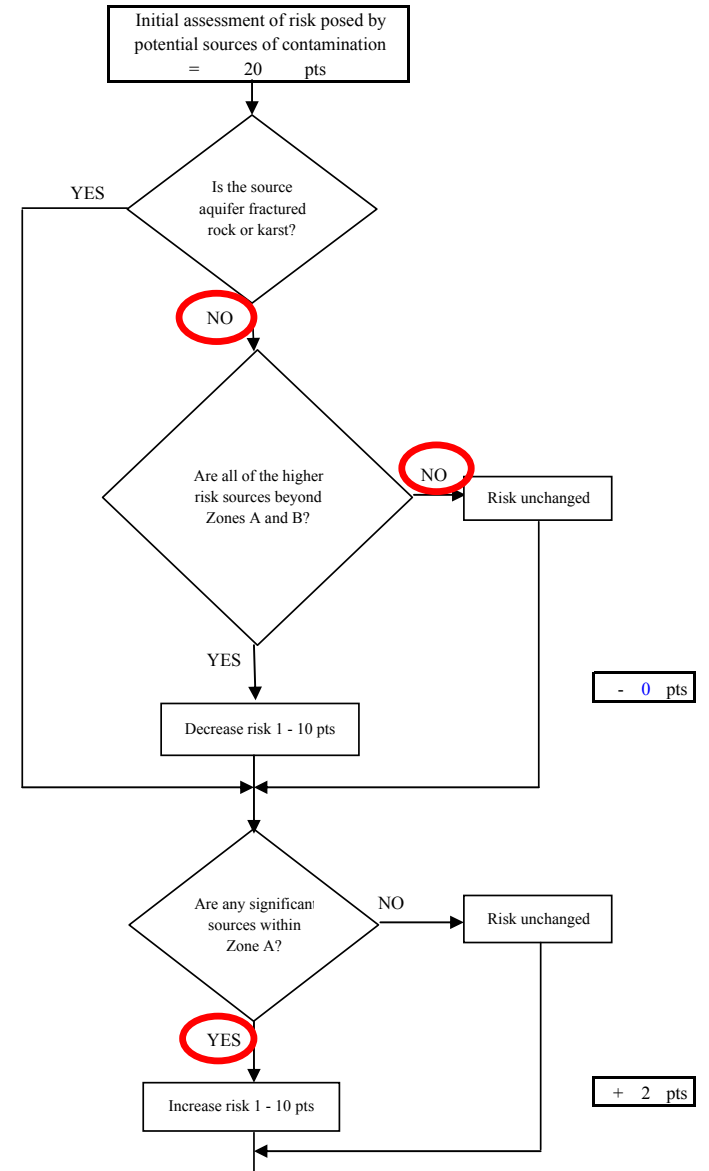
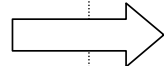
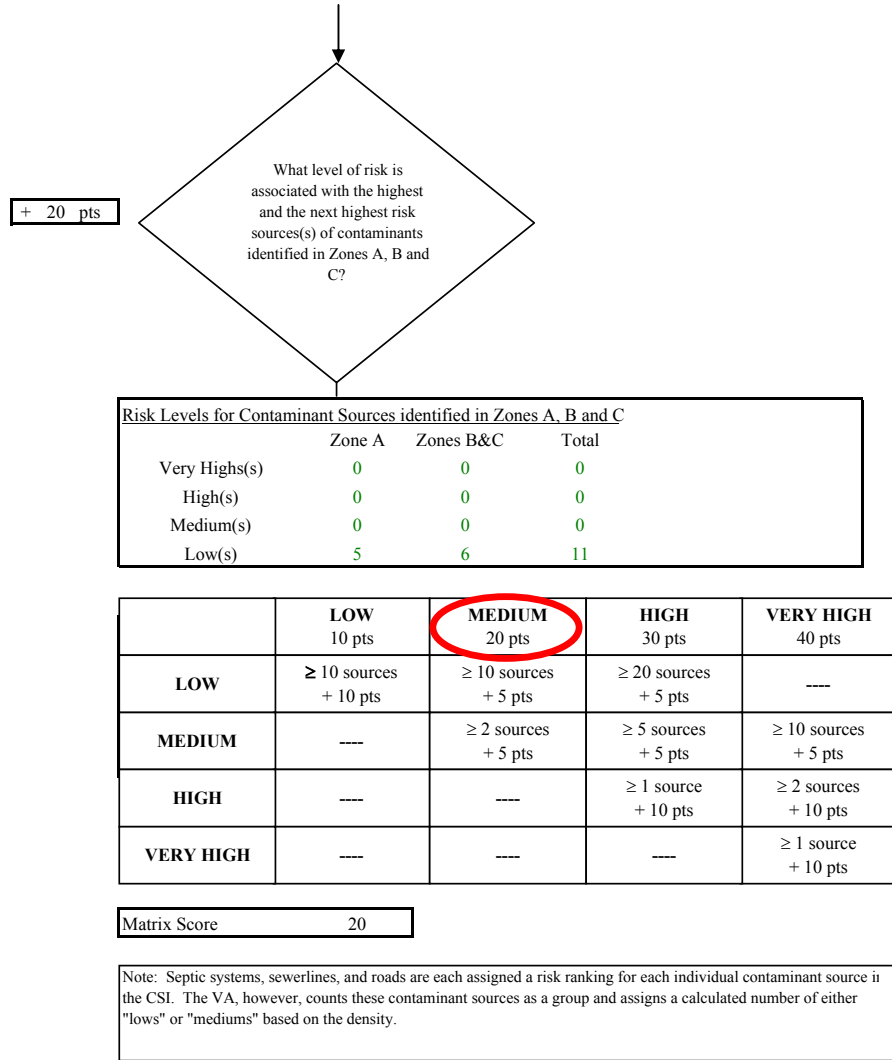


Chart 7. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Volatile Organic Chemicals

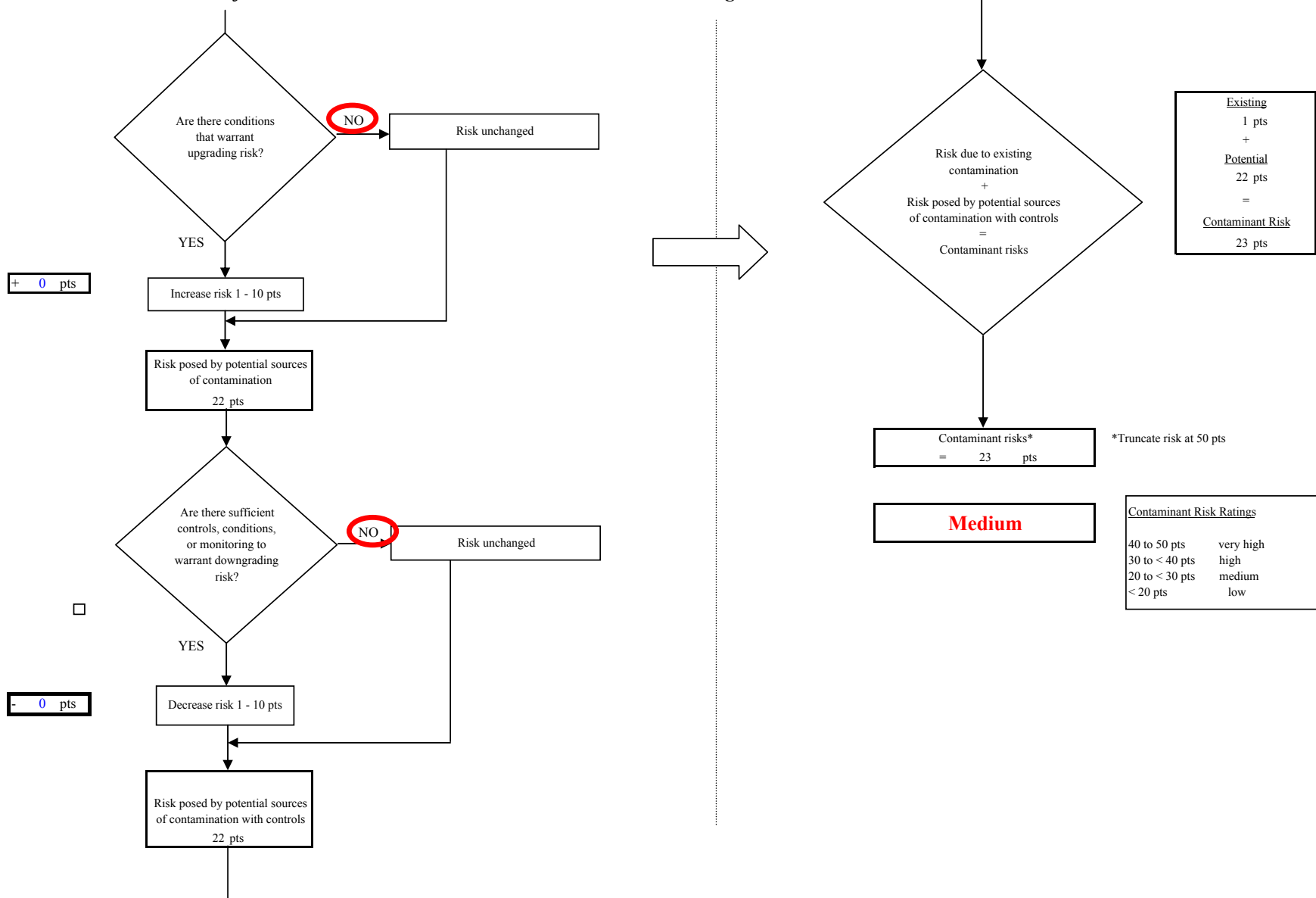


Chart 8. Vulnerability analysis for Bear Creek RV Park PWSID 240773.001 - Volatile Organic Chemicals

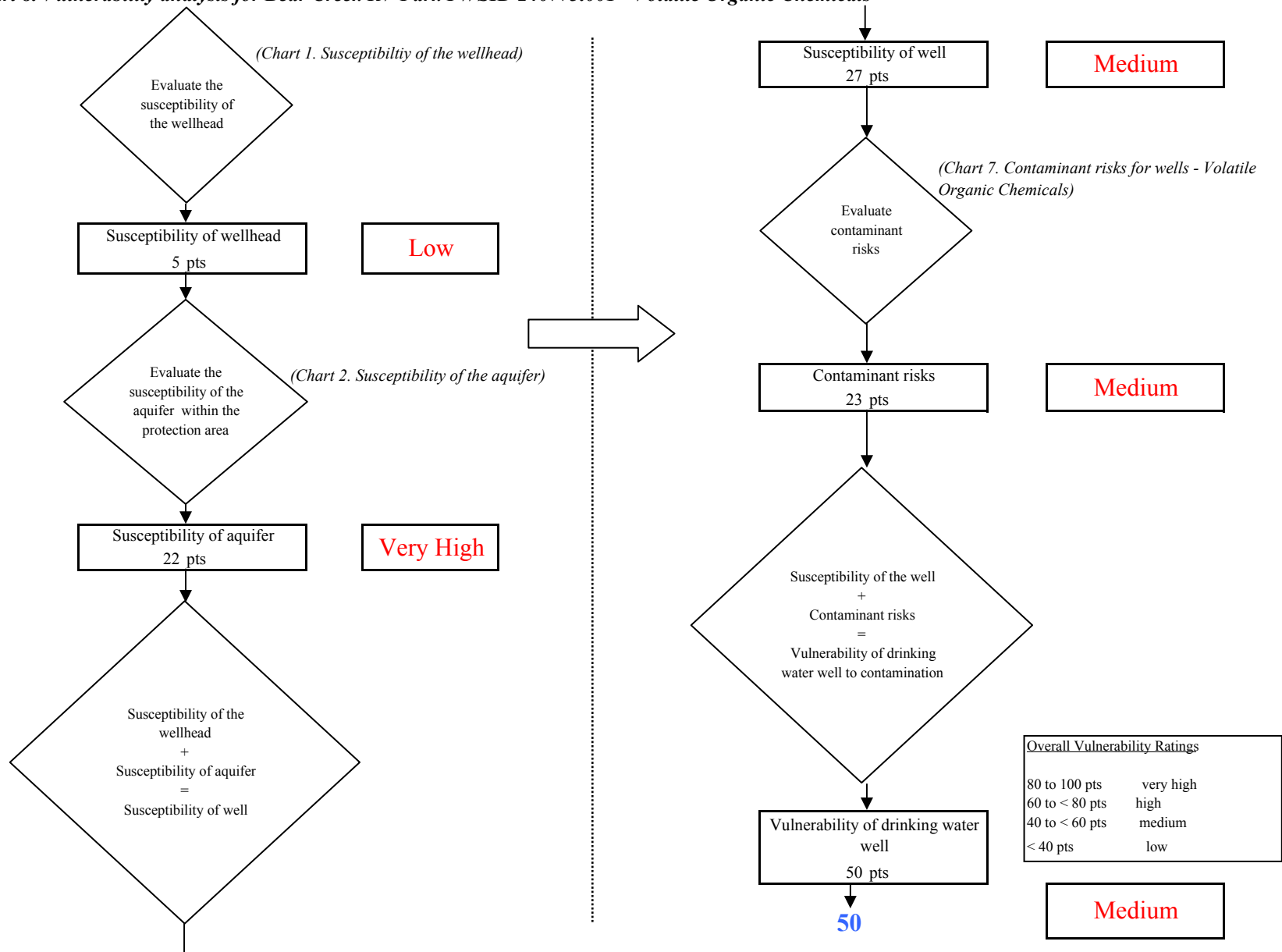


Chart 9. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Heavy Metals, Cyanide and Other Inorganic Chemicals

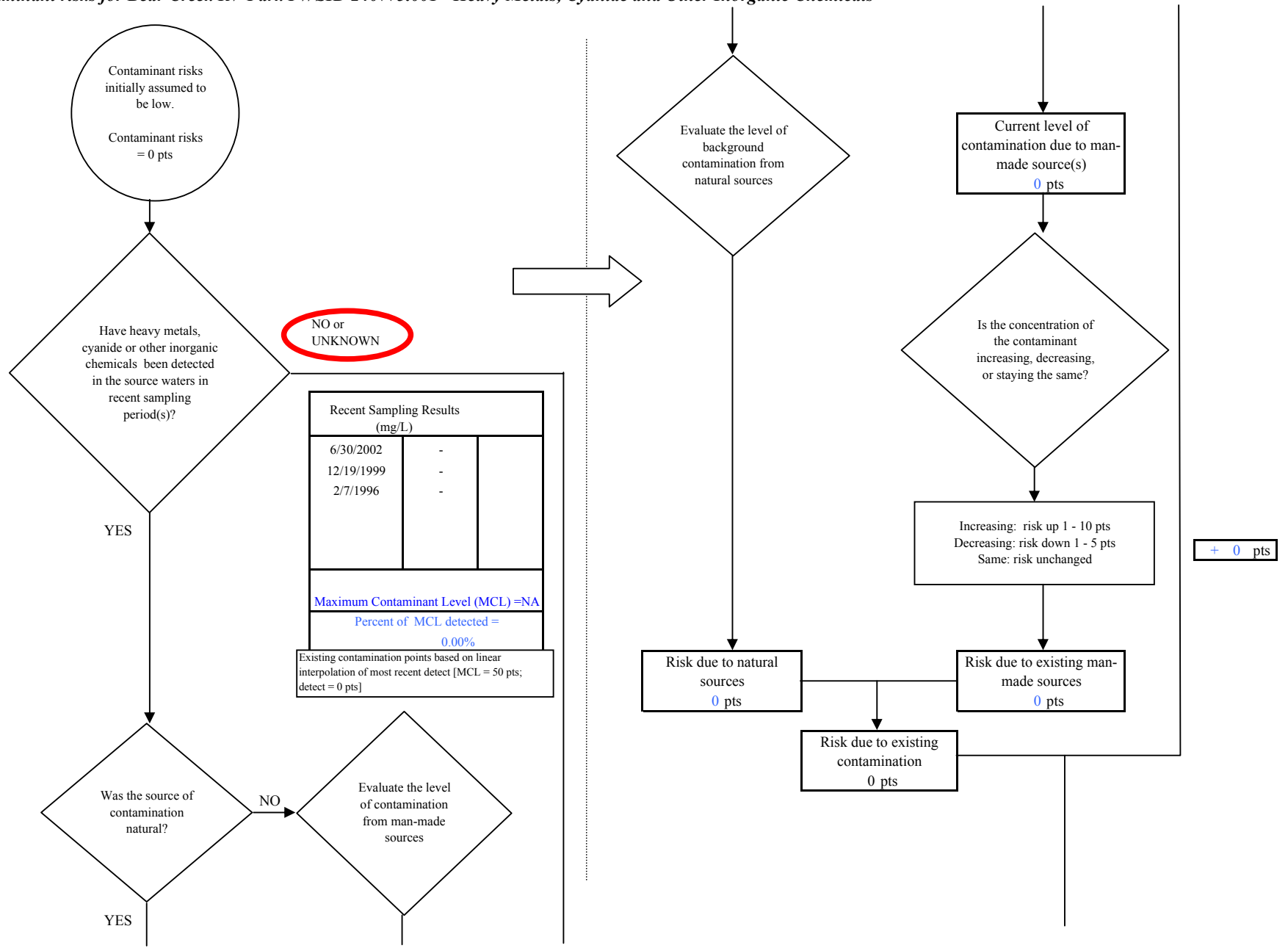


Chart 9. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Heavy Metals, Cyanide and Other Inorganic Chemicals

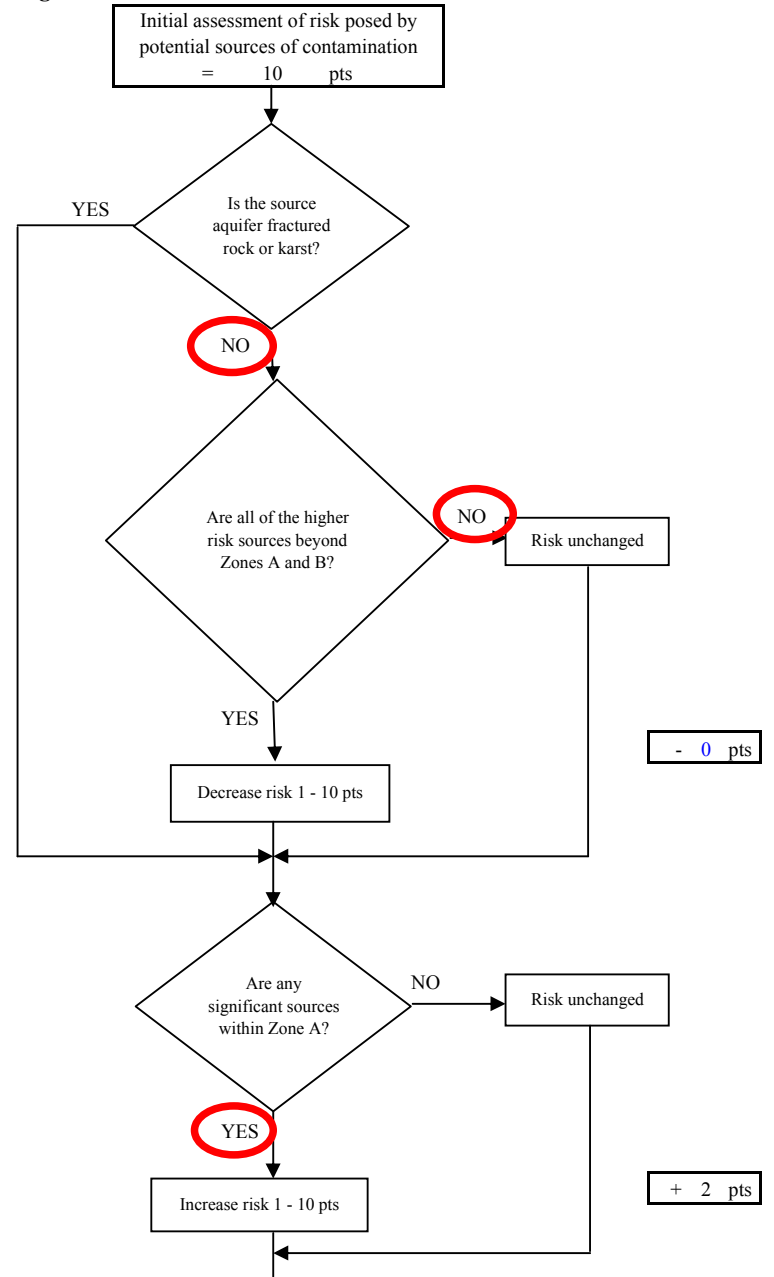
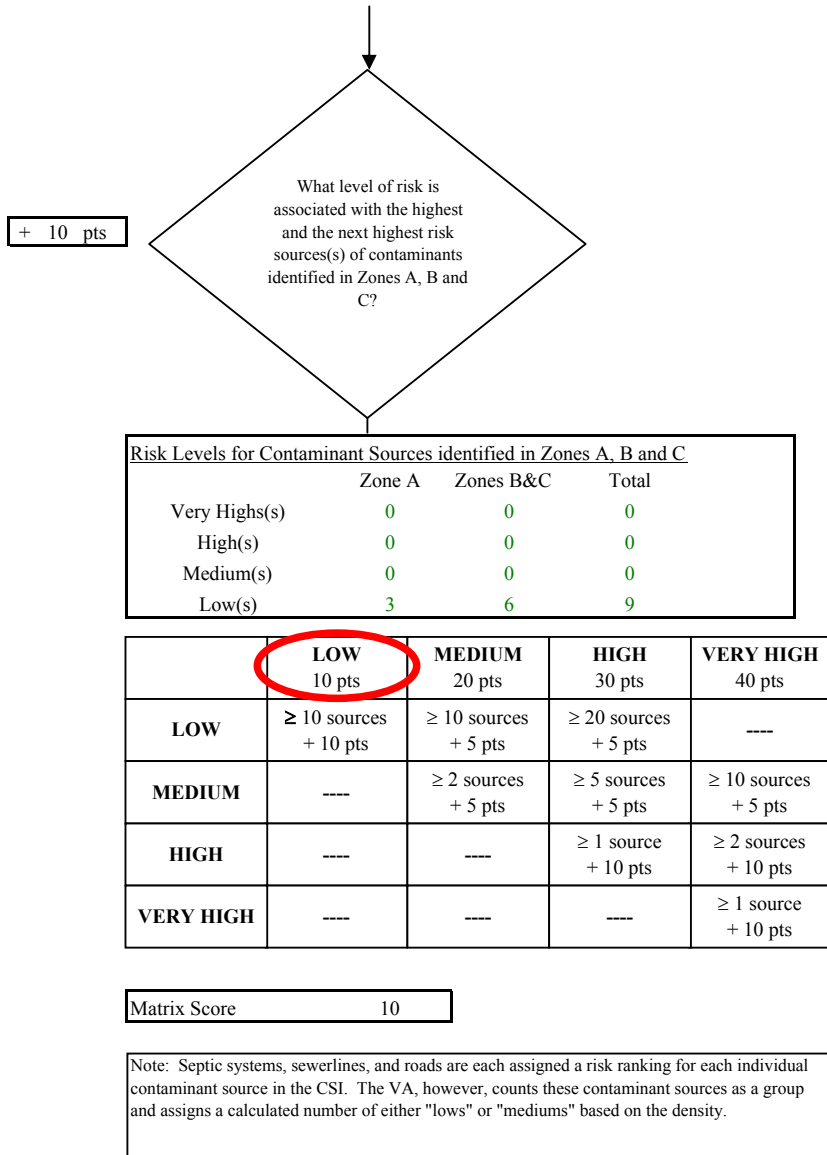


Chart 9. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Heavy Metals, Cyanide and Other Inorganic Chemicals

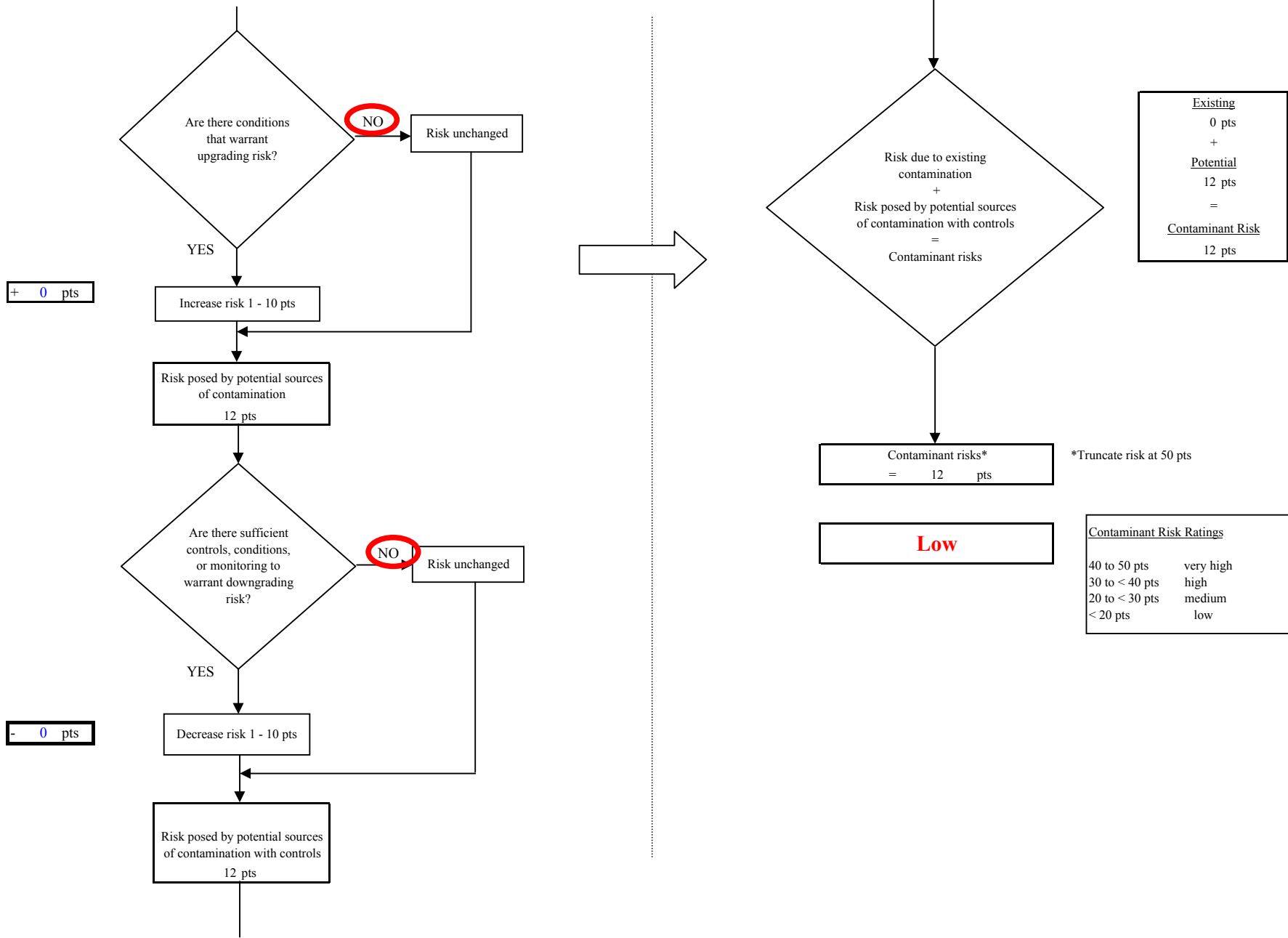


Chart 10. Vulnerability analysis for Bear Creek RV Park PWSID 240773.001 - Heavy Metals, Cyanide and Other Inorganic Chemicals

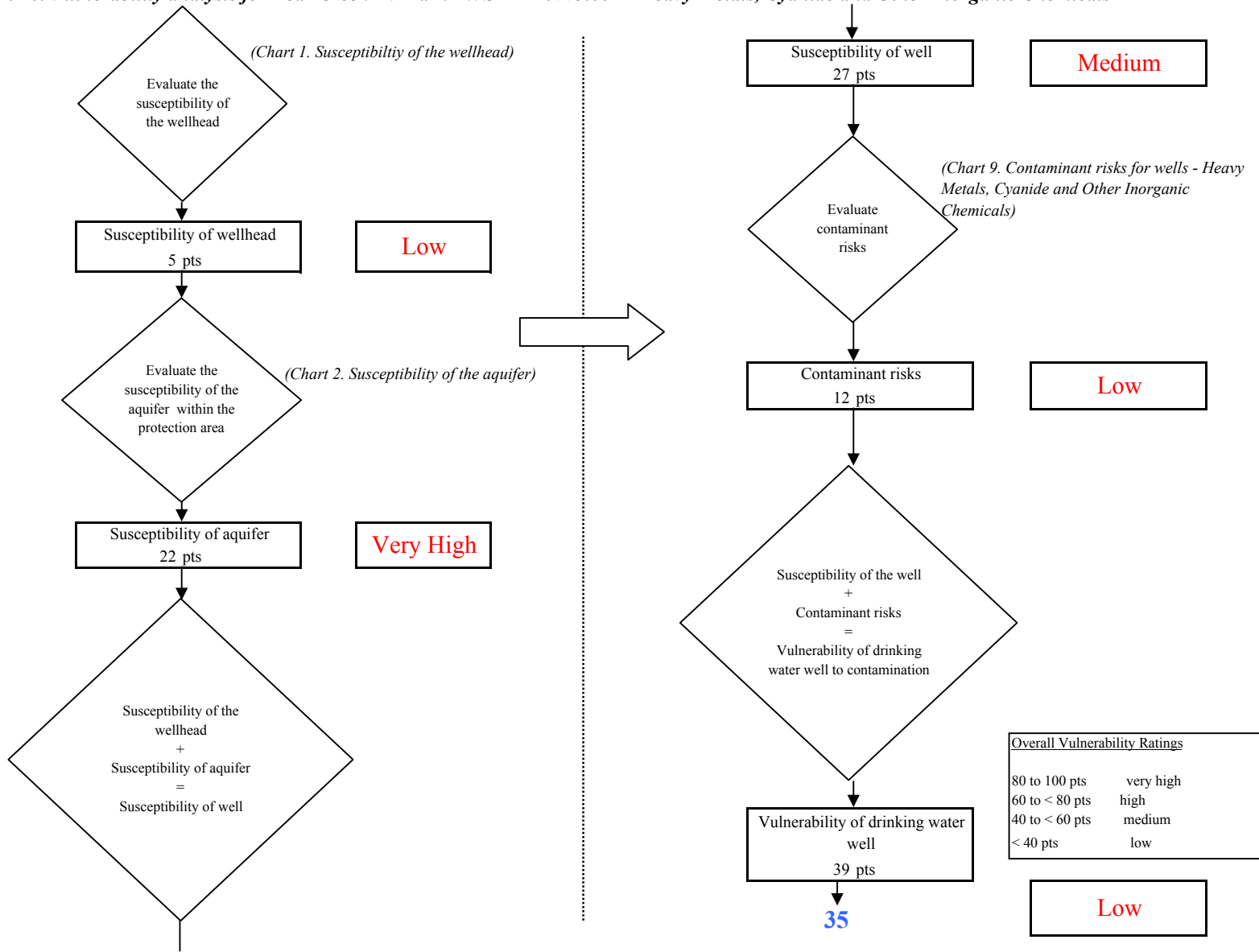


Chart 11. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Synthetic Organic Chemicals

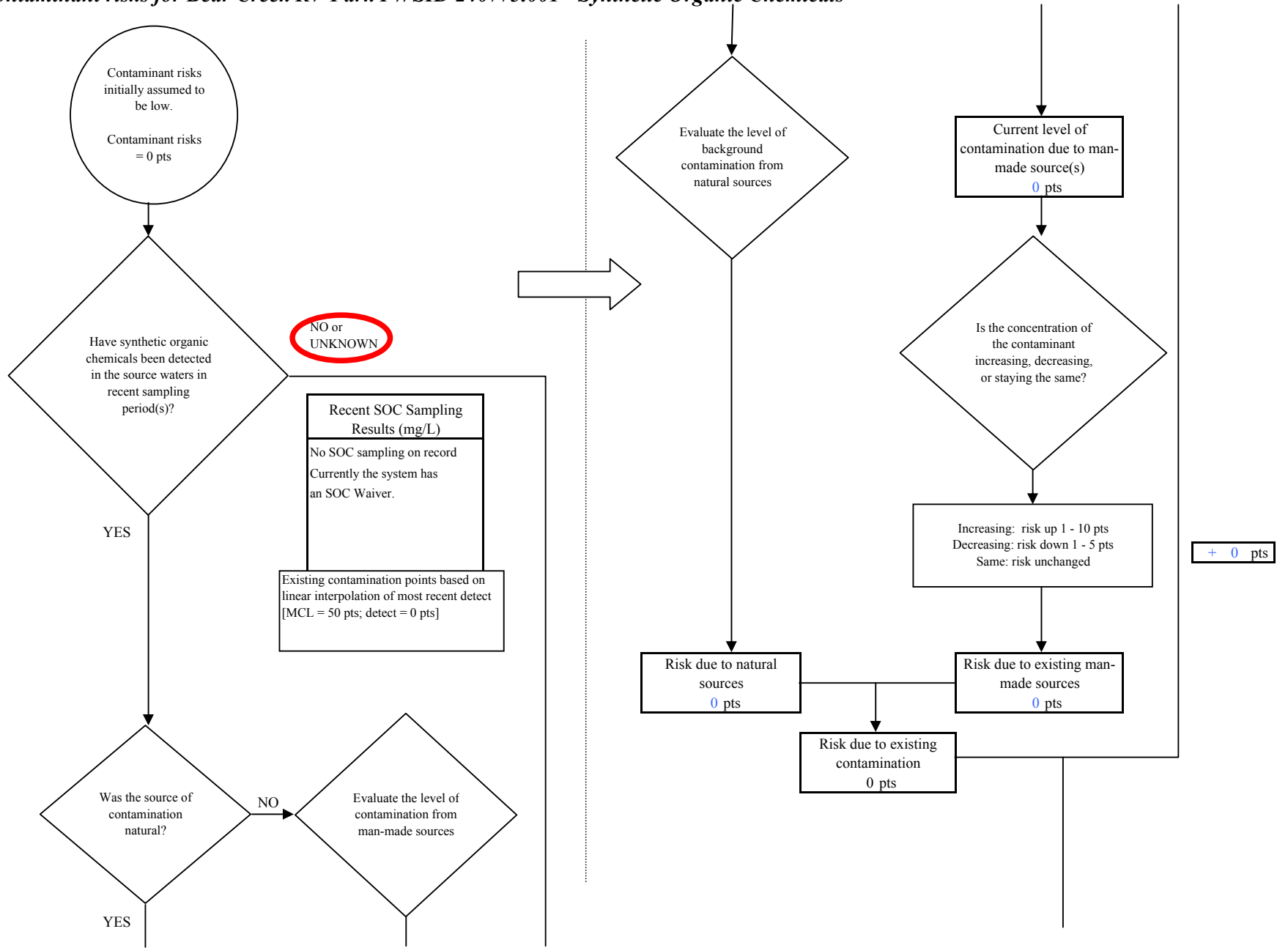


Chart 11. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Synthetic Organic Chemicals

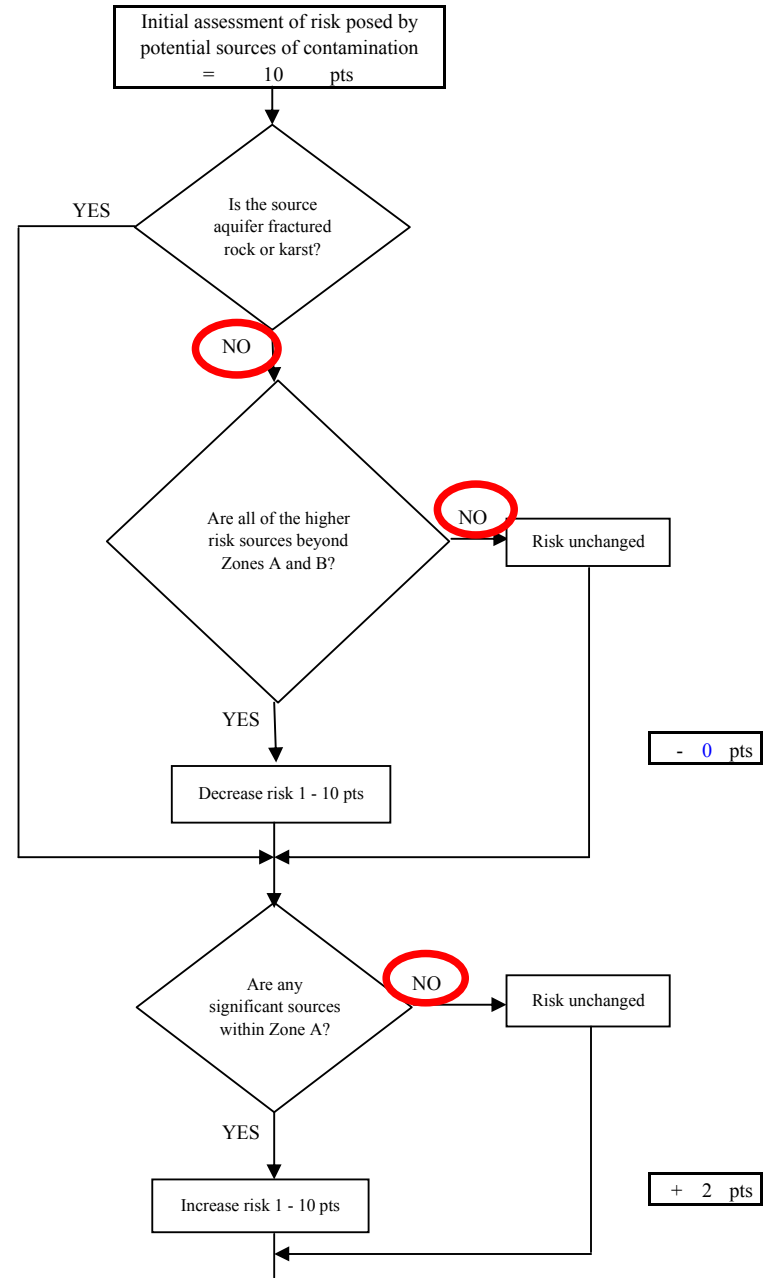
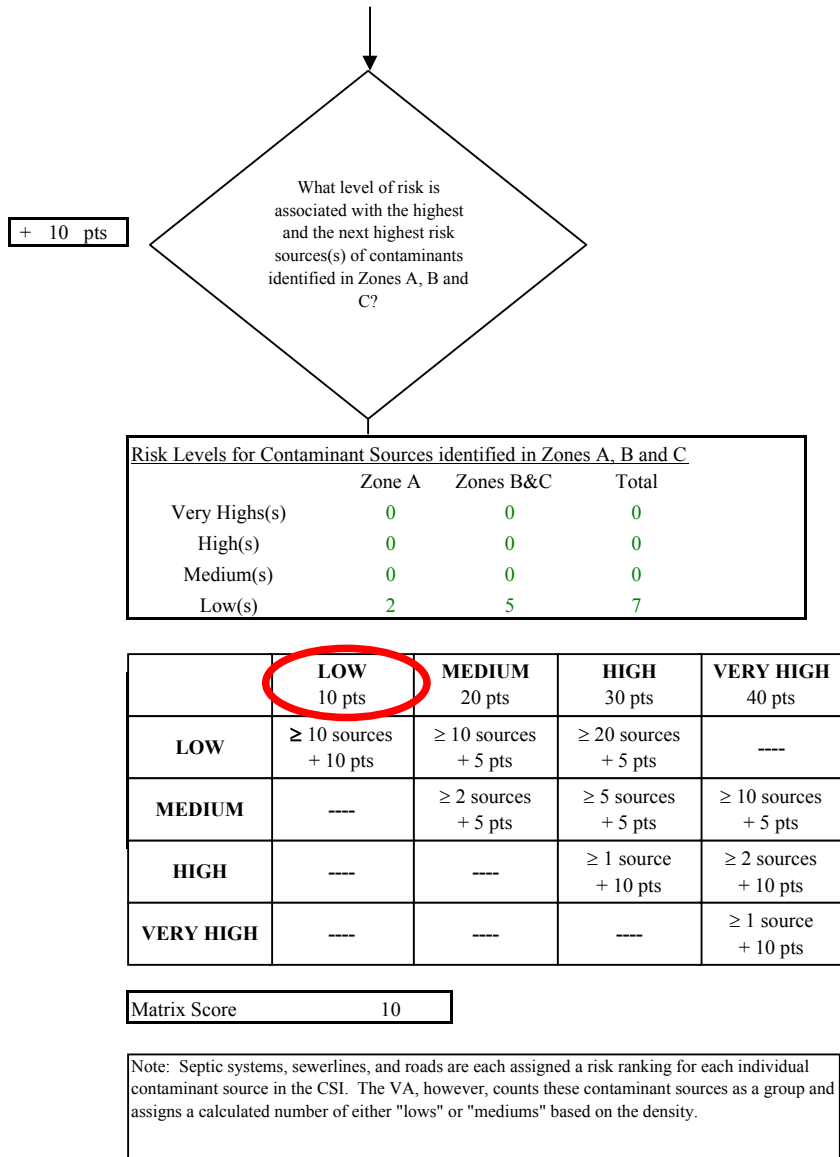


Chart 11. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Synthetic Organic Chemicals

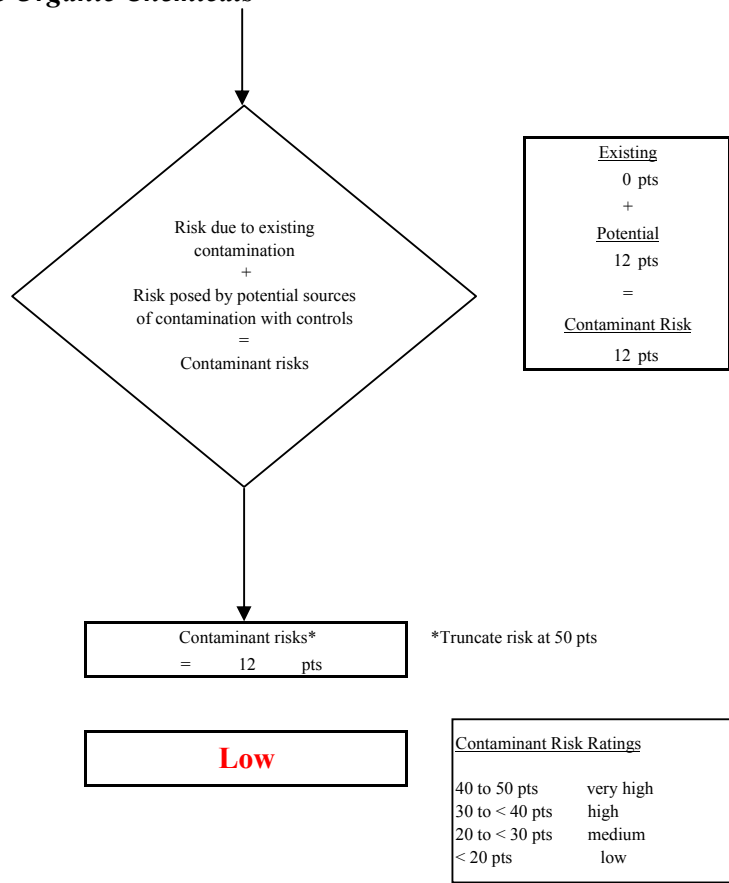
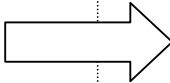
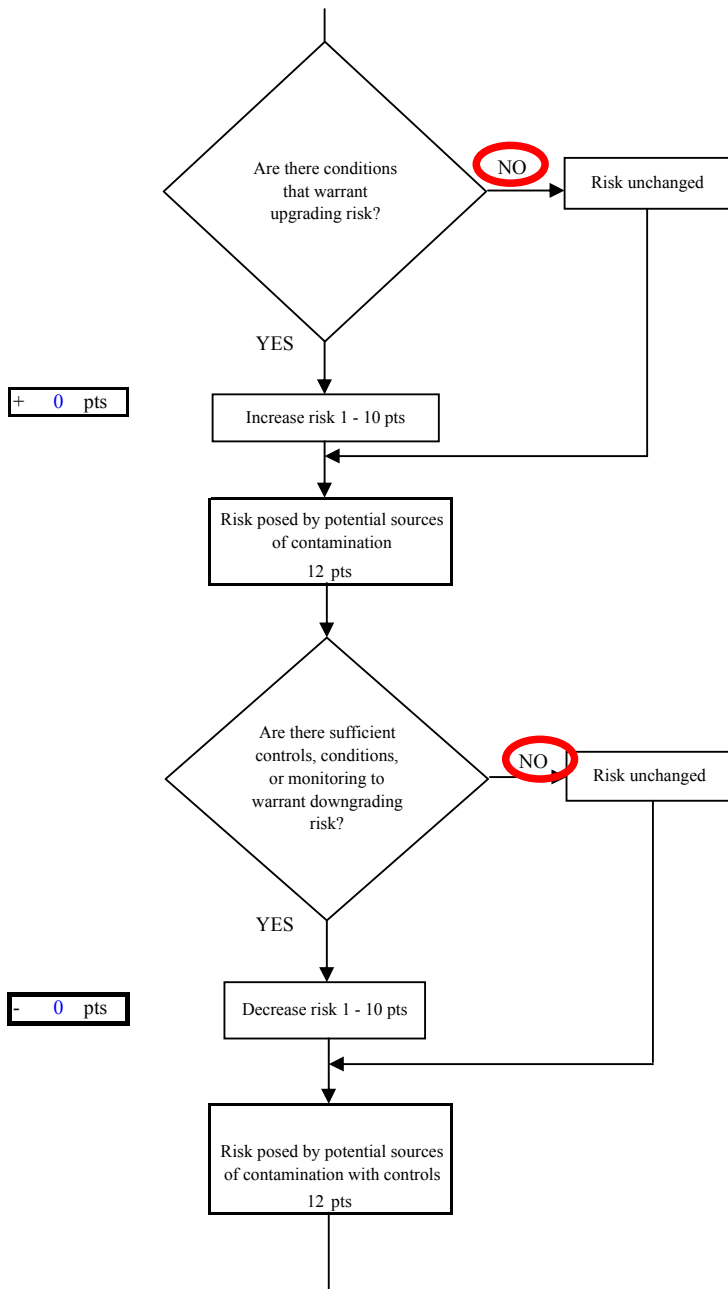


Chart 12. Vulnerability analysis for Bear Creek RV Park PWSID 240773.001 - Synthetic Organic Chemicals

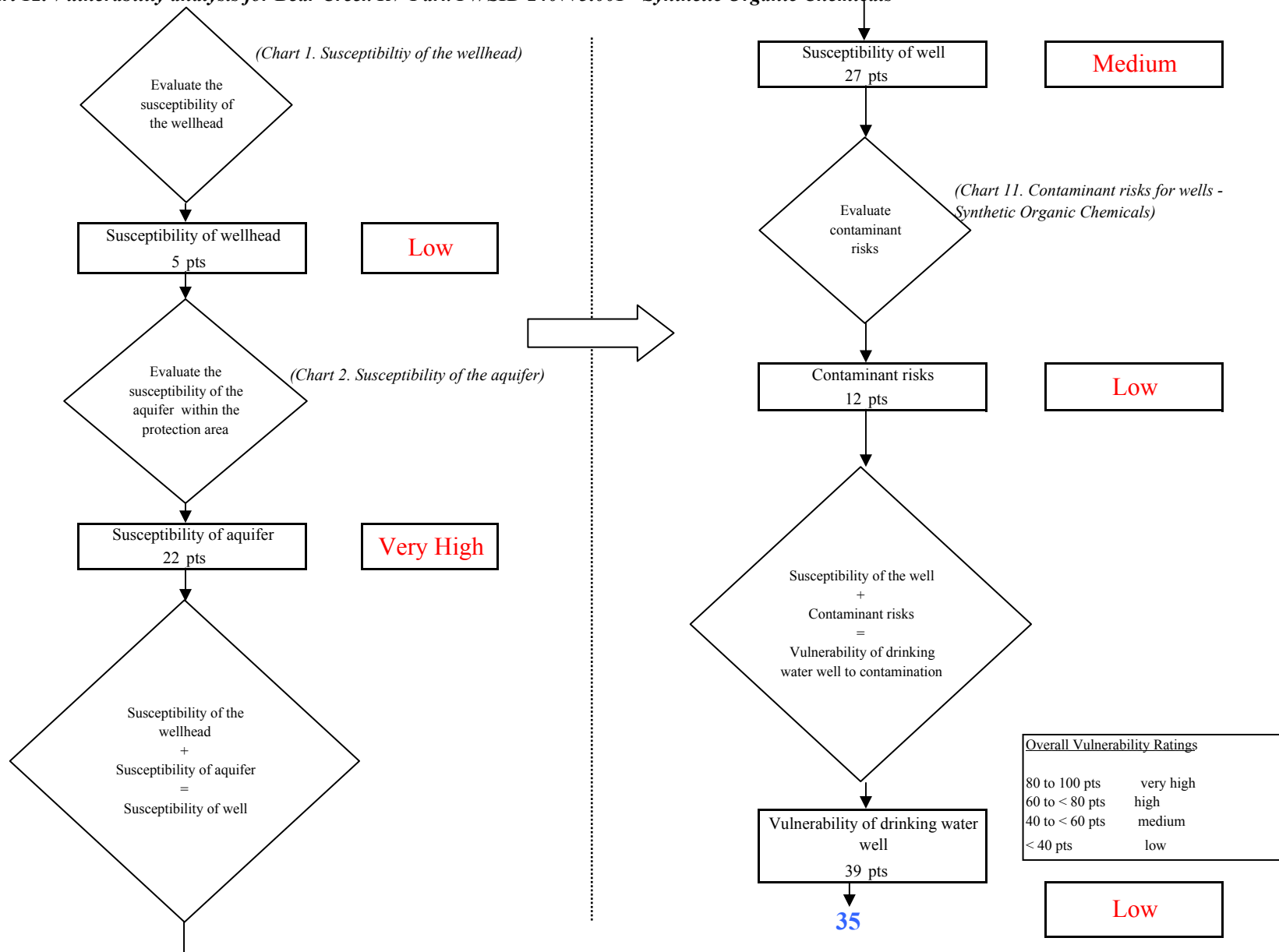


Chart 13. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Other Organic Chemicals

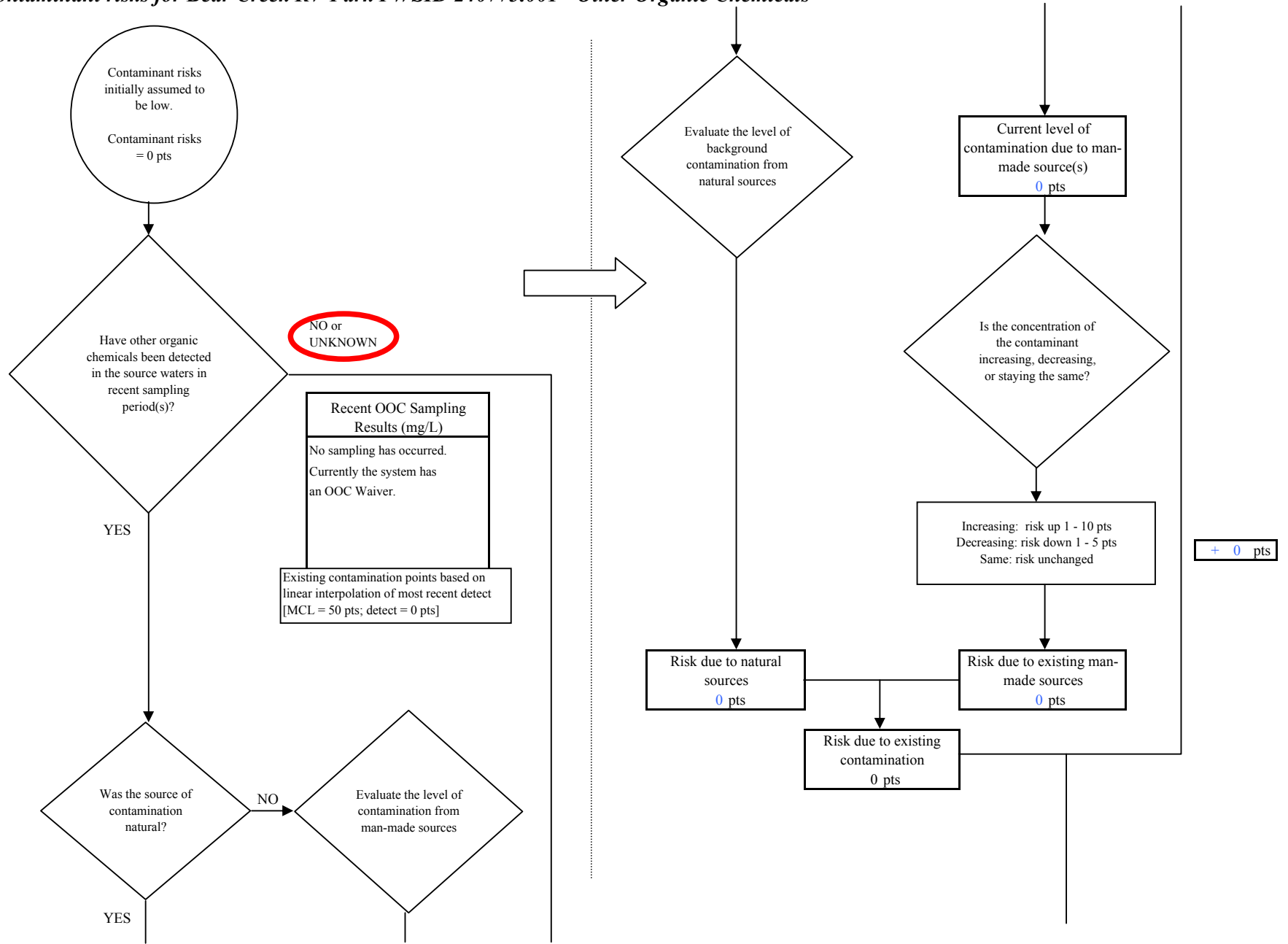


Chart 13. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Other Organic Chemicals

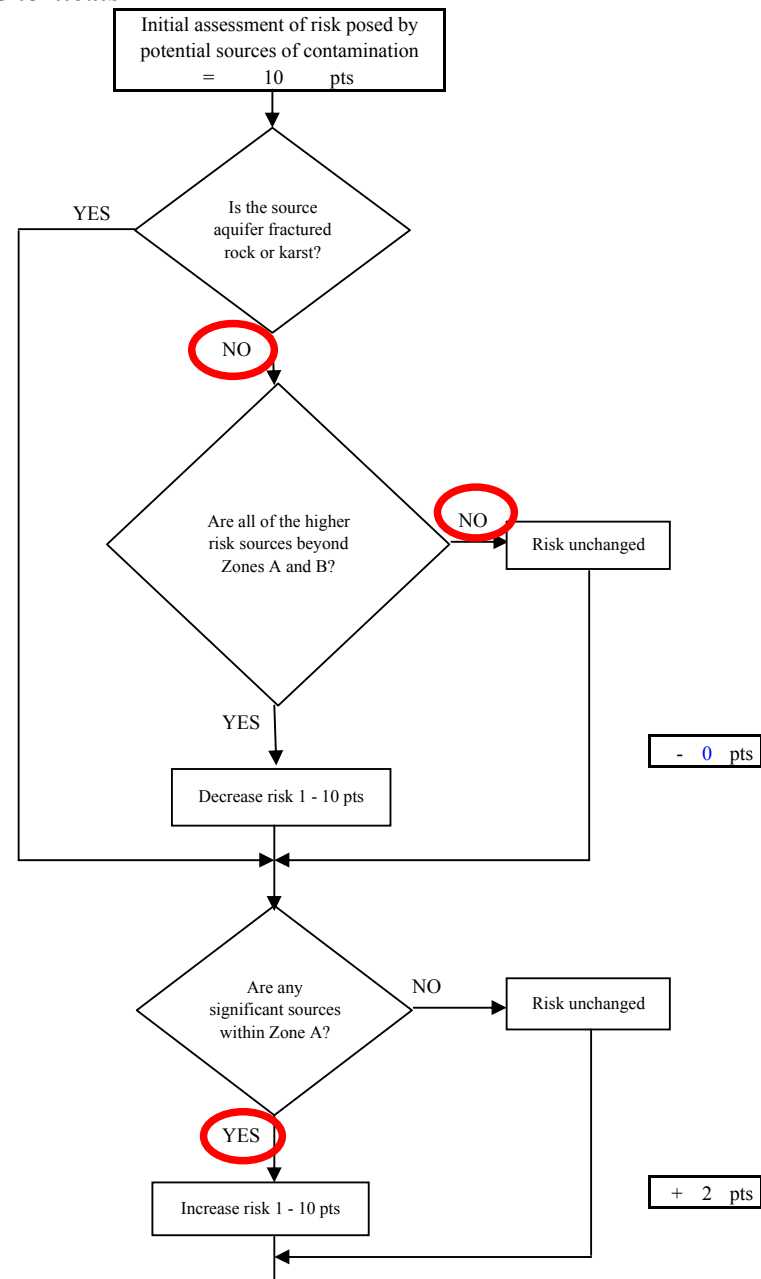
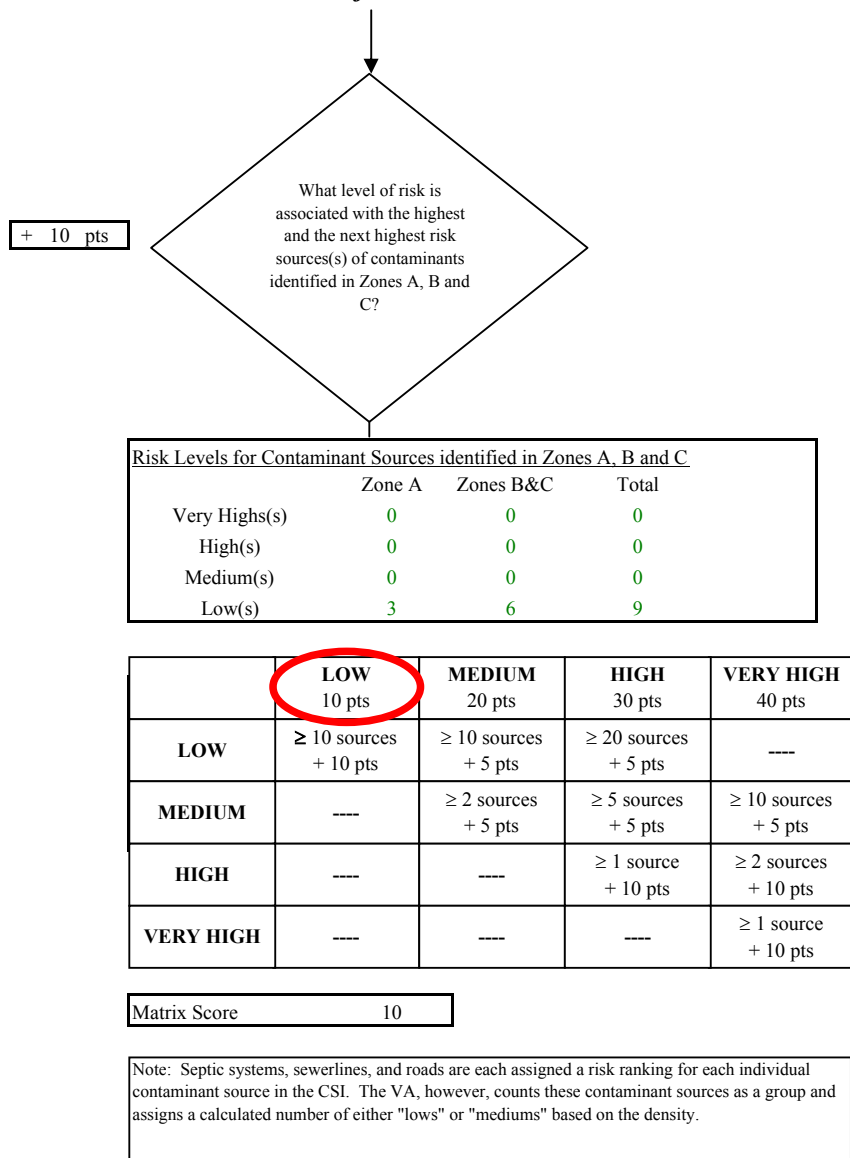


Chart 13. Contaminant risks for Bear Creek RV Park PWSID 240773.001 - Other Organic Chemicals

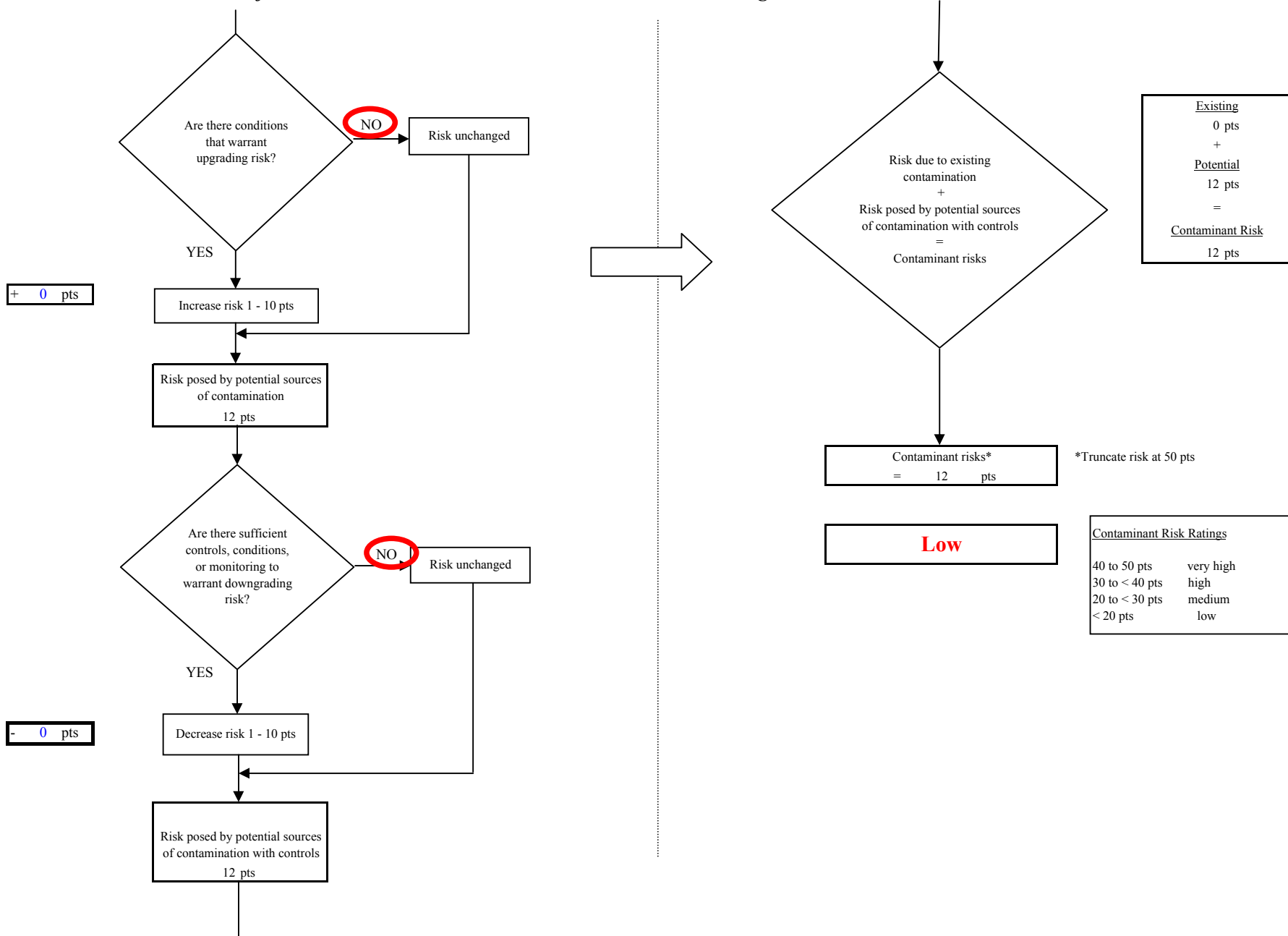


Chart 14. Vulnerability analysis for Bear Creek RV Park PWSID 240773.001 - Other Organic Chemicals

