



---

# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Eielson Air Force Base Well E,  
Eielson Air Force Base, Alaska  
PWSID 370625.001

May 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1512  
Alaska Department of Environmental Conservation

# Source Water Assessment for Eielson Air Force Base Well E Eielson Air Force Base, Alaska PWSID 370625.001

May 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1512

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
Eielson Air Force Base Well E Public Drinking Water System	1	Ranking of Contaminant Risks	2
Eielson Air Force Base Well E Protection Area	1	Vulnerability of Eielson Air Force Base Well E Drinking Water System	2
		References	7

## TABLES

TABLE	1. Definition of Zones	2
	2. Susceptibility	3
	3. Contaminant Risks	4
	3. Overall Vulnerability	4

## APPENDICES

APPENDIX	A. Eielson Air Force Base Well E Drinking Water Protection Area (Map 1)
	B. Contaminant Source Inventory for Eielson Air Force Base Well E (Table 1)
	Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E – Bacteria and Viruses (Table 2)
	Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E – Nitrates/Nitrites (Table 3)
	Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E – Volatile Organic Chemicals (Table 4)
	Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E – Heavy Metals, Cyanide, and Other Inorganic Chemicals (Table 5)
	Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E – Synthetic Organic Chemicals (Table 6)
	Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E – Other Organic Chemicals (Table 7)
	C. Eielson Air Force Base Well E Drinking Potential Contaminant Sources (Map 2)
	D. Vulnerability Analysis for Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E Public Drinking Water Source (Charts 1 – 14)

# Source Water Assessment for Eielson Air Force Base Well E

## Eielson Air Force Base, Alaska

---

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

#### EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability to potential contamination of one of the five wells making up the Class A (community) public water system serving Eielson Air Force Base. This report is an assessment of Well E located near Building 3226 on Eielson Air Force Base, Alaska.

Well E received a natural susceptibility rating of **Very High**. This rating is a combination of a susceptibility rating of **Very High** for the actual wellhead and a **Very High** rating for the aquifer in which Well E is drawing its water from. Identified potential and current sources of contamination for the Eielson Air Force Base Well E public water system include: sewerlines, roads, an asphalt stockpile, an airport, a fire training facility, and DEC-recognized contaminated sites. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals. Combining the natural susceptibility of the well with the contaminant risk, Eielson Air Force Base Well E received an overall vulnerability rating of **High** for nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, and other organic chemicals, and **Medium** for bacteria and viruses, and synthetic organic chemicals.

#### EIELSON AIR FORCE BASE WELL E PUBLIC DRINKING WATER SYSTEM

Eielson Air Force Base public water system is a Class A (community) water system consisting of five wells. This is an assessment of one of the five wells, Well E. Well E is used as a primary source of water for this public water system. Well E is located within Building 3226 south of Central Avenue near its intersection with Chinook Street at Eielson Air Force Base, Alaska (T3S, R3E, Section 11) (See Map 1 of Appendix A). Eielson Air Force Base is located 26 miles south of Fairbanks off the Richardson Highway. Fairbanks is located in the Fairbanks North Star Borough near the center of Alaska (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is 82,840 making it the second-largest population center in the state (ADCED, 2002). Communities located within the Borough include: College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose

Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers.

The Fairbanks area includes two distinct topographic areas: the alluvial plain between the Tanana River and the Chena River, and the uplands north of this alluvial plain. Eielson Air Force Base Well E is located in the alluvial plain at an elevation of approximately 550 feet above sea level.

According to the well log, the depth of Well E is 146 feet below the ground surface and is screened in sands and gravels. The alluvial plain consists of alternating layers of silt, sand and gravel up to over 500 feet thick, in some locations overlain by 1 to 10 feet of silt or sandy silt or a few feet of peat (Glass and others, 1996). Discontinuous permafrost (perennially frozen areas) is also common in the alluvial plain. The depth to permafrost in these areas ranges between 2 and 45 feet below the ground surface with the thickness of the permafrost ranging between 5 and 265 feet (Pewe, 1958). Areas with discontinuous permafrost may locally affect the ground water flow directions.

Primarily the Tanana River, but also the Chena River contribute water to this alluvial aquifer. The Chena River typically only contributes water when its stage is high and the Tanana is low (Nelson, 1978). The Tanana River gets approximately 85% of its water from snowmelt of the Alaska Range and 15% from the Yukon-Tanana uplands (Anderson, 1970).

The Eielson Air Force Base public drinking water system serves approximately 4,444 residents and 4720 non-residents through 2100 service connections.

#### EIELSON AIR FORCE BASE WELL E DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. 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 E is the area that contributes water to the well, the groundwater capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different ways of calculating the size of capture zones. This assessment uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture zone calculated in this assessment is only a best guess using the information and resources available to us, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the whole alluvial plain and were obtained from various United State Geological Survey (USGS) reports, well logs in the area, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

The water table in the area of Eielson Air Force Base Well E is primarily influenced by the Tanana River. Groundwater flow in this area is generally north-northwest at an azimuth of 340° (Sullivan and Koenen, 1997). The capture zone was drawn based on this general flow direction without considering the influence of any pumping wells that might influence the flow directions.

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into four zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the four zones for Well E and the calculated time-of-travel for each:

**Table 1. Definition of Zones**

<b>Zone</b>	<b>Definition</b>
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 time of travel for *contaminants* within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the Eielson Air Force Base Well E on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

## **INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES**

The Drinking Water Protection Program (DWPP) has completed an inventory of potential and existing sources of contamination within the Eielson Air Force Base Well E protection area. This inventory was completed through a search of agency records and other publicly available information. 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 inorganic chemicals.

The sources are displayed on Map 2 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 each 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 combination of toxicity and volume associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only “Very High” and “High” rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

Tables 2 through 7 in Appendix B contain the ranking of inventoried potential and existing sources of contamination with respect to the six contaminant categories.

## **VULNERABILITY OF EIELSON AIR FORCE BASE WELL E DRINKING WATER SYSTEM**

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

- Natural susceptibility; and
- Contaminant risks.

Appendix D contains fourteen charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the properties of the aquifer and the presence of other wells or boreholes in the area. 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 the water system’s contaminant sample results. Lastly, Chart 4 combines the results of the first three charts to produce the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

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

Susceptibility of the Wellhead (0 – 25 Points)  
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)  
(Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well)  
(0 – 50 Points)

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Well E of Eielson Air Force Base received a Very High Susceptibility rating. The 11/7/03 Sanitary Survey indicates that it does not appear that Well E is capped with a sanitary seal. The land surface is sloped away from the well and the well is grouted. A sanitary seal prevents potential contaminants from entering the well

from the inside while sloping the land surface away from the well and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer in the area the Eielson Air Force Base Well E well is completed in received a Very High Susceptibility rating. The highly transmissive aquifer material (sand and gravel) in the area allows contaminants to travel downward from the surface with the precipitation and surface water runoff. The shallow water table allows potential contaminants to come into contact with the water table with little natural filtering where they can disperse quickly. Additionally, other wells in the area can provide a quick pathway for contaminants to reach the aquifer. Table 2 summarizes the Susceptibility scores and ratings for Eielson Air Force Base Well E.

**Table 2. Susceptibility**

	Score	Rating
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	24	Very High
Natural Susceptibility	44	Very High

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources. 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	13	Low
Nitrates and/or Nitrites	16	Low
Volatile Organic Chemicals	30	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	26	Medium
Synthetic Organic Chemicals	15	Low
Other Organic Chemicals	30	High

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

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

Again, rankings are assigned according to a point score:

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

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

**Table 4. Overall Vulnerability**

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and/or Nitrites	60	High
Volatile Organic Chemicals	75	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	70	High
Synthetic Organic Chemicals	55	Medium
Other Organic Chemicals	75	High

**Bacteria and Viruses**

The sewer lines represent the greatest risk of Bacteria and Viruses to this water system. The sewerlines are

encased within a concrete utilidor providing added protection from leaks.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms (a bacteria) 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 coliforms 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). Routine sampling has not detected coliforms in the water.

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**

The sewer lines also represent the greatest risk of nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have not been detected in significant concentrations during recent sampling history for the Eielson Air Force Base Well E.

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 high.

**Volatile Organic Chemicals**

The Eielson Air Force Base landing strip and the DEC-recognized contaminated sites represent the greatest risk for volatile organic chemical contamination to the well.

Toluene was detected once at a very low concentration with respect to its Maximum Contaminant Level (MCL) (0.0012 mg/L on 1/21/03). An MCL is the concentration of a contaminant allowed in the drinking water by the Environmental Protection Area (EPA). Other Volatile Organic Chemicals have not been detected during routine sampling of this water system.

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

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

The DEC-recognized contaminated sites also represent the greatest risk to heavy metals for this source of public drinking water.

Arsenic was detected at a very low concentration with respect to its MCL on 10/23/02 (0.00357 mg/L) in this well. Arsenic was not detected when sampled for in the entire water system. Barium, Cadmium, and Fluoride have all been detected in extremely low concentrations with respect to their MCLs. No other heavy metals were detected during recent routine sampling.

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 high.

### **Synthetic Organic Chemicals**

The airport and the DEC-contaminated site closest to the well represent the greatest risk of synthetic organic chemicals for this source of public drinking water.

Synthetic Organic Chemicals have not been detected during recent sampling of this water system.

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

### **Other Organic Chemicals**

The fire training facility and its associated contaminated site represent the greatest risk of other organic chemicals for this source of public drinking water.

Other Organic Chemicals have not been sampled since 1997 in this water system.

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

### **Existing Contaminated Sites**

There are seven ADEC-recognized contaminated sites located within Zones A and B of the protection area for Well E representing risk to Volatile Organic Chemicals, Heavy Metals, Synthetic Organic Chemicals, and Other Organic Chemicals. The ADEC Contaminated Sites program has identified, assessed, and is ensuring cleanup of these sites based on their prioritized order. Priority is based on risk to human health and the environment, including risk to public drinking water wells. The United States Air Force has also identified and has issued a Record of Decision (ROD) for most of the sites through its Installation Restoration Program. All seven of these sites were identified in the late 1980's or early 1990's and have been extensively characterized since then. Specific information on each site can be found on the internet at

[http://www.dec.state.ak.us/spar/cs/search/csites/csites\\_s](http://www.dec.state.ak.us/spar/cs/search/csites/csites_s)

[earch.asp](#) for contaminated or by calling the ADEC Contaminated Sites Program at (907) 269-7658.

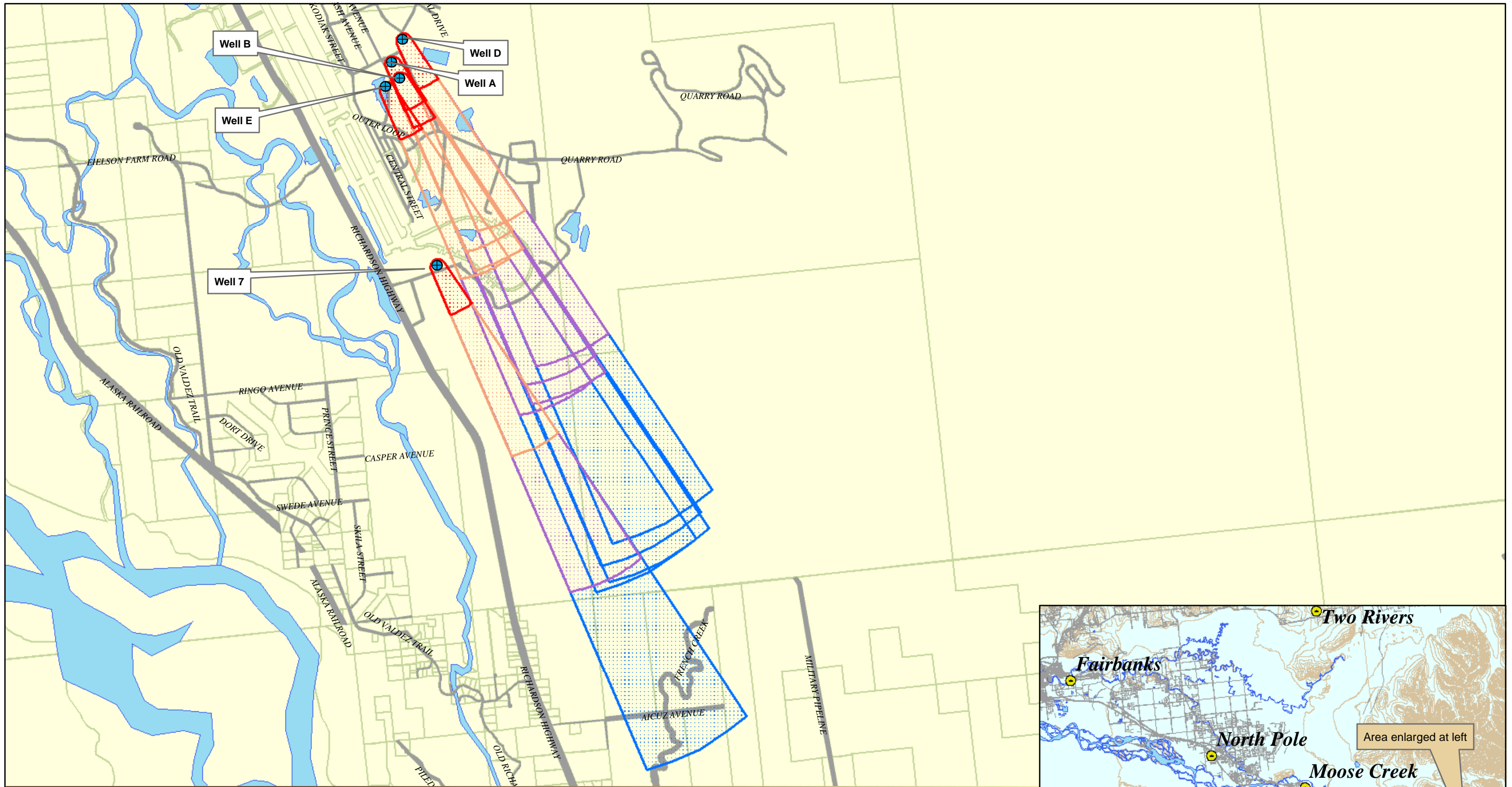


## REFERENCES

- Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL [http://www.dced.state.ak.us/mra/CF\\_BLOCK.cfm](http://www.dced.state.ak.us/mra/CF_BLOCK.cfm).
- Anderson, G.S., 1970, Hydrologic reconnaissance of the Tanana basin, central Alaska: U.S. Geological Survey Hydrologic Investigations Atlas HA-319.
- Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.
- Nakanishi, Allan S. and Lilly, Micheal R., 1998. Estimate of Aquifer Properties by Numerically Simulating Ground-Water/Surface-Water Interactions, Fort Wainwright, Alaska. US Geological Survey Water Resources Investigations Report 98-4088, 27p.
- Nelson, Gordon L., 1978, Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska. US Department of the Interior Geological Survey Open File Report 78-959, 47p.
- Pewe, T.L. 1958. Geology of the Fairbanks (D-2) Quadrangle, Alaska. US Geological Survey
- Sullivan, Dr. John M. and Koenen, Brent A., 1997. Three Dimensional Groundwater Flow and Contaminant Transport Modeling at ST48 – Power Plant Fuel Spills Eielson Air Force Base, Alaska. United States Air Force Civil Engineering Squadron.
- United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL <http://www.epa.gov/safewater/mcl.html>.

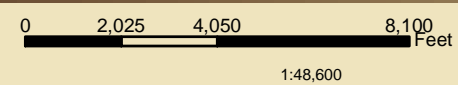
## **APPENDIX A**

### **Eielson Air Force Base Well E Drinking Water Protection Area Location Map (Map 1)**



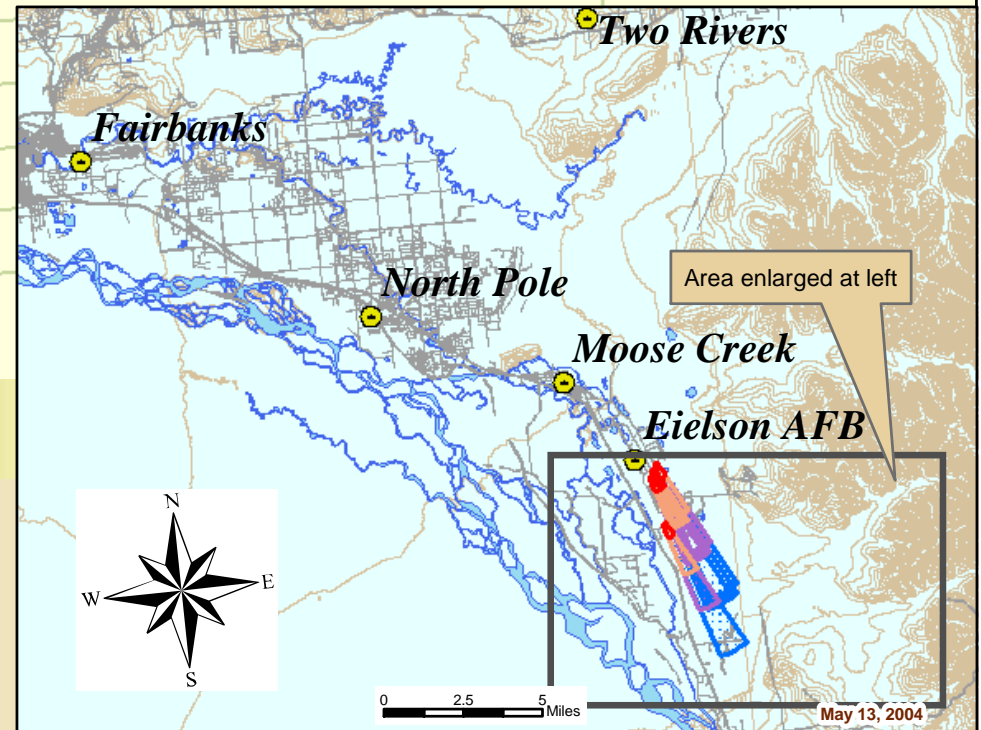
**Map 1: Eielson AFB Drinking Water Protection Areas**

**PWSID: 370625**



**Data Sources:**  
 Parcel, roads - Fairbanks North Star Borough  
 Water bodies, railroad - Geographic Data Technology  
 Elevation contours - USGS digital elevation models (DEMs)

- Legend**
- Zone A
  - Zone B
  - Zone C
  - Zone D
  - Towns
  - Roads
  - Surface Water
  - Parcels



## **APPENDIX B**

### **Contaminant Source Inventory and Risk Ranking for Eielson Air Force Base Well E (Tables 1-7)**

**Table 1****Contaminant Source Inventory for  
Eielson - Air Force Base Well E****PWSID 370625.001**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Map Number</b>	<b>Comments</b>
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	2	5 sewerlines in the utilidor in Zone A
Contaminated sites, DEC recognized	U04	U04-1	A	2	EiAFB (OU4) (SS35) Asphalt Mix Area; RecKey 198731X908359
Highways and roads, paved (cement or asphalt)	X20		A	2	Central Street; Outer Loop
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	2	1 sewerline within the utilidor in Zone A
Asphalt and tar processing/storage	I03	I03-1	B	2	Used asphalt storage
Contaminated sites, DEC recognized	U04	U04-2	B	2	EiAFB (OU-5) (FT09) Fire Training; RecKey 198731X908310
Contaminated sites, DEC recognized	U04	U04-3	B	2	EiAFB (OU-5) (LF03) Landfill; RecKey 198731X908304
Contaminated sites, DEC recognized	U04	U04-4	B	2	EiAFB Hangar - Building 1348; RecKey 199231X006601
Contaminated sites, DEC recognized	U04	U04-5	B	2	EiAFB Hangar - Bldg. 1344 Area #2, RecKey 199231X006602
Contaminated sites, DEC recognized	U04	U04-6	B	2	EiAFB Bldg. 1340, RecKey 199231X006604
Contaminated sites, DEC recognized	U04	U04-7	B	2	EiAFB (OU-1) (ST20) Refueling Loop; RecKey 198731X108321
Airports	X14	X14-1	B	2	Eielson AFB Landing Strip
Highways and roads, paved (cement or asphalt)	X20		B	2	2 roads in Zone B
Fire training facilities	X39	X39-1	B	2	

**Table 2**

*Contaminant Source Inventory and Risk Ranking for  
Eielson - Air Force Base Well E  
Sources of Bacteria and Viruses*

**PWSID 370625.001**

<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>
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Medium	2	5 sewerlines in the utilidors in Zone A
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Medium	2	1 sewerline within the utilidor in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B

**Table 3**

*Contaminant Source Inventory and Risk Ranking for  
Eielson - Air Force Base Well E  
Sources of Nitrates/Nitrites*

**PWSID 370625.001**

<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>
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Medium	2	5 sewerlines in the utilidors in Zone A
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Medium	2	1 sewerline within the utilidor in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Airports	X14	X14-1	B	Low	2	Eielson AFB Landing Strip

Table 4

*Contaminant Source Inventory and Risk Ranking for  
Eielson - Air Force Base Well E  
Sources of Volatile Organic Chemicals*

PWSID 370625.001

<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>
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	5 sewerlines in the utilidors in Zone A
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Contaminated sites, DEC recognized	U04	U04-1	A	Medium	2	EiAFB (OU4) (SS35) Asphalt Mix Area; RecKey 198731X908359
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Low	2	1 sewerline within the utilidor in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Asphalt and tar processing/storage	I03	I03-1	B	Low	2	Used asphalt storage
Contaminated sites, DEC recognized	U04	U04-2	B	High	2	EiAFB (OU-5) (FT09) Fire Training; RecKey 198731X908310
Contaminated sites, DEC recognized	U04	U04-3	B	High	2	EiAFB (OU-5) (LF03) Landfill; RecKey 198731X908304
Contaminated sites, DEC recognized	U04	U04-4	B	Low	2	EiAFB Hangar - Building 1348; RecKey 199231X006601
Contaminated sites, DEC recognized	U04	U04-5	B	Low	2	EiAFB Hangar - Bldg. 1344 Area #2, RecKey 199231X006602
Contaminated sites, DEC recognized	U04	U04-6	B	Low	2	EiAFB Bldg. 1340, RecKey 199231X006604
Airports	X14	X14-1	B	High	2	Eielson AFB Landing Strip
Fire training facilities	X39	X39-1	B	Low	2	



Table 5

*Contaminant Source Inventory and Risk Ranking for  
Eielson - Air Force Base Well E  
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

PWSID 370625.001

<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>
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	5 sewerlines in the utilidors in Zone A
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Contaminated sites, DEC recognized	U04	U04-1	A	Medium	2	EiAFB (OU4) (SS35) Asphalt Mix Area; RecKey 198731X908359
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Low	2	1 sewerline within the utilidor in Zone A
Asphalt and tar processing/storage	I03	I03-1	B	Low	2	Used asphalt storage
Contaminated sites, DEC recognized	U04	U04-3	B	High	2	EiAFB (OU-5) (LF03) Landfill; RecKey 198731X908304
Contaminated sites, DEC recognized	U04	U04-4	B	Low	2	EiAFB Hangar - Building 1348; RecKey 199231X006601
Contaminated sites, DEC recognized	U04	U04-5	B	Low	2	EiAFB Hangar - Bldg. 1344 Area #2, RecKey 199231X006602
Contaminated sites, DEC recognized	U04	U04-6	B	Low	2	EiAFB Bldg. 1340, RecKey 199231X006604
Airports	X14	X14-1	B	Low	2	Eielson AFB Landing Strip
Fire training facilities	X39	X39-1	B	Low	2	

Table 6

*Contaminant Source Inventory and Risk Ranking for  
Eielson - Air Force Base Well E  
Sources of Synthetic Organic Chemicals*

PWSID 370625.001

<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>
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	5 sewerlines in the utilidors in Zone A
Contaminated sites, DEC recognized	U04	U04-1	A	Medium	2	EiAFB (OU4) (SS35) Asphalt Mix Area; RecKey 198731X908359
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Low	2	1 sewerline within the utilidor in Zone A
Airports	X14	X14-1	B	Medium	2	Eielson AFB Landing Strip

**Table 7**

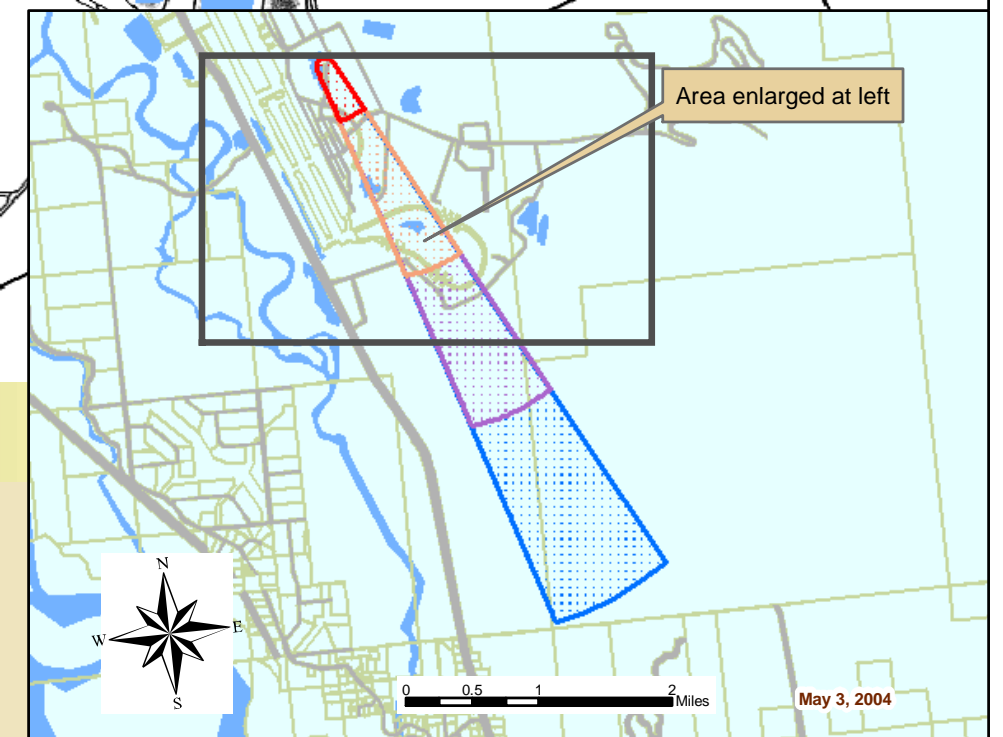
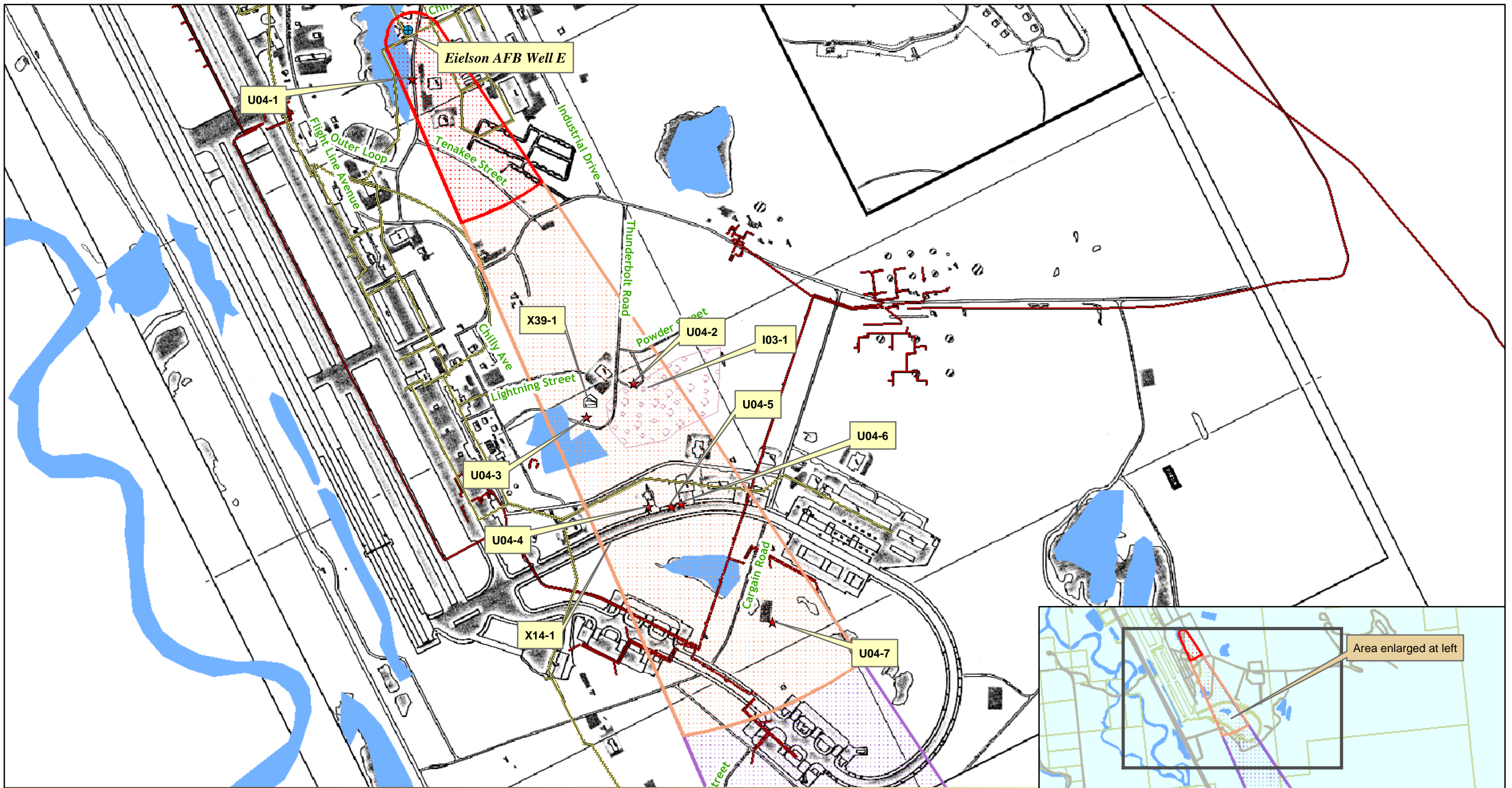
*Contaminant Source Inventory and Risk Ranking for  
Eielson - Air Force Base Well E  
Sources of Other Organic Chemicals*

**PWSID 370625.001**

<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>
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Central Street; Outer Loop
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	5 sewerlines in the utilidors in Zone A
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Low	2	1 sewerline within the utilidor in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Asphalt and tar processing/storage	I03	I03-1	B	Medium	2	Used asphalt storage
Contaminated sites, DEC recognized	U04	U04-2	B	High	2	EiAFB (OU-5) (FT09) Fire Training; RecKey 198731X908310
Contaminated sites, DEC recognized	U04	U04-3	B	High	2	EiAFB (OU-5) (LF03) Landfill; RecKey 198731X908304
Airports	X14	X14-1	B	Medium	2	Eielson AFB Landing Strip
Fire training facilities	X39	X39-1	B	High	2	

## **APPENDIX C**

### **Eielson Air Force Base Well E Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)**



**Map 2: Eielson AFB Well E Drinking Water Protection Area**

**PWSID: 370625.001**



**Data Sources:**  
 Background image - Eielson AFB site map  
 Parcel, roads - Fairbanks North Star Borough  
 Water bodies, railroad - Geographic Data Technology

1:13,200  
 0 550 1,100 2,200 3,300 Feet

**Legend**

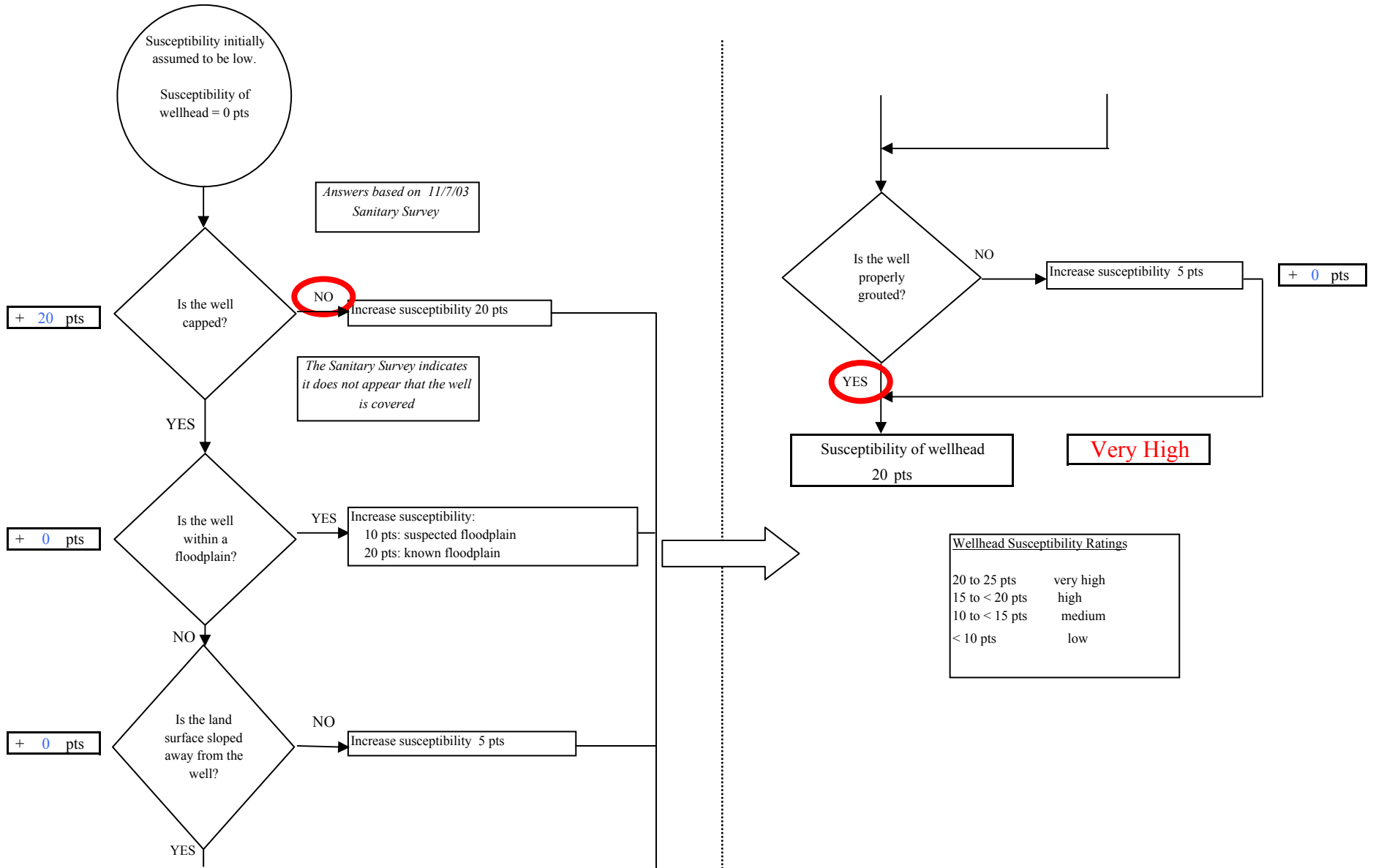
- ★ U04, DEC-recognized contaminated site
- 🏠 X39, Fire training facility
- 🛣️ Roads
- 📐 Parcels
- 🌊 Surface water
- 🟡 Asphalt stockpile, I03

May 3, 2004

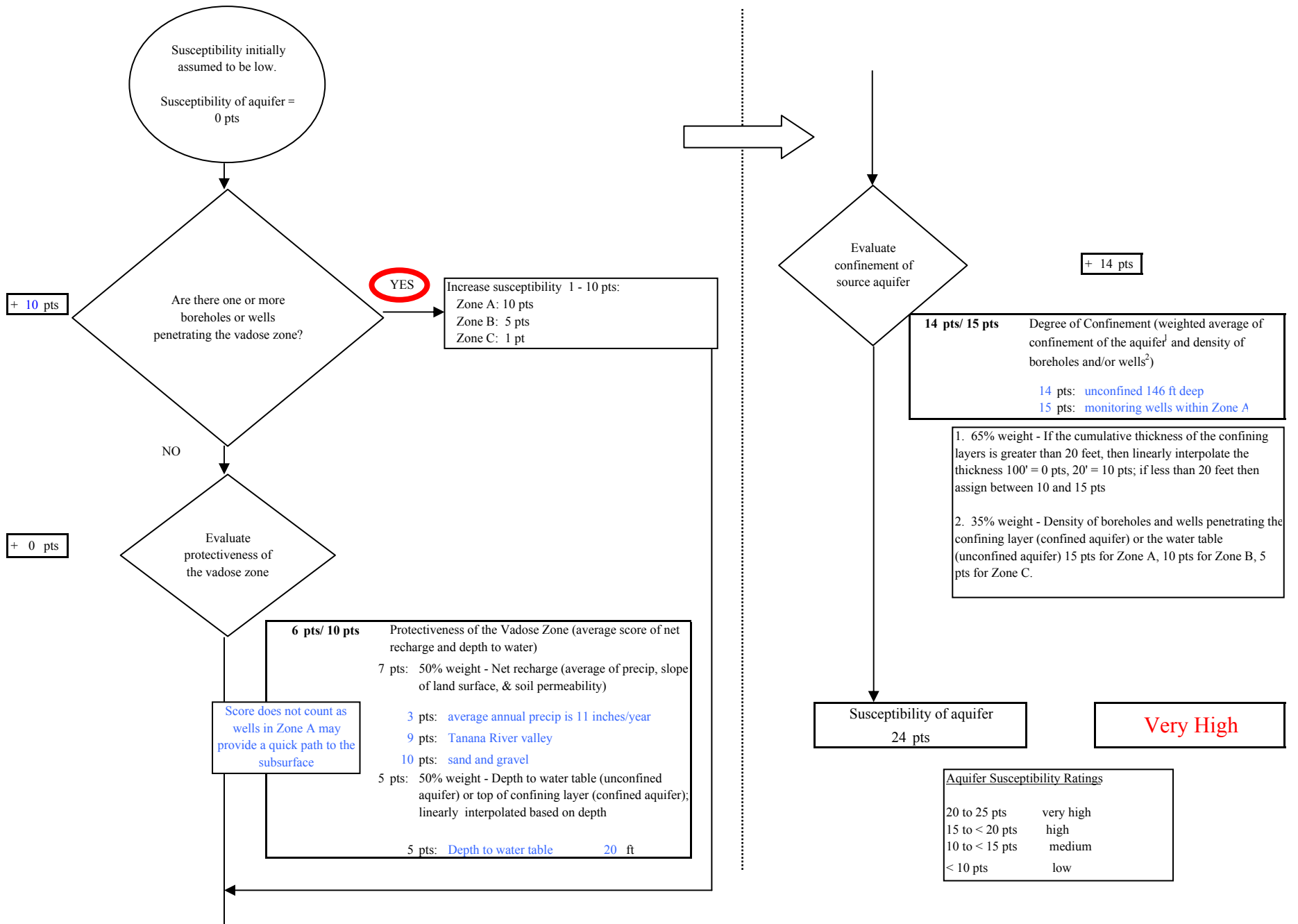
## **APPENDIX D**

### **Vulnerability Analysis for Eielson Air Force Base Well E Public Drinking Water Source (Charts 1-14)**

**Chart 1. Susceptibility of the wellhead - Eielson AFB Well E**

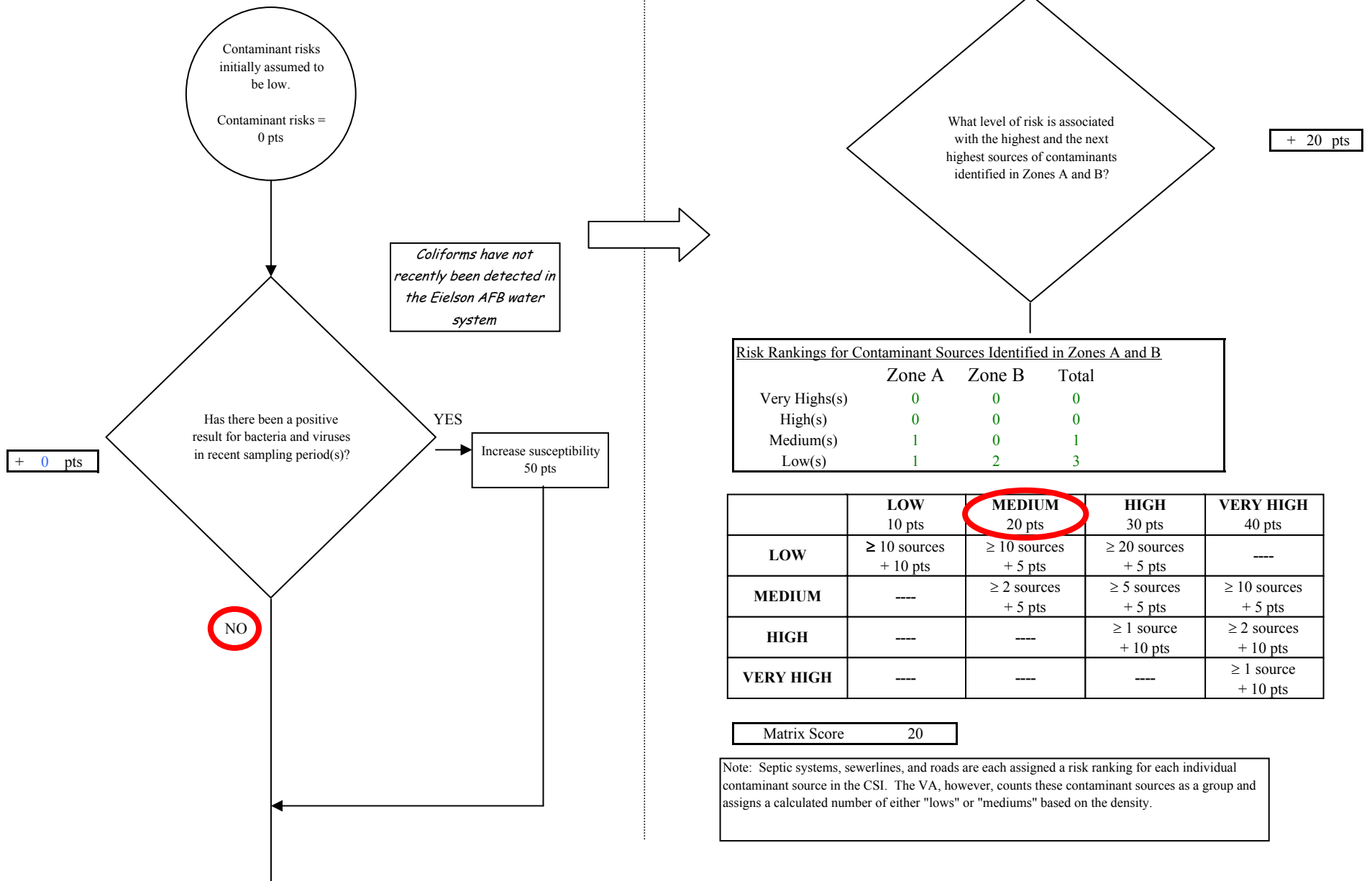


**Chart 2. Susceptibility of the aquifer - Eielson AFB Well E**

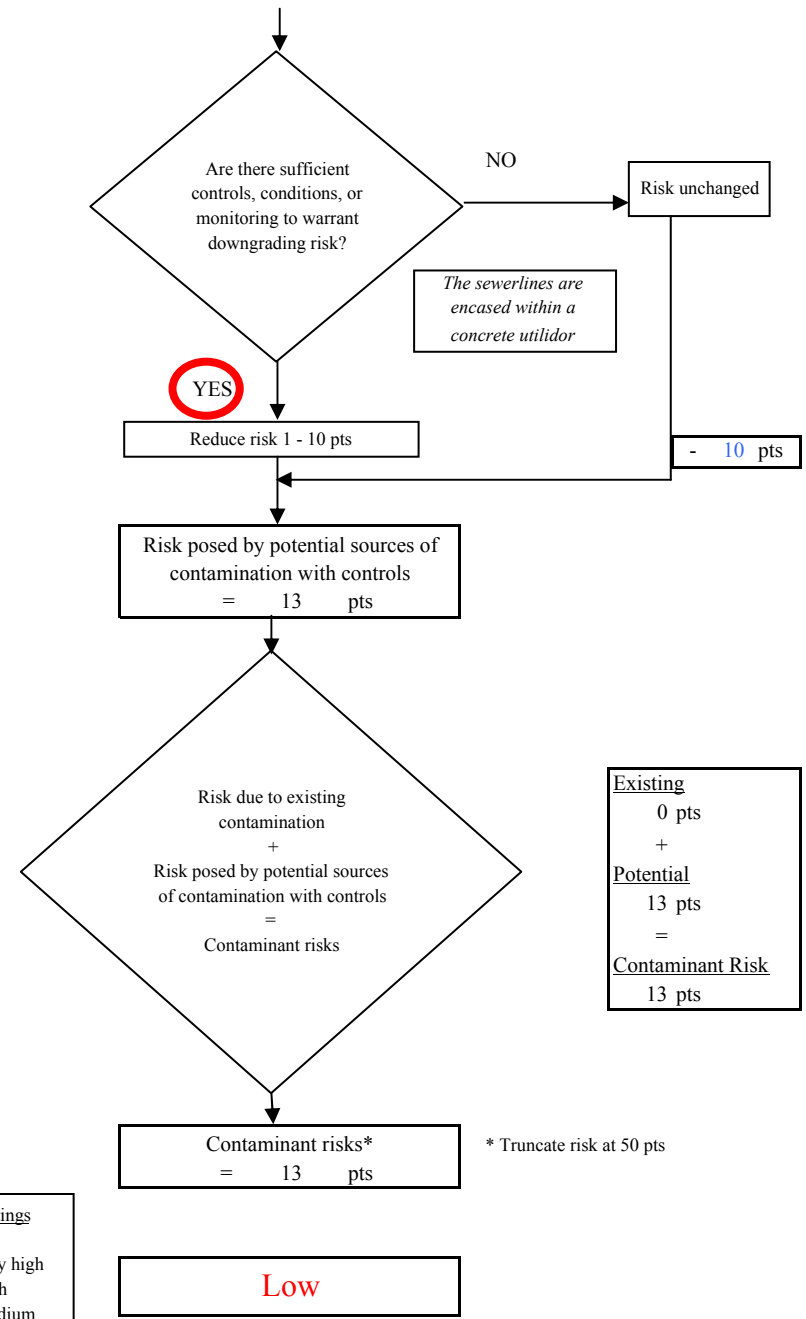
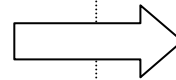
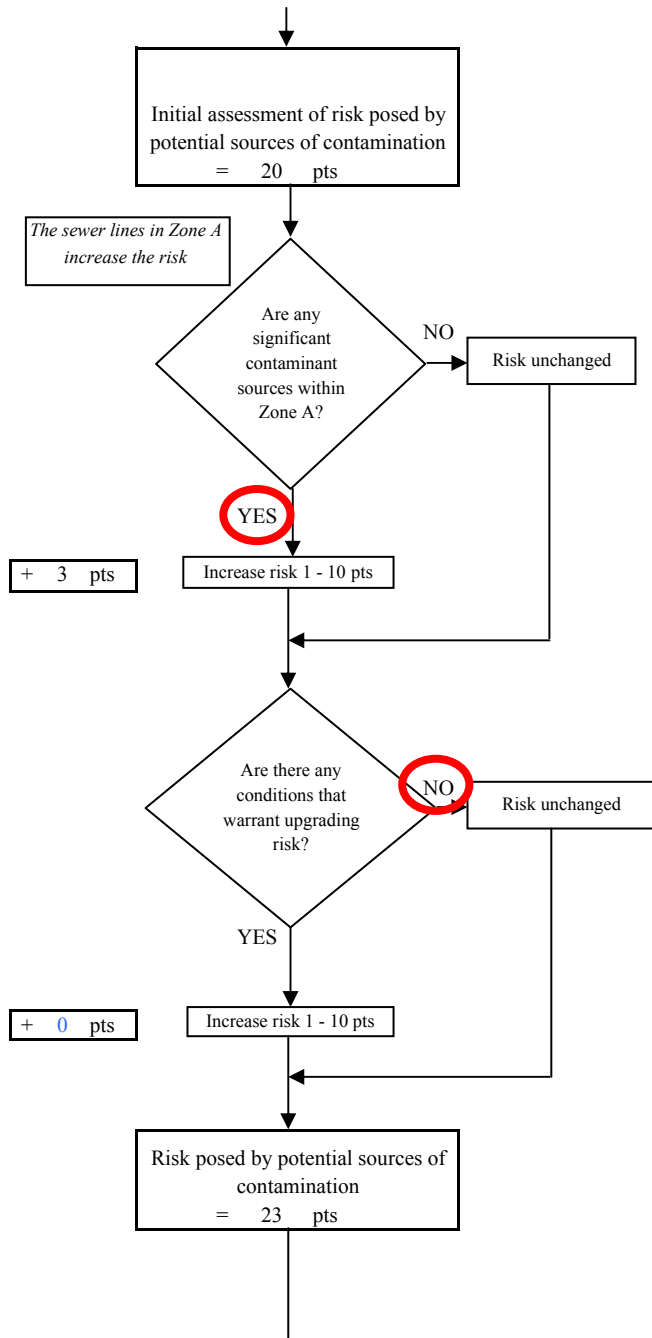




**Chart 3. Contaminant risks for Eielson AFB Well E - Bacteria & Viruses**

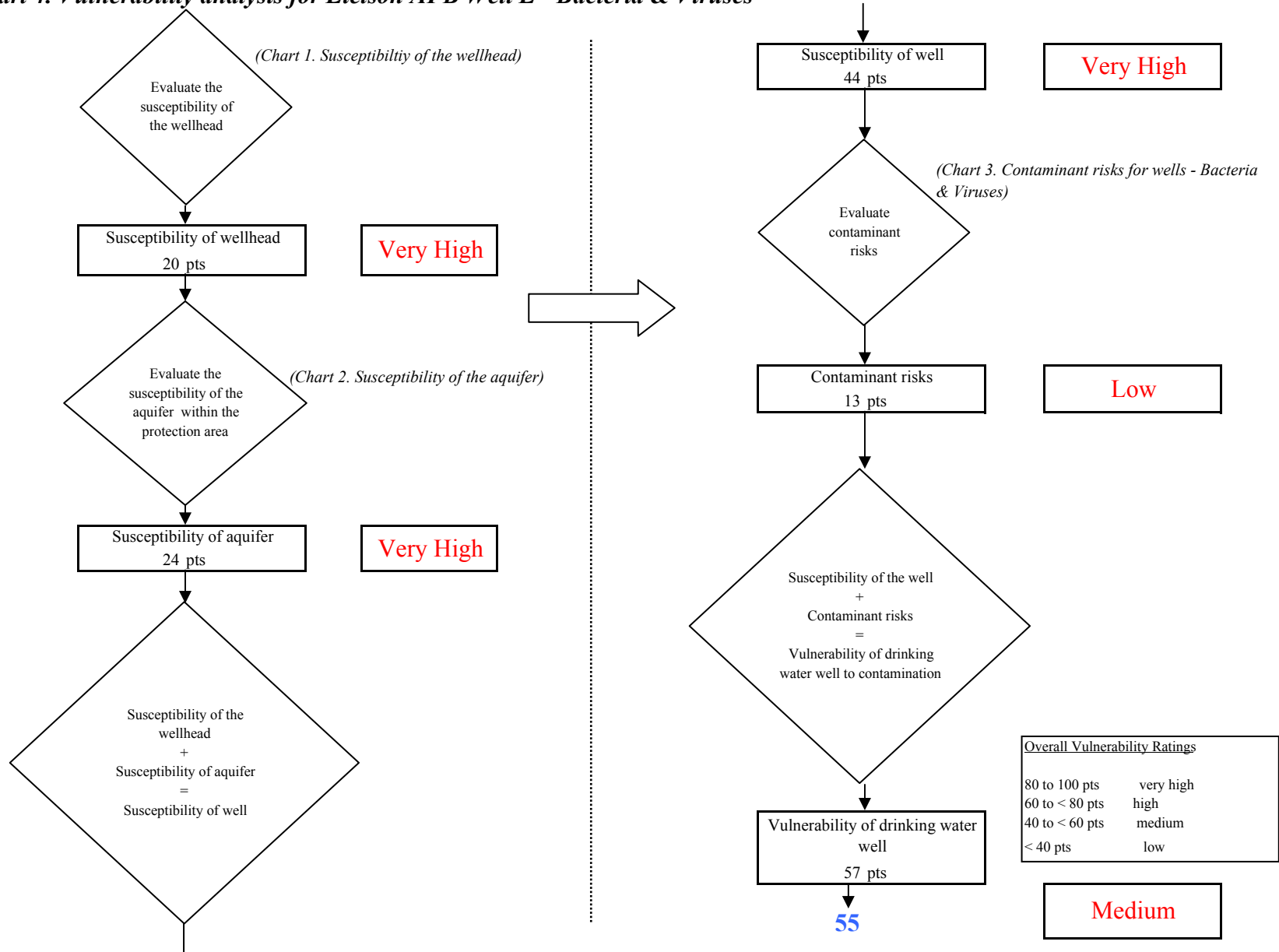


**Chart 3. Contaminant risks for Eielson AFB Well E - Bacteria & Viruses**

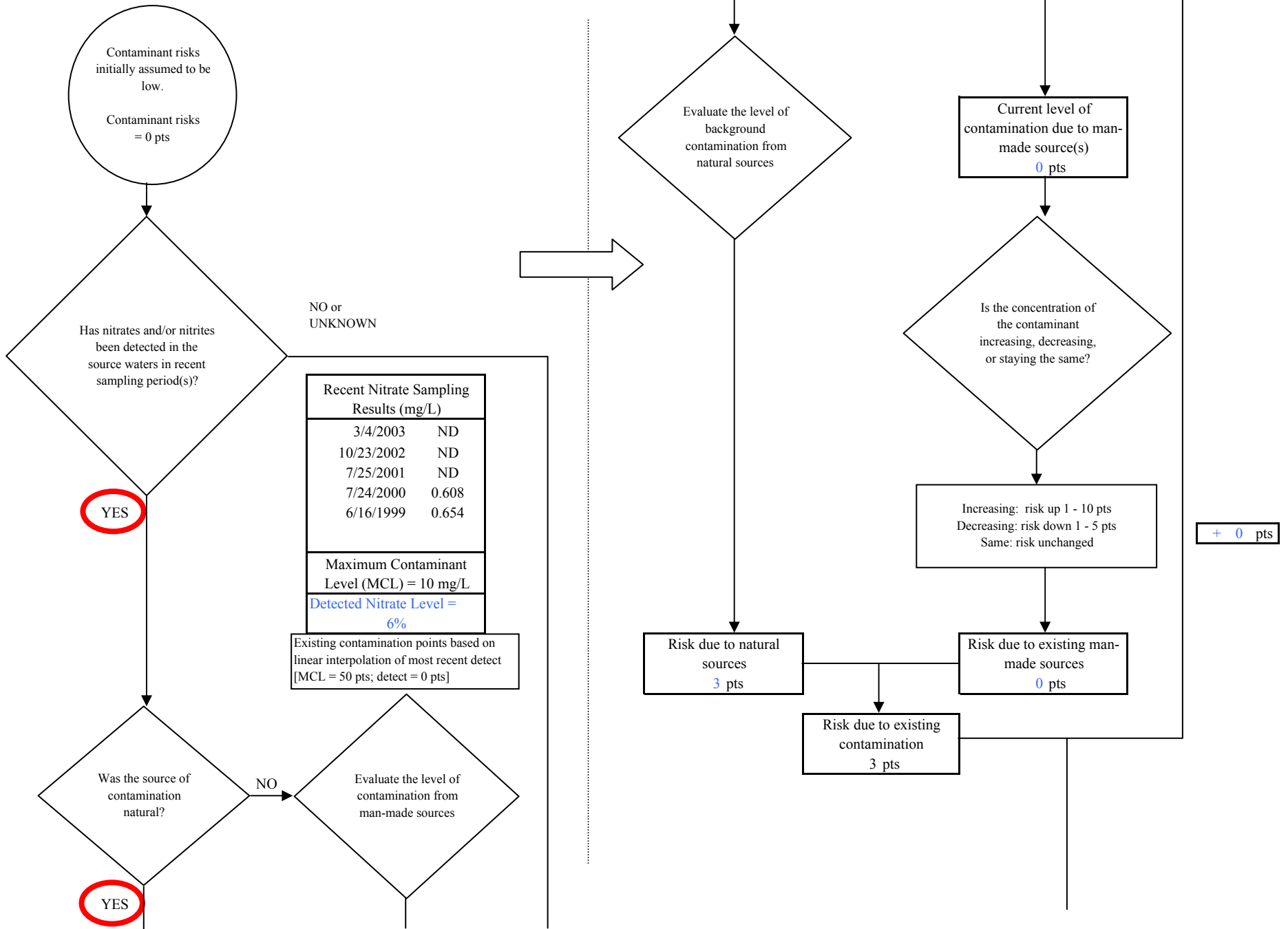


Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

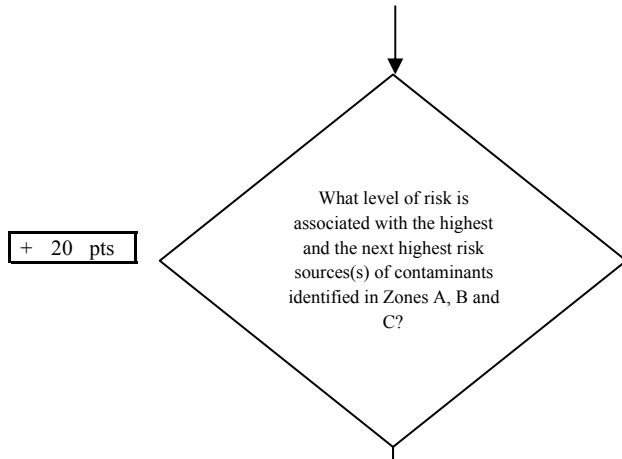
**Chart 4. Vulnerability analysis for Eielson AFB Well E - Bacteria & Viruses**



**Chart 5. Contaminant risks for Eielson AFB Well E - Nitrates and Nitrites**



**Chart 5. Contaminant risks for Eielson AFB Well E - Nitrates and Nitrites**



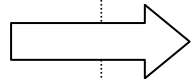
+ 20 pts

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	1	3	4

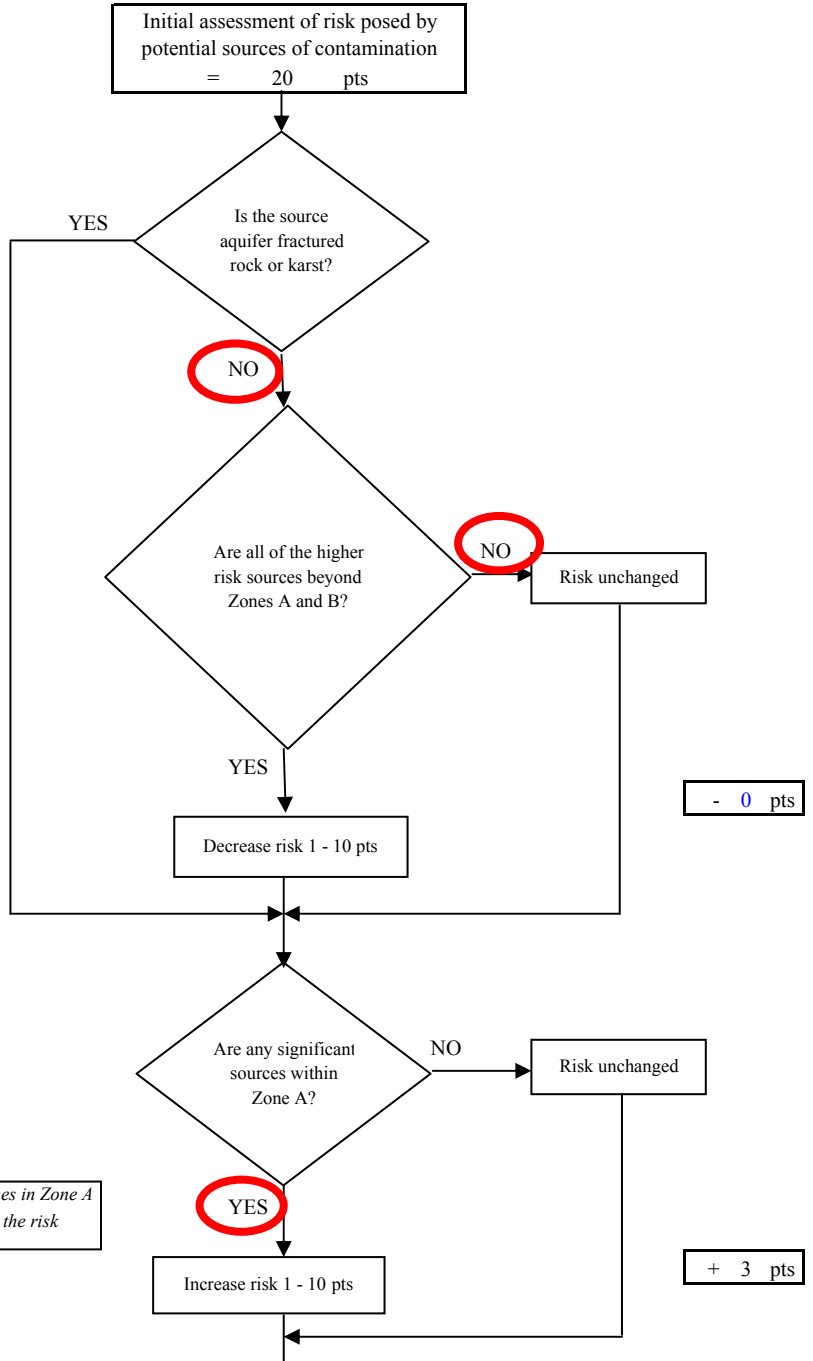
	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
<b>LOW</b>	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
<b>MEDIUM</b>	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
<b>HIGH</b>	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
<b>VERY HIGH</b>	----	----	----	≥ 1 source + 10 pts

Matrix Score 20

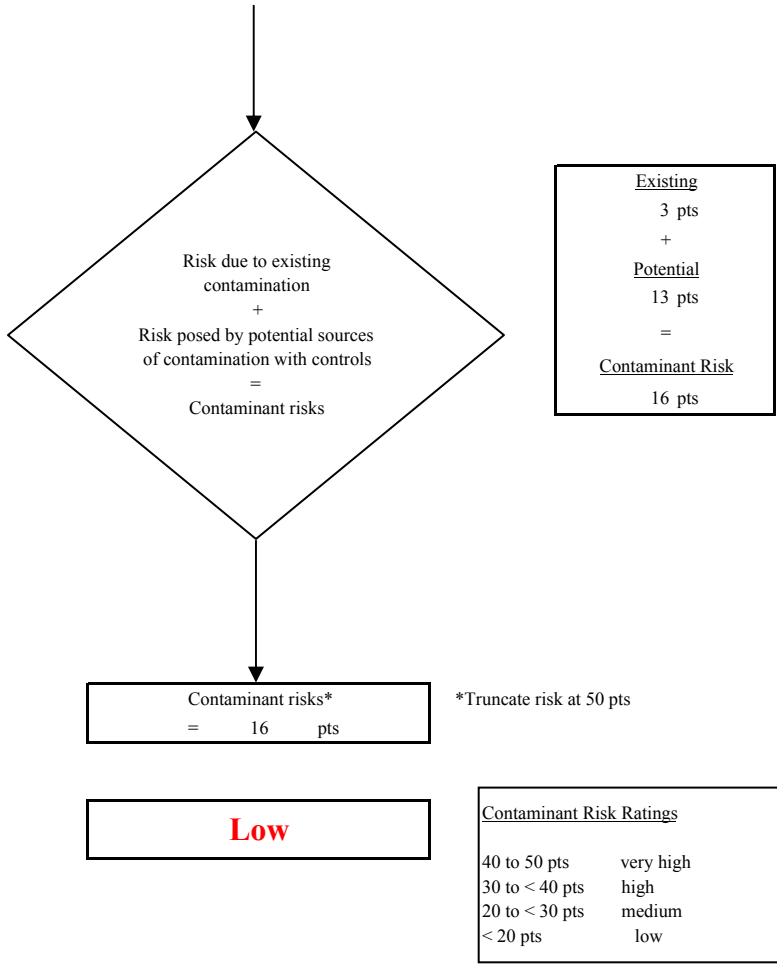
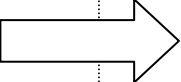
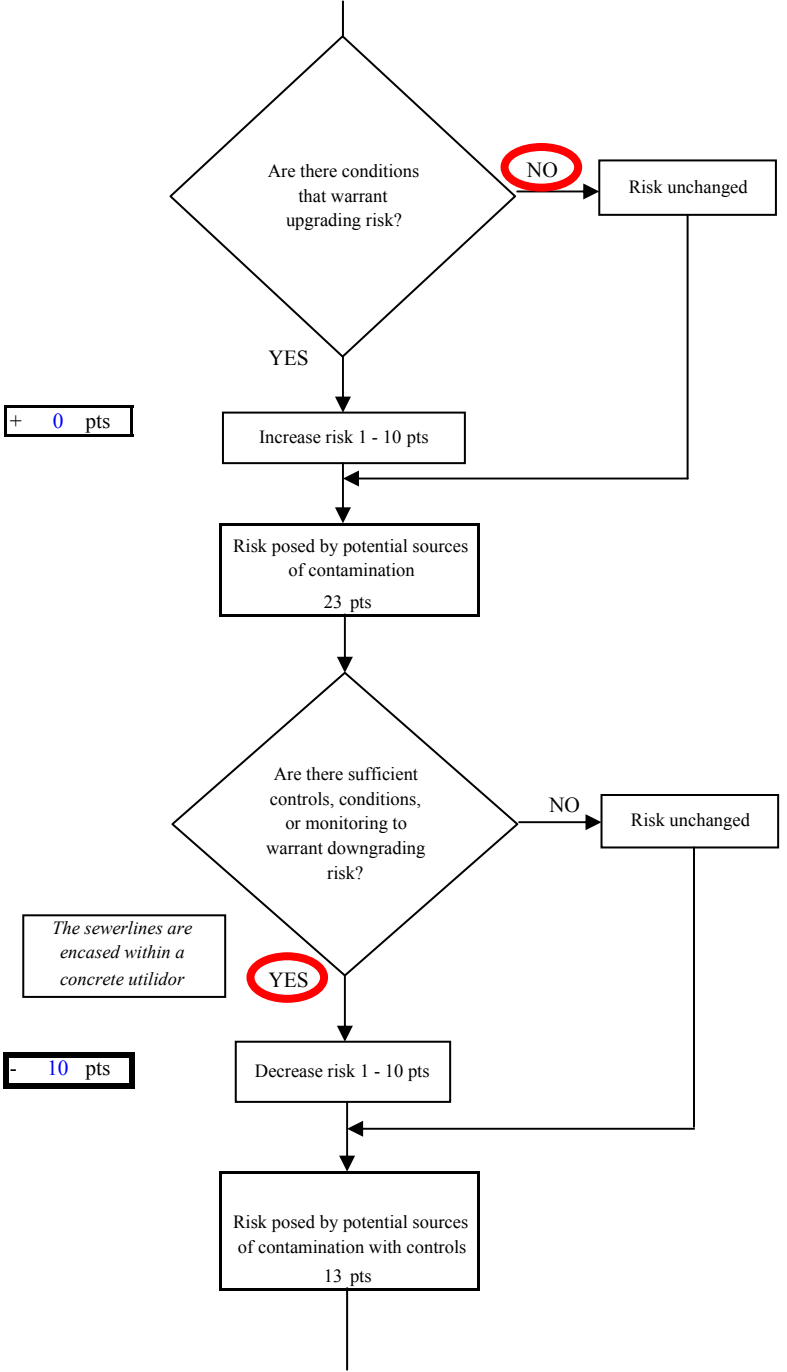
Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



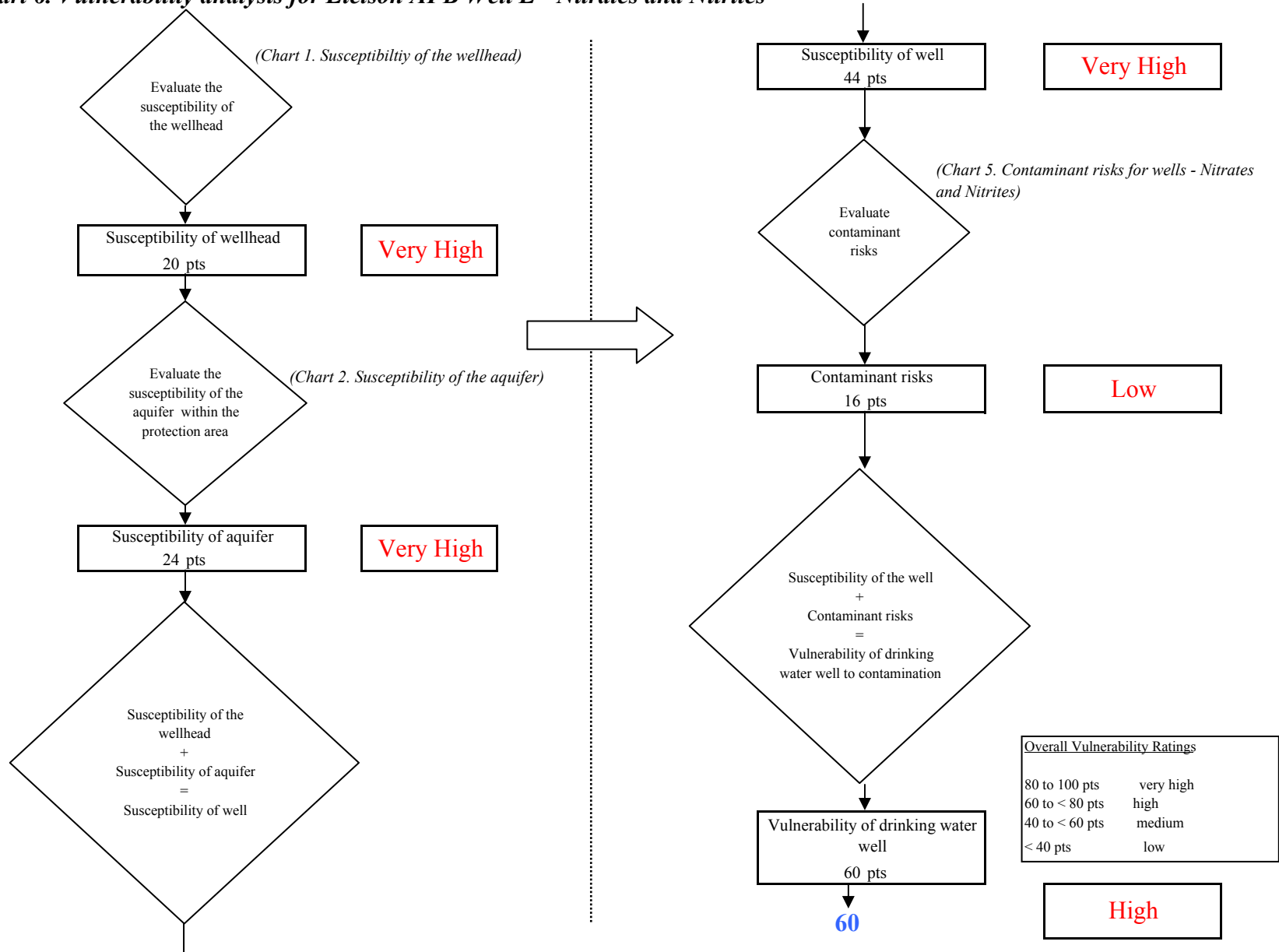
The sewer lines in Zone A increase the risk



**Chart 5. Contaminant risks for Eielson AFB Well E - Nitrates and Nitrites**



**Chart 6. Vulnerability analysis for Eielson AFB Well E - Nitrates and Nitrites**



**Chart 7. Contaminant risks for Eielson AFB Well E - Volatile Organic Chemicals**

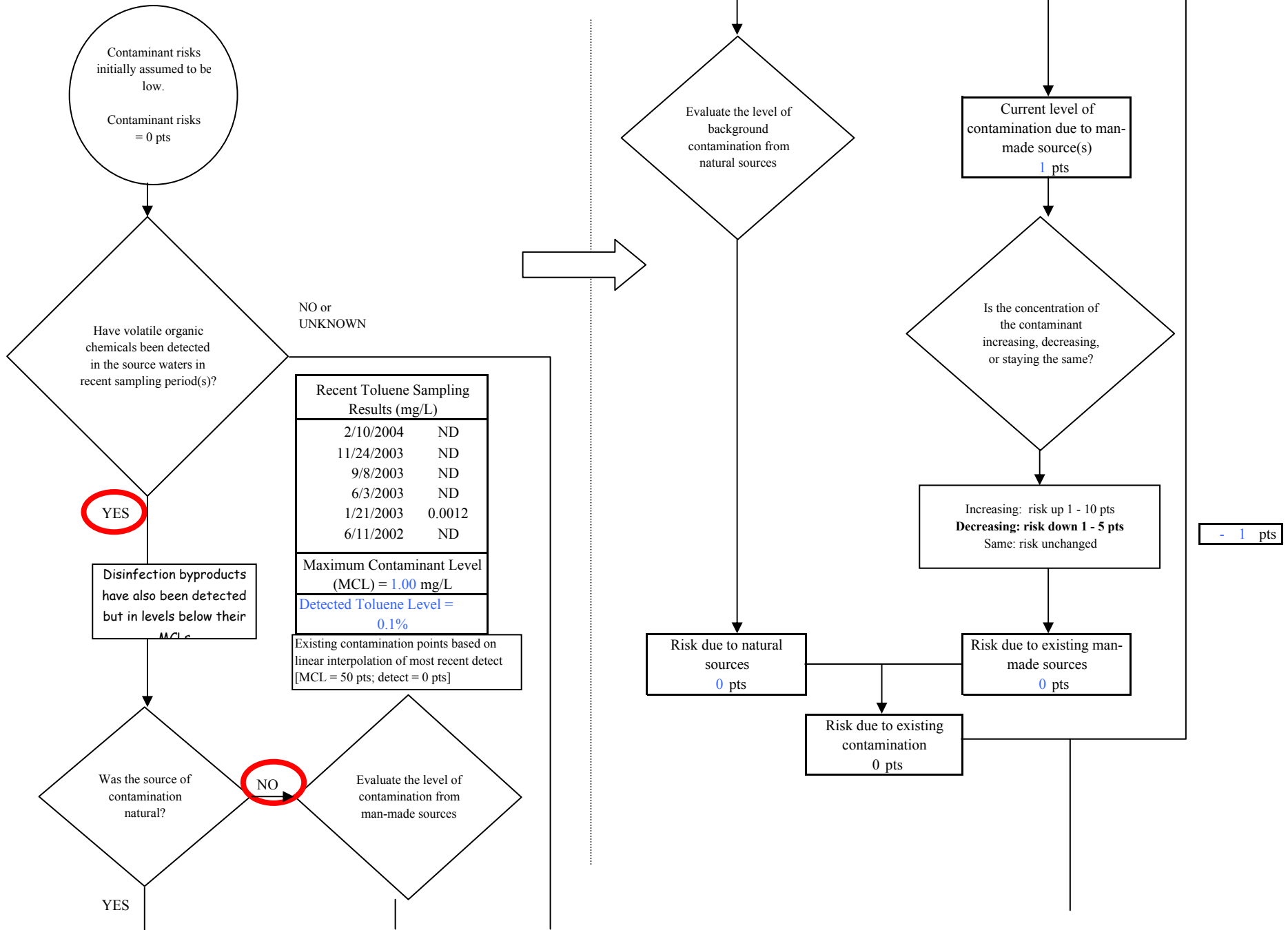
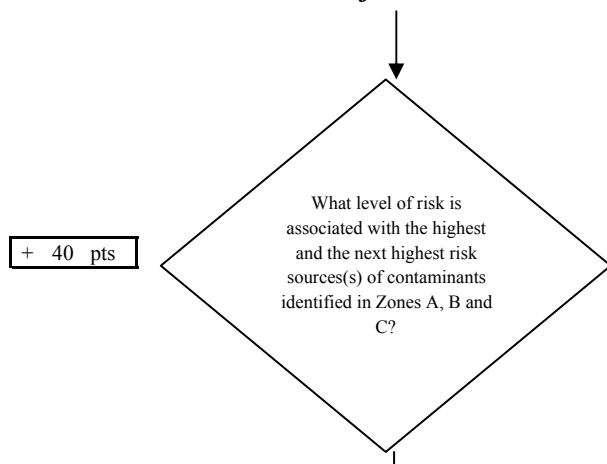




Chart 7. Contaminant risks for Eielson AFB Well E - Volatile Organic Chemicals

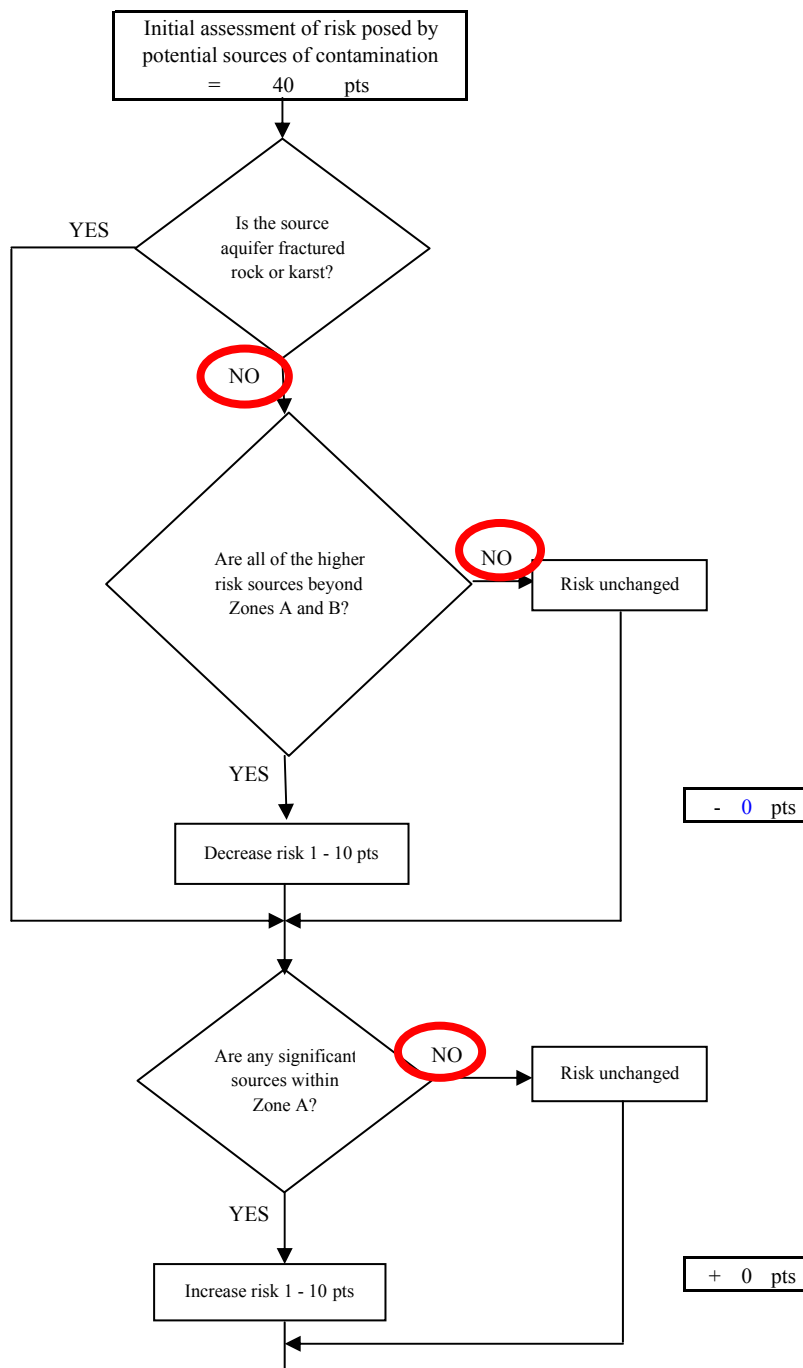
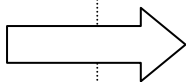


Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	0	3	3
Medium(s)	1	0	1
Low(s)	2	7	9

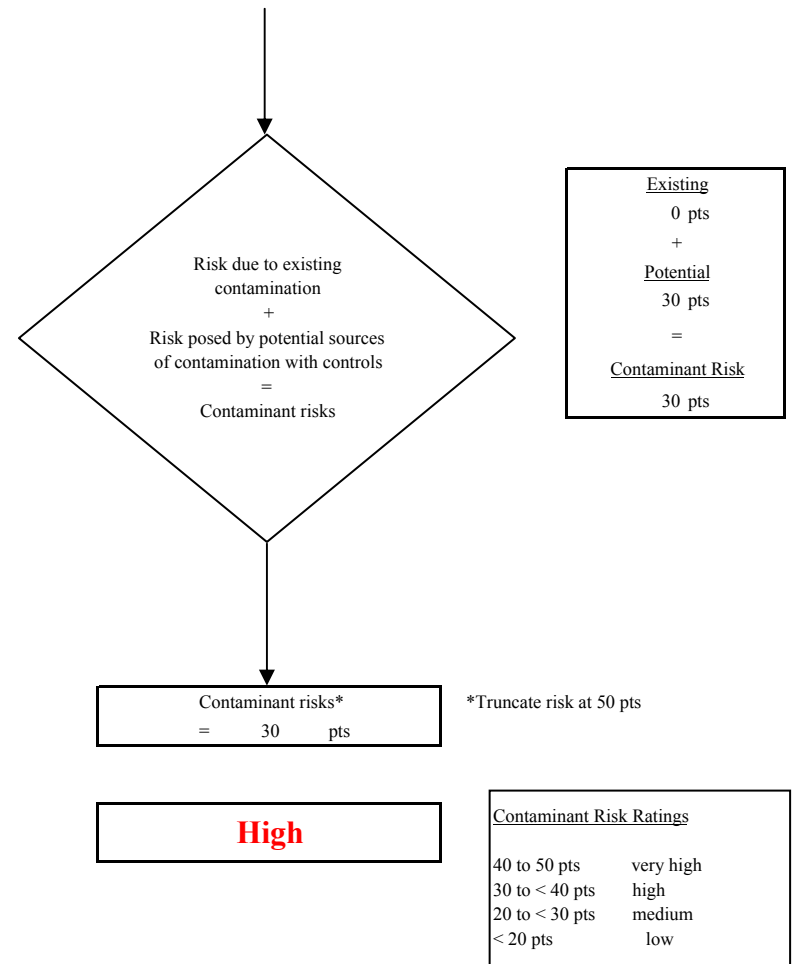
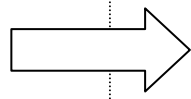
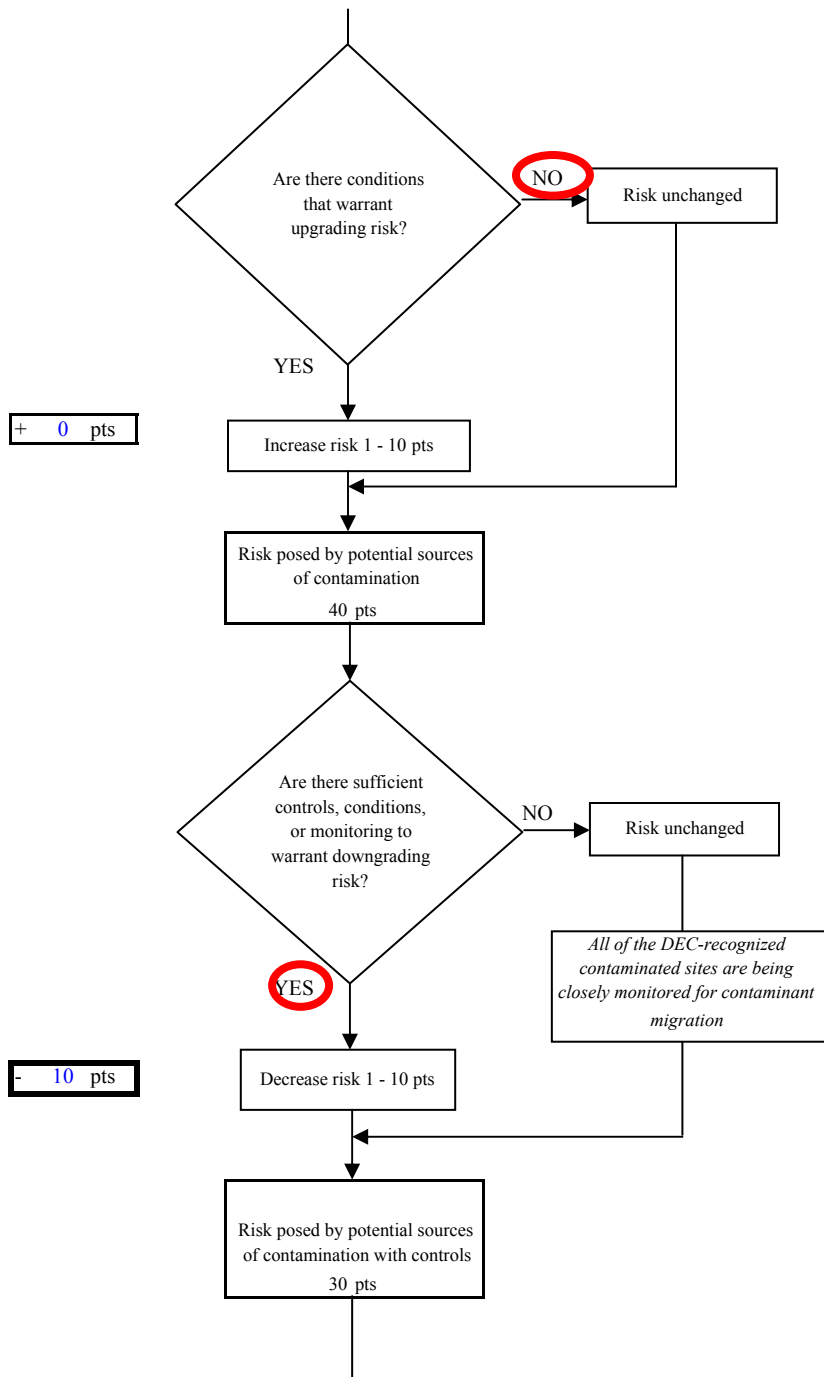
	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

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 7. Contaminant risks for Eielson AFB Well E - Volatile Organic Chemicals**



**Chart 8. Vulnerability analysis for Eielson AFB Well E - Volatile Organic Chemicals**

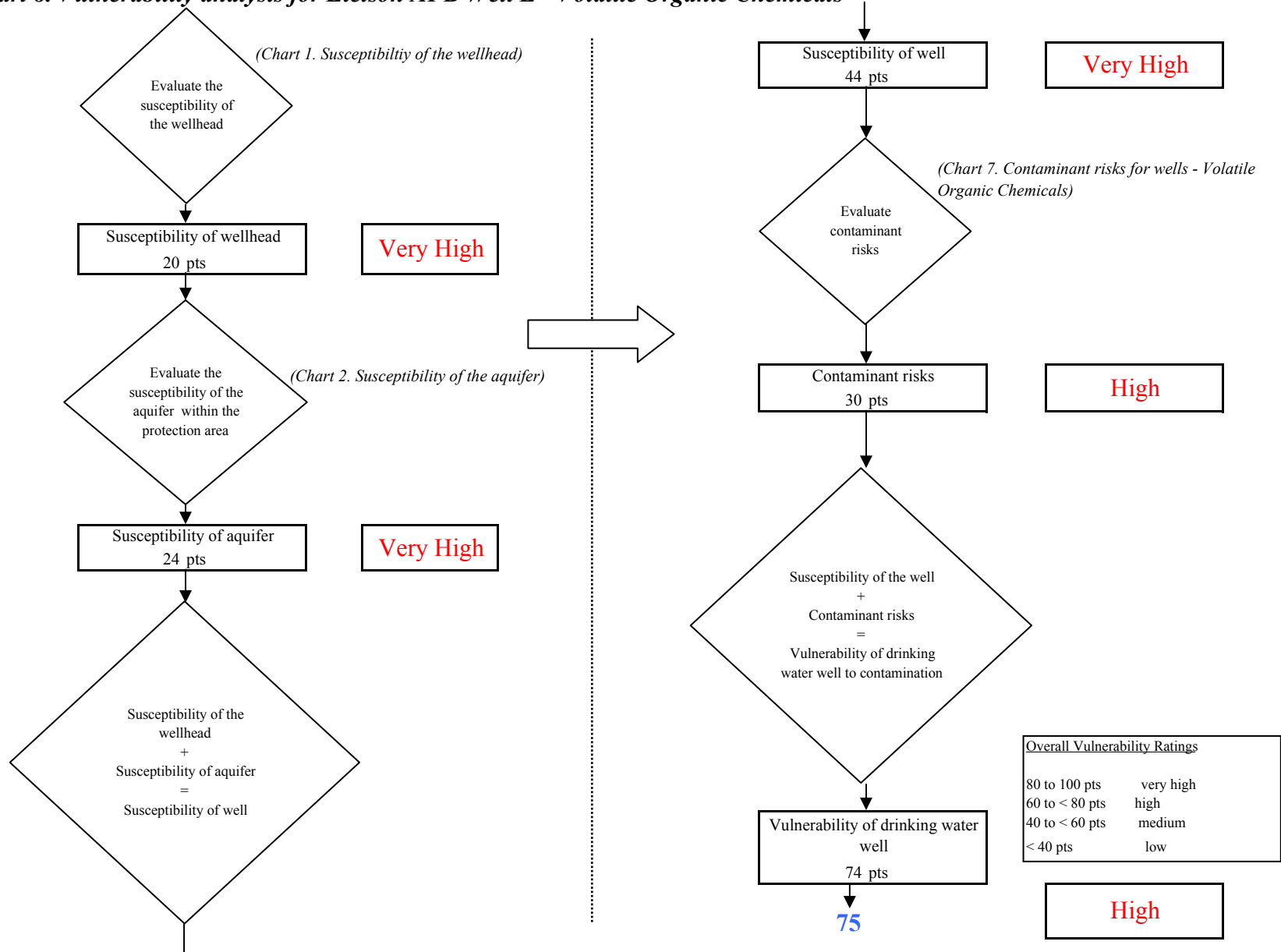
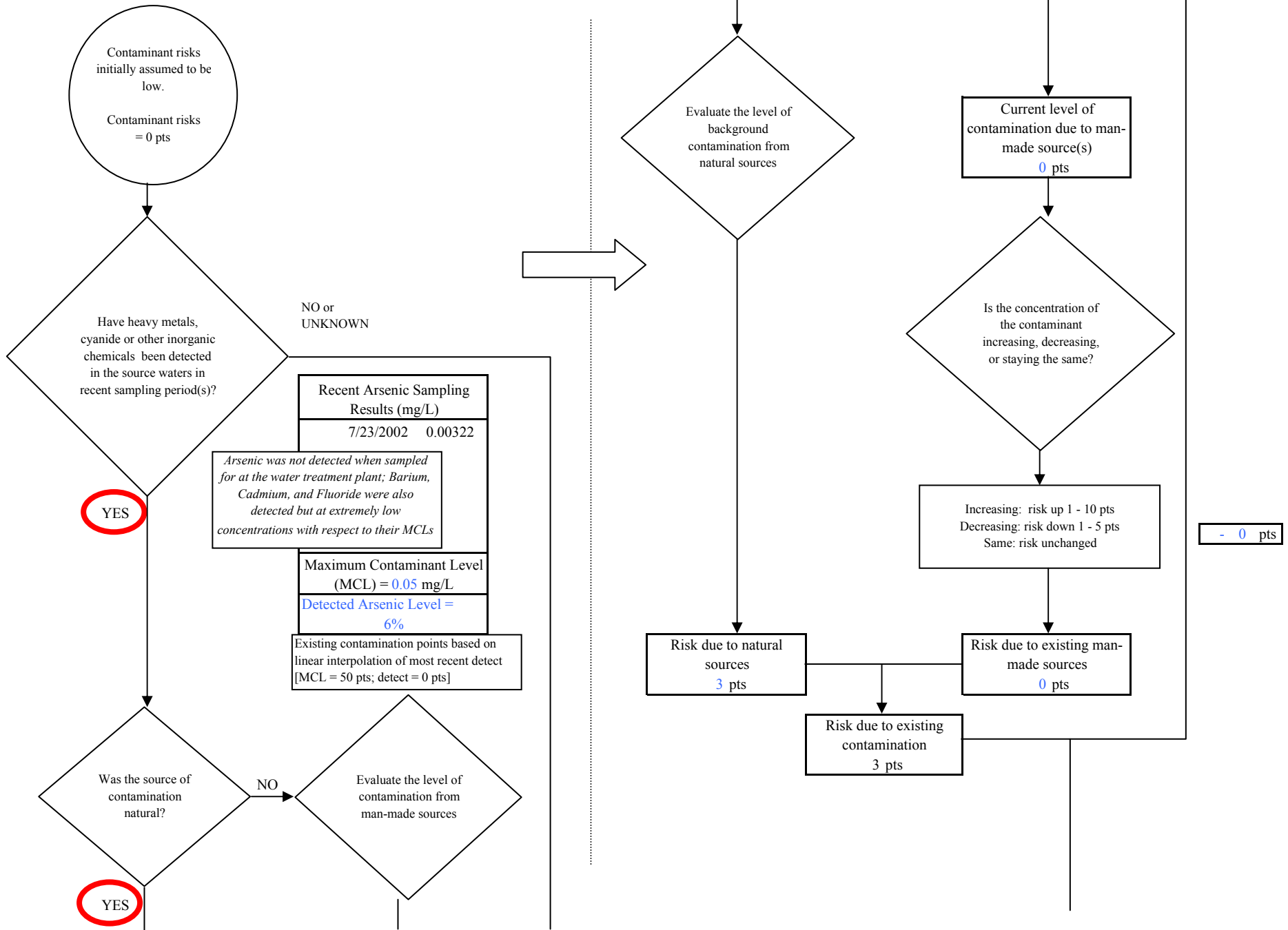
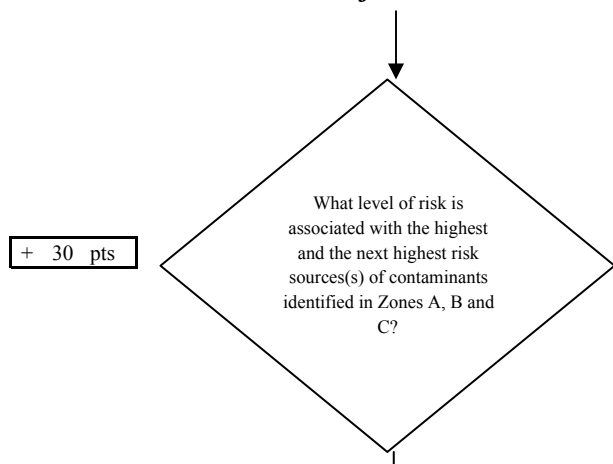


Chart 9. Contaminant risks for Eielson AFB Well E - Heavy Metals, Cyanide and Other Inorganic Chemicals



**Chart 9. Contaminant risks for Eielson AFB Well E - Heavy Metals, Cyanide and Other Inorganic Chemicals**



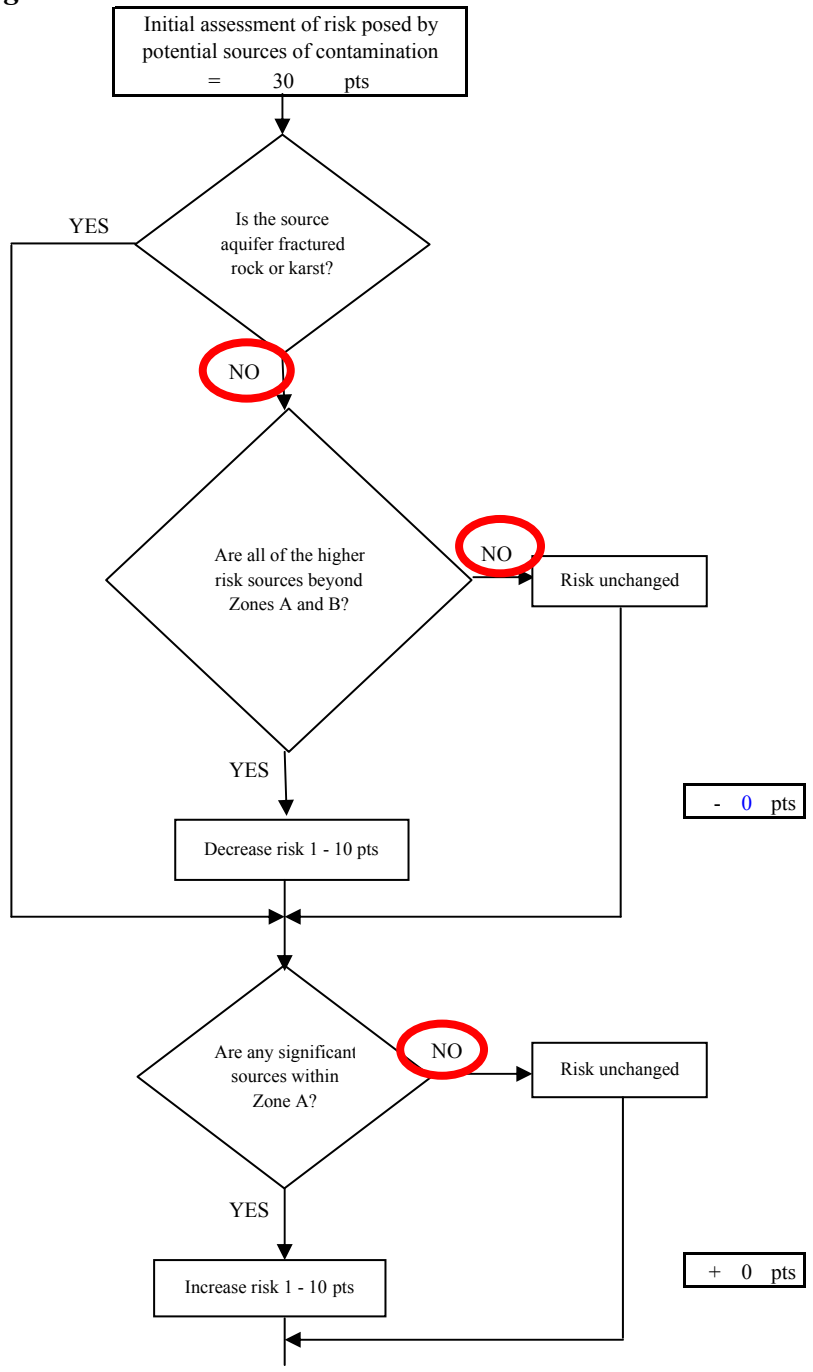
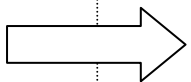
+ 30 pts

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	0	1	1
Medium(s)	1	0	1
Low(s)	2	8	10

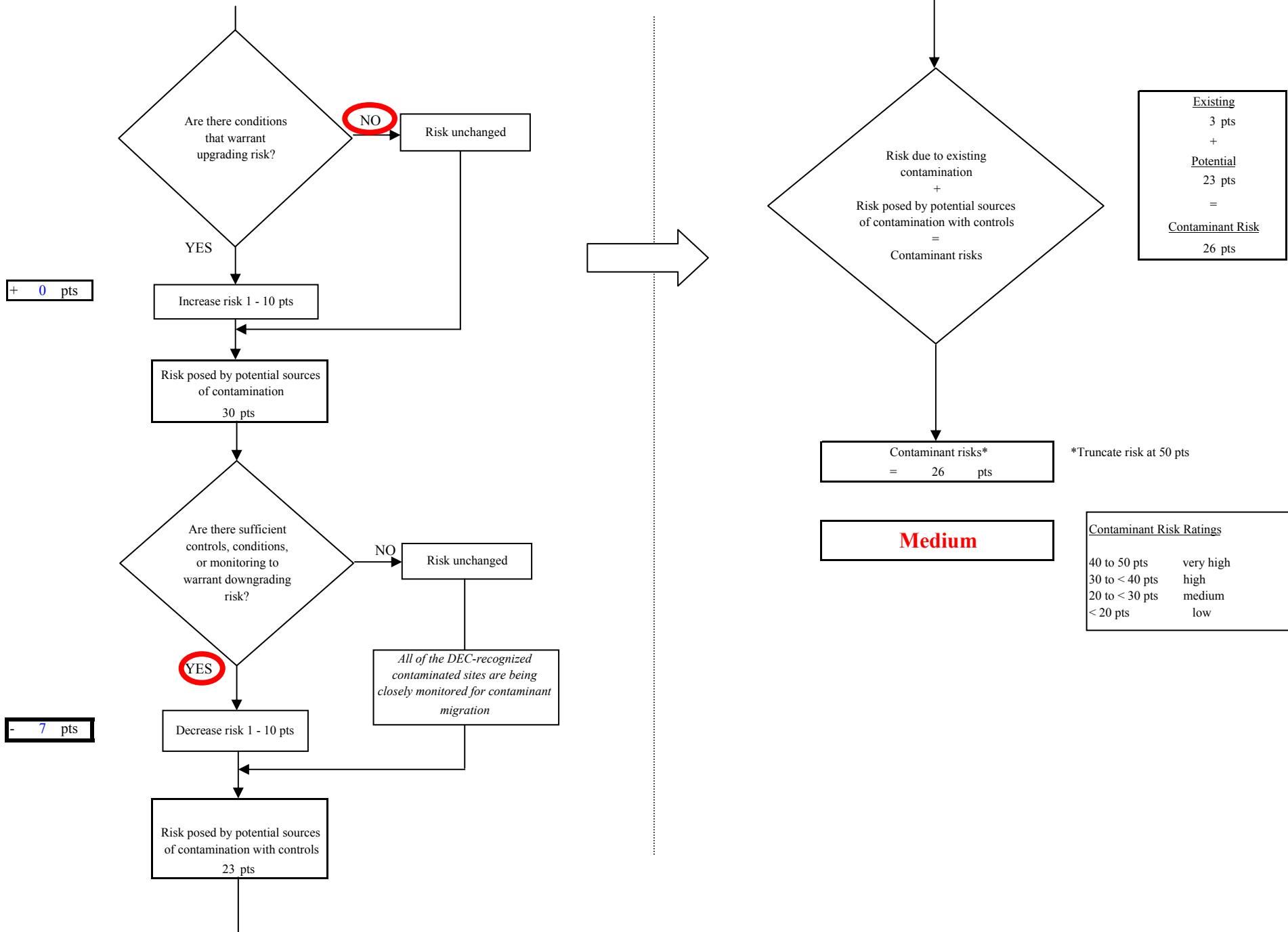
	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
<b>LOW</b>	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
<b>MEDIUM</b>	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
<b>HIGH</b>	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
<b>VERY HIGH</b>	----	----	----	≥ 1 source + 10 pts

Matrix Score      30

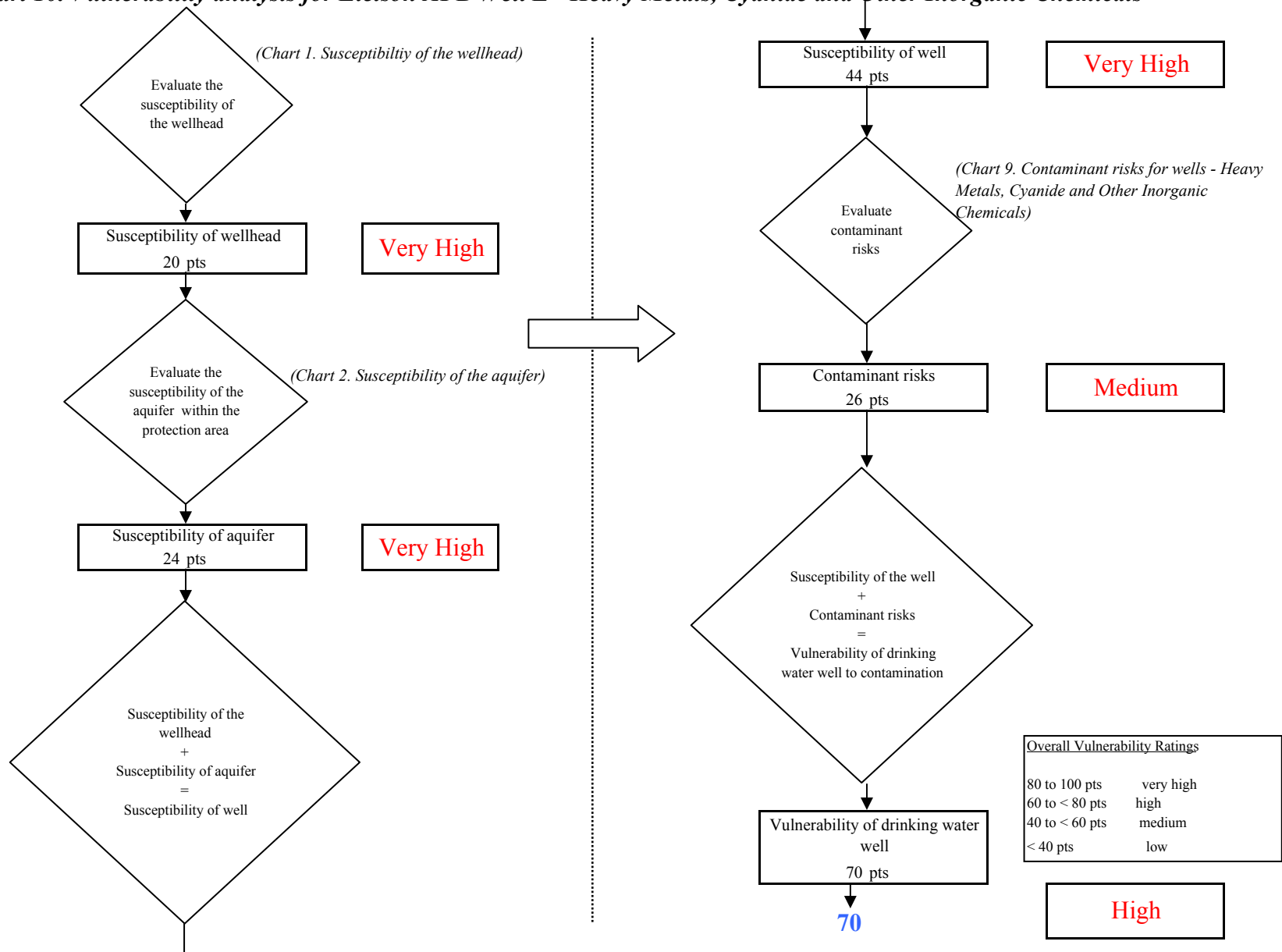
Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



**Chart 9. Contaminant risks for Eielson AFB Well E - Heavy Metals, Cyanide and Other Inorganic Chemicals**



**Chart 10. Vulnerability analysis for Eielson AFB Well E - Heavy Metals, Cyanide and Other Inorganic Chemicals**



**Chart 11. Contaminant risks for Eielson AFB Well E - Synthetic Organic Chemicals**

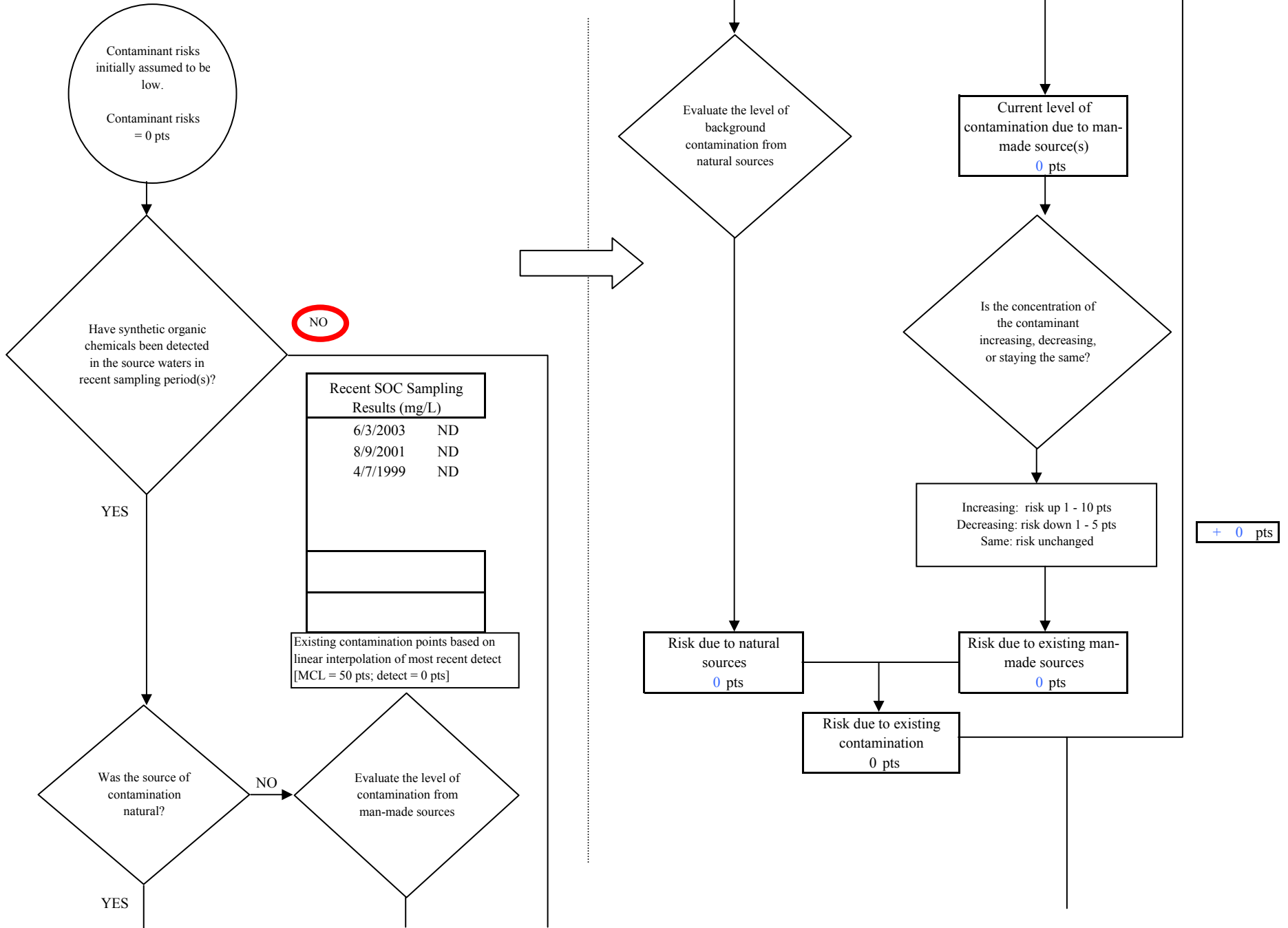
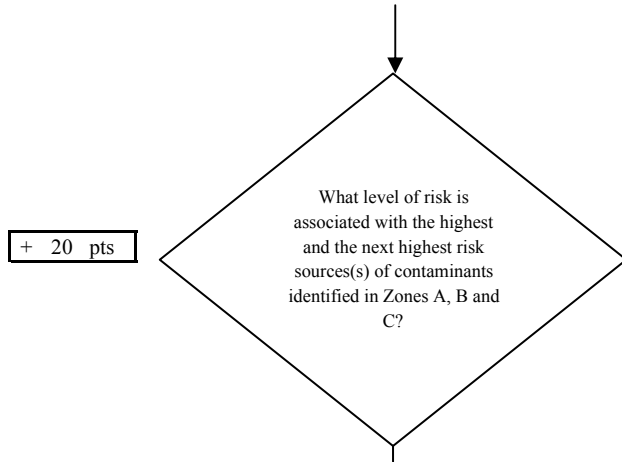




Chart 11. Contaminant risks for Eielson AFB Well E - Synthetic Organic Chemicals



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)	1	1	2
Low(s)	1	1	2

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

Matrix Score 20

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.

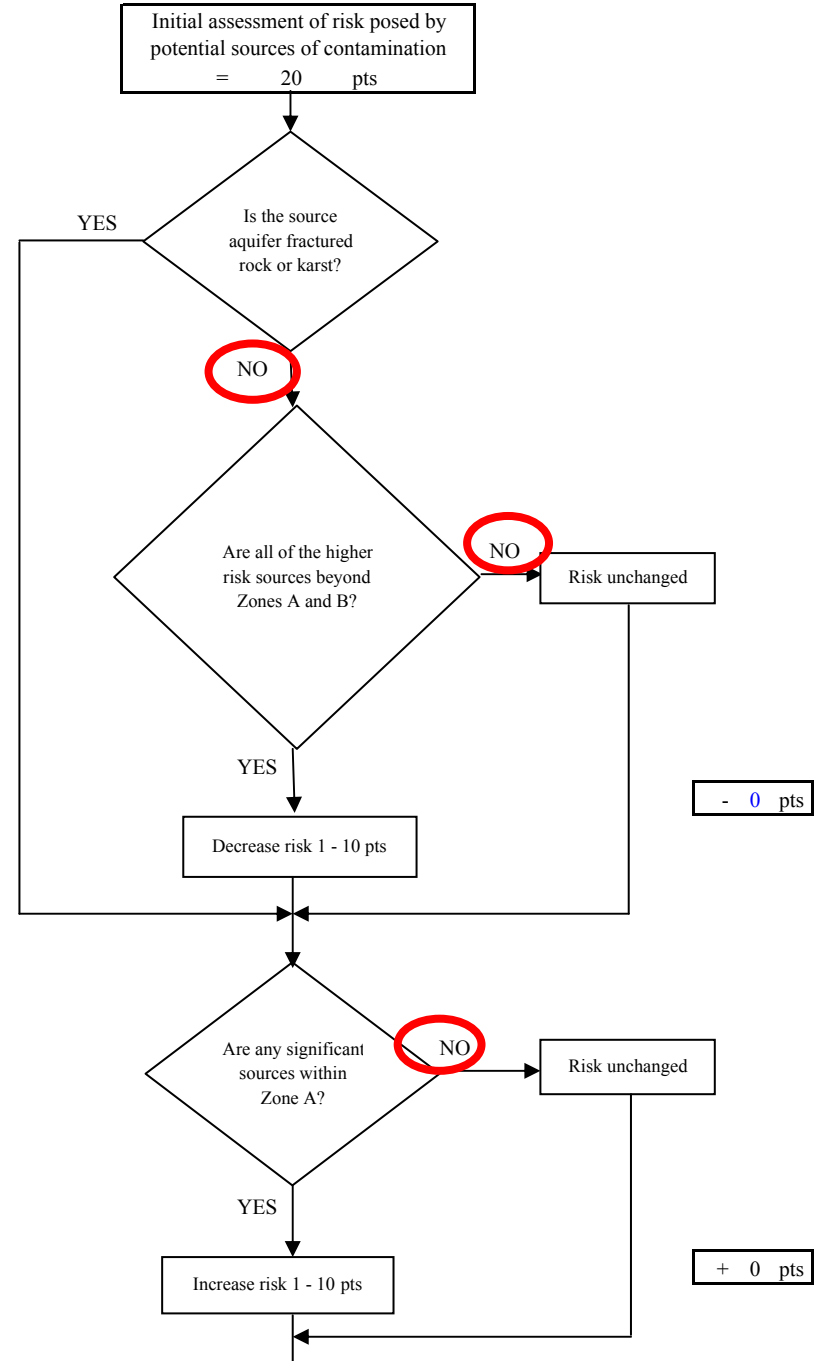
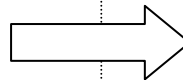
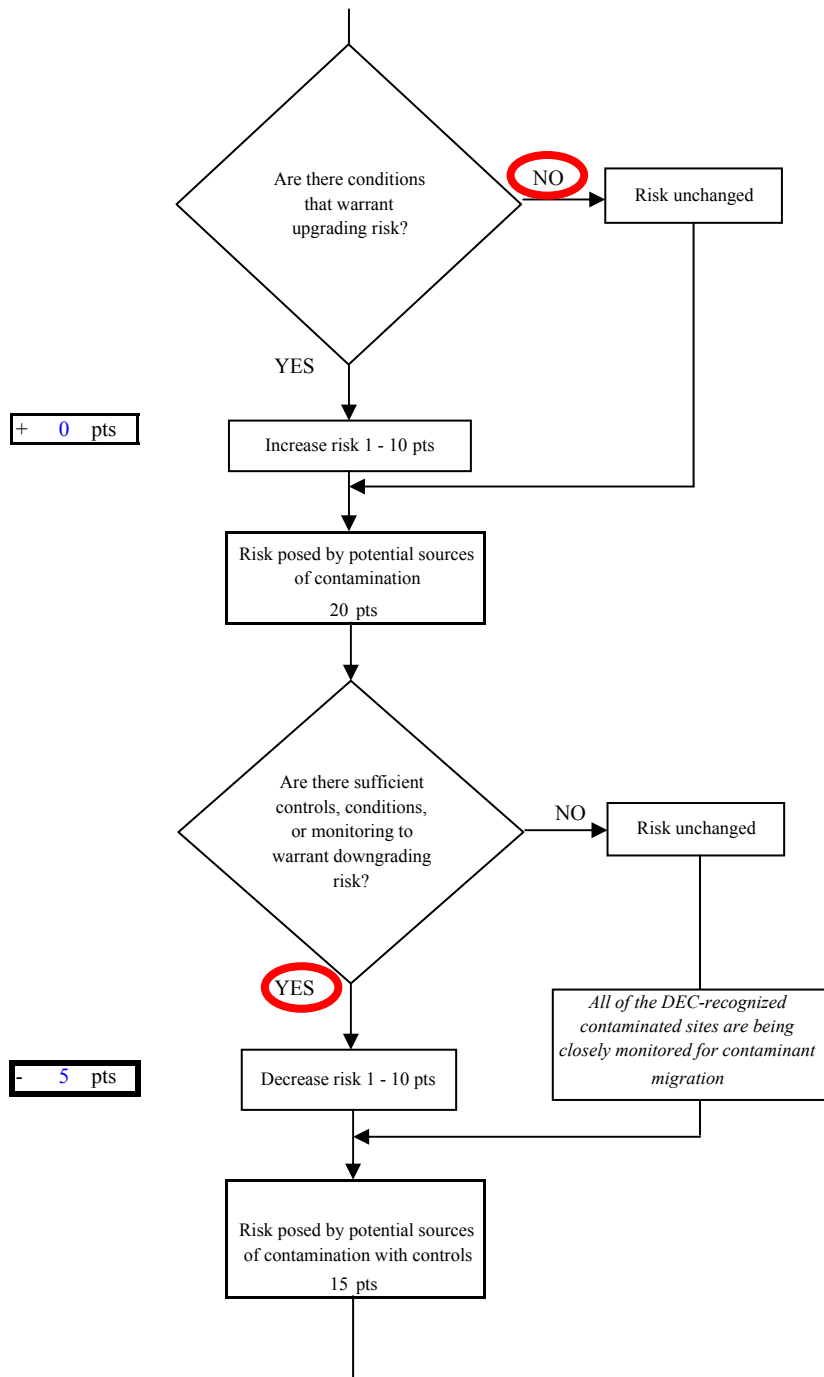
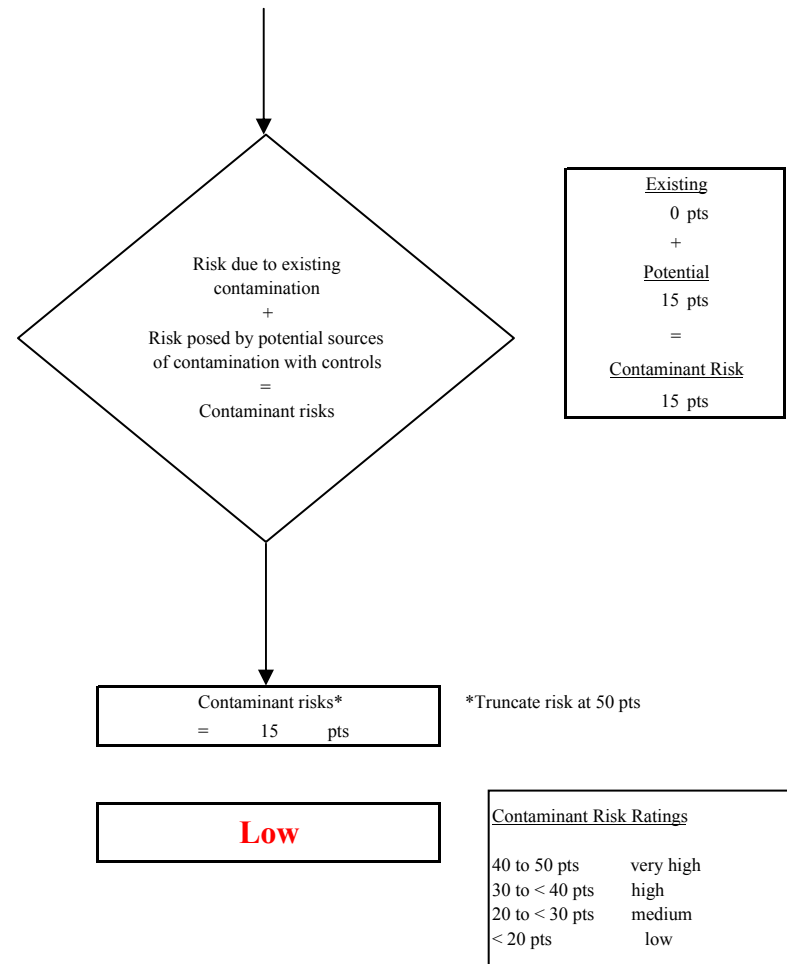
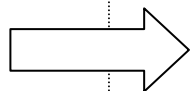


Chart 11. Contaminant risks for Eielson AFB Well E - Synthetic Organic Chemicals

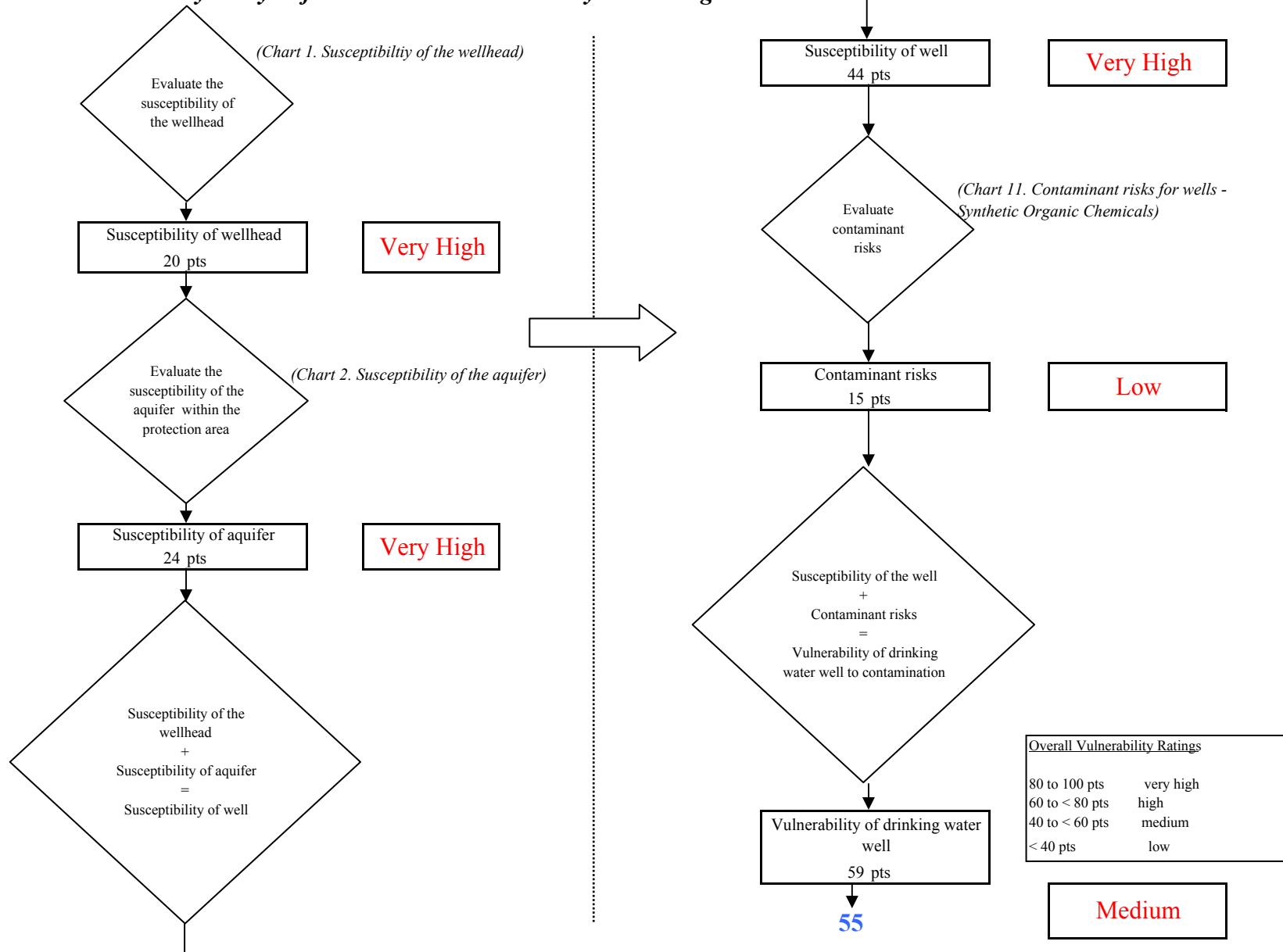


+ 0 pts

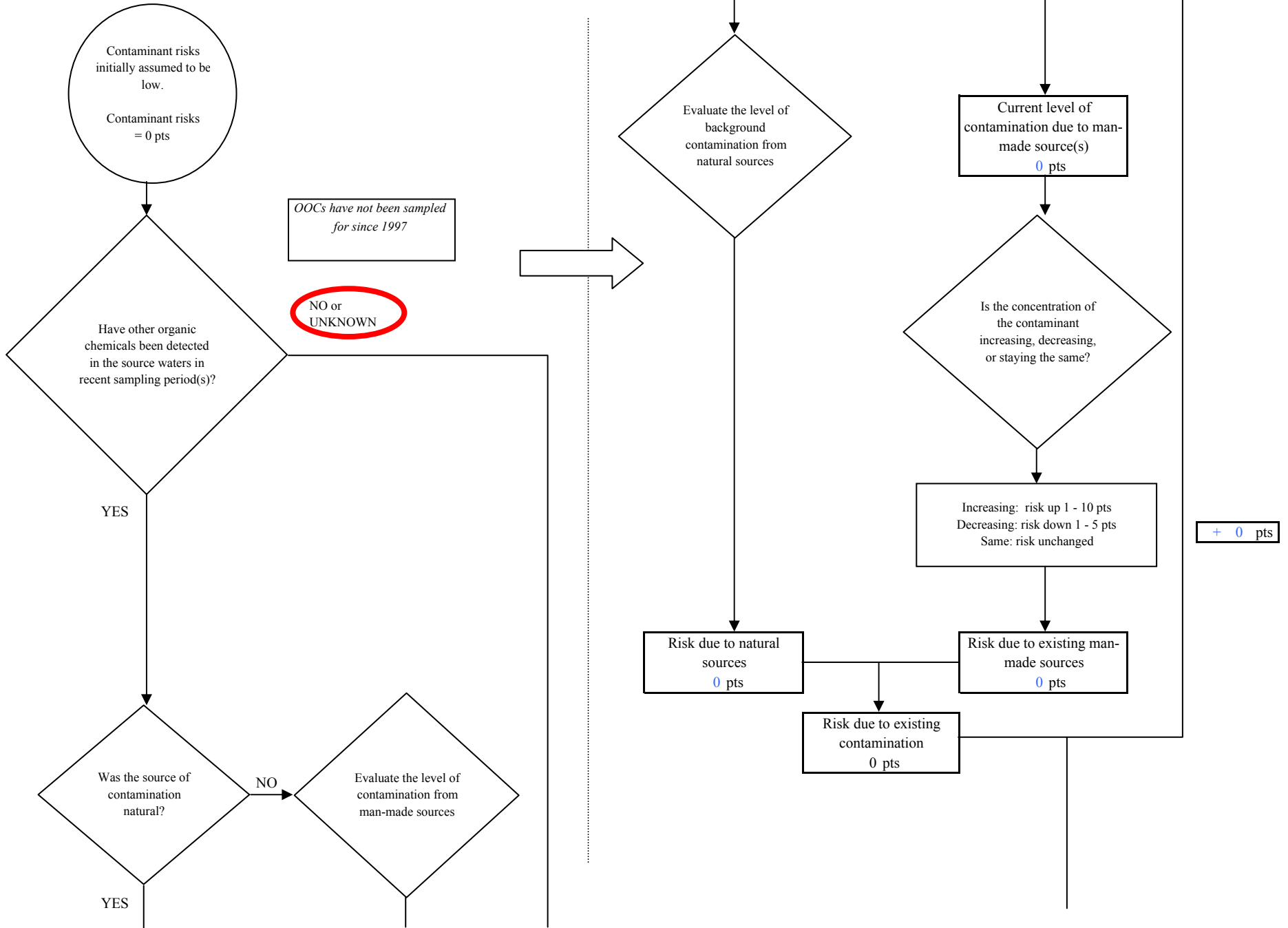
- 5 pts



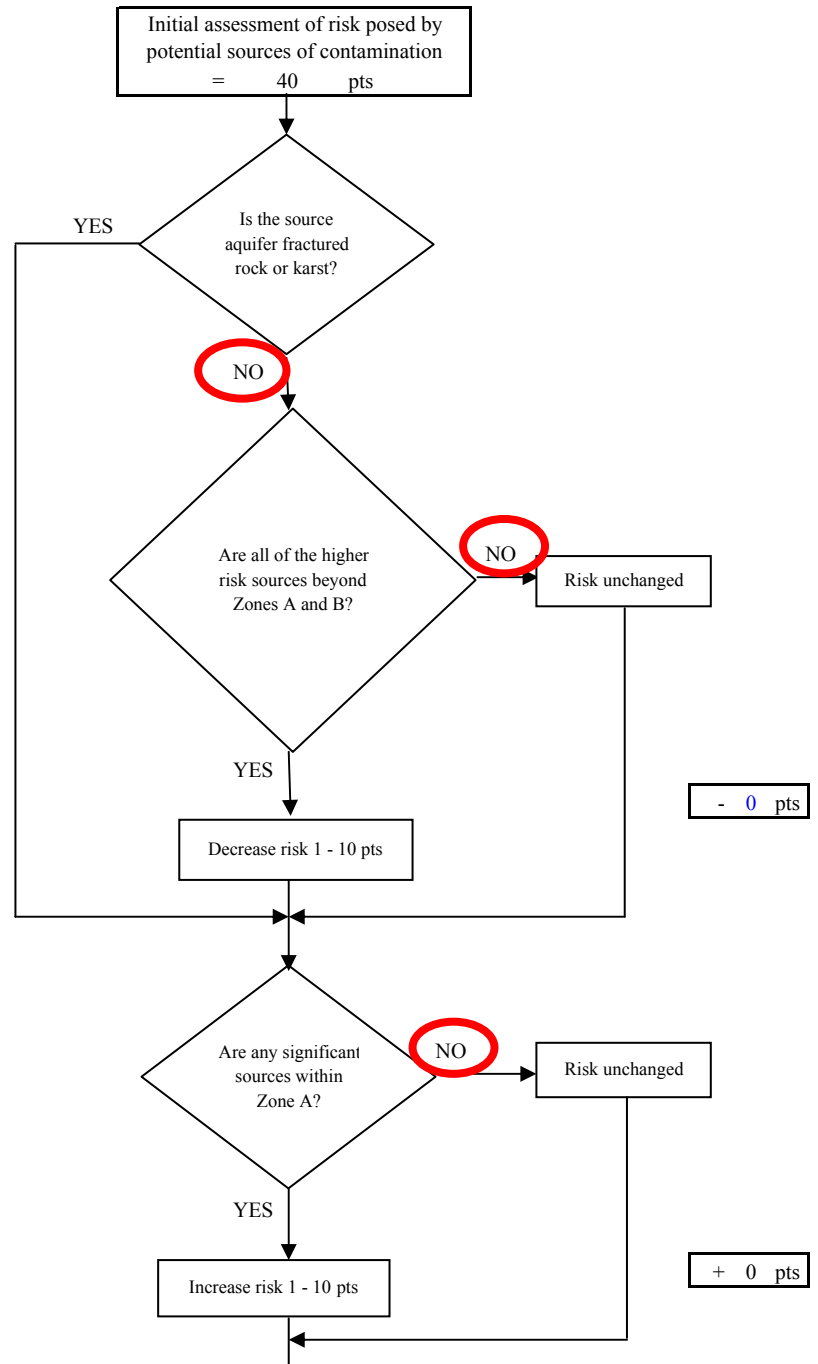
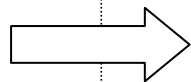
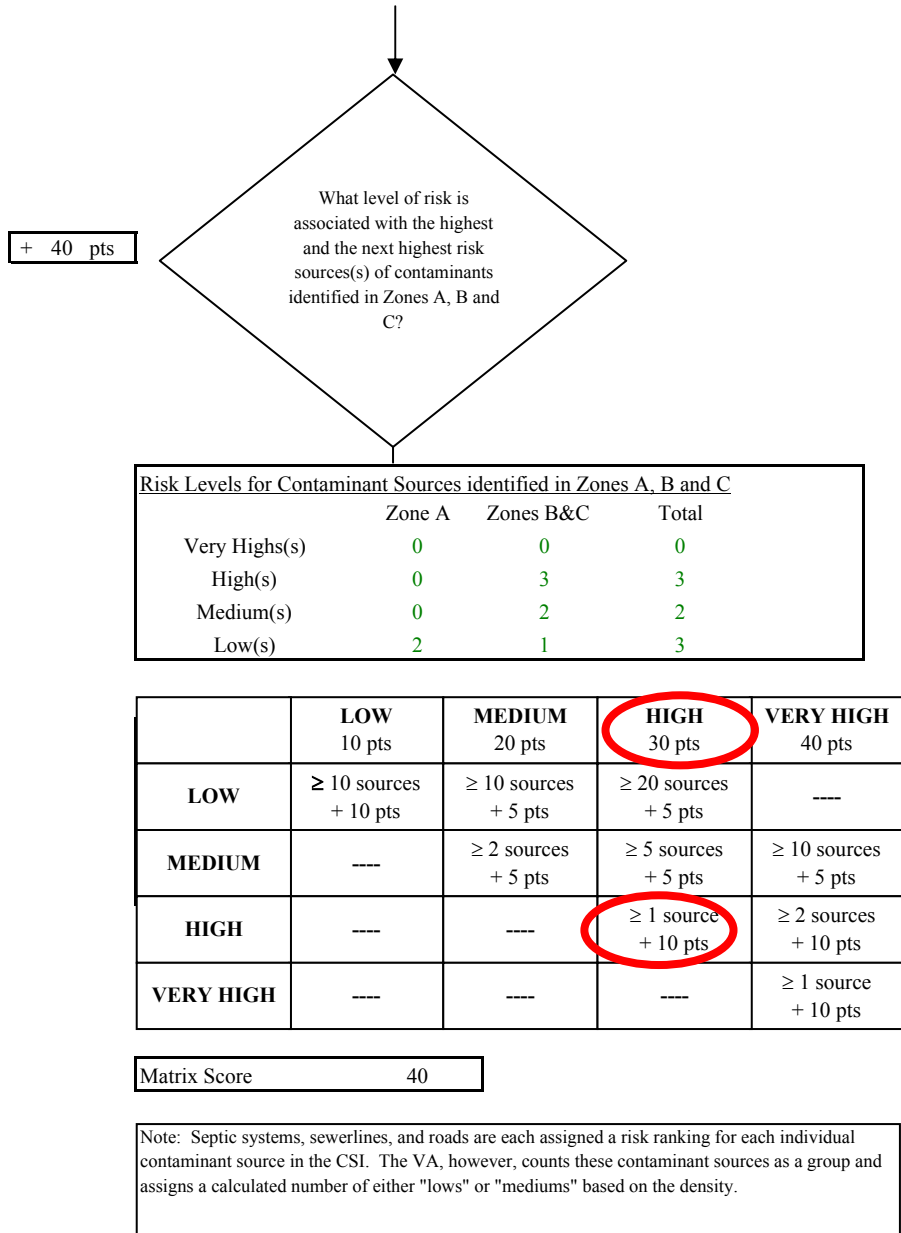
**Chart 12. Vulnerability analysis for Eielson AFB Well E - Synthetic Organic Chemicals**



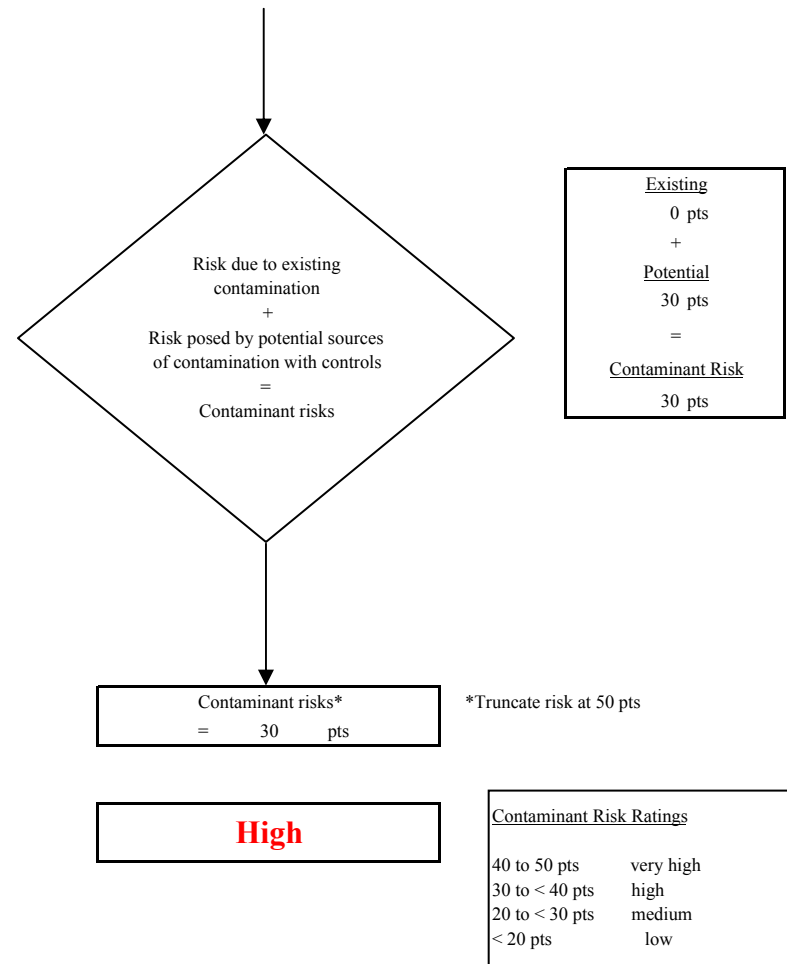
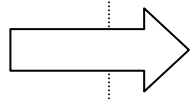
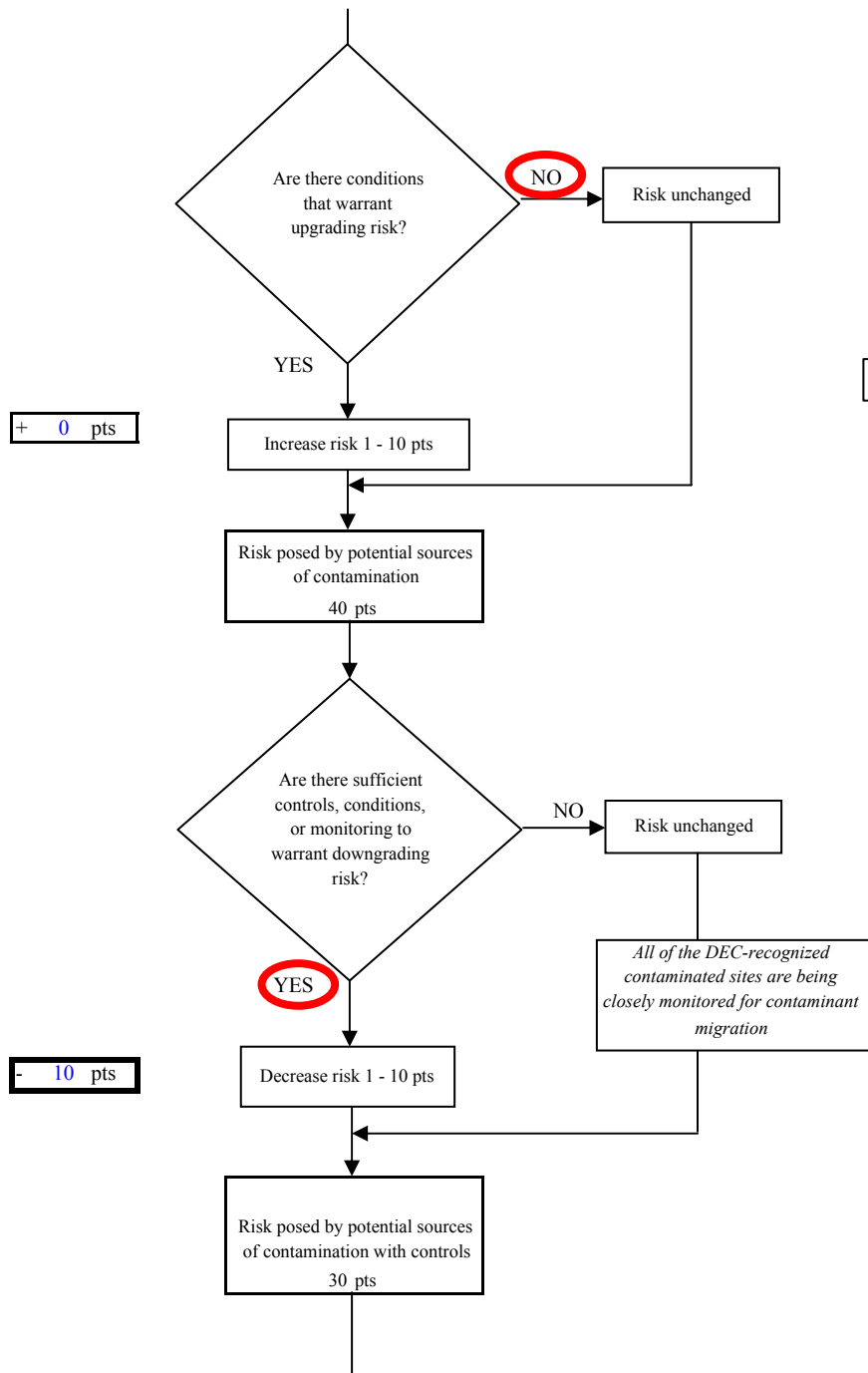
**Chart 13. Contaminant risks for Eielson AFB Well E - Other Organic Chemicals**



**Chart 13. Contaminant risks for Eielson AFB Well E - Other Organic Chemicals**



**Chart 13. Contaminant risks for Eielson AFB Well E - Other Organic Chemicals**



**Chart 14. Vulnerability analysis for Eielson AFB Well E - Other Organic Chemicals**

