Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Eielson Air Force Base Well 7, Eielson Air Force Base, Alaska PWSID 370625.005

May 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1521
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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APPENDICES

Source Water Assessment for Eielson Air Force Base Well 7
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 7 located near Building 6204 on Eielson Air Force Base, Alaska. Well 7 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 **High** rating for the aquifer in which Well 7 is drawing its water from. Identified potential and current sources of contamination for the Eielson Air Force Base Well 7 public water system include: a road and a sewer line. 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 7 received an overall vulnerability rating of **Medium** for all six contaminant categories.

EIELSON AIR FORCE BASE WELL 7 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 7. Well 7 is used as a backup source of water for this public water system. Well 7 is located at Building 1301 along Cargain Road on Eielson Air Force Base, Alaska (T3S, R3E, Section 24) (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 7 is located in the alluvial plain at an elevation of approximately 550 feet above sea level.

According to the 11/07/03 Sanitary Survey, the depth of Well 7 is 103 feet below the ground surface. Other wells in this area are screened in sands and gravels and it is assumed this one is also. 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 4,720 non-residents through 2,100 service connections.

EIELSON AIR FORCE BASE WELL 7 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 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 7 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 7 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 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 7 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 7 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 7 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 nd 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 7 of Eielson Air Force Base received a Low Susceptibility rating. The 11/7/03 Sanitary Survey indicates that Well 7 may not be capped with a sanitary seal, and the well is not grouted. However, the land surface is sloped away from the well. 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 7 well is completed in received a 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. Table 2 summarizes the Susceptibility scores and ratings for Eielson Air Force Base Well 7.

Table 2. Susceptibility

	Score	**Rating**
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	16	High
Natural Susceptibility	41	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	10	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	14	Low
Synthetic Organic Chemicals	10	Low
Other Organic Chemicals	10	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 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	55	Medium
Volatile Organic Chemicals	50	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	55	Medium
Synthetic Organic Chemicals	50	Medium
Other Organic Chemicals	50	Medium

Bacteria and Viruses

The sewer lines represent the greatest risk of Bacteria and Viruses to this water system. The sewer lines are encased within a concrete utilidor providing some protection.

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 7.

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 road and the sewer lines represent the risk for volatile organic chemical contamination to the well.

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 medium.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The road and sewer lines also represent the only identified risks to heavy metals for this source of public drinking water.

Barium, Cadmium, and Fluoride have all been detected in extremely low concentrations with respect to their MCLs. An MCL is the concentration of a contaminant allowed in the drinking water by the Environmental Protection Area (EPA). 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 medium.

Synthetic Organic Chemicals

The sewer lines represent the only identified 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

Again, the road and the sewer lines represent the only identified 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 medium.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL 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 7
Drinking Water Protection Area Location Map
(Map 1)

Well B
Well D
Well A
Well E
Well 7
QUARRY ROAD
OUTER LOOP
EIELSON FARM ROAD
CENTRAL STREET
RICHARDSON HIGHWAY
ALASKA RAILROAD
OLD VALDEZ TRAIL
RINGO AVENUE
DORT DRIVE
PRINCE STREET
CASPER AVENUE
SWEDE AVENUE
SKILA STREET
FRENCH CREEK
AICUZ AVENUE
MILITARY PIPELINE

Map 1: Eielson AFB Drinking Water Protection Areas

PWSID: 370625

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 2,025 4,050 8,100 Feet

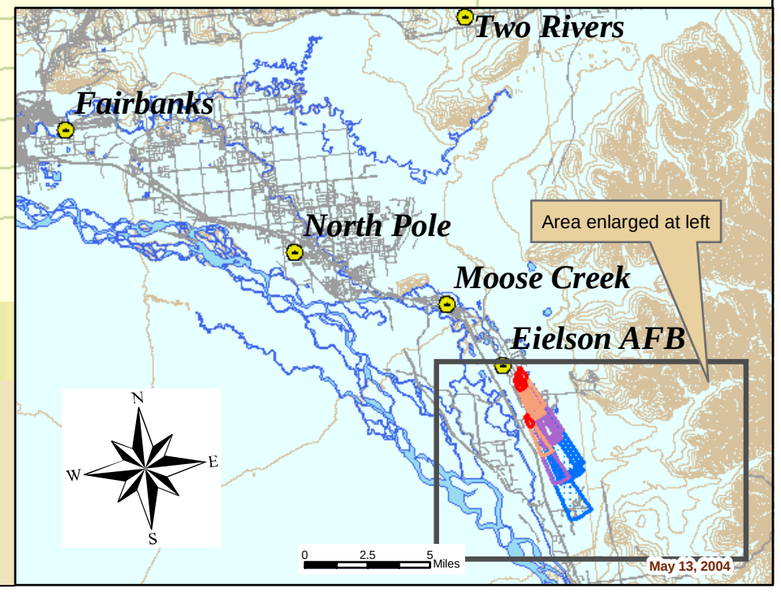
1:48,600

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 7 (Tables 1-7)

Table 1

Contaminant Source Inventory for
Eielson - Air Force Base Well 7

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	2	One sewer line within the utilidor
Highways and roads, paved (cement or asphalt)	X20		A	2	one road in Zone A

Table 2

Contaminant Source Inventory and Risk Ranking for Eielson - Air Force Base Well 7 Sources of Bacteria and Viruses

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Medium	2	One sewer line within the utilidor
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	one road in Zone A

Table 3

Contaminant Source Inventory and Risk Ranking for Eielson - Air Force Base Well 7 Sources of Nitrates/Nitrites

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Medium	2	One sewer line within the utilidor
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	one road in Zone A

Table 4

Contaminant Source Inventory and Risk Ranking for Eielson - Air Force Base Well 7 Sources of Volatile Organic Chemicals

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	One sewer line within the utilidor
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	one road in Zone A

Table 5

Contaminant Source Inventory and Risk Ranking for Eielson - Air Force Base Well 7 Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	One sewer line within the utilidor
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	one road in Zone A

Table 6

Contaminant Source Inventory and Risk Ranking for Eielson - Air Force Base Well 7 Sources of Synthetic Organic Chemicals

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	One sewer line within the utilidor

Table 7

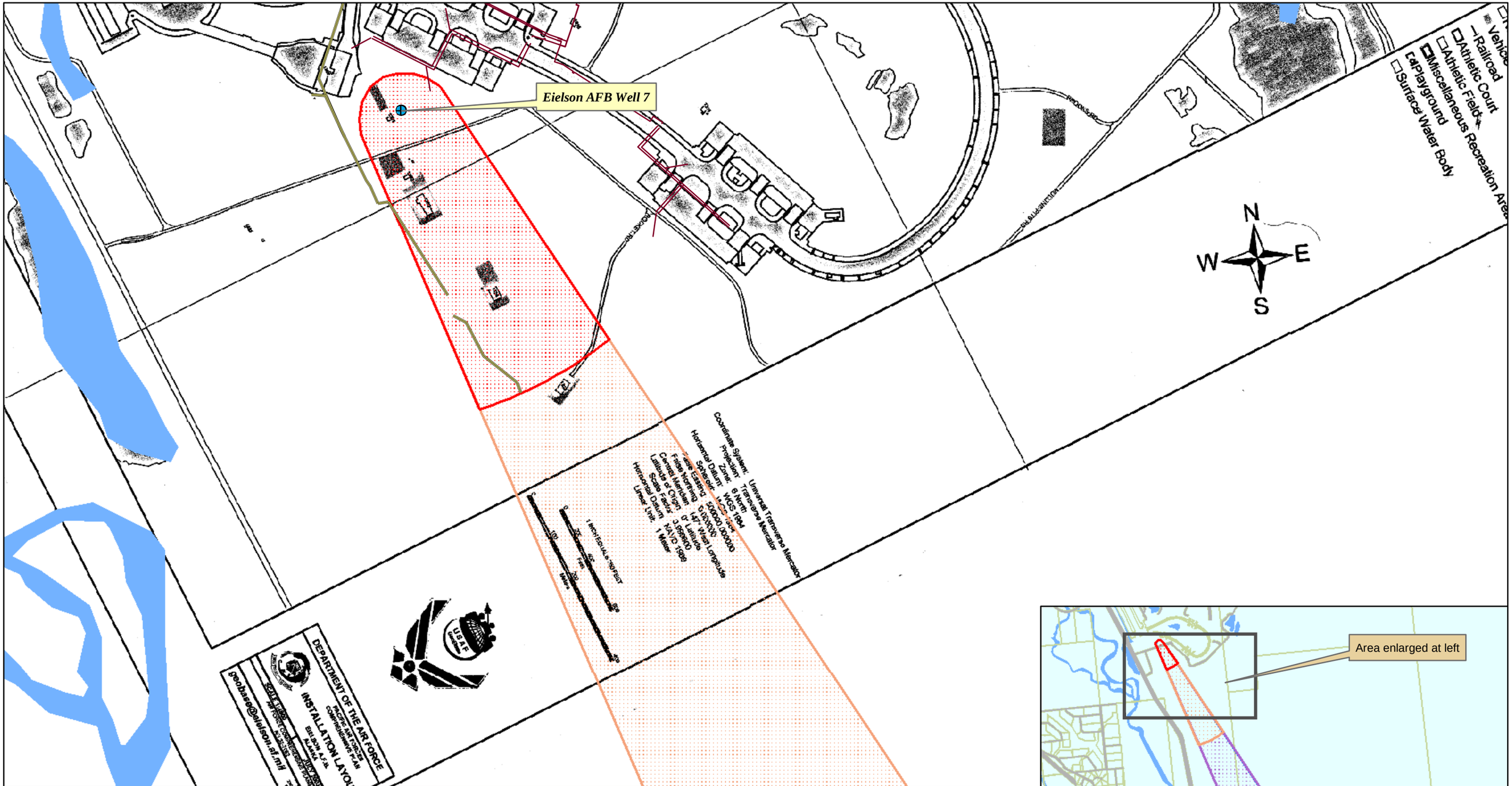
Contaminant Source Inventory and Risk Ranking for Eielson - Air Force Base Well 7 Sources of Other Organic Chemicals

PWSID 370625.005

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01		A	Low	2	One sewer line within the utilidor
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	one road in Zone A

APPENDIX C

Eielson Air Force Base Well 7
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)



Map 2: Eielson AFB Well 7 Potential Contaminant Sources

PWSID: 370625.005

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 335 670 1,340 2,010 Feet

1:8,040

Data Sources:

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

Legend

- Roads
- Parcels
- Surface water
- Utilidors
- Fuel
- Zone A
- Zone B
- Zone C
- Zone D
- Eielson AFB Well 7

0 0.5 1 2 3 Miles

APPENDIX D

Vulnerability Analysis for Eielson Air Force Base Well 7 Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Eielson AFB Well 7

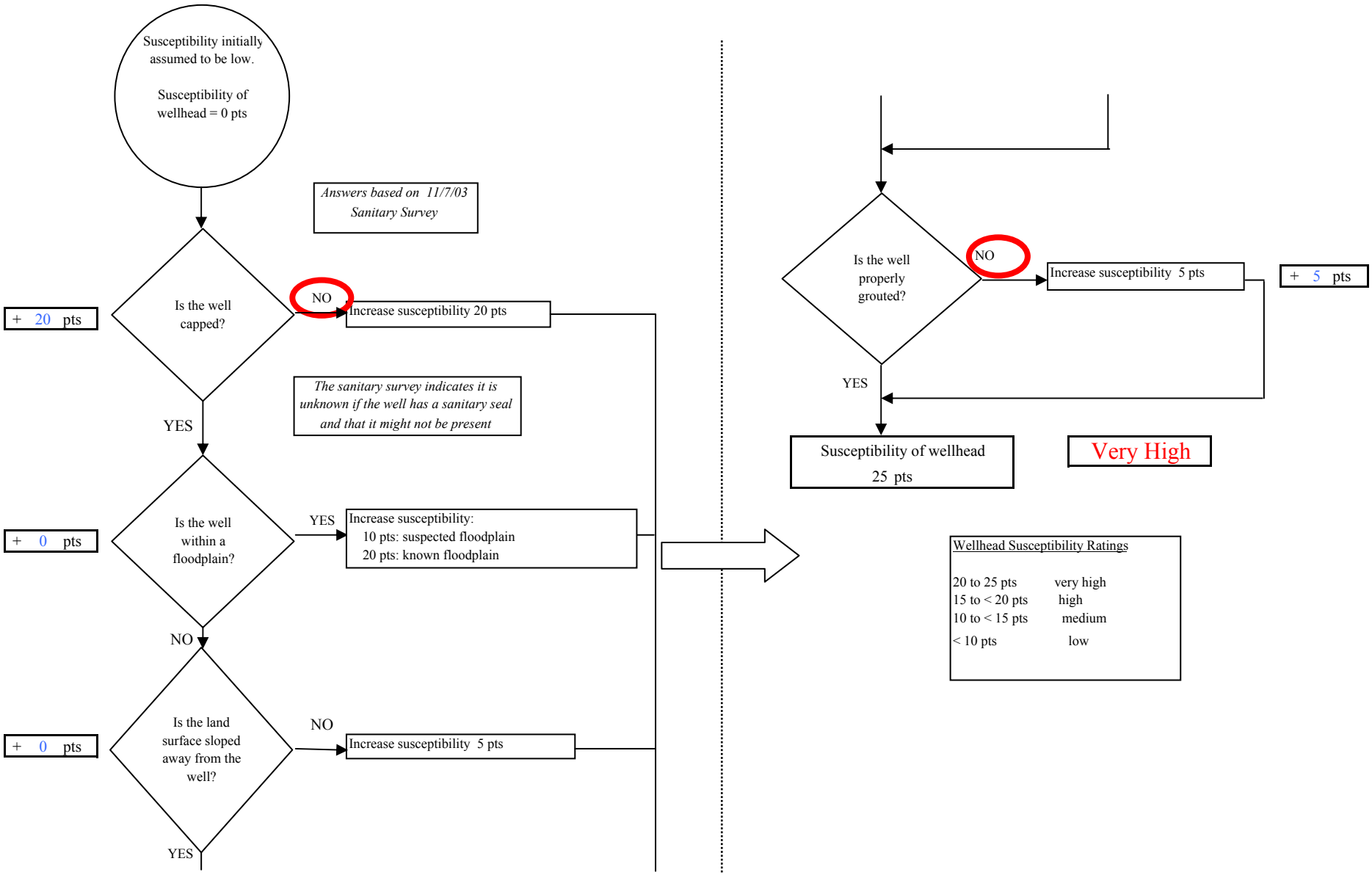


Chart 2. Susceptibility of the aquifer - Eielson AFB Well 7

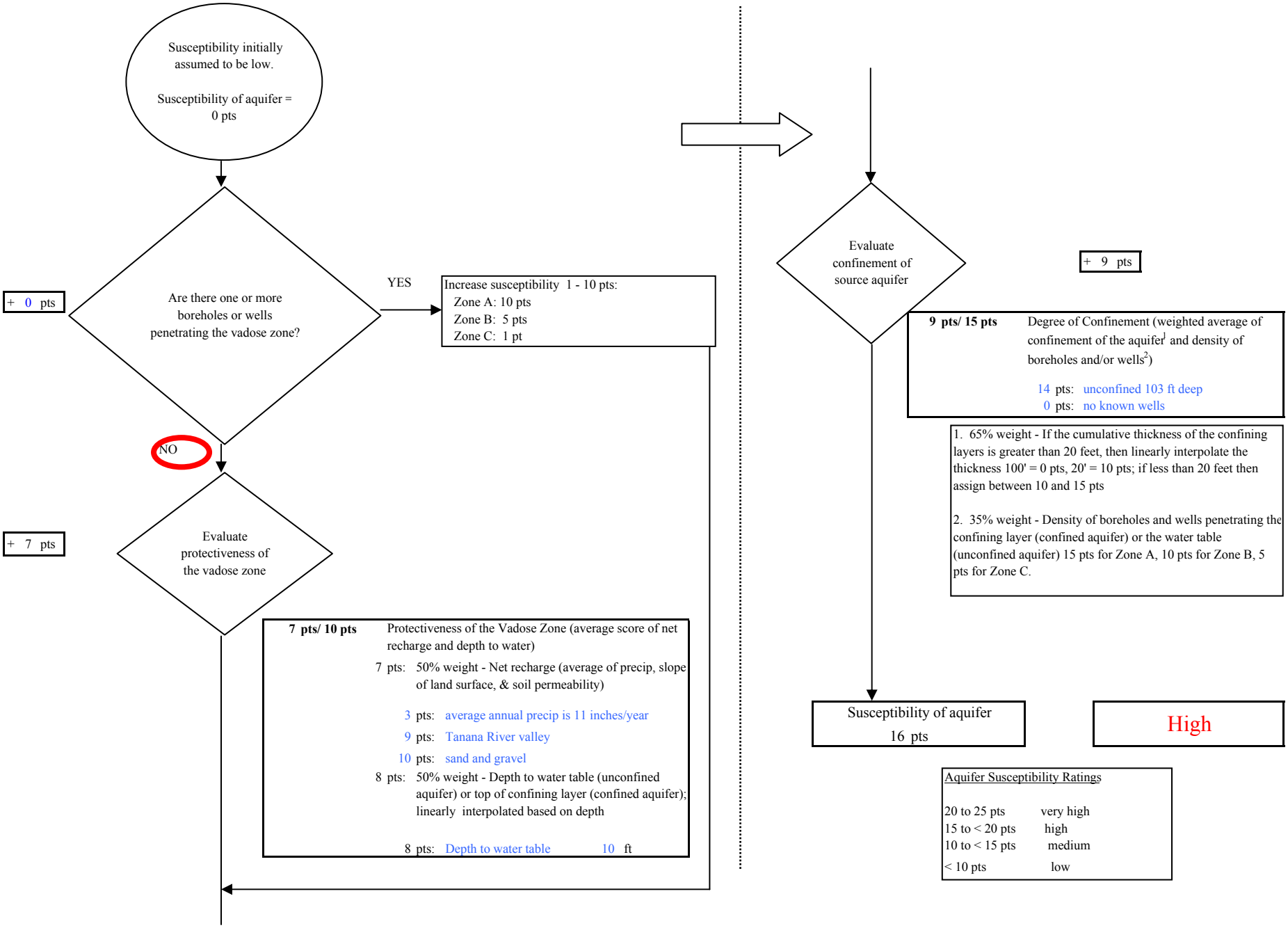
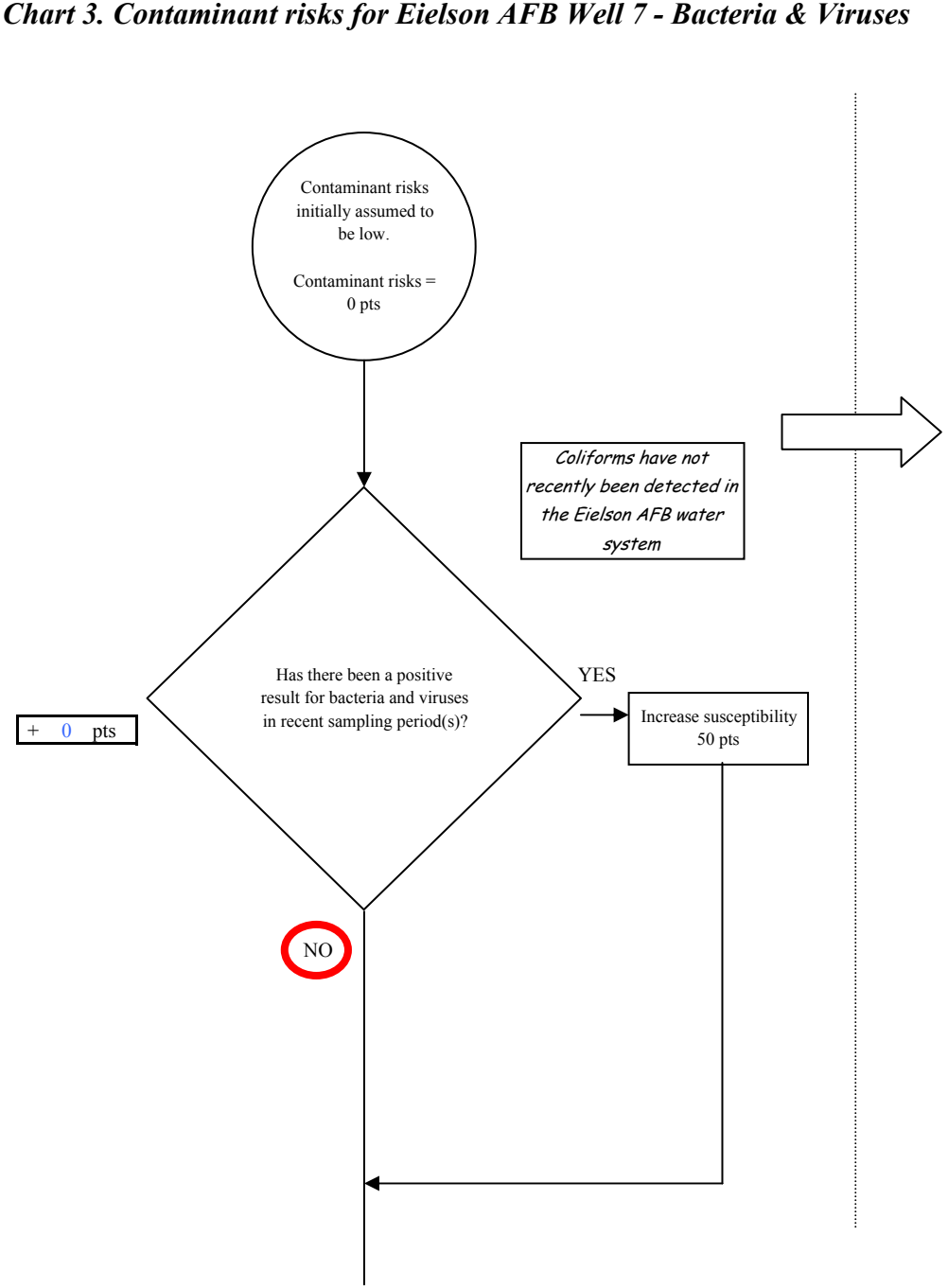
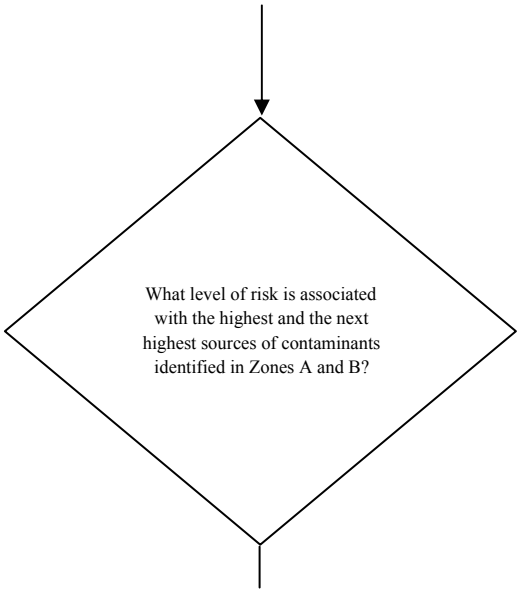


Chart 3. Contaminant risks for Eielson AFB Well 7 - Bacteria & Viruses





+ 20 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)	0	0	0
Medium(s)	1	0	1
Low(s)	1	0	1

	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 3. Contaminant risks for Eielson AFB Well 7 - Bacteria & Viruses

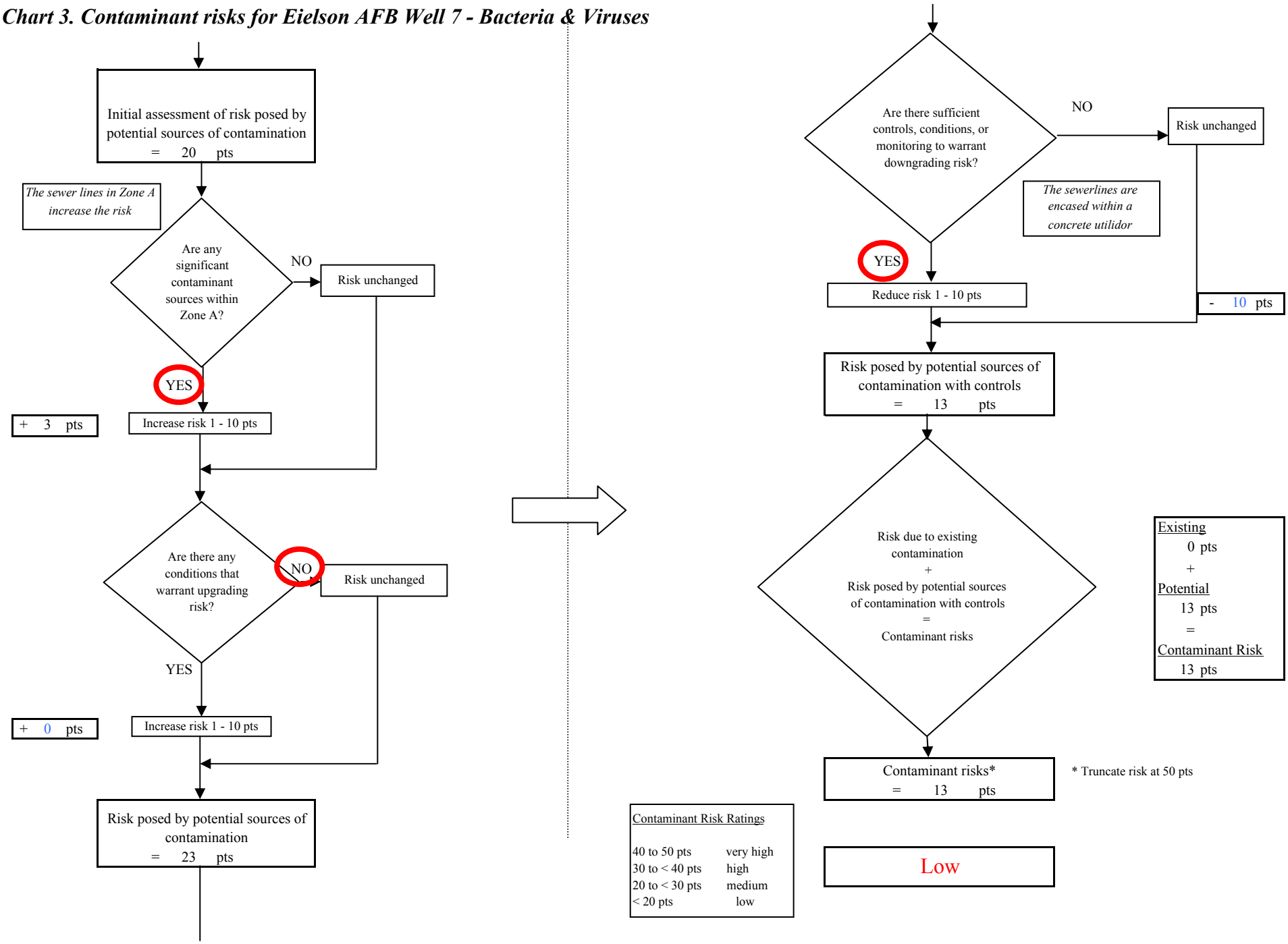


Chart 4. Vulnerability analysis for Eielson AFB Well 7 - Bacteria & Viruses

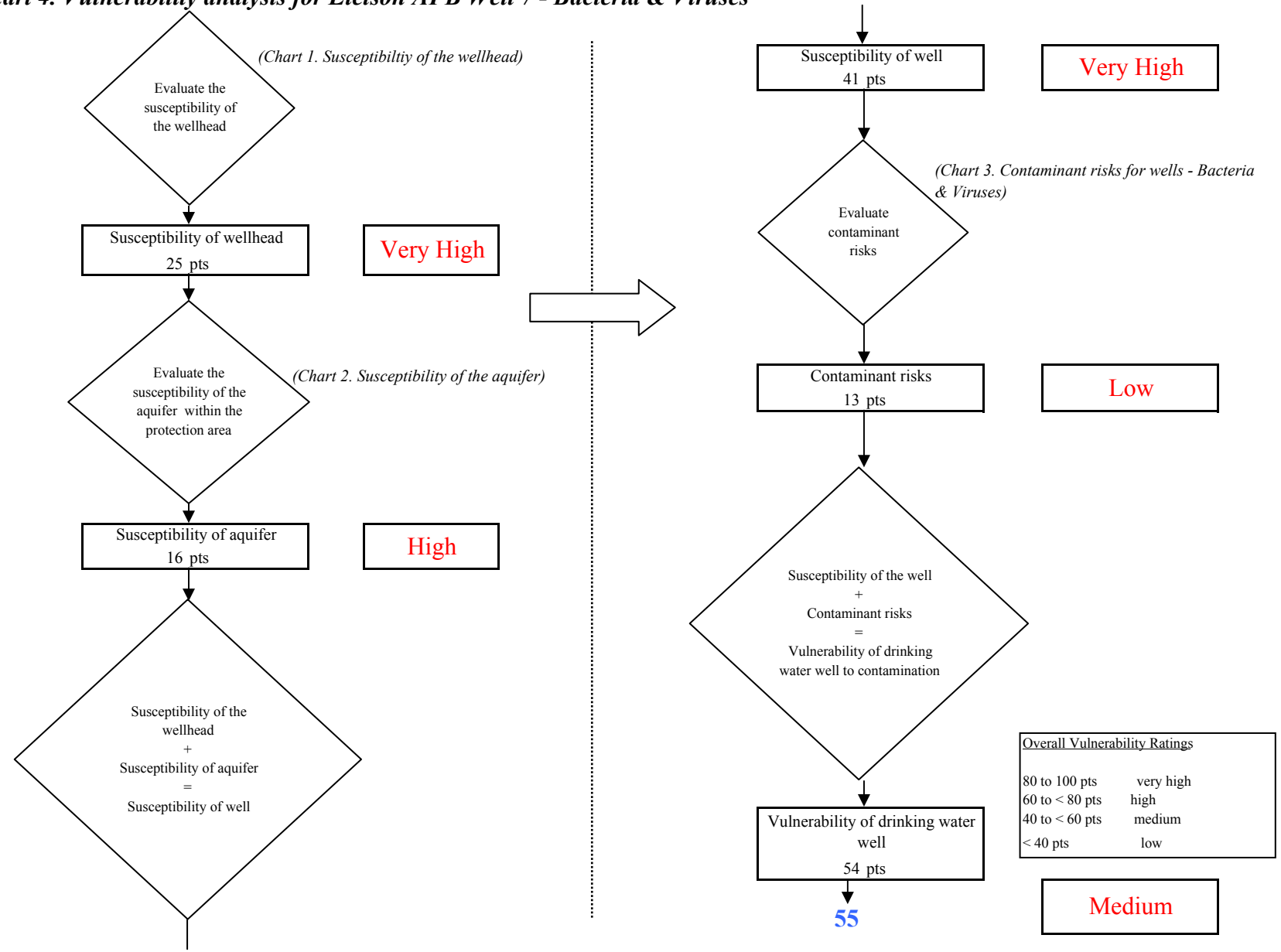


Chart 5. Contaminant risks for Eielson AFB Well 7 - Nitrates and Nitrites

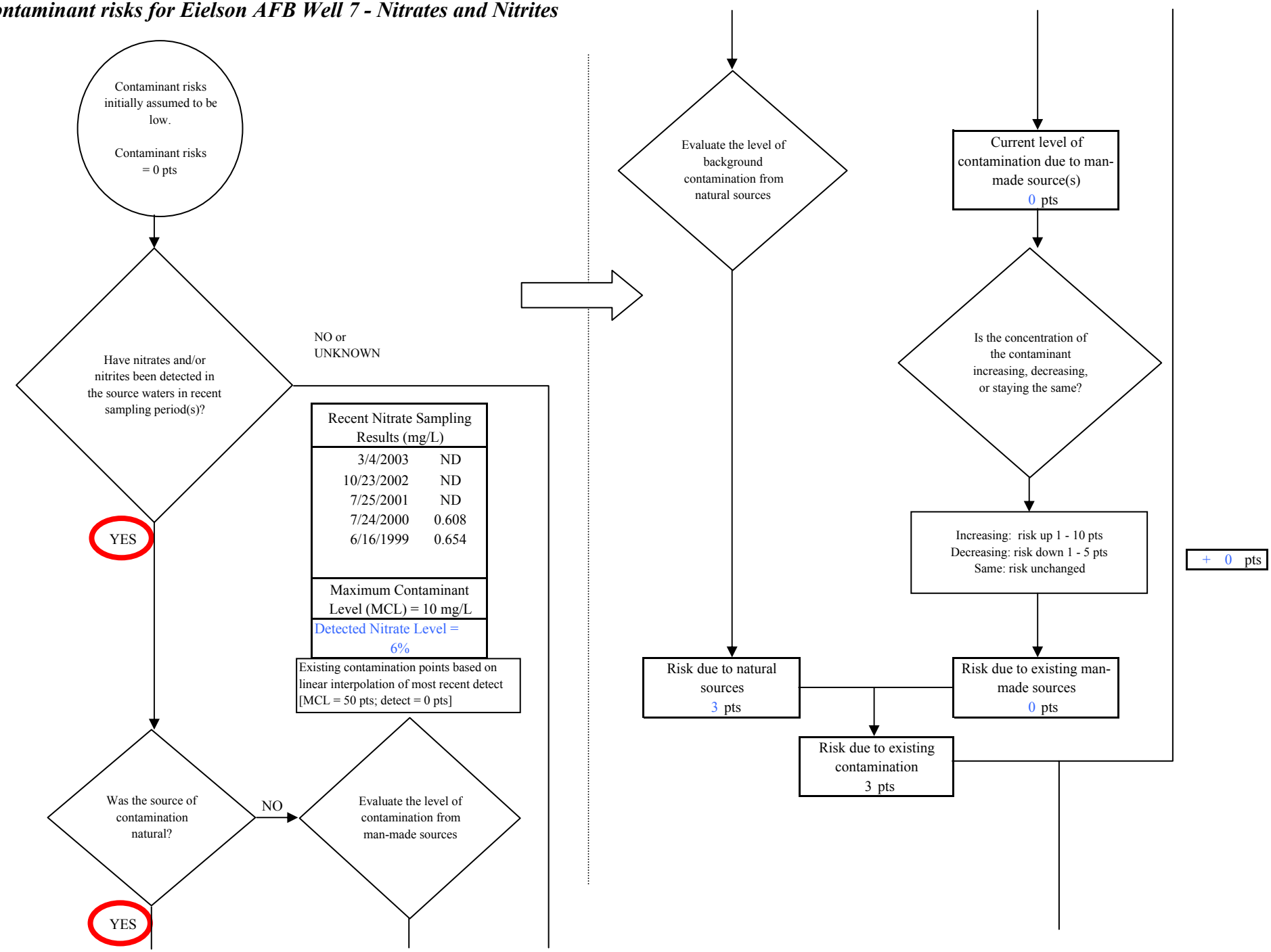
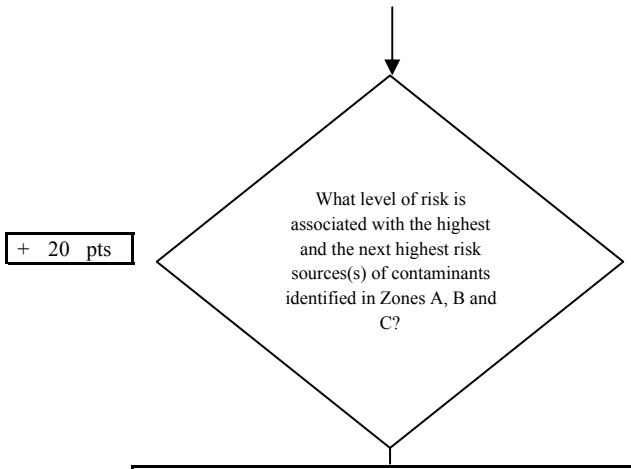


Chart 5. Contaminant risks for Eielson AFB Well 7 - Nitrates and Nitrites



+ 20 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)	1	0	1
Low(s)	1	0	1

	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.

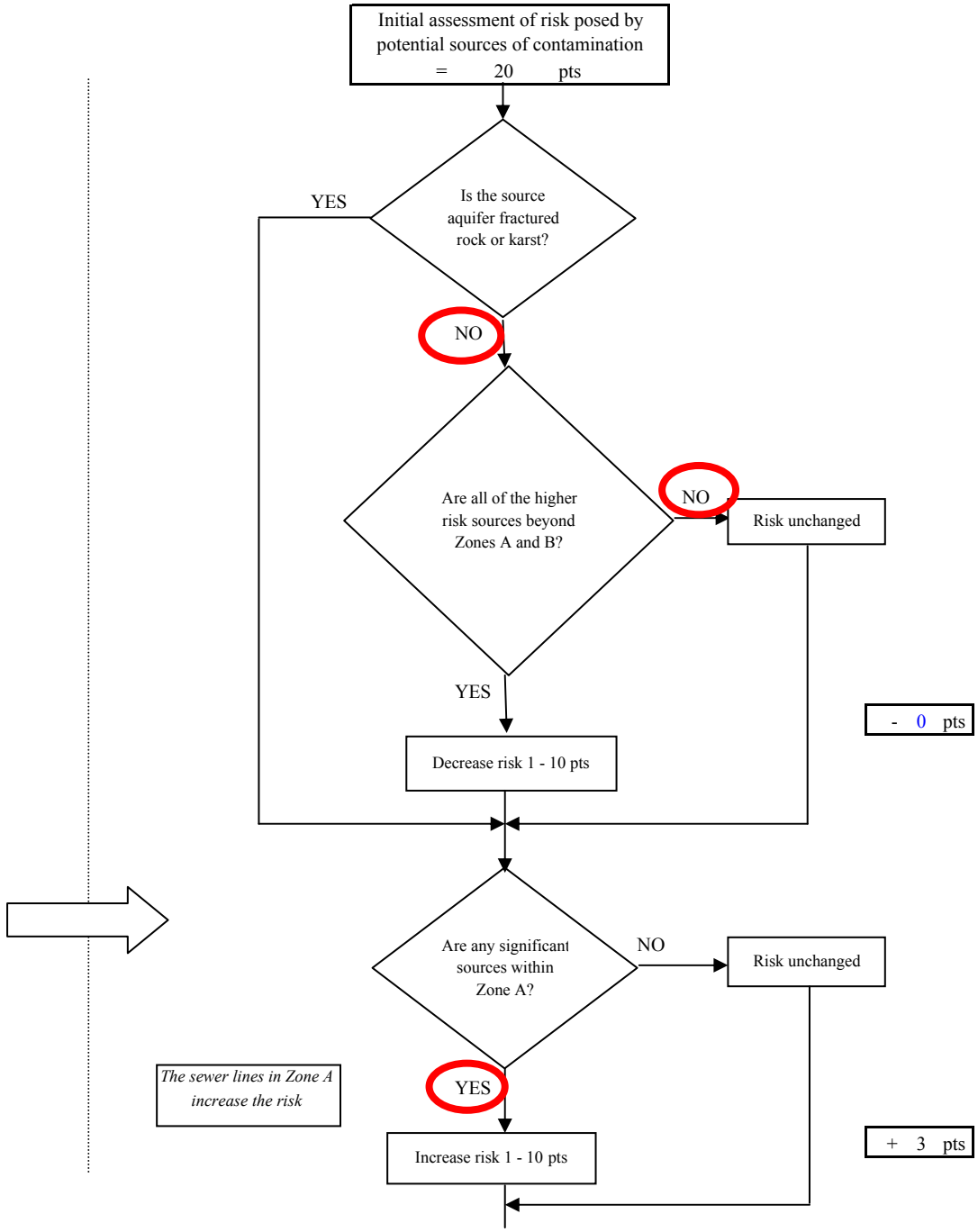


Chart 5. Contaminant risks for Eielson AFB Well 7 - Nitrates and Nitrites

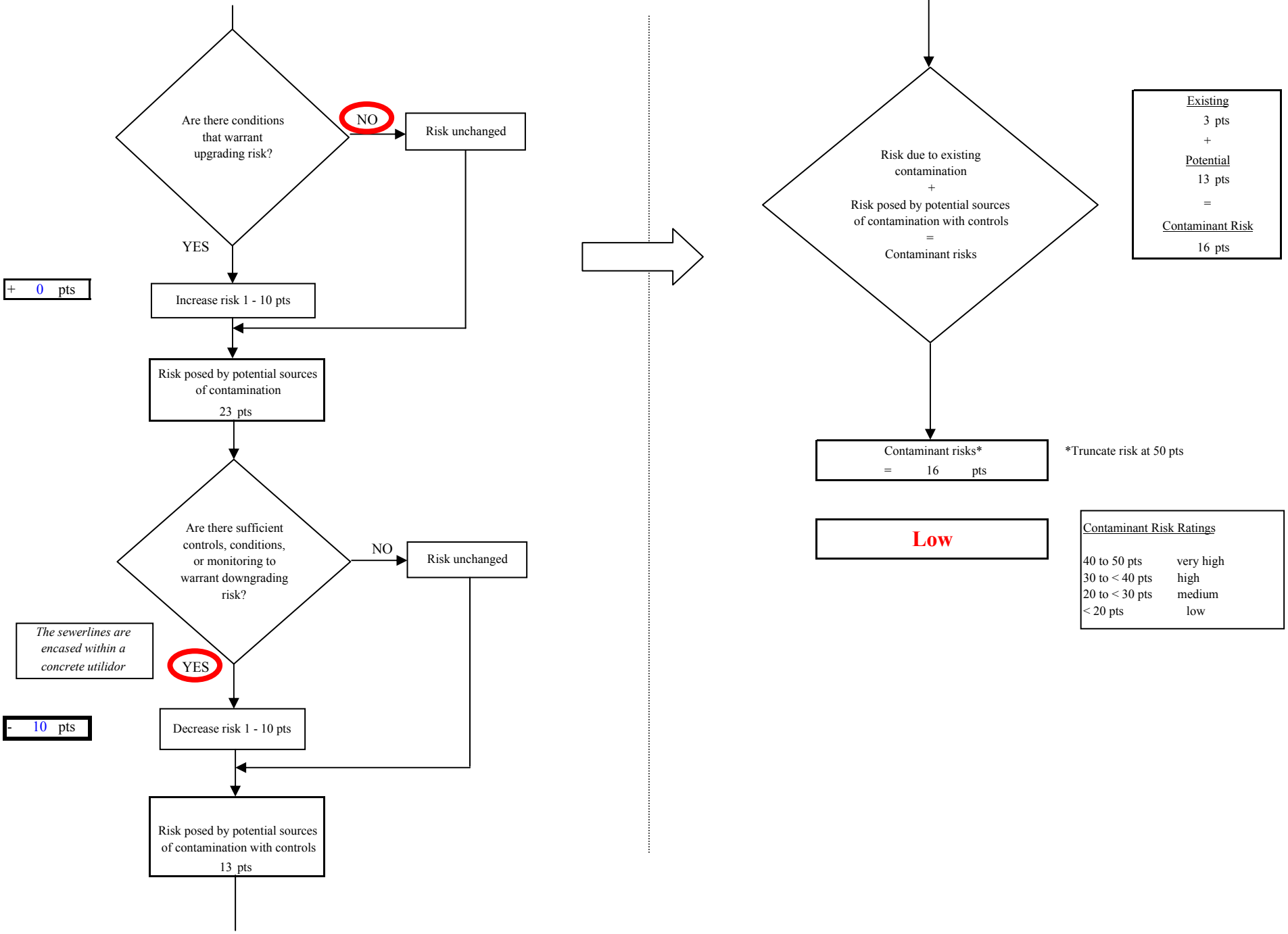


Chart 6. Vulnerability analysis for Eielson AFB Well 7 - Nitrates and Nitrites

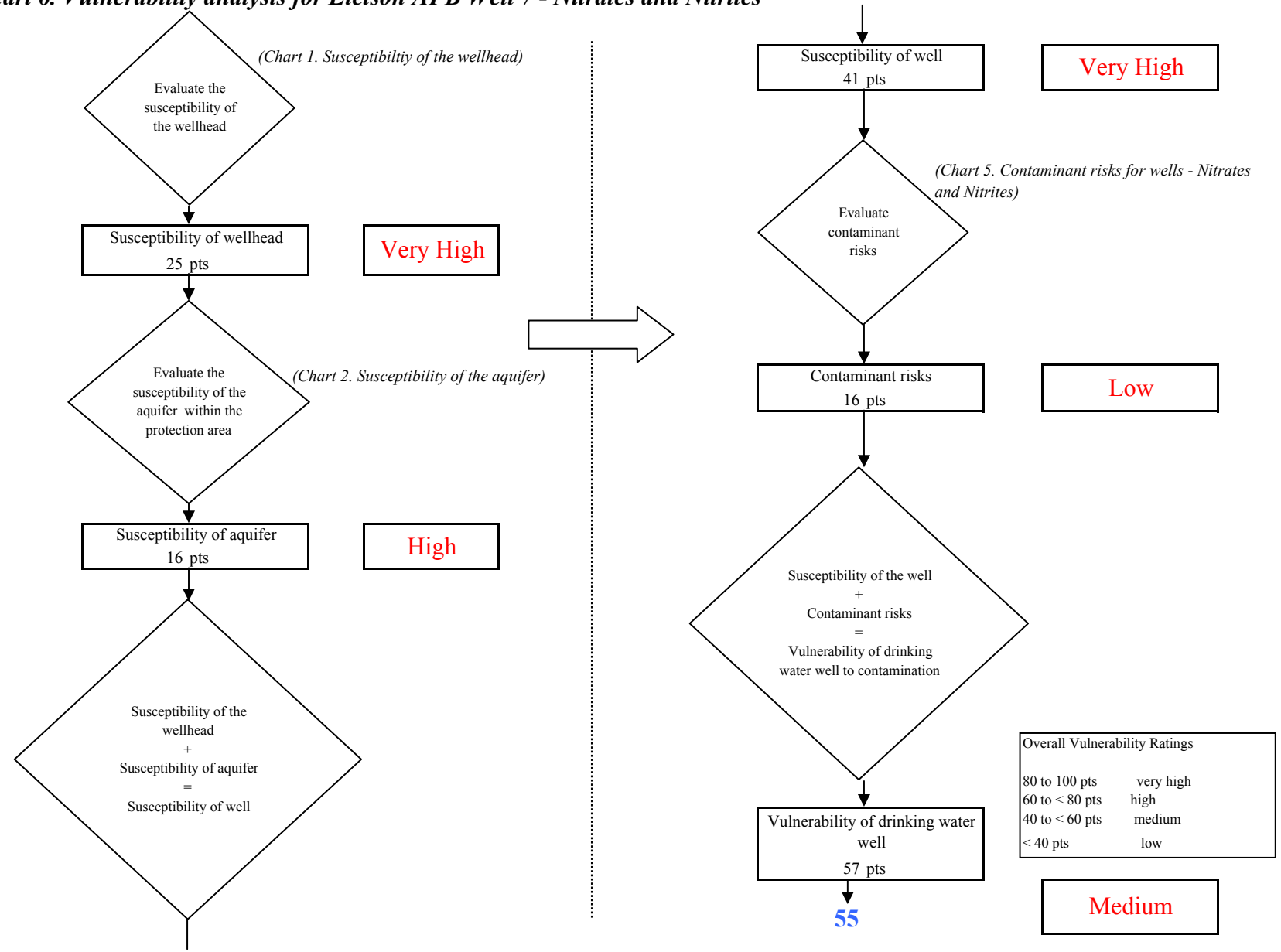


Chart 7. Contaminant risks for Eielson AFB Well 7 - Volatile Organic Chemicals

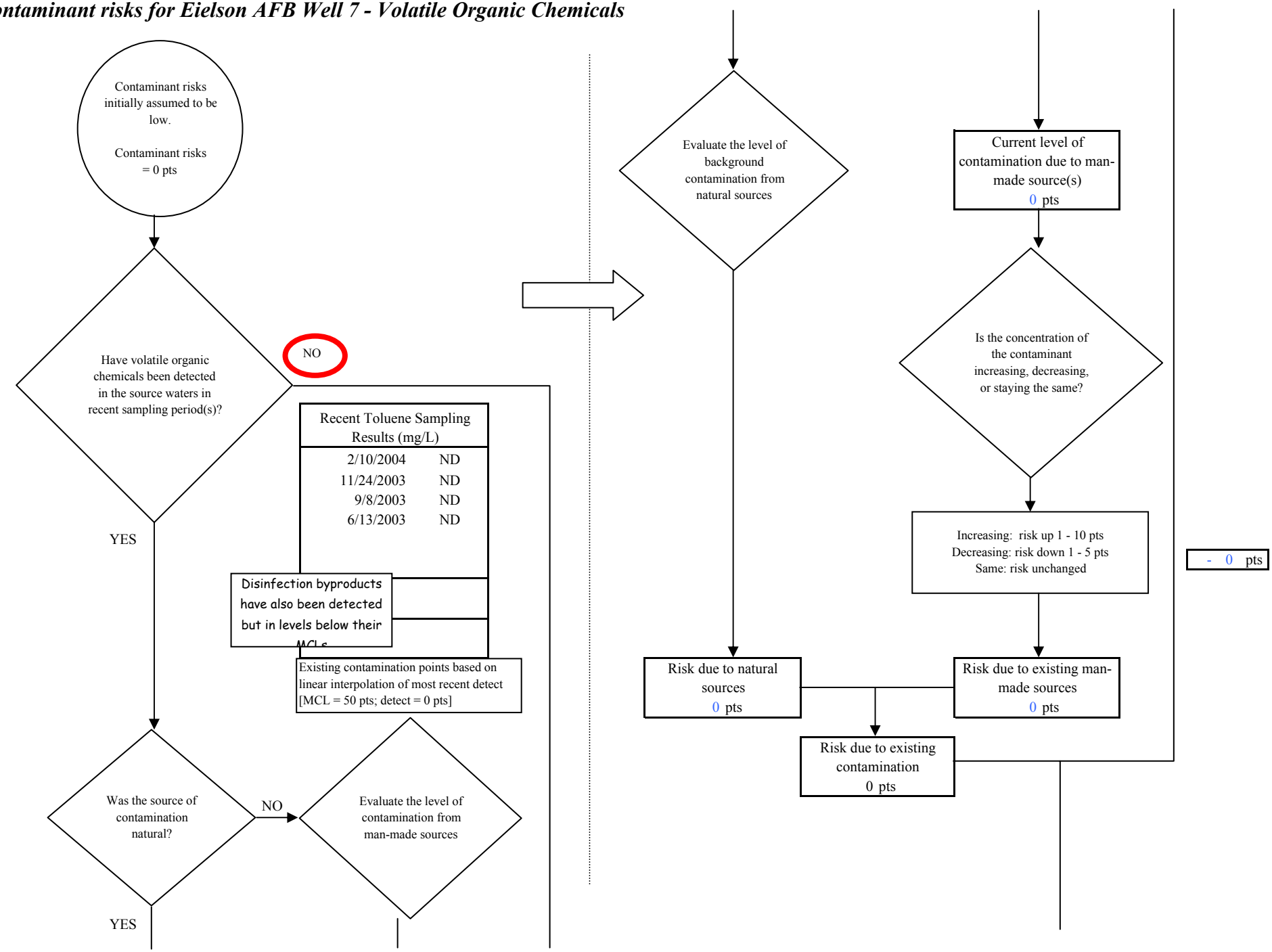


Chart 7. Contaminant risks for Eielson AFB Well 7 - Volatile Organic Chemicals

+ 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)	2	0	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 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.

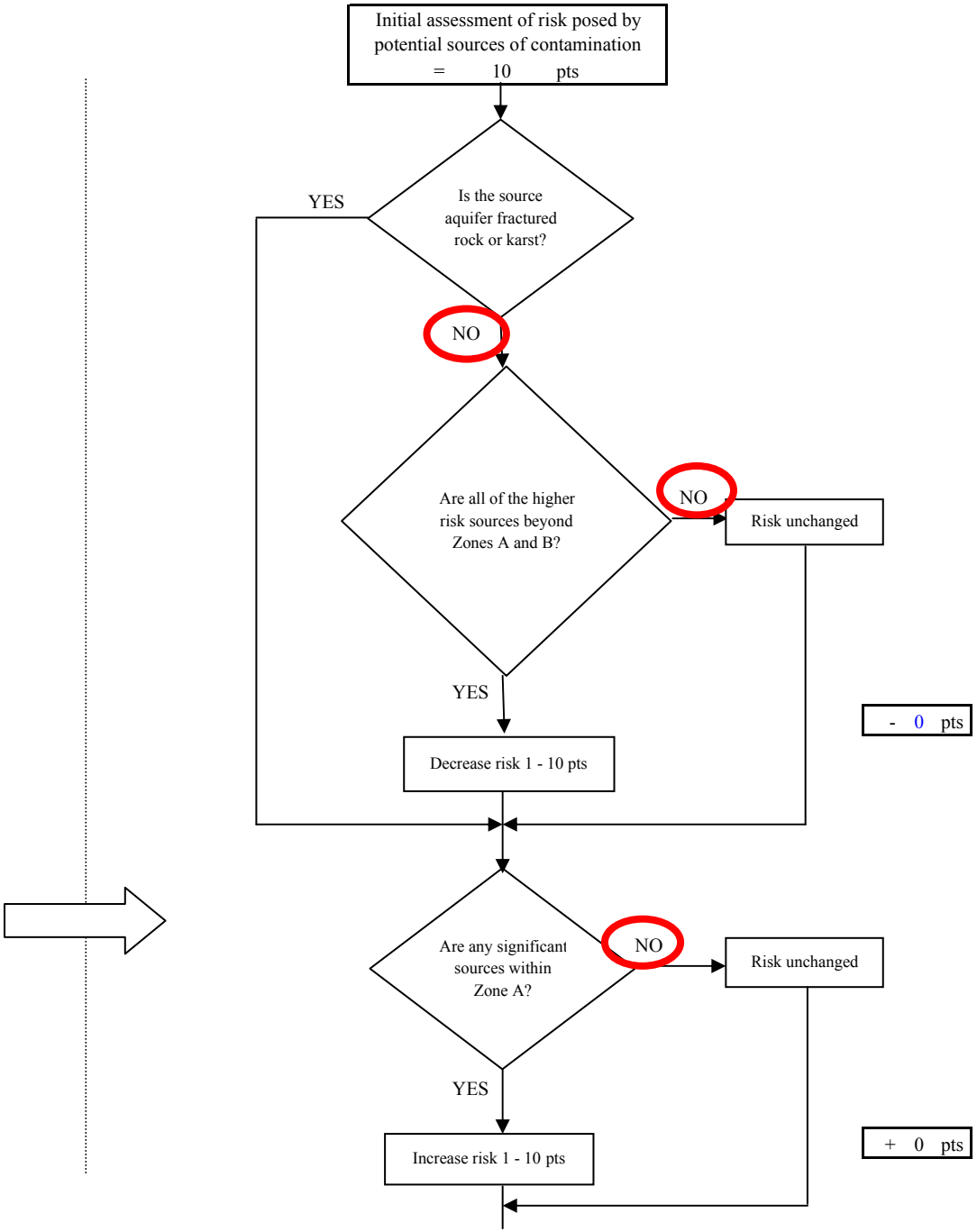


Chart 7. Contaminant risks for Eielson AFB Well 7 - Volatile Organic Chemicals

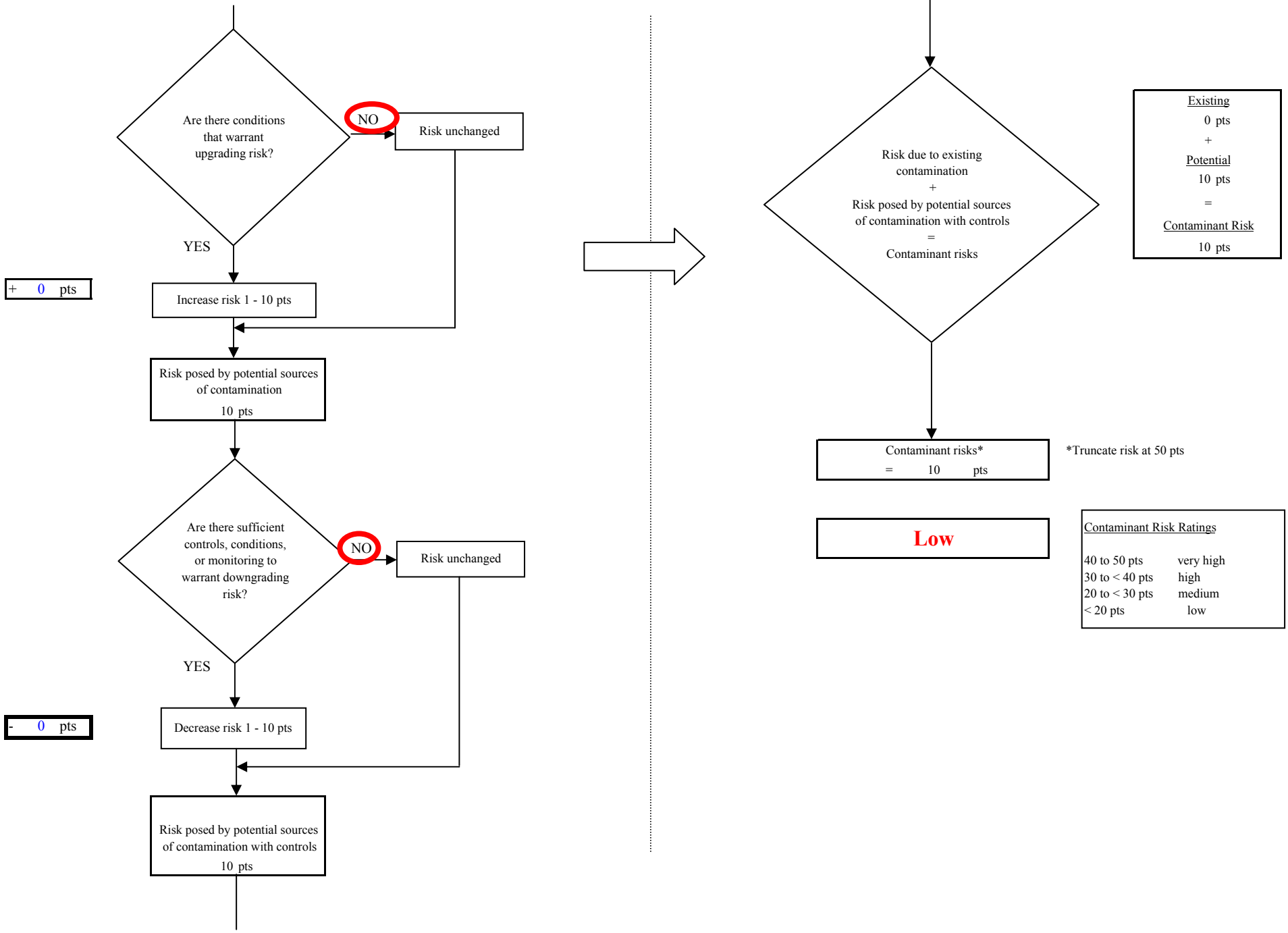


Chart 8. Vulnerability analysis for Eielson AFB Well 7 - Volatile Organic Chemicals

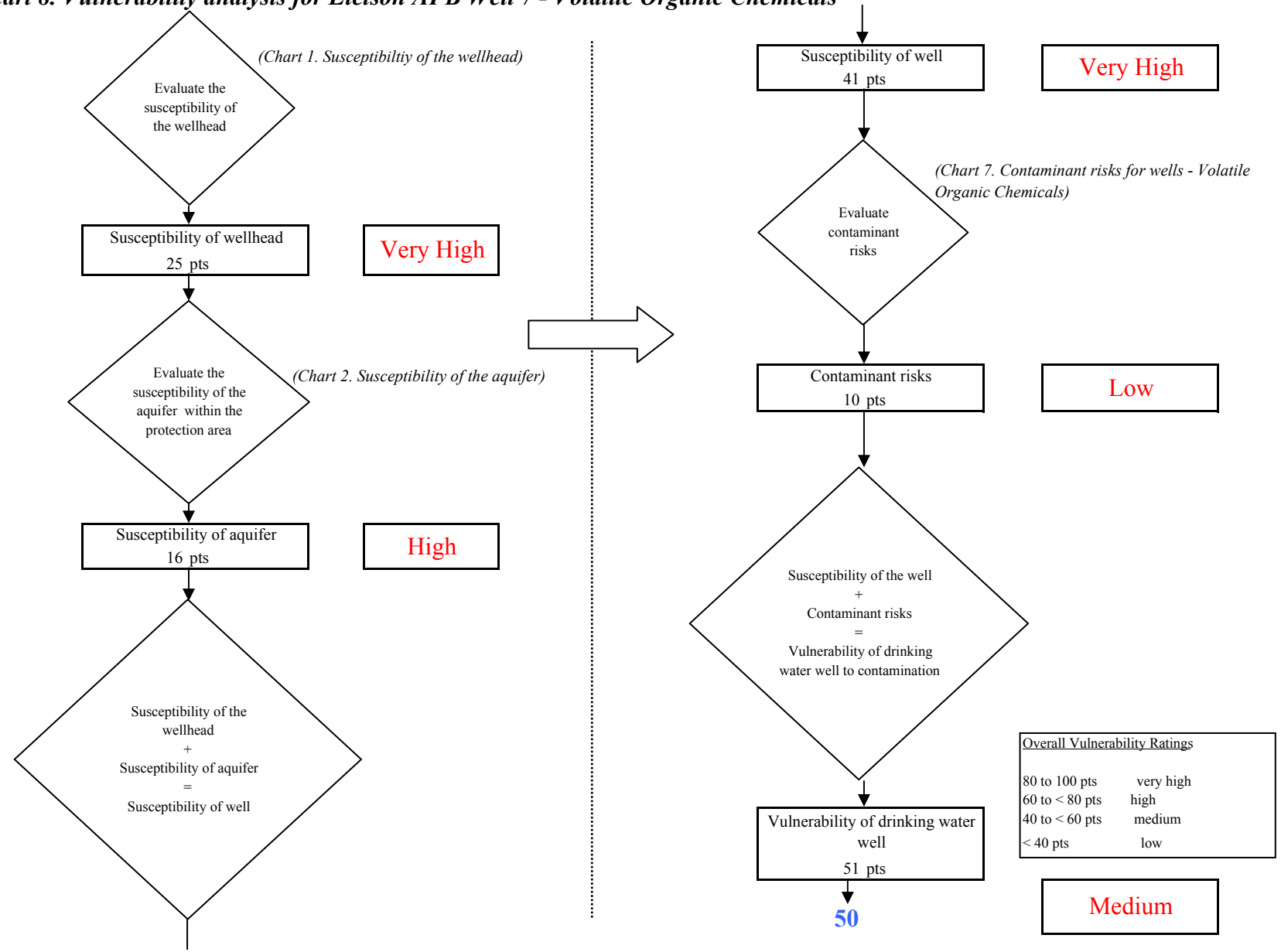


Chart 9. Contaminant risks for Eielson AFB Well 7 - Heavy Metals, Cyanide and Other Inorganic Chemicals

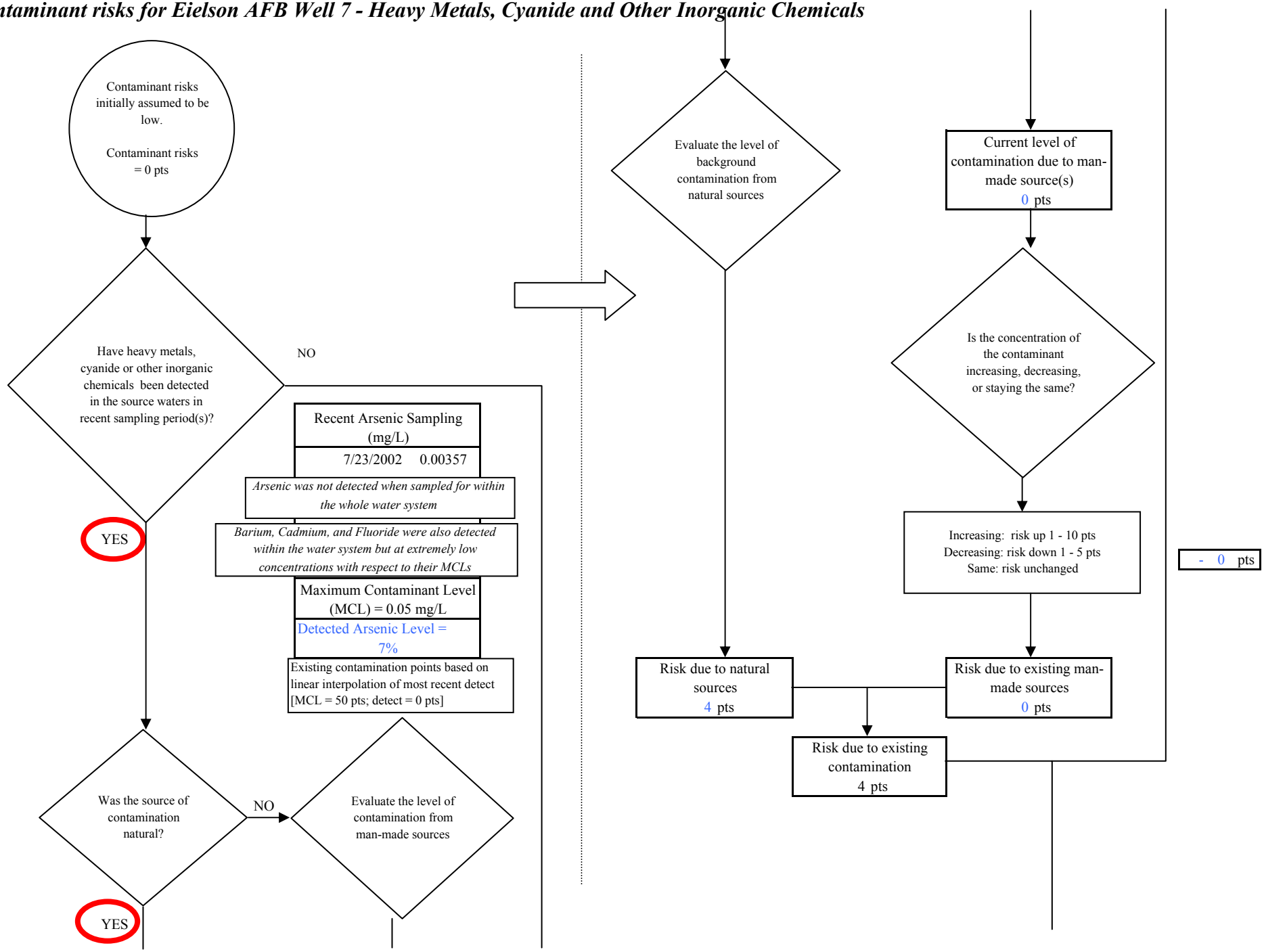


Chart 9. Contaminant risks for Eielson AFB Well 7 - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 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)	2	0	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 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

+ 0 pts

Chart 9. Contaminant risks for Eielson AFB Well 7 - Heavy Metals, Cyanide and Other Inorganic Chemicals

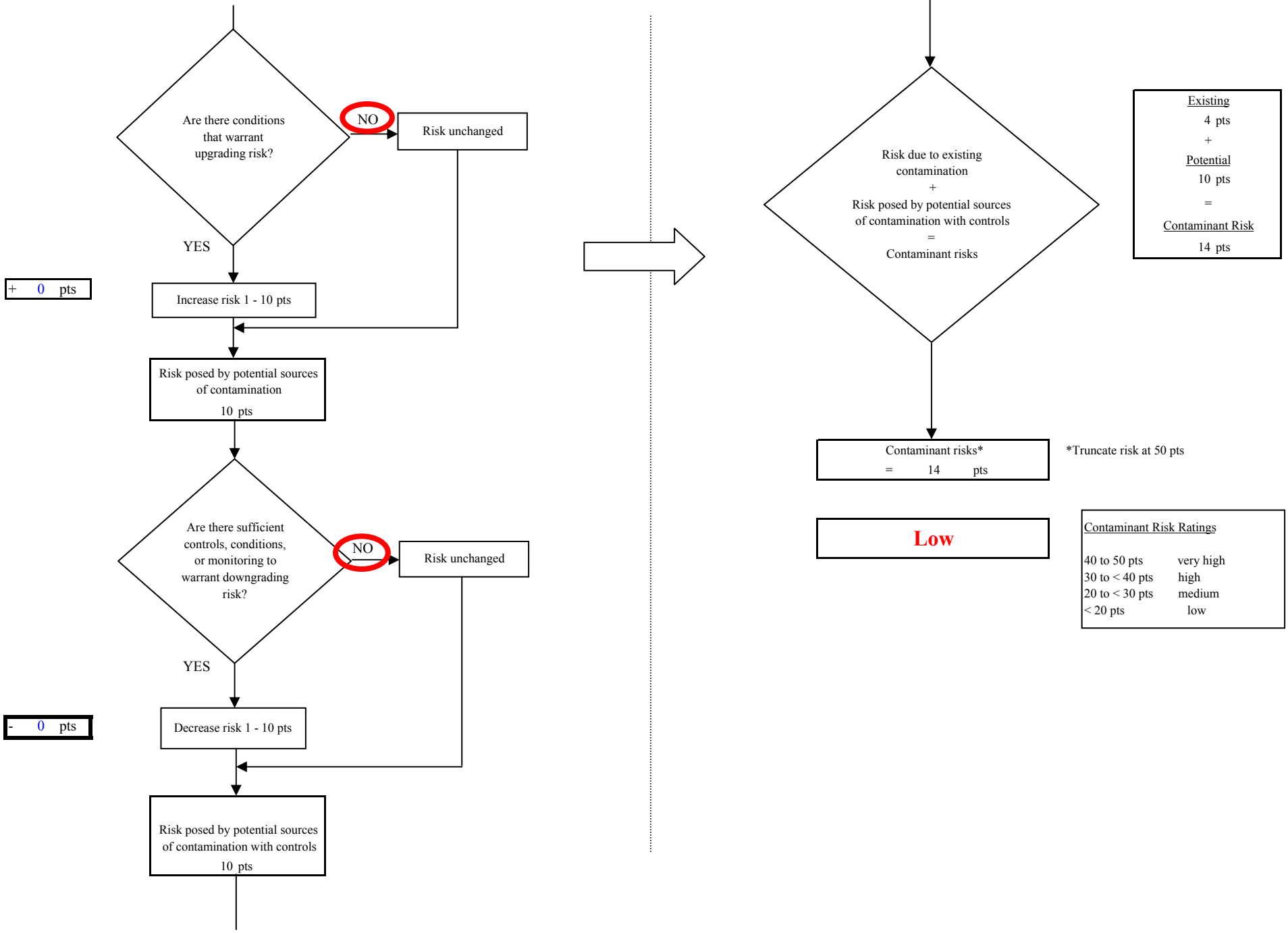


Chart 10. Vulnerability analysis for Eielson AFB Well 7 - Heavy Metals, Cyanide and Other Inorganic Chemicals

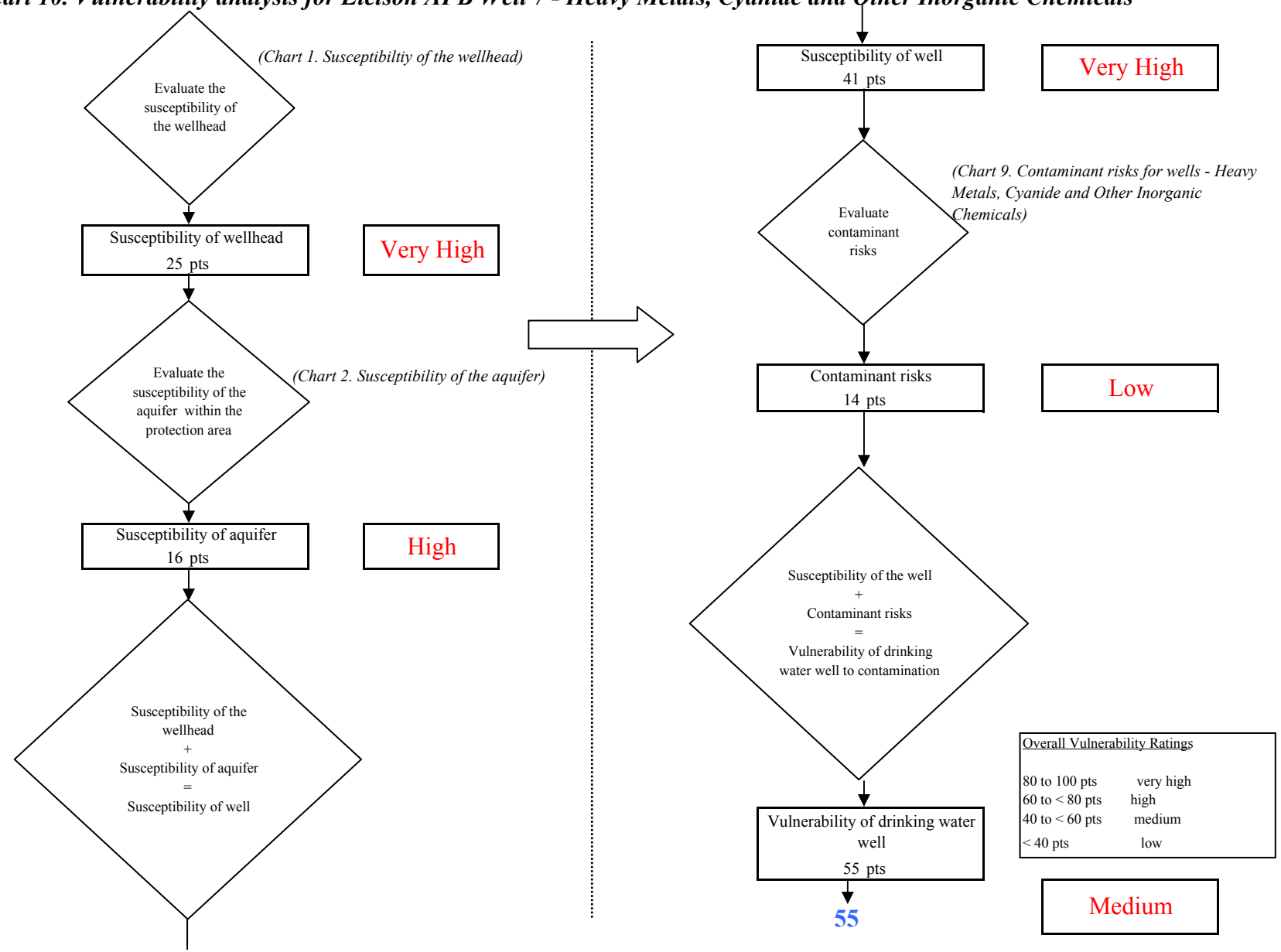


Chart 11. Contaminant risks for Eielson AFB Well 7 - Synthetic Organic Chemicals

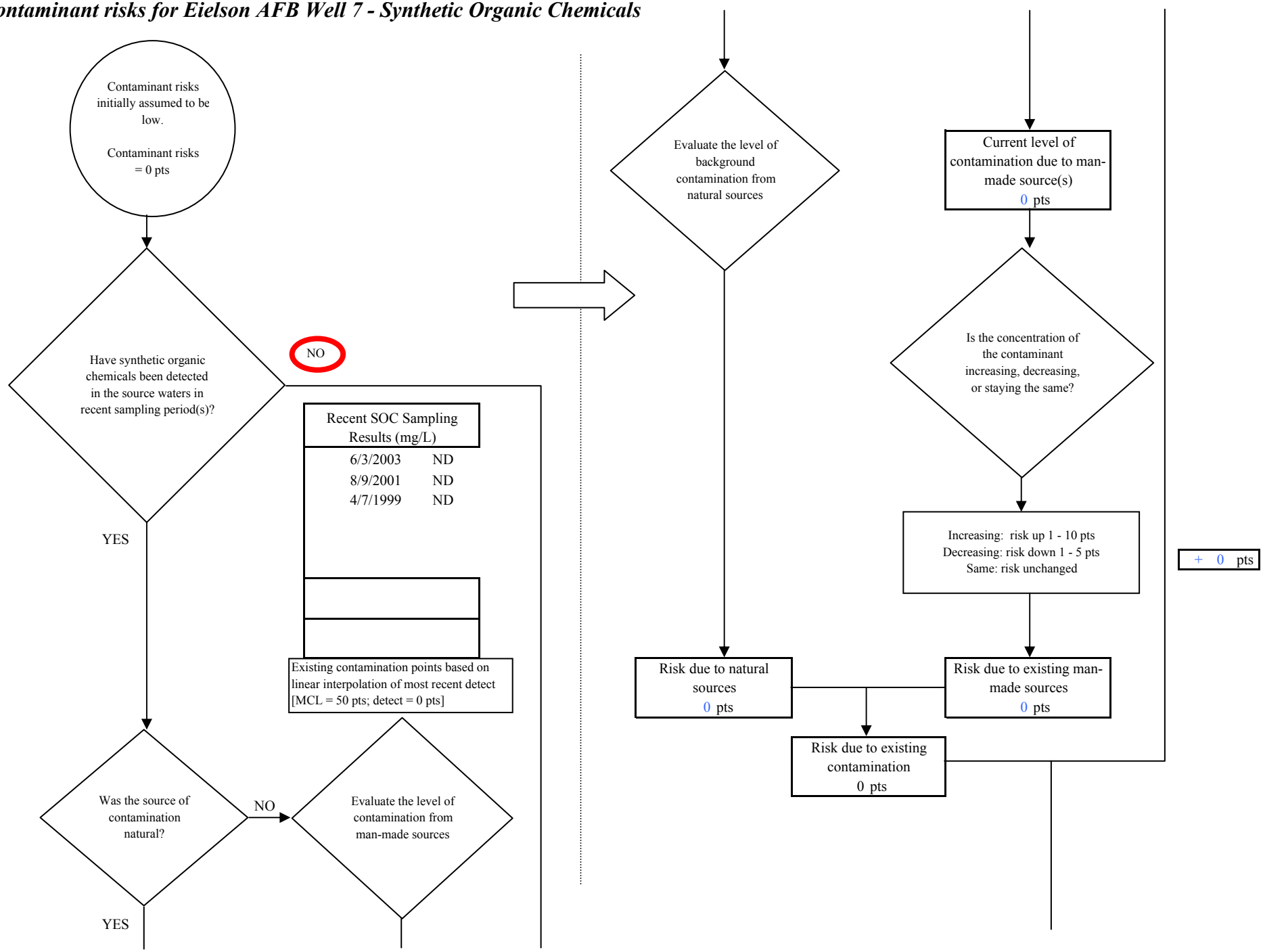
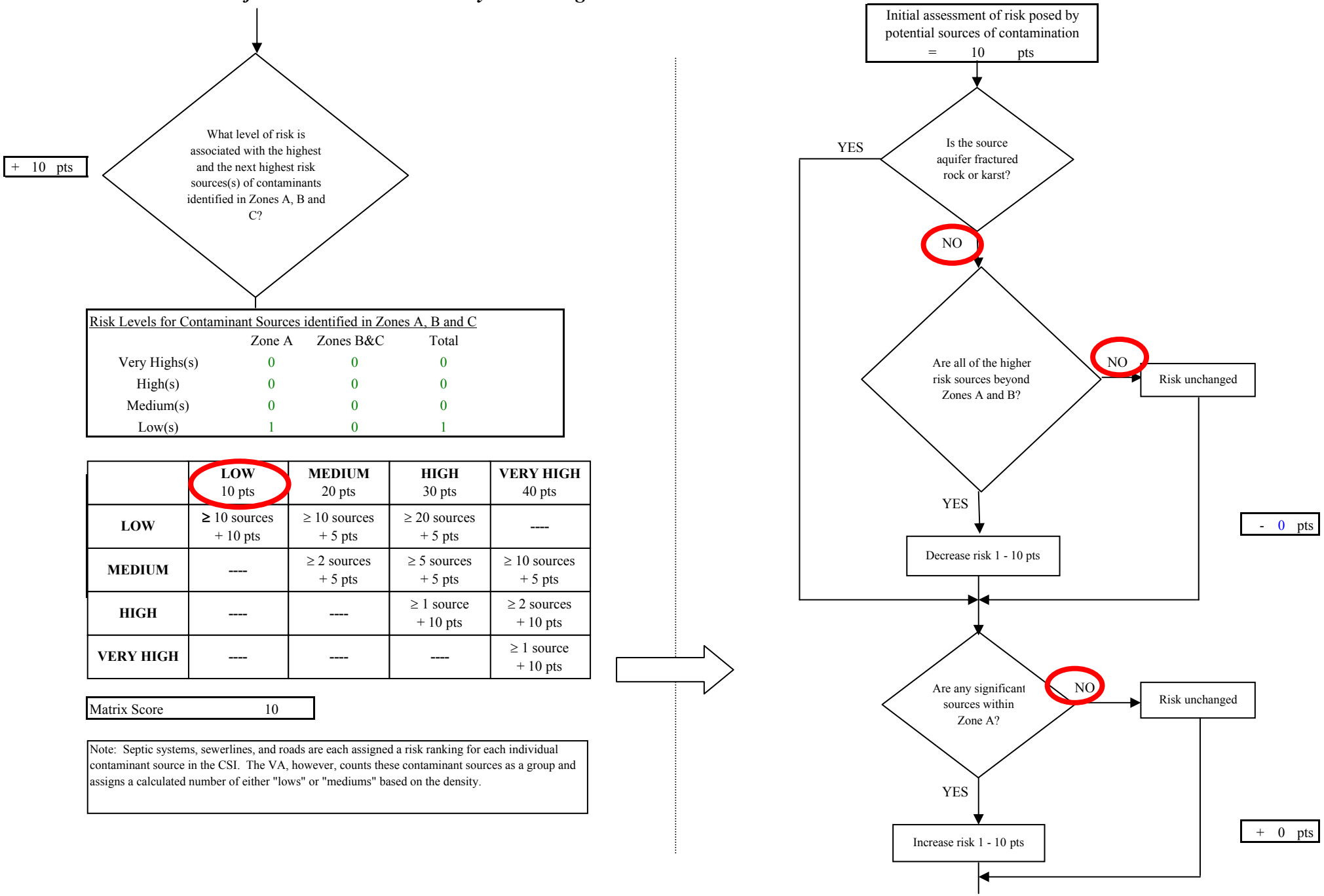


Chart 11. Contaminant risks for Eielson AFB Well 7 - Synthetic Organic Chemicals



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)	1	0	1

	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 Eielson AFB Well 7 - Synthetic Organic Chemicals

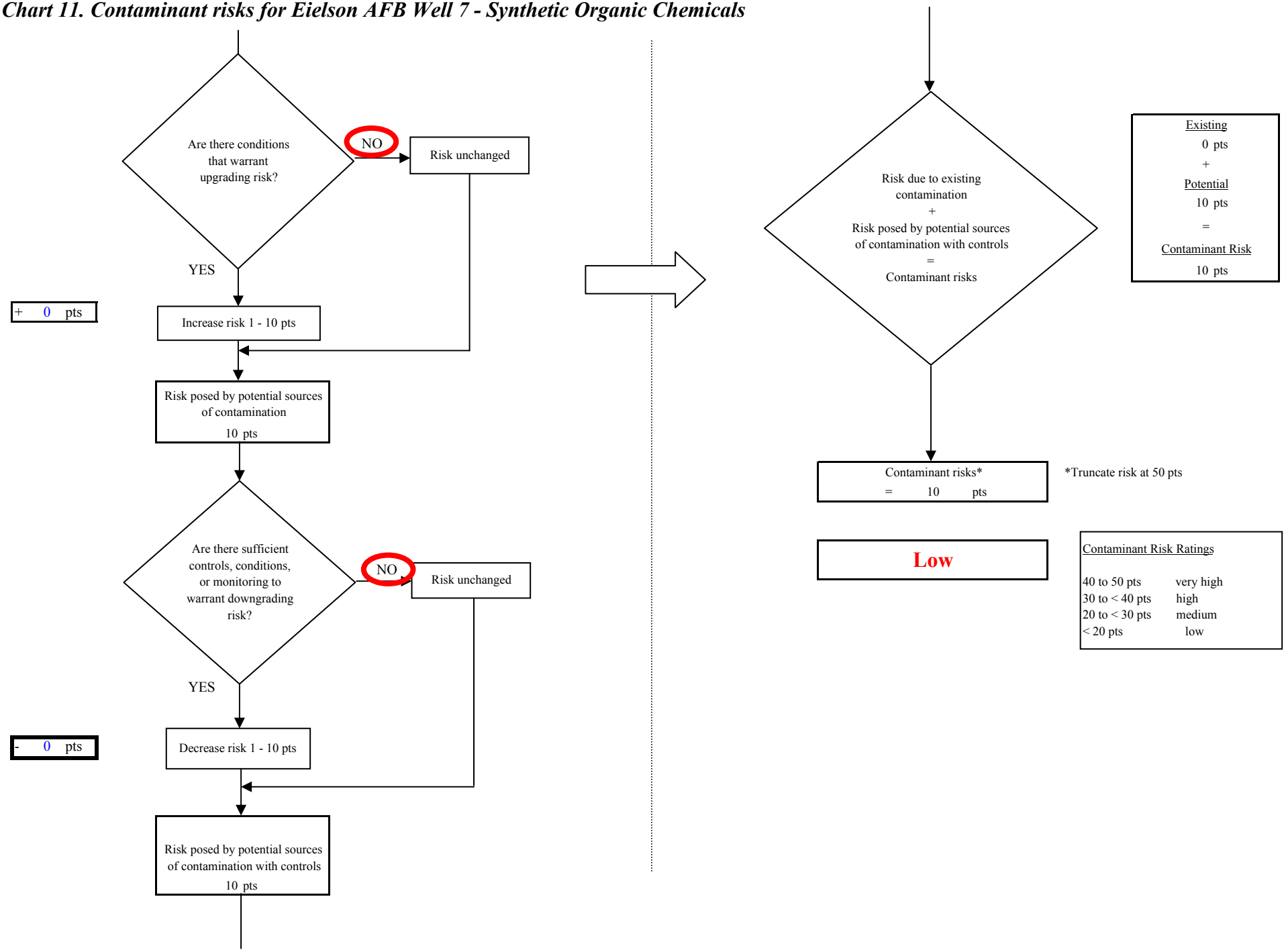


Chart 12. Vulnerability analysis for Eielson AFB Well 7 - Synthetic Organic Chemicals

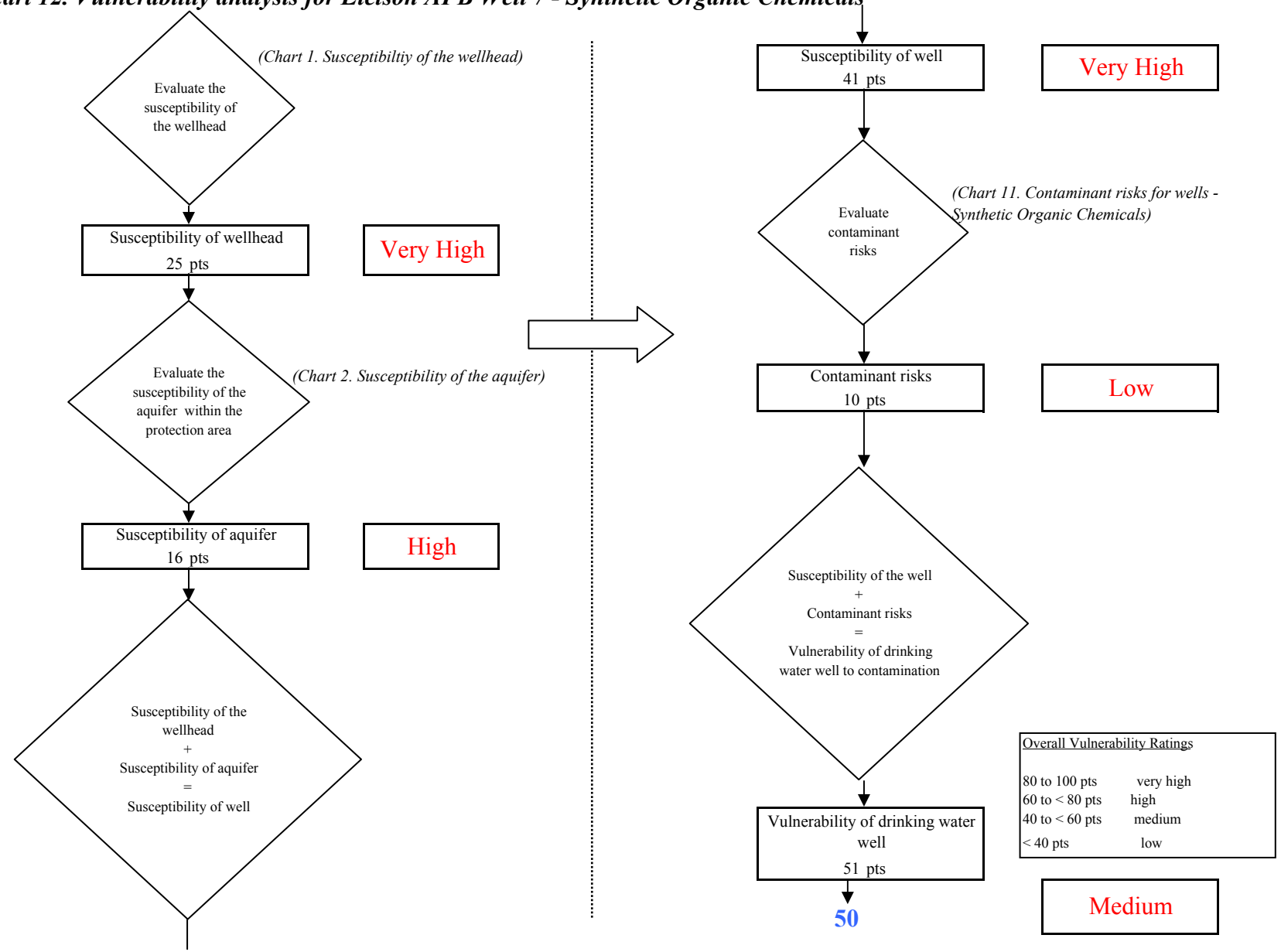


Chart 13. Contaminant risks for Eielson AFB Well 7 - Other Organic Chemicals

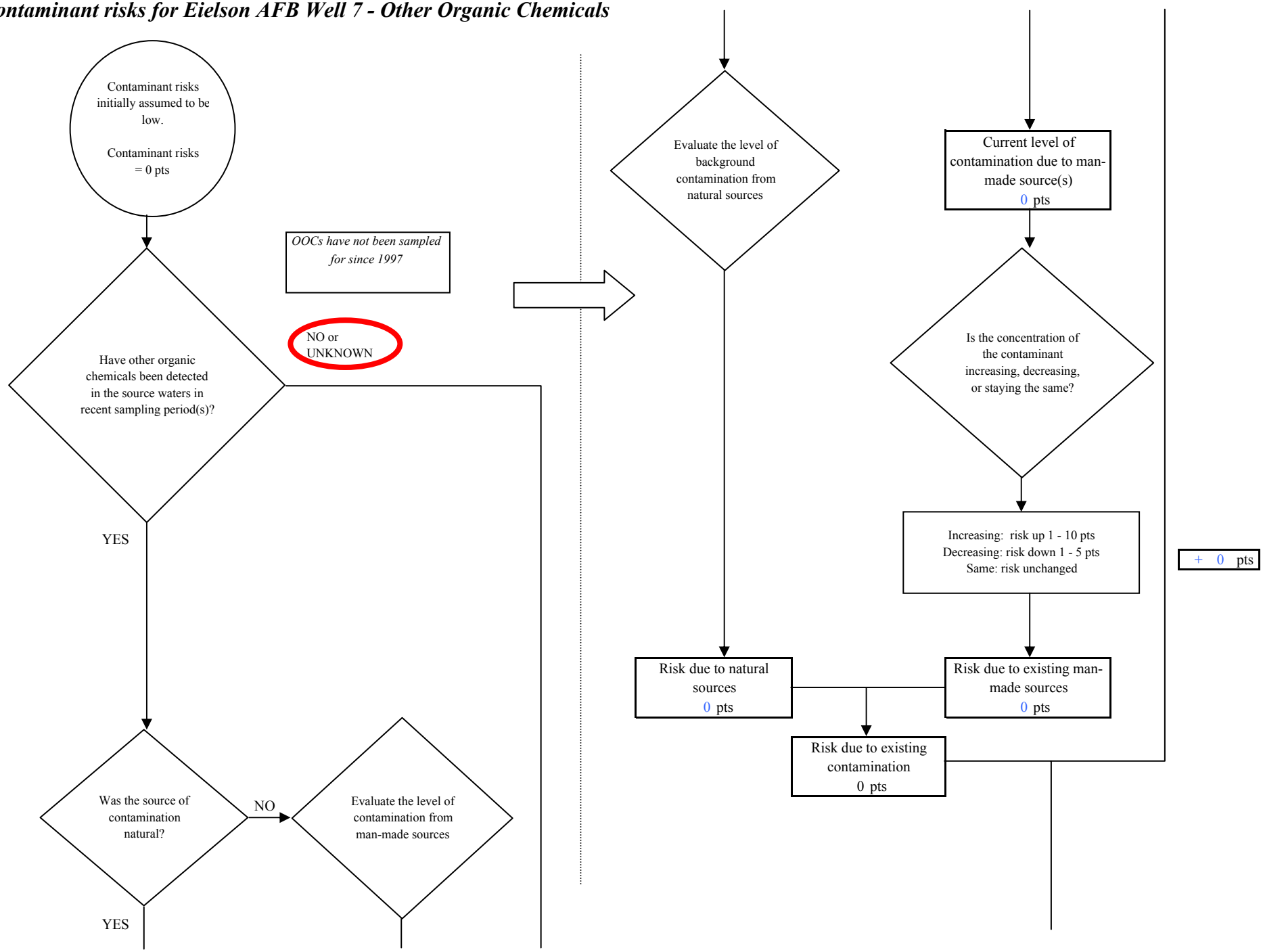


Chart 13. Contaminant risks for Eielson AFB Well 7 - Other Organic Chemicals

+ 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)	2	0	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 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.

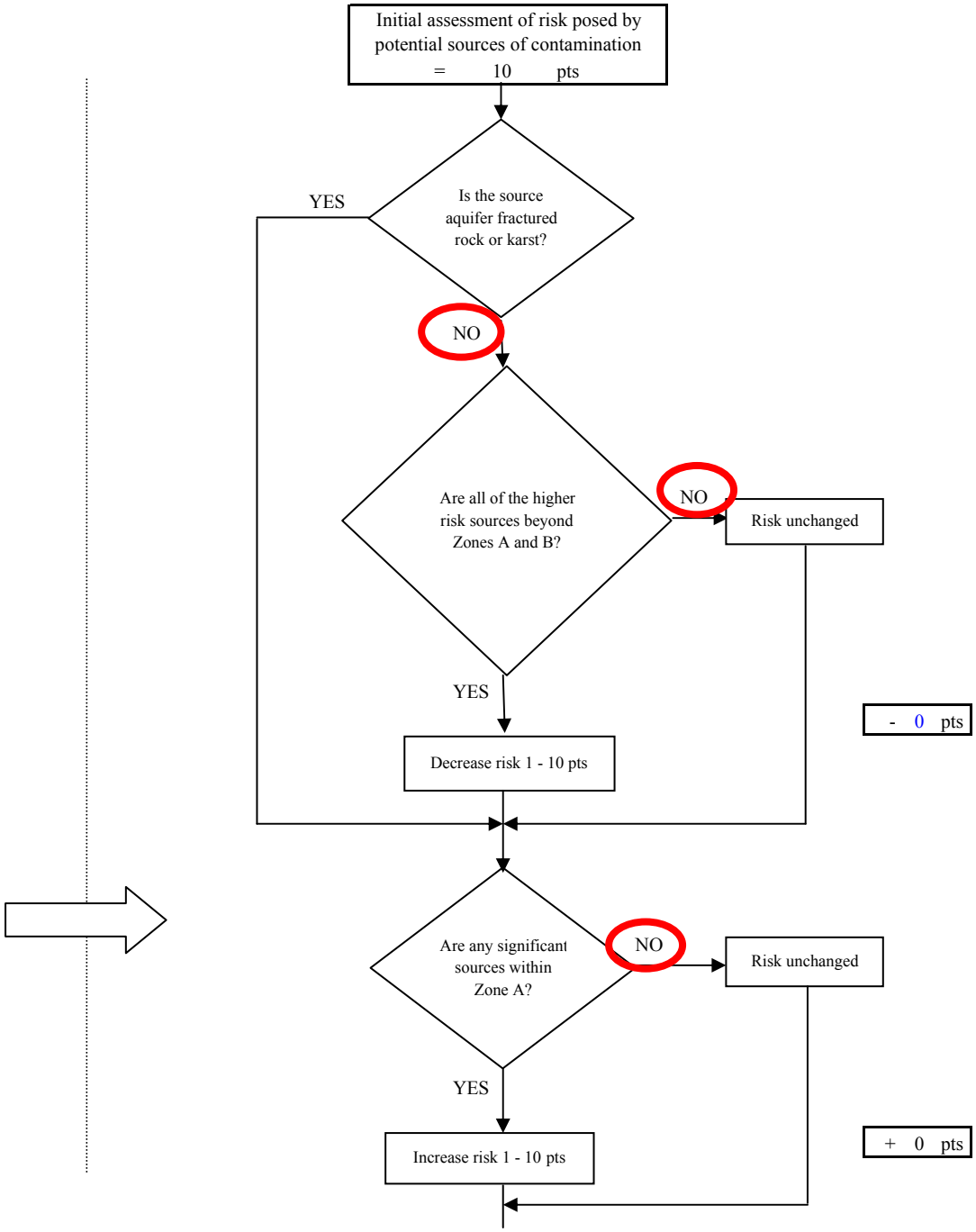


Chart 13. Contaminant risks for Eielson AFB Well 7 - Other Organic Chemicals

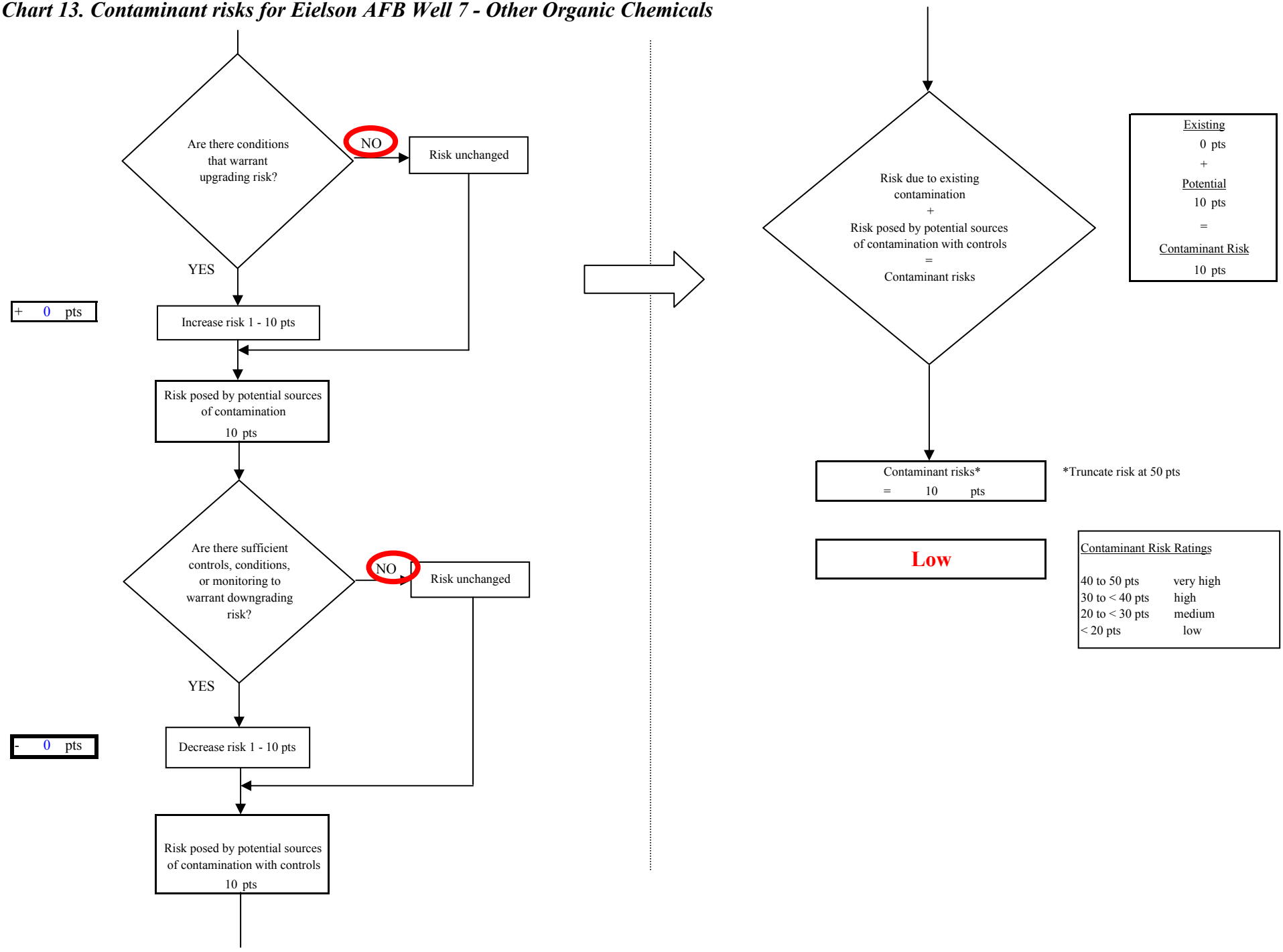


Chart 14. Vulnerability analysis for Eielson AFB Well 7 - Other Organic Chemicals