Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Sackett Center Drinking Water System, Aniak, Alaska

PWSID # 271643.001

March 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1224
Alaska Department of Environmental Conservation

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Sackett Center
Drinking Water System
Aniak, Alaska

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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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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Sackett Center has one Public Water System (PWS) well. The well (PWSID# 271643.001) system is said to have begun operation in 1985, and has presumably been used as a drinking water source since that time. The date of well construction is unknown.

The well is a Class B (transient/non-community) water system located approximately 1-mile from the Aniak town-site. Available records indicate that there are two water storage tanks with a combined capacity of 120-gallons, and the untreated drinking water source is derived directly from the wellhead. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **Very High** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for the primary public drinking water source include: domestic wastewater collection systems, landfills, aboveground fuel tanks, water supply wells, roads, an ADEC recognized contaminated site, an airport, residential areas, electric power generation, firehouses, a motor/motor vehicle repair shop, and a medical/veterinary facility. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the water well received a vulnerability rating of **Very High** for bacteria and viruses, a vulnerability rating of **Very High** for nitrates and nitrites, and a vulnerability rating of **Very High** for the volatile organic chemicals contaminant categories.

SACKETT CENTER PUBLIC DRINKING WATER SYSTEM

The Sackett Center water well is a Class B (transient/non-community) public water system located approximately 1-mile from the Aniak town-site (Sec. 11, T17N, R57W, Seward Meridian; see Map A of Appendix A). Aniak is located on the south bank of the Kuskokwim River in the Yukon-Kuskokwim Delta. The village is located about 92 miles northeast of Bethel and 317 miles west of Anchorage. The community has a population of 539 (ADCED, 2003). The Sackett Center has a serves non-resident population of approximately 70 people. Average annual precipitation in Aniak is 19 inches, including approximately 60 inches of snowfall. Temperatures can be as extreme as -55 to 87°F.

The community of Aniak gets most of their water supply from individual wells. Most households are served by the piped sewage collection system and the remaining households either have individual septic tanks or pit privies (ADCED, 2003). Aniak receives electrical power from the Aniak Light and Power Company. Power generating facilities are fueled by diesel (ADCED, 2003).

According to information supplied by ADEC for the Sackett Center PWS, the depth of the primary water well is 25 feet below the ground surface. Based on available information, it is assumed the well is in an unconfined aquifer and is not screened. Unconfined aquifers are more susceptible to groundwater impacts resulting from the downward migration of surface contaminants. The well is located in a floodplain.

Information acquired from an August 1991 sanitary survey for the PWS indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces potential of contaminant migration down the well casing annulus. Based on lack of information regarding well construction, it is assumed the well is not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Aniak is located on a flat former floodplain of the Kuskokwim River and the topographic relief in the area is less than 20 feet. Soils information is limited. Generally, the soils consist of sandy silt overlying sand and fine gravels. Aniak is located in an area that is considered a discontinuous permafrost zone and the permafrost masses are small, thin and

generally isolated (U.S. Department of Health and Human Services, et. al, 1983).

SACKETT CENTER DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the Sackett Center PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

The protection areas established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than the 2 year time-of-travel
C	Less Than the 5 year time-of-travel
D	Less than the 10 year time-of-travel

The DWPA for the Sackett Center PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Sackett Center 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 B public water system assessments, three categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile organic chemicals.

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

RANKING OF CONTAMINANT RISKS

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

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

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

VULNERABILITY OF THE SACKETT CENTER DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains eight charts, which together form the 'Vulnerability Analysis' for a source water assessment for a public drinking water source. Chart 1 analyzes the 'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

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

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

+

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

=

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

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

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

The Sackett Center's water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the Susceptibility scores and ratings for both wells in this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	25	Very High
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	50	Very High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	Very 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:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

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

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

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	100	Very High
Nitrates and Nitrites	100	Very High
Volatile Organic Chemicals	100	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of landfills in Zones A and C (see Table 2 – Appendix B).

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

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High**. The risk to this source of public drinking water is primarily attributed to the presence of landfills in Zones A and C (see Table 3 – Appendix B).

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

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

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of landfills, an ADEC recognized contaminated site, and an airport in Zones A, B, and C. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

No recent sampling data was available in ADEC records for the Sackett Center (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

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

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the Sackett Center and the community of Aniak to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL: http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm

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Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey

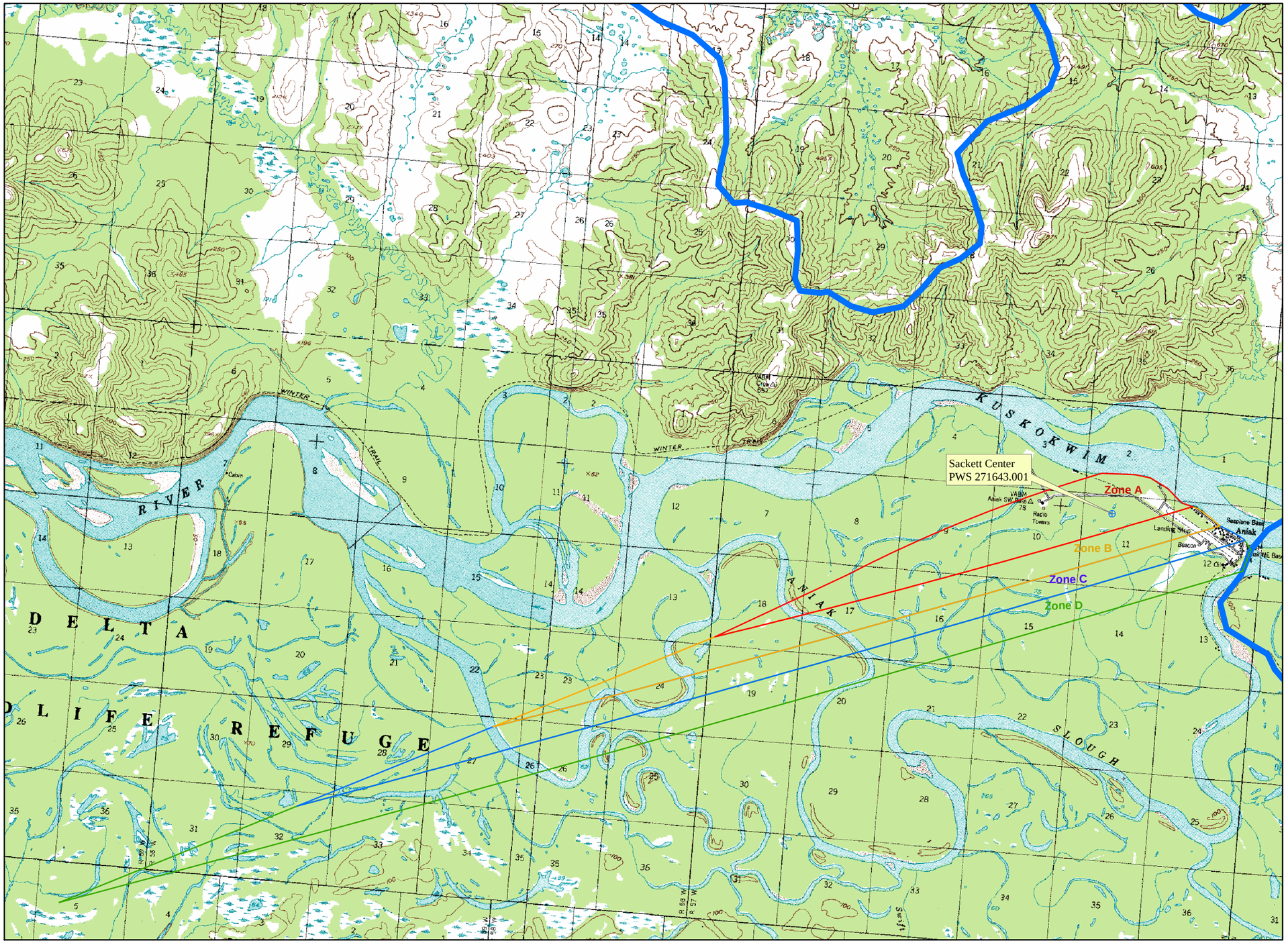
United States Department of Health and Human Services, et.al, 1983. Final Report, Sanitation Facilities Construction for Aniak, Alaska, Project No. AN-80-222.

United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #271643.001 Sackett Center



LEGEND

- Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours
- Watershed Boundary

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)

Groundwater Protection Zones

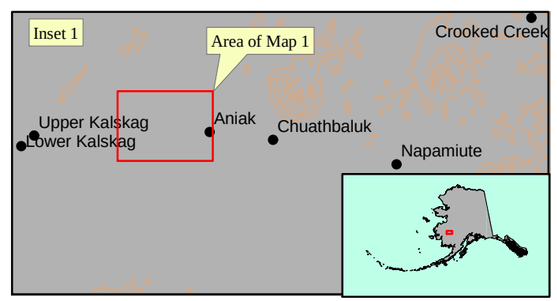
- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone C Protection Area– 5 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time or Watershed Boundary

Data Sources:
Contaminant Sources, Public Water System Wells, Contours Alaska Department of Environmental Conservation (ADEC)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

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



Sackett Center
PWS 271643.001

Appendix A Map 1

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Sackett Center***

PWSID 271643.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-01	A	C	Assumed that 1 to 10 sewer lines are located in Zone A
Landfills (municipal; Class III)	D51	D50-01	A	C	Aniak Class III Municipal Landfill, Active
Landfills (municipal; Class III)	D51	D50-02	A	C	Aniak Class III Municipal Landfill, Closed
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	C	Aniak Traditional Council
Tanks, heating oil, nonresidential (aboveground)	T14	T14-17	A	C	Anyaraqmuite Office Center
Water supply wells	W09	W09-01	A	C	
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assumed that 1 to 20 roads exist in Zone A
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-02	B	C	Assumed that 1 to 10 sewer lines are located in Zone B
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	B	C	Aniak Propane Sales
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	B	C	Diamond Willow CafT
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	B	C	George Givot Shop
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	B	C	Sanbiel Step & Shop
Tanks, heating oil, nonresidential (aboveground)	T14	T14-18	B	C	Kuspuk School District Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-21	B	C	US Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-22	B	C	Alascom Building
Tanks, heating oil, nonresidential (aboveground)	T14	T14-23	B	C	ANIAK HIGH SCHOOL
Tanks, heating oil, nonresidential (aboveground)	T14	T14-24	B	C	ANIAK MIDDLE SCHOOL
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	B	C	Mark - Aniak Airport. ADEC RecKey# 192250119301. Site is active wit high priority. Soil contaminated with hydrocarbons.
Water supply wells	W09	W09-02	B	C	
Airports	X14	X14-01	B	C	10/28
Highways and roads, dirt/gravel	X24	X24-02	B	C	Assumed that 1 to 20 roads exist in Zone B
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-03	C	C	Assumed that 1 to 10 sewer lines are located in Zone C
Landfills (municipal; Class III)	D51	T14-14	C	C	Public Library
Residential Areas	R01	R01-01	C	C	Assumed that 50 or less acres of residential area located in Zone C

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-01	C	C	Assumed that 10 or less above ground residential heating oil tanks are loca in Zone C
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	C	C	Aniak Light & Power
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	C	C	Aniak Power House
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	C	C	Bushtell
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	C	C	Assembly of God Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	C	C	Catholic Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	C	C	Old Community Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	C	C	Fire Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-25	C	C	AUNTIE MARY NICOLI ELEMENTARY
Water supply wells	W09	W09-03	C	C	
Water supply wells	W09	W09-04	C	C	
Highways and roads, dirt/gravel	X24	X24-03	C	C	Assumed that 1 to 20 roads exist in Zone C
Electric power generation (fossil fuels)	X36	X36-01	C	C	Aniak Light & Power
Electric power generation (fossil fuels)	X36	X36-02	C	C	Aniak Power House
Firehouses	X38	X38-01	C	C	Fire Hall
Motor /motor vehicle repair shops	C31	C31-01	D	C	City Shop
Residential Areas	R01	R01-02	D	C	Assumed that 50 or less acres of residential area located in Zone D
Tanks, heating oil, residential (above ground)	R08	R08-02	D	C	Assumed that 10 or less above ground residential heating oil tanks are loca Zone D
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	D	C	NA
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	D	C	AC Store
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	D	C	Aniak City Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-19	D	C	State of Alaska Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-20	D	C	State Troopers Office
Highways and roads, dirt/gravel	X24	X24-04	D	C	Assumed that 1 to 20 roads exist in Zone D
Medical/veterinary facilities (doctor or dentist offices, hospitals nursing homes)	X40	X40-01	D	C	NA

Table 2

Contaminant Source Inventory and Risk Ranking for Sackett Center

Sources of Bacteria and Viruses

PWSID 271643.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	Assumed that 1 to 10 sewer lines are located in Zone A
Landfills (municipal; Class III)	D51	D50-01	A	High	C	Aniak Class III Municipal Landfill, Active
Landfills (municipal; Class III)	D51	D50-02	A	High	C	Aniak Class III Municipal Landfill, Closed
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed that 1 to 20 roads exist in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-02	B	Medium	C	Assumed that 1 to 10 sewer lines are located in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assumed that 1 to 20 roads exist in Zone B
Landfills (municipal; Class III)	D51	T14-14	C	High	C	Public Library

Table 3

Contaminant Source Inventory and Risk Ranking for Sackett Center
Sources of Nitrates/Nitrites

PWSID 271643.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	Assumed that 1 to 10 sewer lines are located in Zone A
Landfills (municipal; Class III)	D51	D50-01	A	Very High	C	Aniak Class III Municipal Landfill, Active
Landfills (municipal; Class III)	D51	D50-02	A	Very High	C	Aniak Class III Municipal Landfill, Closed
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed that 1 to 20 roads exist in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-02	B	Medium	C	Assumed that 1 to 10 sewer lines are located in Zone B
Airports	X14	X14-01	B	Low	C	10/28
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assumed that 1 to 20 roads exist in Zone B
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-03	C	Medium	C	Assumed that 1 to 10 sewer lines are located in Zone C
Residential Areas	R01	R01-01	C	Low	C	Assumed that 50 or less acres of residential area located in Zone C
Landfills (municipal; Class III)	D51	T14-14	C	Very High	C	Public Library
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assumed that 1 to 20 roads exist in Zone C

Table 4

Contaminant Source Inventory and Risk Ranking for Sackett Center

Sources of Volatile Organic Chemicals

PWSID 271643.001

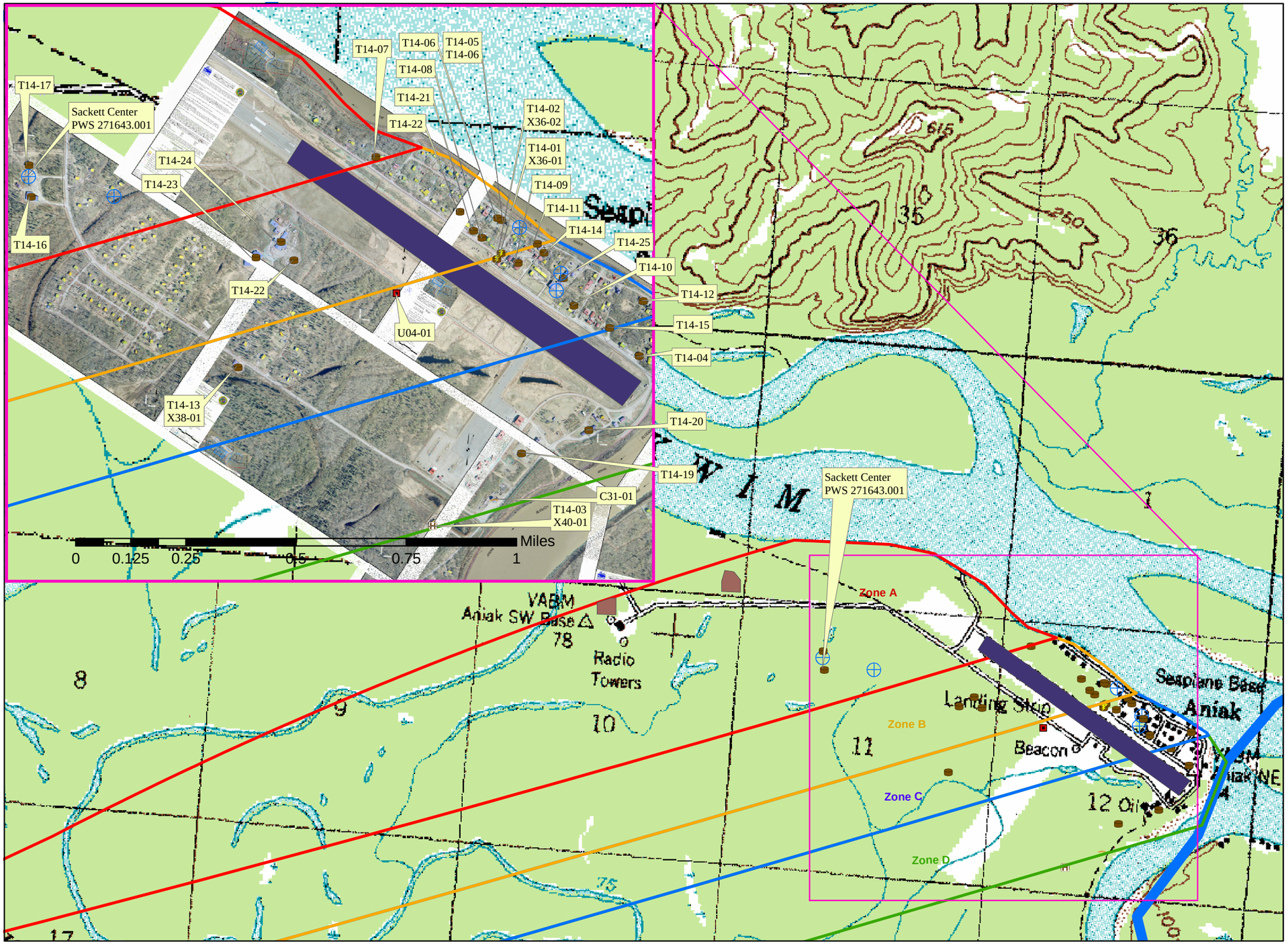
Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	Assumed that 1 to 10 sewer lines are located in Zone A
Landfills (municipal; Class III)	D51	D50-01	A	High	C	Aniak Class III Municipal Landfill, Active
Landfills (municipal; Class III)	D51	D50-02	A	High	C	Aniak Class III Municipal Landfill, Closed
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	Low	C	Aniak Traditional Council
Tanks, heating oil, nonresidential (aboveground)	T14	T14-17	A	Low	C	Anyaraqmuite Office Center
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assumed that 1 to 20 roads exist in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-02	B	Low	C	Assumed that 1 to 10 sewer lines are located in Zone B
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	B	Low	C	Aniak Propane Sales
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	B	Low	C	Diamond Willow CafT
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	B	Low	C	George Givot Shop
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	B	Low	C	Sanbiel Step & Shop
Tanks, heating oil, nonresidential (aboveground)	T14	T14-18	B	Low	C	Kuspuk School District Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-21	B	Low	C	US Post Office
Tanks, heating oil, nonresidential (aboveground)	T14	T14-22	B	Low	C	Alascom Building
Tanks, heating oil, nonresidential (aboveground)	T14	T14-23	B	Low	C	ANIAK HIGH SCHOOL
Tanks, heating oil, nonresidential (aboveground)	T14	T14-24	B	Low	C	ANIAK MIDDLE SCHOOL
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	B	High	C	Mark - Aniak Airport. ADEC RecKey# 192250119301. Site is active with priority. Soil contaminated with hydrocarbons.
Airports	X14	X14-01	B	High	C	10/28
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assumed that 1 to 20 roads exist in Zone B
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-03	C	Low	C	Assumed that 1 to 10 sewer lines are located in Zone C
Residential Areas	R01	R01-01	C	Low	C	Assumed that 50 or less acres of residential area located in Zone C

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-01	C	Medium	C	Assumed that 10 or less above ground residential heating oil tanks are locat in Zone C
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	C	Low	C	Aniak Light & Power
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	C	Low	C	Aniak Power House
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	C	Low	C	Bushtell
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	C	Low	C	Assembly of God Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	C	Low	C	Catholic Church
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	C	Low	C	Old Community Hall
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	C	Low	C	Fire Hall
Landfills (municipal; Class III)	D51	T14-14	C	High	C	Public Library
Tanks, heating oil, nonresidential (aboveground)	T14	T14-25	C	Low	C	AUNTIE MARY NICOLI ELEMENTARY
Highways and roads, dirt/gravel	X24	X24-03	C	Low	C	Assumed that 1 to 20 roads exist in Zone C
Electric power generation (fossil fuels)	X36	X36-01	C	Medium	C	Aniak Light & Power
Electric power generation (fossil fuels)	X36	X36-02	C	Medium	C	Aniak Power House
Firehouses	X38	X38-01	C	Low	C	Fire Hall

APPENDIX C

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

Public Water Well System for PWS #271643.001 Sackett Center
Showing Potential and Existng Sources of Contamination



LEGEND

- Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours
- Watershed Boundary

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)

Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone C Protection Area– 5 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time
- or Watershed Boundary

Existing or Potential Contaminant Sources

- Motor/Motor Vehicle Repair Shops (C31)
- Tanks, Heating Oil, non-Residential (T14)
- Contaminated Sites, DEC Recongnized, non-Superfund, non-RCRA (U04)
- Electric Power Generation (Fossil Fuels) (X36)
- Firehouses (X38)
- Medical/Veterinary Facilities (X40)
- Landfills (Municiple; Class II) (D50)
- Airports/Landing Strips (X14)

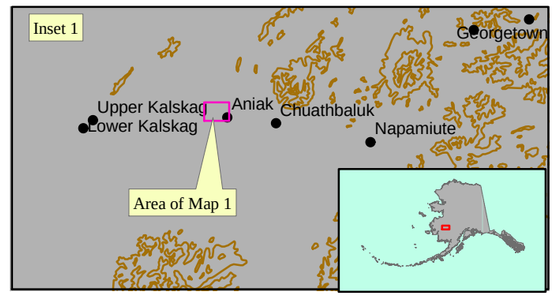
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Critical Facilities, Federal Emergency Management Agency (FEMA)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

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



Sackett Center
PWS 271643.001

Appendix C Map 2

APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Sackett Center (PWS No. 271643.001)

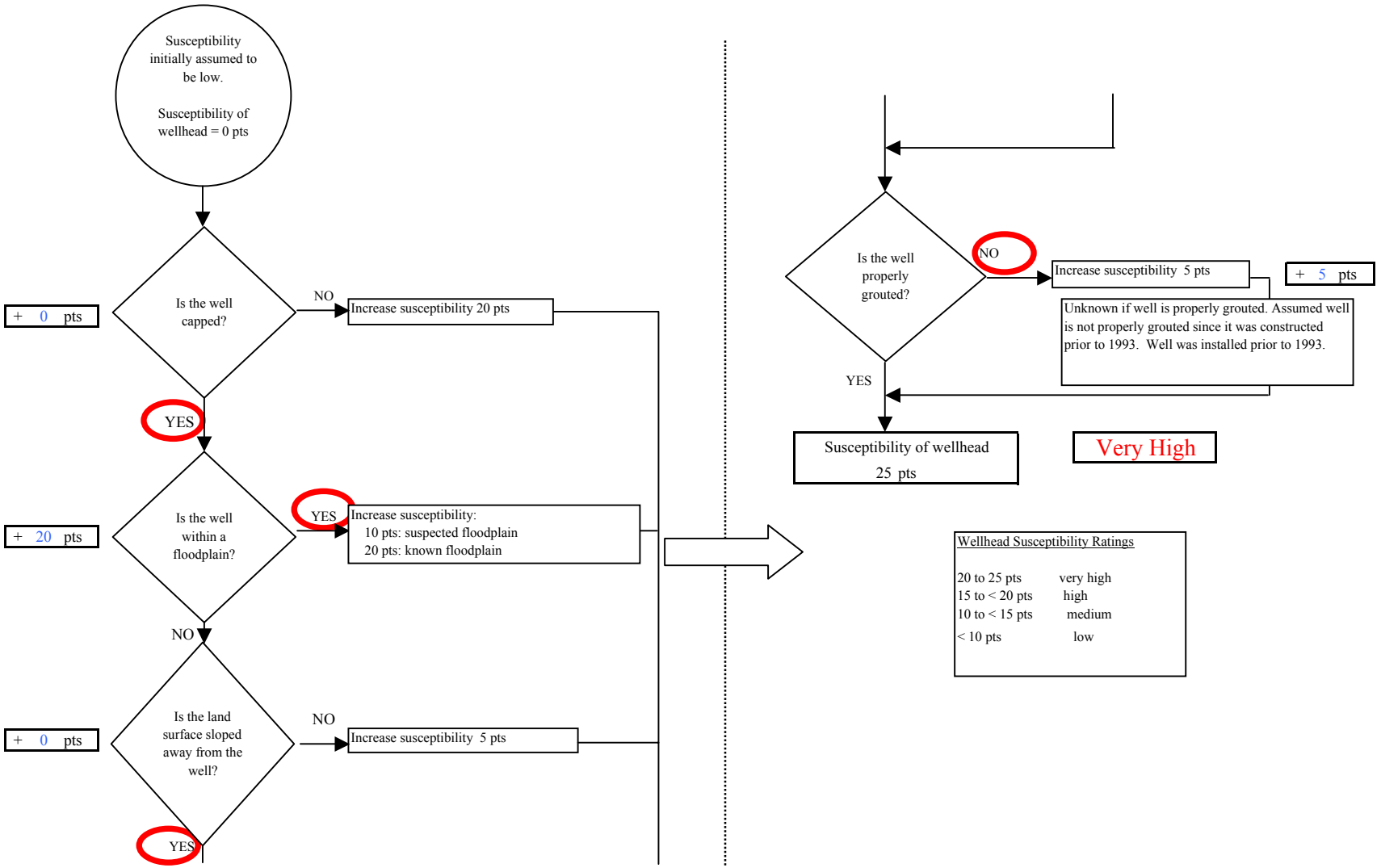


Chart 2. Susceptibility of the aquifer Sackett Center (PWS No. 271643.001)

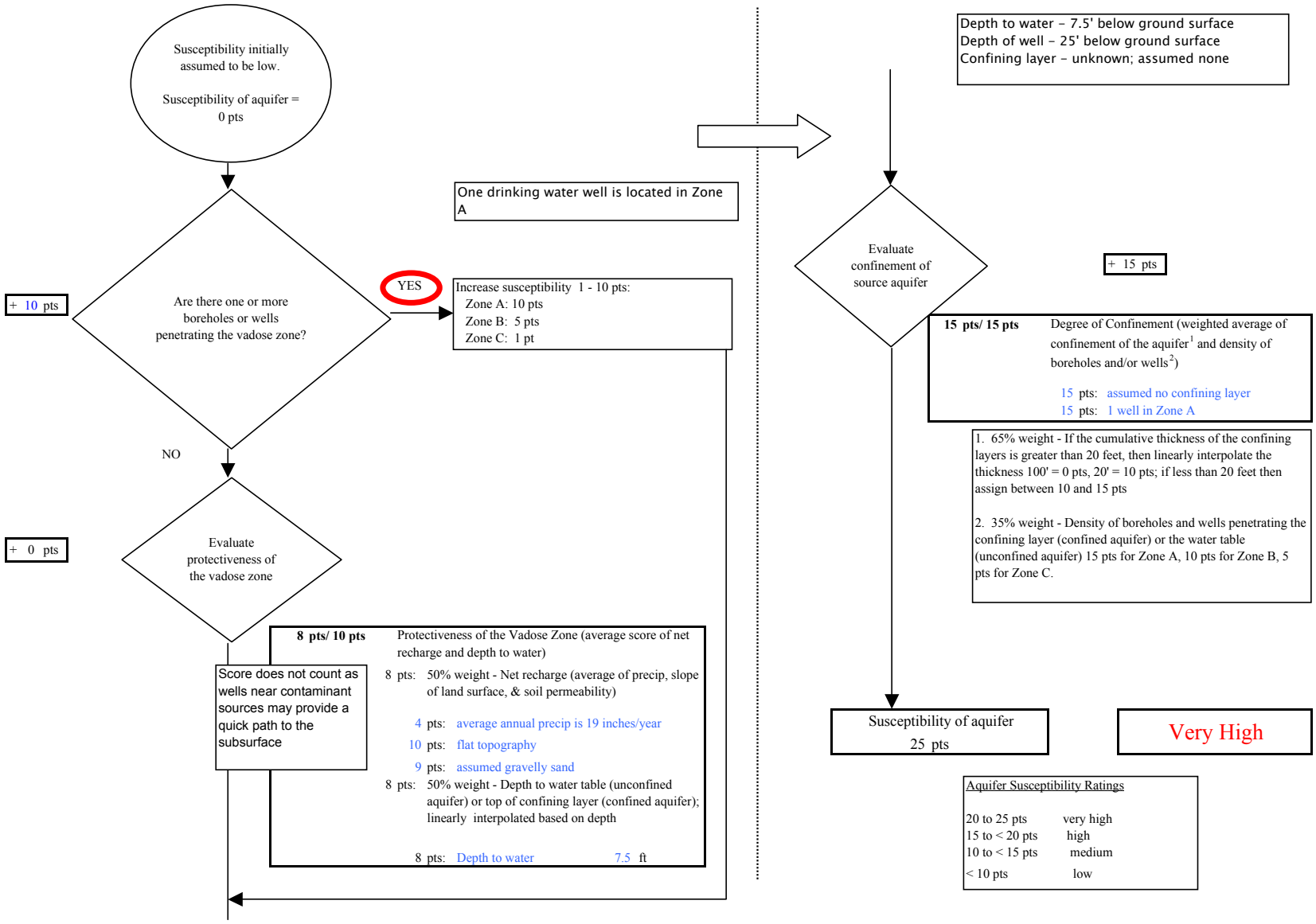
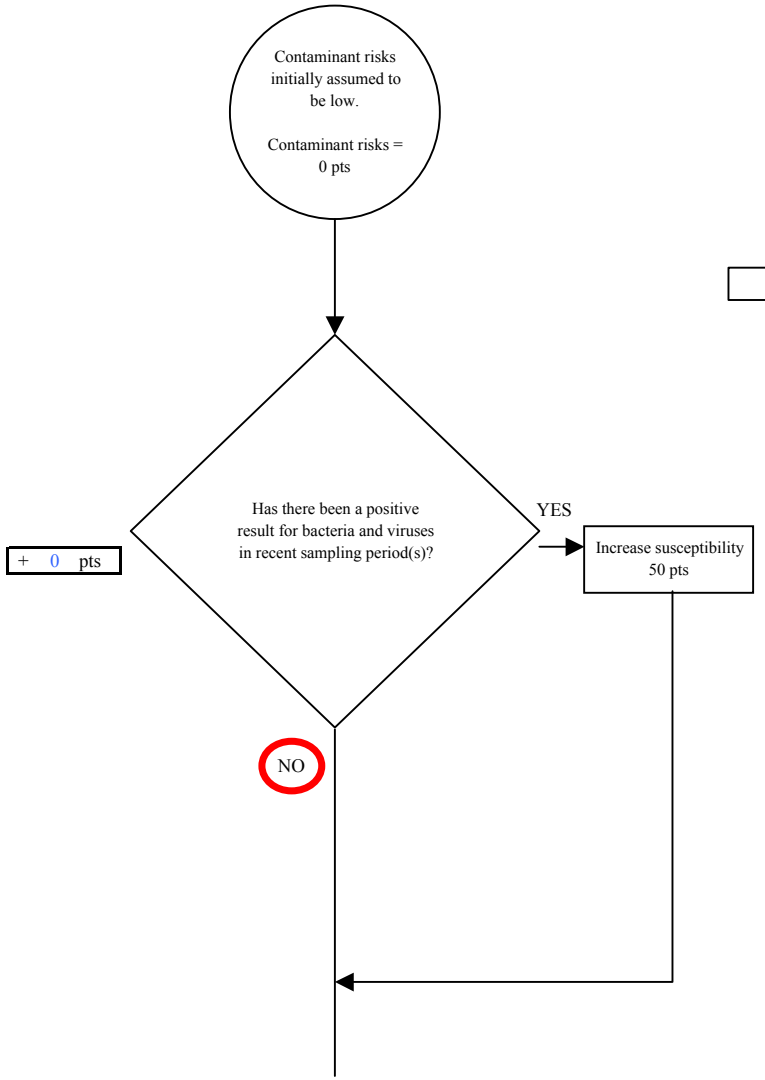
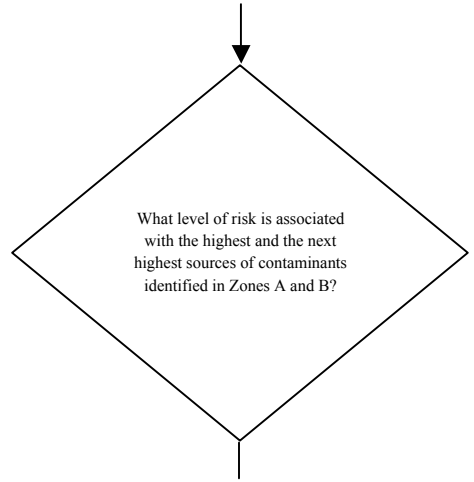


Chart 3. Contaminant risks for Sackett Center (PWS No. 271643.001) - Bacteria & Viruses





+ 40 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

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

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

Matrix Score 40

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

Chart 3. Contaminant risks for Sackett Center (PWS No. 271643.001) - Bacteria & Viruses

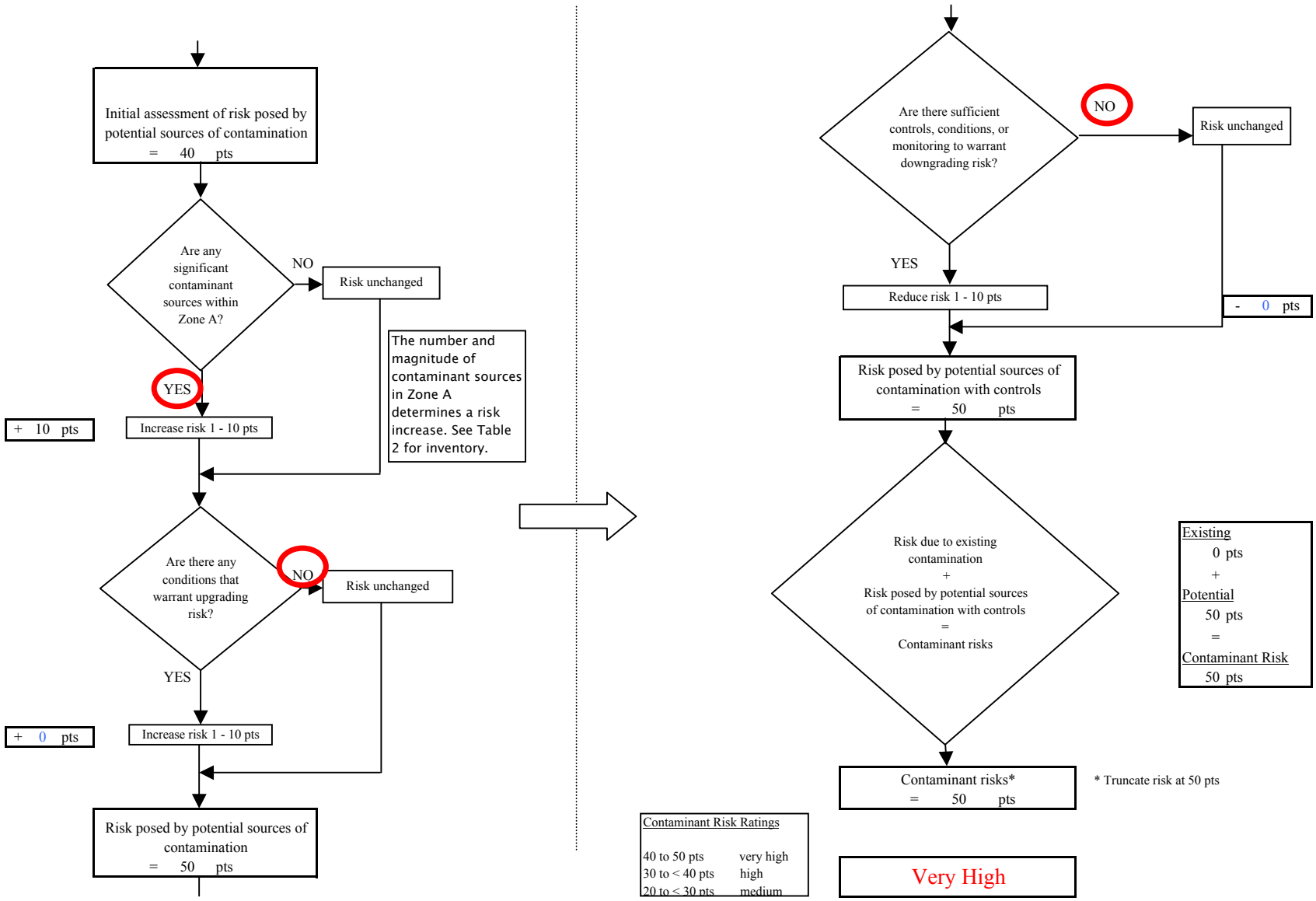


Chart 4. Vulnerability analysis for Sackett Center (PWS No. 271643.001) - Bacteria & Viruses

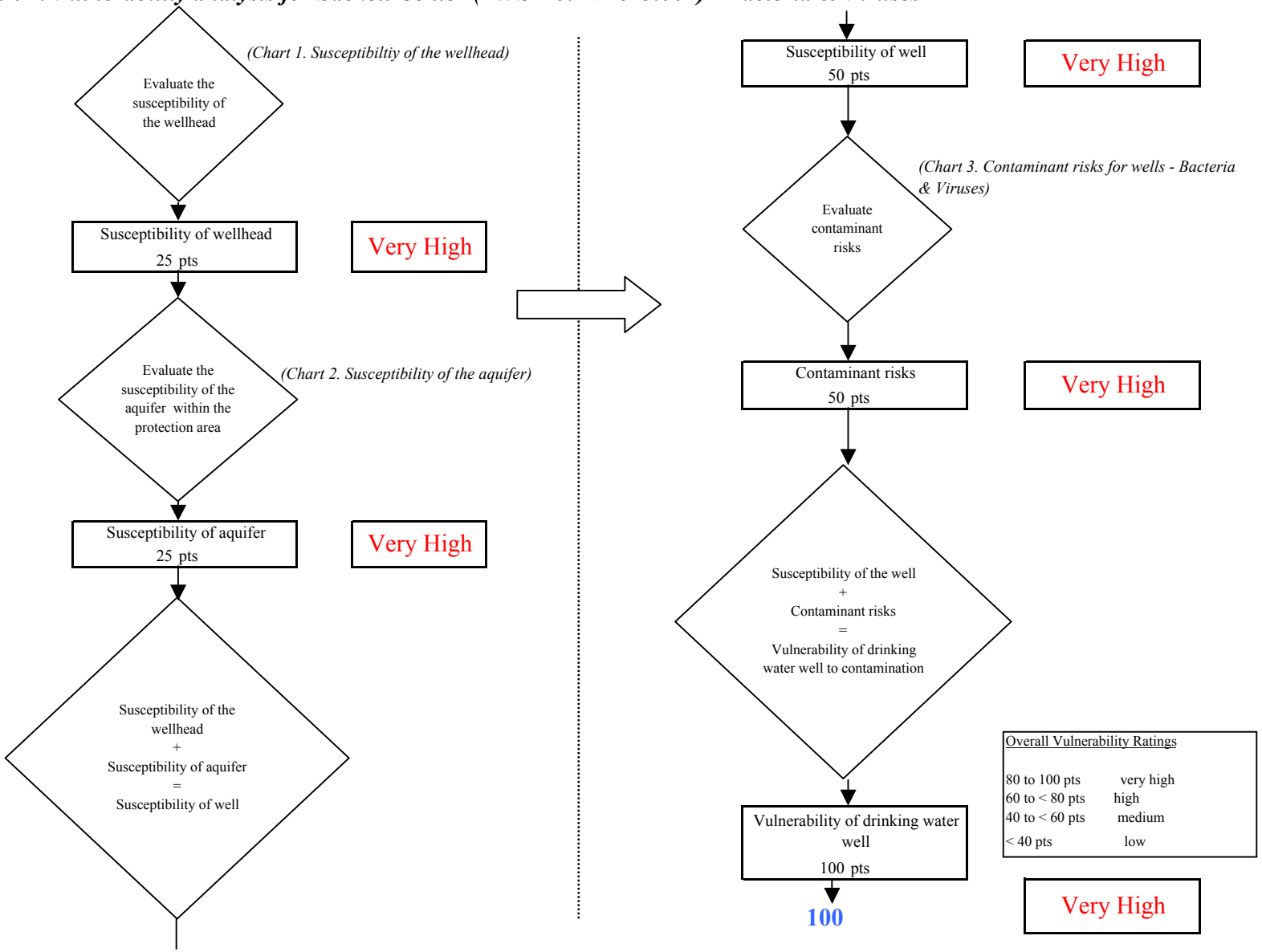


Chart 5. Contaminant risks for Sackett Center (PWS No. 271643.001) - Nitrates and Nitrites

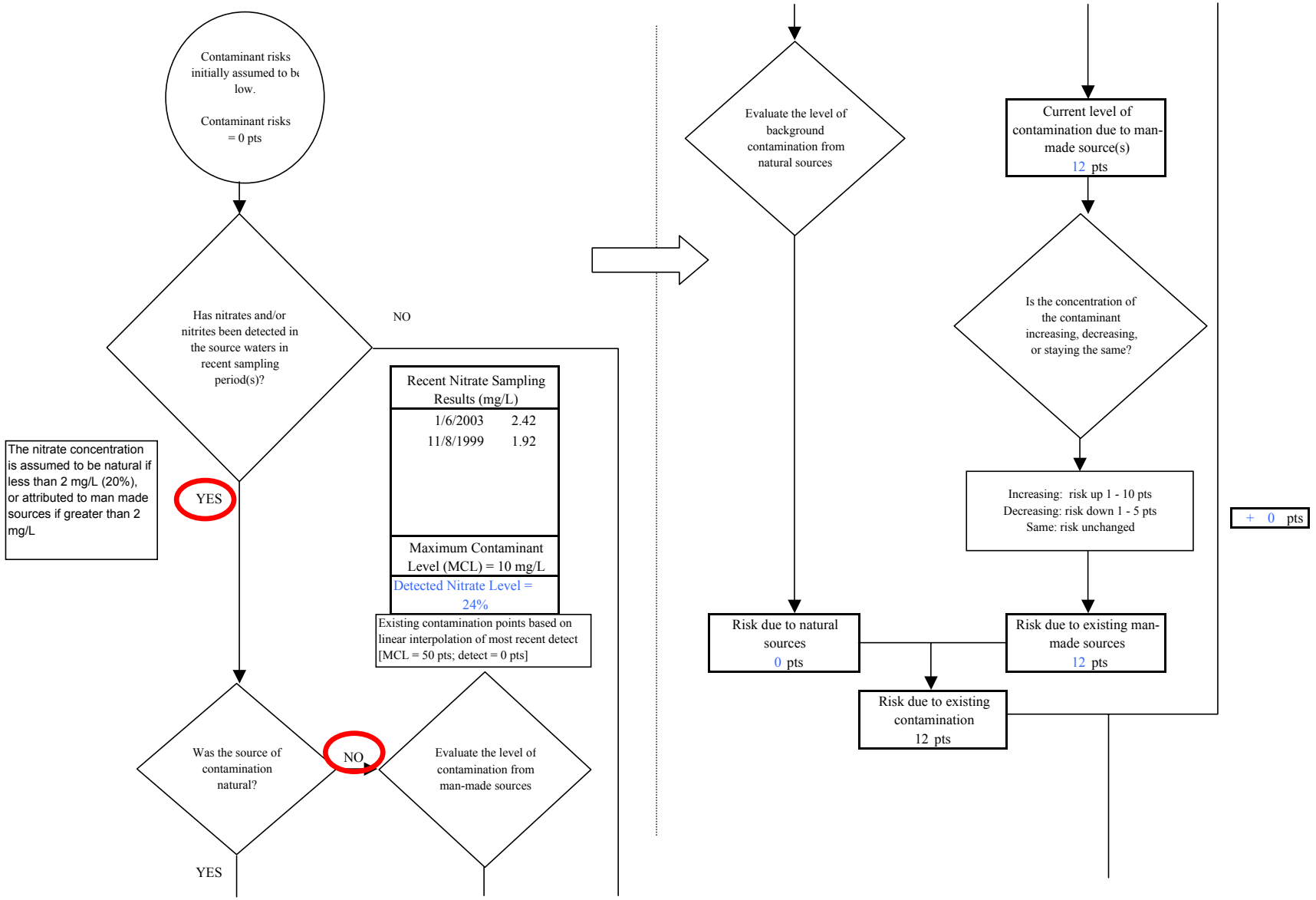


Chart 5. Contaminant risks for Sackett Center (PWS No. 271643.001) - Nitrates and Nitrites

+ 50 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)	2	1	3
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	1	5	6

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

Matrix Score 50

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individua 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.

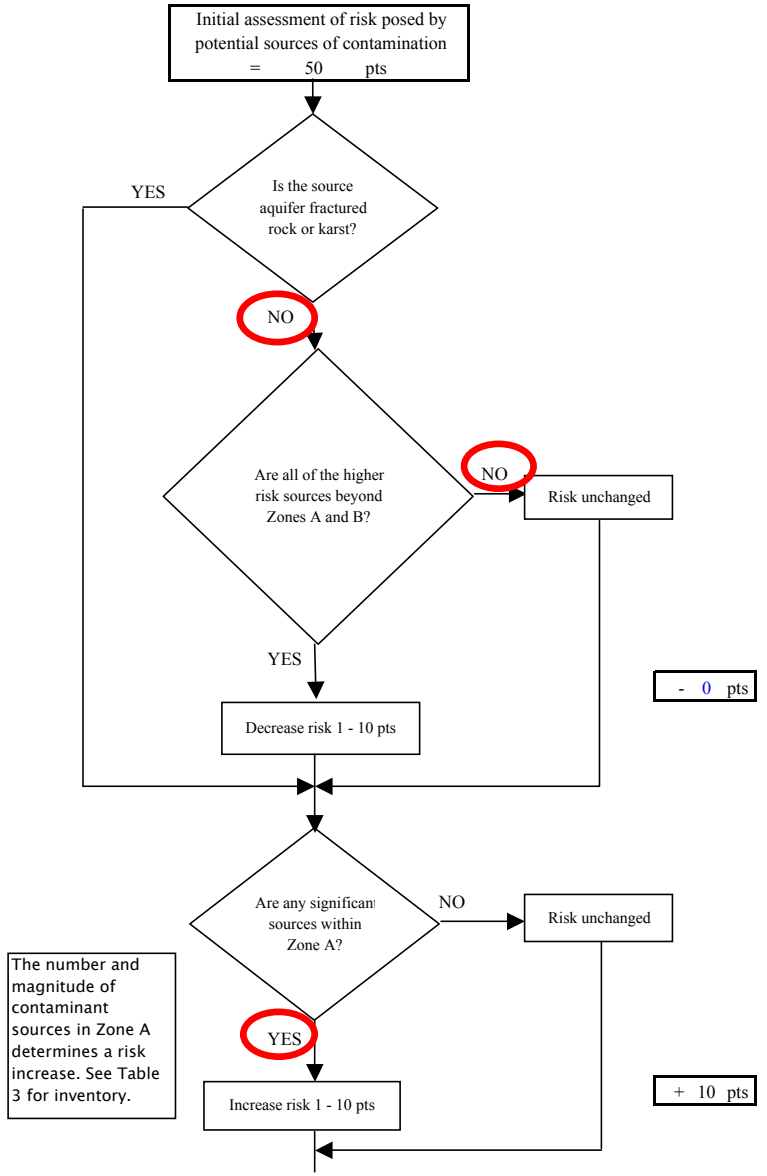


Chart 5. Contaminant risks for Sackett Center (PWS No. 271643.001) - Nitrates and Nitrites

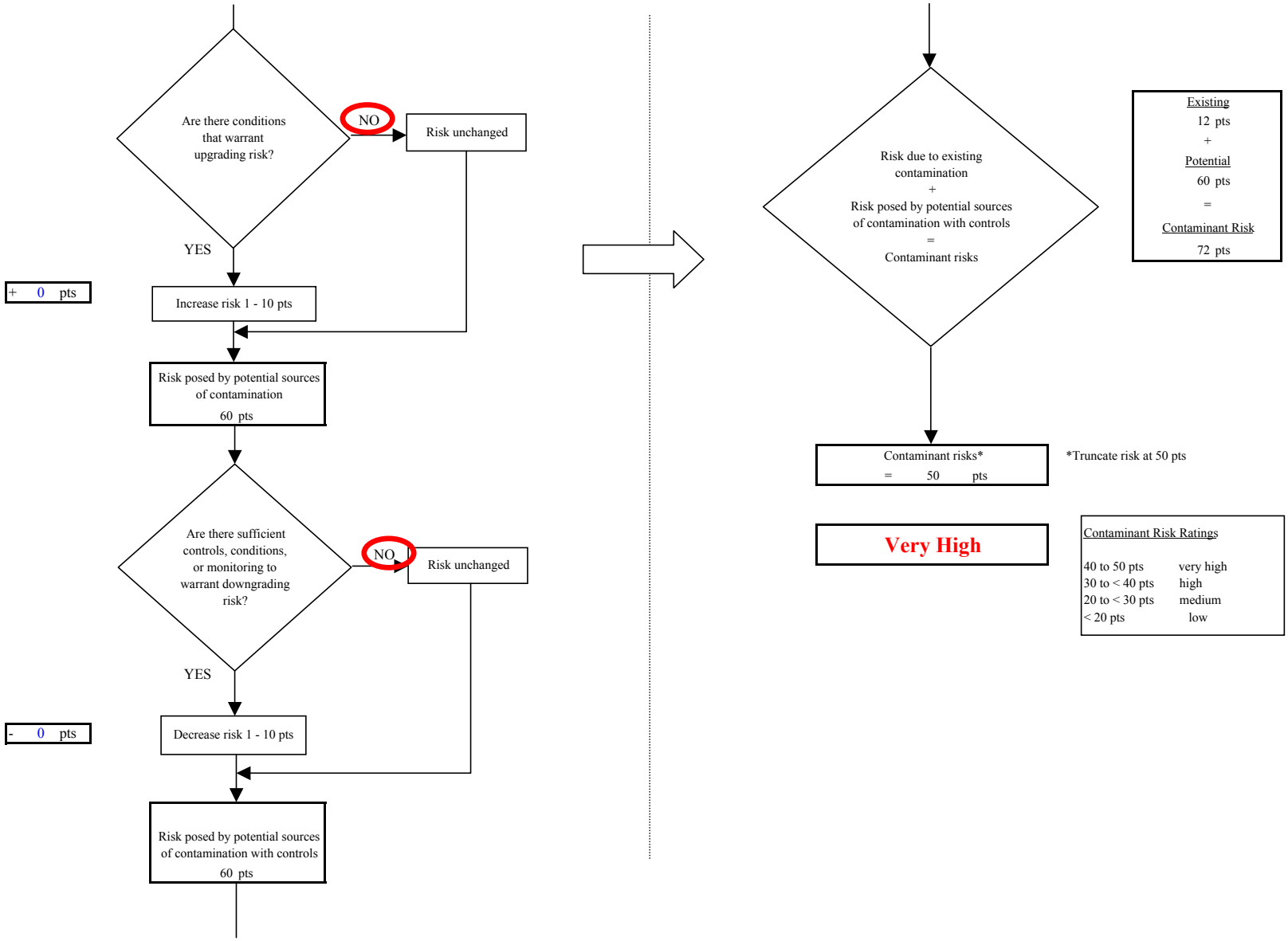


Chart 6. Vulnerability analysis for Sackett Center (PWS No. 271643.001) - Nitrates and Nitrites

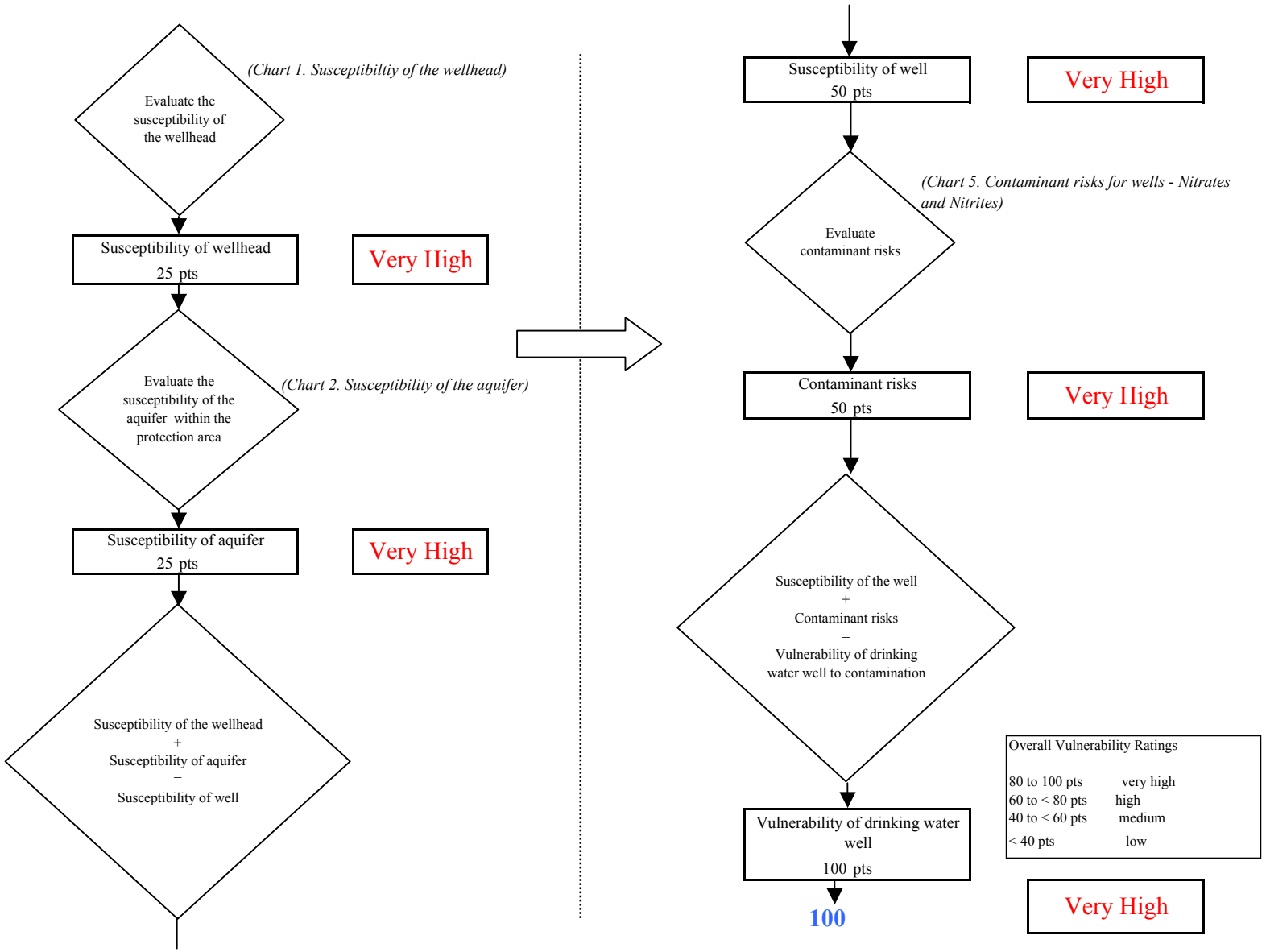


Chart 7. Contaminant risks for Sackett Center (PWS No. 271643.001) - Volatile Organic Chemicals

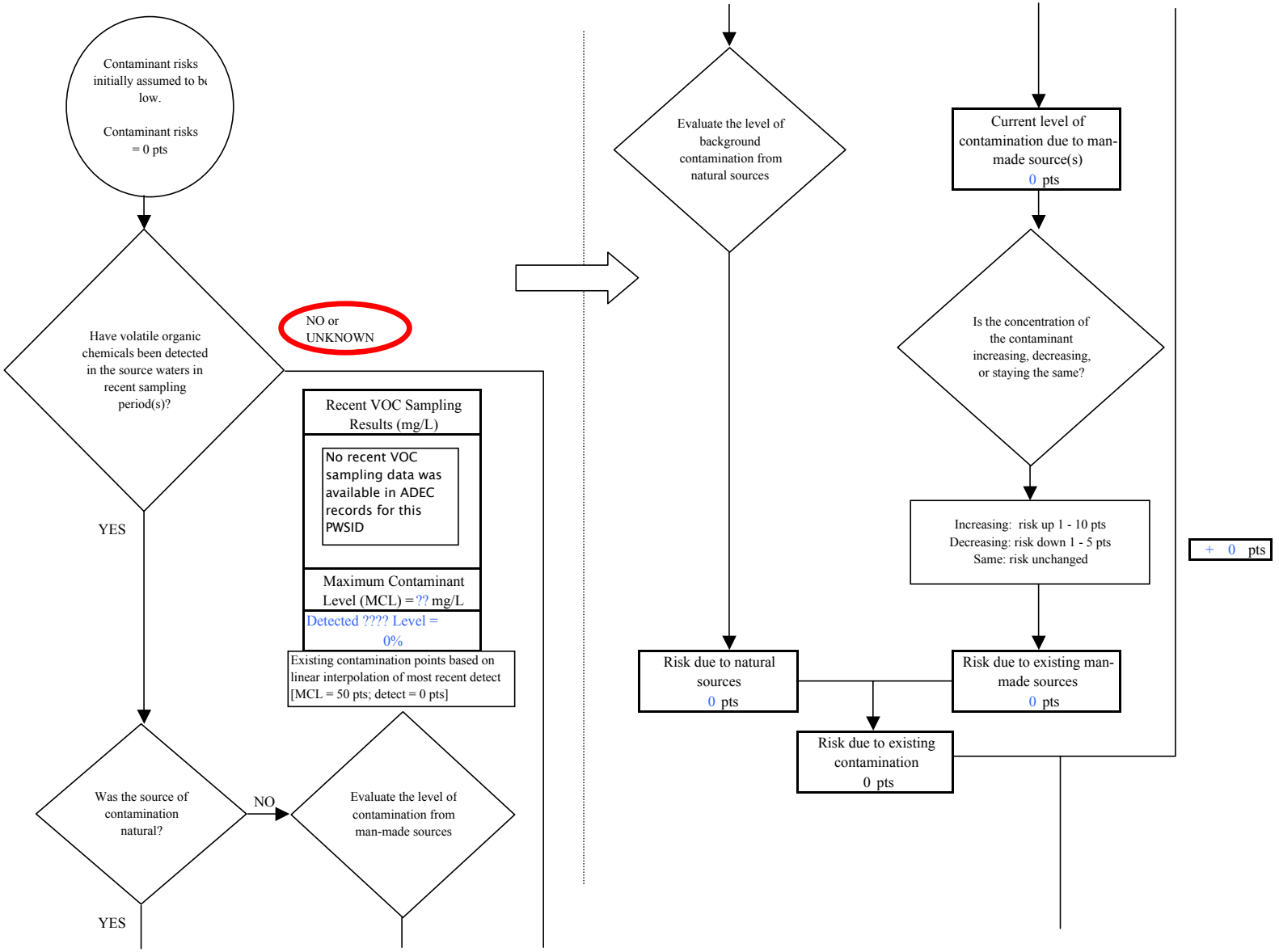
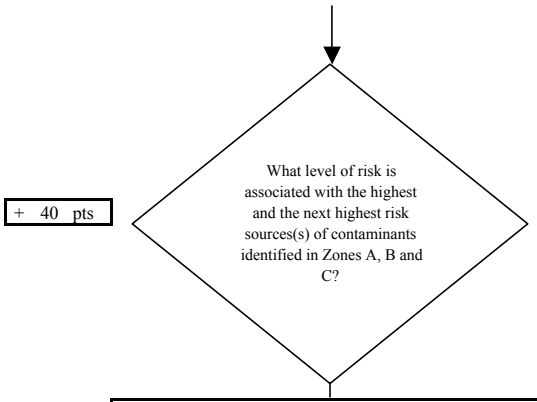


Chart 7. Contaminant risks for Sackett Center (PWS No. 271643.001) - Volatile Organic Chemicals



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)	2	3	5
Medium(s)	0	13	13
Low(s)	4	21	25

	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 individua 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.

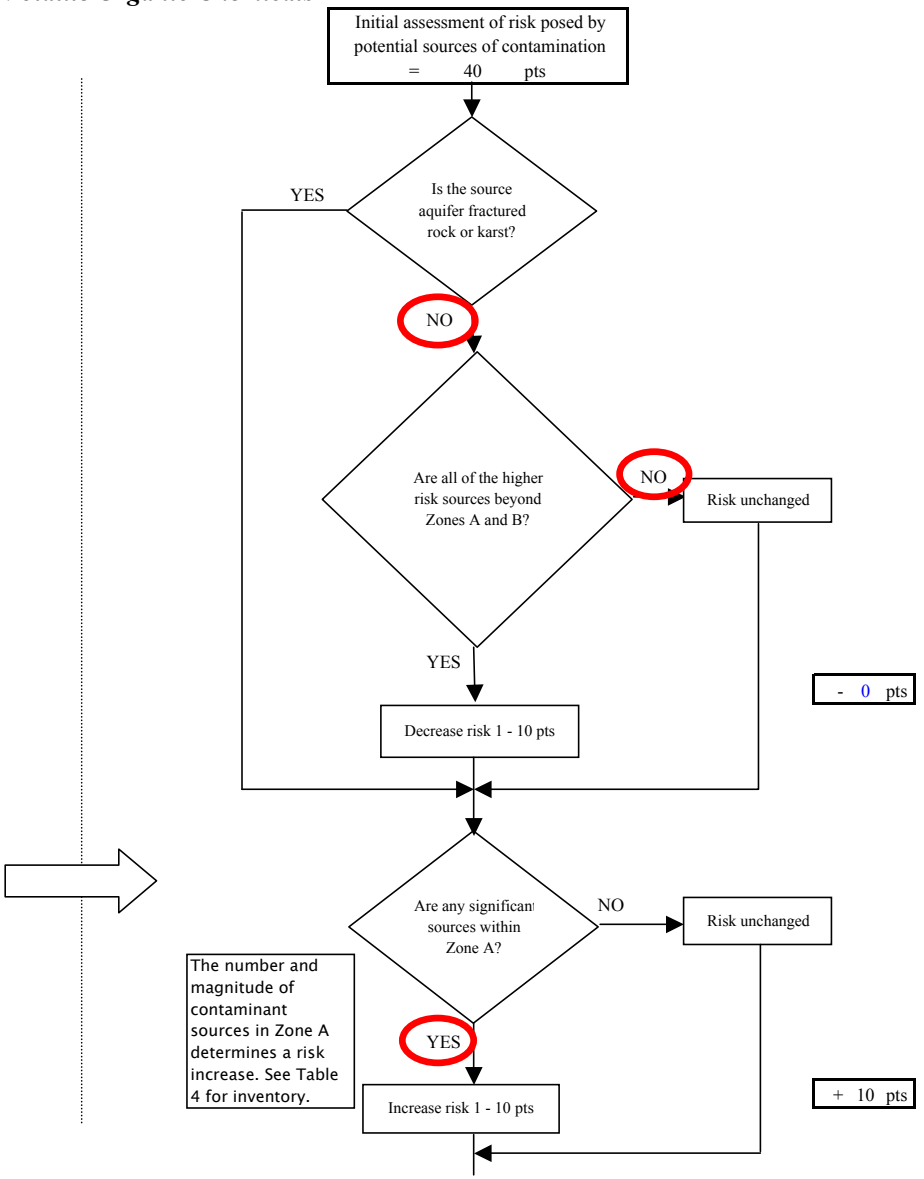


Chart 7. Contaminant risks for Sackett Center (PWS No. 271643.001) - Volatile Organic Chemicals

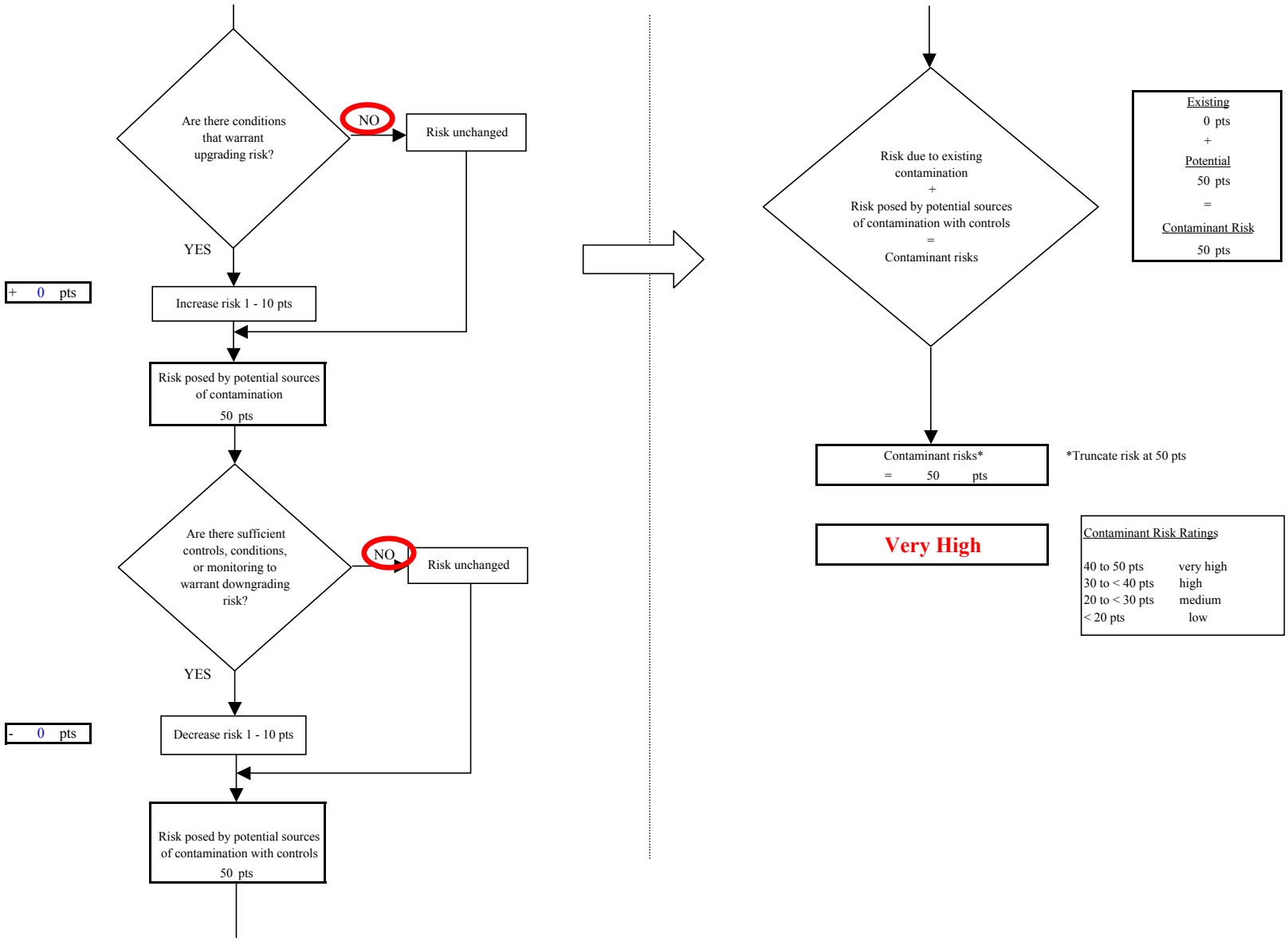


Chart 8. Vulnerability analysis for Sackett Center (PWS No. 271643.001) - Volatile Organic Chemicals