Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Galena Water Project Drinking Water System, Galena, Alaska

PWSID # 360272.001

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DRINKING WATER PROTECTION PROGRAM REPORT 1344
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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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Galena Water Project Water System has two Public Water System (PWS) wells. The well (PWS No. 360272.001) has been used as a drinking water source since it was drilled in 1997. This source water assessment report is exclusively limited to PWSID #360272.001.

The well is a Class A (community and non-transient non-community) water system located on the northwest corner of Denega East in Galena, Alaska. Available records indicate that there is secondary storage of drinking water, with a capacity of 97,000-gallons, and that the drinking water source is treated with calcium hypochlorite. This system holds a waiver for sampling synthetic organic and other organic chemicals through 2004. The system operates year round and serves approximately 500 residents through 40 service connections. 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 public drinking water source include: domestic wastewater collection systems, domestic wastewater treatment plant disposal ponds/lagoons, domestic water treatment (filter backwash water lagoons/ponds), pit toilets, residential septic systems, heating oil tanks, above ground diesel tanks, DEC recognized contaminated sites, abandoned wells, a petroleum product bulk station/terminal, government vehicle maintenance facilities, roads, a pipeline, electric power generation, medical/veterinary facilities, and a kennel. These identified potential and existing sources of contamination are considered 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 contaminant categories.

Overall, the water well received a vulnerability rating of **Very High** for bacteria and viruses, nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

PUBLIC DRINKING WATER SYSTEM

The Galena Water Project well is a Class A (community/non-transient/non-community) public water system. The system is located on the northwest corner of Denega East in Galena, Alaska (Sec. 06, T009S, R010E, Kateel River Meridian; see Map A of Appendix A). The community of Galena is located on the north bank of the Yukon River, 45 miles east of Nulato and 270 air miles west of Fairbanks. It lies northeast of the Innoko National Wildlife Refuge. The community has a population of approximately 760 (ADCED, 2003). Average annual precipitation in Galena is 12.7 inches, including approximately 60 inches of snowfall. Temperatures can be as extreme as -64 to 92°F.

The community of Galena obtains most of their water supply from the two public water systems. Few residents are connected to the piped water and sewer system. Almost half of the residents have septic tanks, while others use a flush/haul system or honeybuckets. The City provides refuse collection and a landfill (ADCED, 2003). Diesel powered electricity is provided by the City of Galena (ADCED, 2003).

According to information supplied by ADEC for the Galena Water Project PWS, the depth of the primary water well is 336 feet below the ground surface and is screened in a confined aquifer based on available construction details. The well is located within a floodplain.

The 2003 sanitary survey for the public water system indicates 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 the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Galena is situated on the Yukon River floodplain. The regional topography consists of relatively flat floodplain deposits dominated by oxbow lakes and abandoned river meanders. Galena soils consist of a thick sequence of undifferentiated fluvial sediments deposited by the Yukon River. A layer of discontinuous permafrost underlies the local area (URS, 2001).

DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what the most likely pathways are 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 Galena Water Project 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 A Public Water Systems for additional information).

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

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than 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 Galena Water Project 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 Galena Water Project DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile organic chemicals,
- Heavy metals, cyanide and other inorganic chemicals,
- Synthetic organic chemicals,
- Other 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, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF THE 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 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. Chart 4 contains 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

The Galena Water Project water well is in a confined aquifer. Confined aquifers are less 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 this PWS.

Table 2. Susceptibility

	Score	**Rating**
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	22	Very High
Natural Susceptibility	42	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
Heavy Metals, Cyanide and Other Inorganic Chemicals	50	Very High
Synthetic Organic Chemicals	40	Very High
Other 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 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	90	Very High
Nitrates and Nitrites	90	Very High
Volatile Organic Chemicals	90	Very High
Heavy Metals, Cyanide and Other Inorganic Chemicals	90	Very High
Synthetic Organic Chemicals	80	Very High
Other Organic Chemicals	90	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of domestic wastewater treatment plant disposal ponds/lagoons in Zone A. (see Table 2 – Appendix B).

Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, they are 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. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2003).

No positive bacteria counts have been 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 domestic wastewater treatment plant disposal ponds/lagoons, and an abandoned well in Zone A. Other potential contaminant sources are also found within the protection area (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 they did not exceed the MCL of 10mg/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).

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 a petroleum product bulk station/terminal in Zone A. Other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

High concentrations of trihalomethanes (TTHMs) were reported in recent sampling events for this public water system. The concentrations of TTHM reported in 2001, 2002, and 2003 exceeded the MCL of 0.08 mg/L. TTHM's are considered water treatment byproducts and are not representative of source water conditions, however, risk points were assigned since the analyte exceeded 100% of the MCL.

Aside from being water treatment byproducts, possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, roads, and airports. See Table 4 in Appendix B for a complete listing.

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**.

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Very High**. The risk is primarily attributed to the presence of an abandoned well in Zone A (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, high levels of copper and lead have been detected exceeding or meeting their respective MCL's of 1.3mg/L and 0.015mg/L (see Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Very High**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Very High**. The risk is primarily attributed to the presence of an abandoned well in Zone A (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Galena Water Project (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

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 **Very High**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of an abandoned well, a petroleum product bulk station/terminal, a pipeline, and electric power generation in Zone A. Other potential contaminant sources are also found within the protection area (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for the Galena Water Project (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

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 **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 Galena Water Project and of the community of Galena 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

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

URS Corporation, 2001, Information from Follow-On Investigation at Former UST Sites Report, Galena Airport, Alaska, September 2001.

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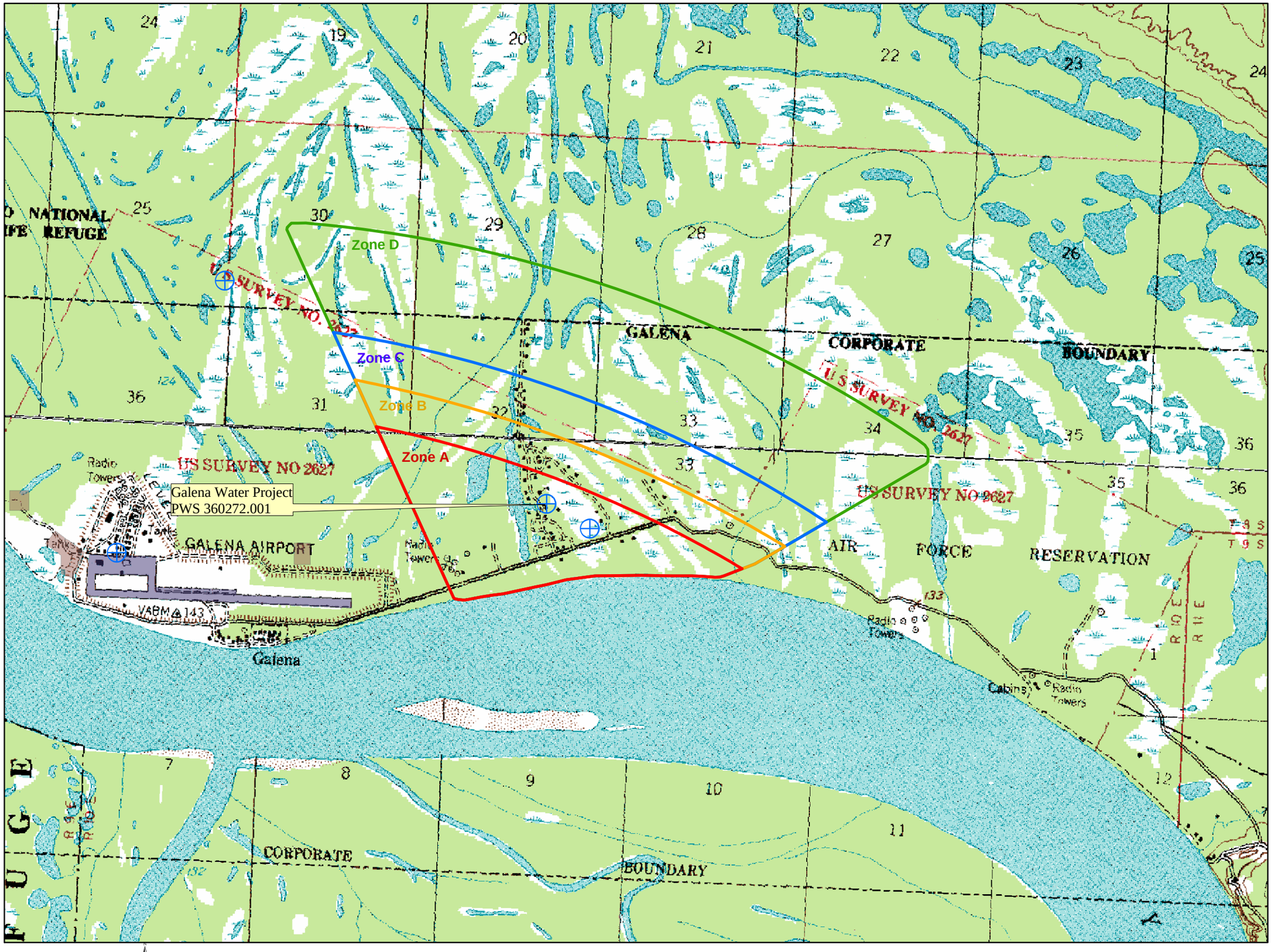
APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #360272.001 Galena Water Project



LEGEND

- Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours

Transportation

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

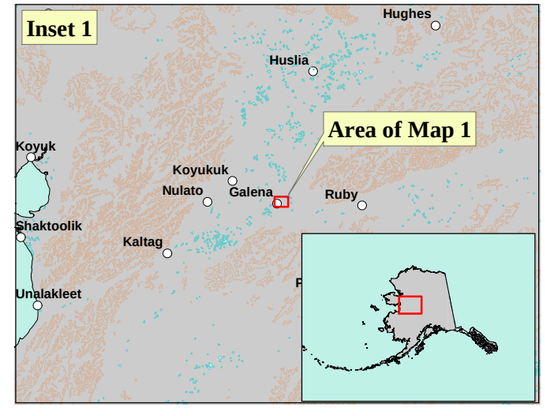
Protection Zones

- 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

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 A Public Water Systems" published by ADEC

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



Galena Water Project
PWS 360272.001
Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking (Tables 1-7)

Table 1

Contaminant Source Inventory for ***Galena Water Project***

PWSID 360272.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	C	
Domestic water treatment - filter backwash water lagoons/ponds	D06	D06-01	A	C	
Domestic water treatment - filter backwash water lagoons/ponds	D06	D06-02	A	C	
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	C	Assume 50 or less septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assume 65 or less heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	C	Galena AFS-POL Tank Farm, Reckey #198531X130501, Status: MOGAS fill stand lost ~200-500 gallons in 1985; free-product detected on groundwater; DRO, GRO and Benzene contamination
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	C	Campion Air Force Station/Galena AFS Fire Training Area, Reckey #198831X127206, Status: Fuel sprayed onto items to start fires for training; potential exposure pathways identified as groundwater, surface water, sediment, and soil
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	A	C	Galena AFS-Bldg. 1400 & 1401 USTs, Reckey #199331X124201, Status: Soil contamination found during removal of two heating oil tanks in NE area of runway on 8/30/93. Contamination isolated to tank area; three monitoring wells installed
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	A	C	Galena AFS-Perimeter Dike Drums, Reckey #198831X927203, Status: Seasonal high water of the Yukon has distributed thousands of drums used to construct a flood control dike throughout the woods; 1% are suspected to contain product, mostly asphault
Abandoned wells	W01	W01-01	A	C	Indicated in SOC Waiver but exact location is unverified
Petroleum product bulk station/terminals	X11	X11-01	A	C	Indicated in Sanitary Survey but exact location is unverified
Government vehicle maintenance facilities	X19	X19-01	A	C	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-01	A	C	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	C	
Electric power generation (fossil fuels)	X36	X36-01	A	C	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	C	Indicated in SOC Waiver but exact location is unverified
Kennels	X49	X49-01	A	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	B	C	Assume 25 or less sewer lines in Zone B
Pit toilets (open hole), nonresidential (one or more)	D16	D16-02	B	C	Assume 40 or less pit toilets/outhouses in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	C	Assume 50 or less septic systems in Zone B
Tanks, heating oil, residential (above ground)	R08	R08-02	B	C	Assume 65 or less heating oil tanks in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	C	Assume 1-20 roads in Zone B

Table 2

Contaminant Source Inventory and Risk Ranking for Galena Water Project
Sources of Bacteria and Viruses

PWSID 360272.001

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	D01-01	A	Medium	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	High	C	
Domestic water treatment - filter backwash water lagoons/ponds	D06	D06-01	A	Medium	C	
Domestic water treatment - filter backwash water lagoons/ponds	D06	D06-02	A	Medium	C	
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 50 or less septic systems in Zone A
Abandoned wells	W01	W01-01	A	Medium	C	Indicated in SOC Waiver but exact location is unverified
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Medium	C	Indicated in SOC Waiver but exact location is unverified
Kennels	X49	X49-01	A	Medium	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	B	Medium	C	Assume 25 or less sewer lines in Zone B
Pit toilets (open hole), nonresidential (one or more)	D16	D16-02	B	Medium	C	Assume 40 or less pit toilets/outhouses in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	Low	C	Assume 50 or less septic systems in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B

Table 3

Contaminant Source Inventory and Risk Ranking for Galena Water Project Sources of Nitrates/Nitrites

PWSID 360272.001

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	D01-01	A	Medium	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	High	C	
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 50 or less septic systems in Zone A
Abandoned wells	W01	W01-01	A	High	C	Indicated in SOC Waiver but exact location is unverified
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Indicated in SOC Waiver but exact location is unverified
Kennels	X49	X49-01	A	Medium	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	B	Medium	C	Assume 25 or less sewer lines in Zone B
Pit toilets (open hole), nonresidential (one or more)	D16	D16-02	B	Medium	C	Assume 40 or less pit toilets/outhouses in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	Low	C	Assume 50 or less septic systems in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B

Table 4

Contaminant Source Inventory and Risk Ranking for Galena Water Project
Sources of Volatile Organic Chemicals

PWSID 360272.001

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	D01-01	A	Low	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	Low	C	
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 50 or less septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 65 or less heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	High	C	Galena AFS-POL Tank Farm, Reckey #198531X130501, Status: MOGAS fill stand lost ~200-500 gallons in 1985; free-product detected on groundwater; DRO, GRO and Benzene contamination
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	High	C	Campion Air Force Station/Galena AFS Fire Training Area, Reckey #198831X127206, Status: Fuel sprayed onto items to start fires for training; potential exposure pathways identified as groundwater, surface water, sediment and soil
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	A	High	C	Galena AFS-Bldg. 1400 & 1401 USTs, Reckey #199331X124201, Status: Soil contamination found during removal of two heating oil tanks in NE area of runway on 8/30/93. Contamination isolated to tank area; three monitoring wells installed
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	A	High	C	Galena AFS-Perimeter Dike Drums, Reckey #198831X927203, Status: Seasonal high water of the Yukon has distributed thousands of drums used to construct a flood control dike throughout the woods; 1% are suspected to contain product, mostly asphault
Abandoned wells	W01	W01-01	A	High	C	Indicated in SOC Waiver but exact location is unverified
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	C	Indicated in Sanitary Survey but exact location is unverified
Government vehicle maintenance facilities	X19	X19-01	A	Medium	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A

Contaminant Source Inventory and Risk Ranking for Galena Water Project

Sources of Volatile Organic Chemicals

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Pipelines (oil and gas)	X28	X28-01	A	Medium	C	
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Indicated in SOC Waiver but exact location is unverified
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	B	Low	C	Assume 25 or less sewer lines in Zone B
Pit toilets (open hole), nonresidential (one or more)	D16	D16-02	B	Low	C	Assume 40 or less pit toilets/outhouses in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	Low	C	Assume 50 or less septic systems in Zone B
Tanks, heating oil, residential (above ground)	R08	R08-02	B	Medium	C	Assume 65 or less heating oil tanks in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B

Table 5

Contaminant Source Inventory and Risk Ranking for Galena Water Project

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 360272.001

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	D01-01	A	Low	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	Low	C	
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 40 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 50 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	C	Galena AFS-POL Tank Farm, Reckey #198531X130501, Status: MOGAS fill stand lost ~200-500 gallons in 1985; free-product detected on groundwater; DRO, GRO and Benzene contamination
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	C	Campion Air Force Station/Galena AFS Fire Training Area, Reckey #198831X127206, Status: Fuel sprayed onto items to start fires for training; potential exposure pathways identified as groundwater, surface water, sediment and soil
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	A	Low	C	Galena AFS-Bldg. 1400 & 1401 USTs, Reckey #199331X124201, Status: Soil contamination found during removal of two heating oil tanks in NE area of runway on 8/30/93. Contamination isolated to tank area; three monitoring wells installed
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	A	Low	C	Galena AFS-Perimeter Dike Drums, Reckey #198831X927203, Status: Seasonal high water of the Yukon has distributed thousands of drums used to construct a flood control dike throughout the woods; 1% are suspected to contain product, mostly asphault
Abandoned wells	W01	W01-01	A	Very High	C	Indicated in SOC Waiver but exact location is unverified
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	Indicated in Sanitary Survey but exact location is unverified
Government vehicle maintenance facilities	X19	X19-01	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	Low	C	
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	

Contaminant Source Inventory and Risk Ranking for
Galena Water Project
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Indicated in SOC Waiver but exact location is unverified
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	B	Low	C	Assume 25 or less sewer lines in Zone B
Pit toilets (open hole), nonresidential (one or more)	D16	D16-02	B	Low	C	Assume 40 or less pit toilets/outhouses in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	Low	C	Assume 50 or less septic systems in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B

Table 6

Contaminant Source Inventory and Risk Ranking for Galena Water Project
Sources of Synthetic Organic Chemicals

PWSID 360272.001

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	D01-01	A	Low	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	Low	C	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 50 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	C	Galena AFS-POL Tank Farm, Reckey #198531X130501, Status: MOGAS fill stand lost ~200-500 gallons in 1985; free-product detected on groundwater; DRO, GRO and Benzene contamination
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	C	Campion Air Force Station/Galena AFS Fire Training Area, Reckey #198831X127206, Status: Fuel sprayed onto items to start fires for training; potential exposure pathways identified as groundwater, surface water, sediment and soil
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	A	Low	C	Galena AFS-Bldg. 1400 & 1401 USTs, Reckey #199331X124201, Status: Soil contamination found during removal of two heating oil tanks in NE area of runway on 8/30/93. Contamination isolated to tank area; three monitoring wells installed
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	A	Low	C	Galena AFS-Perimeter Dike Drums, Reckey #198831X927203, Status: Seasonal high water of the Yukon has distributed thousands of drums used to construct a flood control dike throughout the woods; 1% are suspected to contain product, mostly asphault
Abandoned wells	W01	W01-01	A	High	C	Indicated in SOC Waiver but exact location is unverified
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	Indicated in Sanitary Survey but exact location is unverified
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	C	Indicated in SOC Waiver but exact location is unverified
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	B	Low	C	Assume 25 or less sewer lines in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	Low	C	Assume 50 or less septic systems in Zone B

Table 7

Contaminant Source Inventory and Risk Ranking for Galena Water Project
Sources of Other Organic Chemicals

PWSID 360272.001

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	D01-01	A	Low	C	Assume 25 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-02	A	Low	C	
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 50 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	C	Galena AFS-POL Tank Farm, Reckey #198531X130501, Status: MOGAS fill stand lost ~200-500 gallons in 1985; free-product detected on groundwater; DRO, GRO and Benzene contamination
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	C	Campion Air Force Station/Galena AFS Fire Training Area, Reckey #198831X127206, Status: Fuel sprayed onto items to start fires for training; potential exposure pathways identified as groundwater, surface water, sediment and soil
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	A	Low	C	Galena AFS-Bldg. 1400 & 1401 USTs, Reckey #199331X124201, Status: Soil contamination found during removal of two heating oil tanks in NE area of runway on 8/30/93. Contamination isolated to tank area; three monitoring wells installed
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	A	Low	C	Galena AFS-Perimeter Dike Drums, Reckey #198831X927203, Status: Seasonal high water of the Yukon has distributed thousands of drums used to construct a flood control dike throughout the woods; 1% are suspected to contain product, mostly asphault
Abandoned wells	W01	W01-01	A	High	C	Indicated in SOC Waiver but exact location is unverified
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	Indicated in Sanitary Survey but exact location is unverified
Government vehicle maintenance facilities	X19	X19-01	A	Medium	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	High	C	
Electric power generation (fossil fuels)	X36	X36-01	A	High	C	

Contaminant Source Inventory and Risk Ranking for Galena Water Project

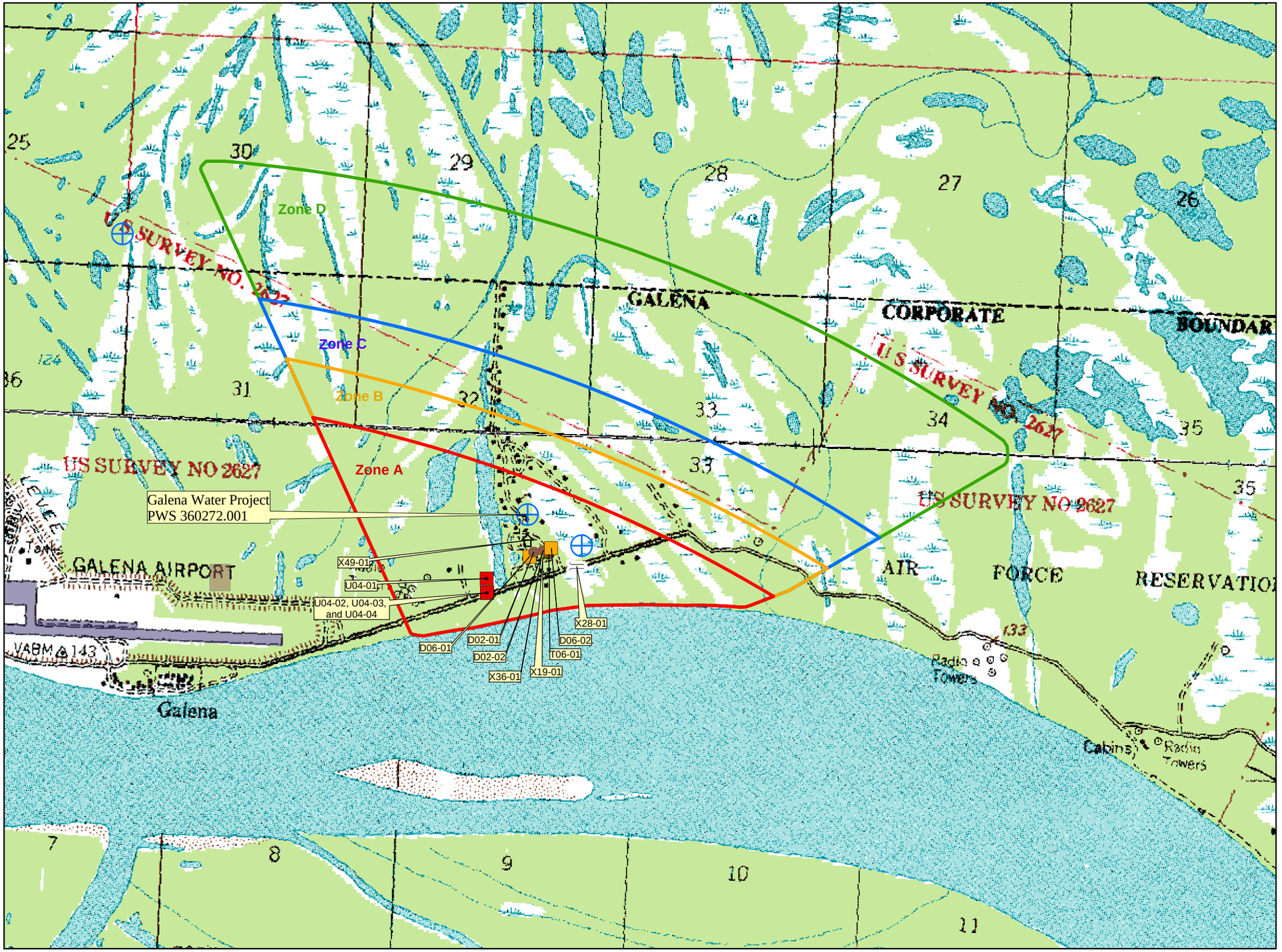
Sources of Other Organic Chemicals

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	D01-01	B	Low	C	Assume 25 or less sewer lines in Zone B
Septic systems (serves one single-family home)	R02	R02-02	B	Low	C	Assume 50 or less septic systems in Zone B
Highways and roads, dirt/gravel	X24	X24-02	B	Low	C	Assume 1-20 roads in Zone B

APPENDIX C

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

Public Water Well System for PWS #360272.001 Galena Water Project
Showing Potential and Existing Sources of Contamination



LEGEND

Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours

Transportation

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

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

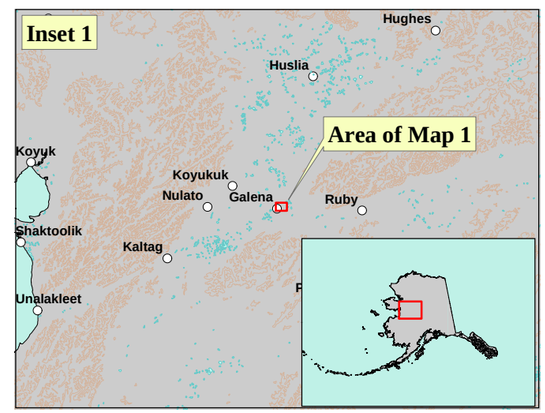
Existing or Potential Contaminant Sources

- Domestic wastewater treatment plant disposal ponds/lagoons (D02)
- Tanks, diesel (above ground) (T06)
- Contaminated sites, DEC recognized, non-Superfund, non-RCRA (U04)
- Government vehicle maintenance facilities (X19)
- Pipelines (oil and gas) (X28)
- Electric power generation (fossil fuels) (X36)
- Kennels (X49)
- Domestic water treatment - filter backwash water lagoons/ponds (D06)

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 A Public Water Systems" published by ADEC

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



0 0.3 0.6 1.2 1.8 2.4 Miles

Galena Water Project
PWS 360272.001
Appendix C Map C

APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-14)

Chart 1. Susceptibility of the wellhead - Galena Water Project (PWS No. 360272.001)

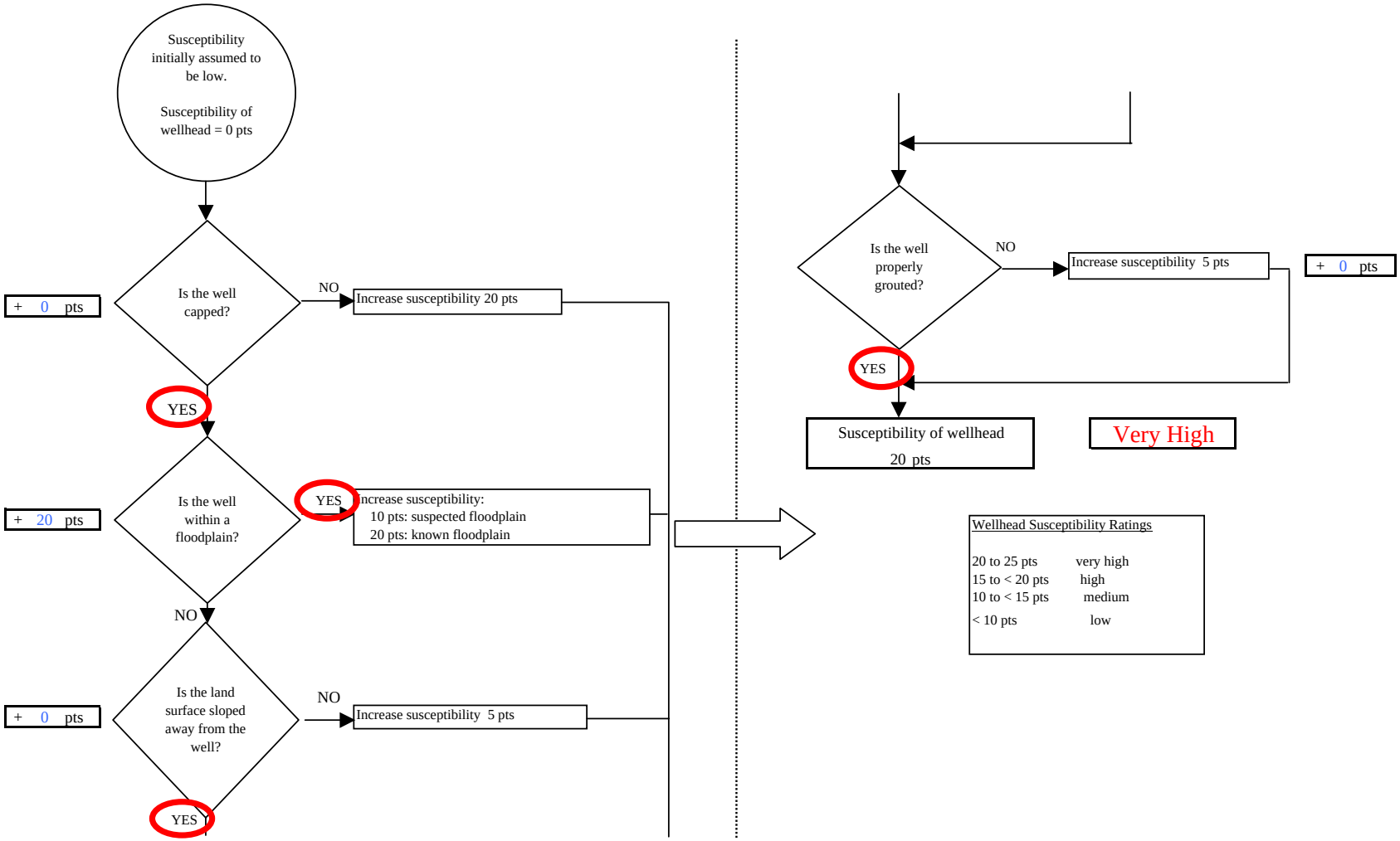


Chart 2. Susceptibility of the aquifer Galena Water Project (PWS No. 360272.001)

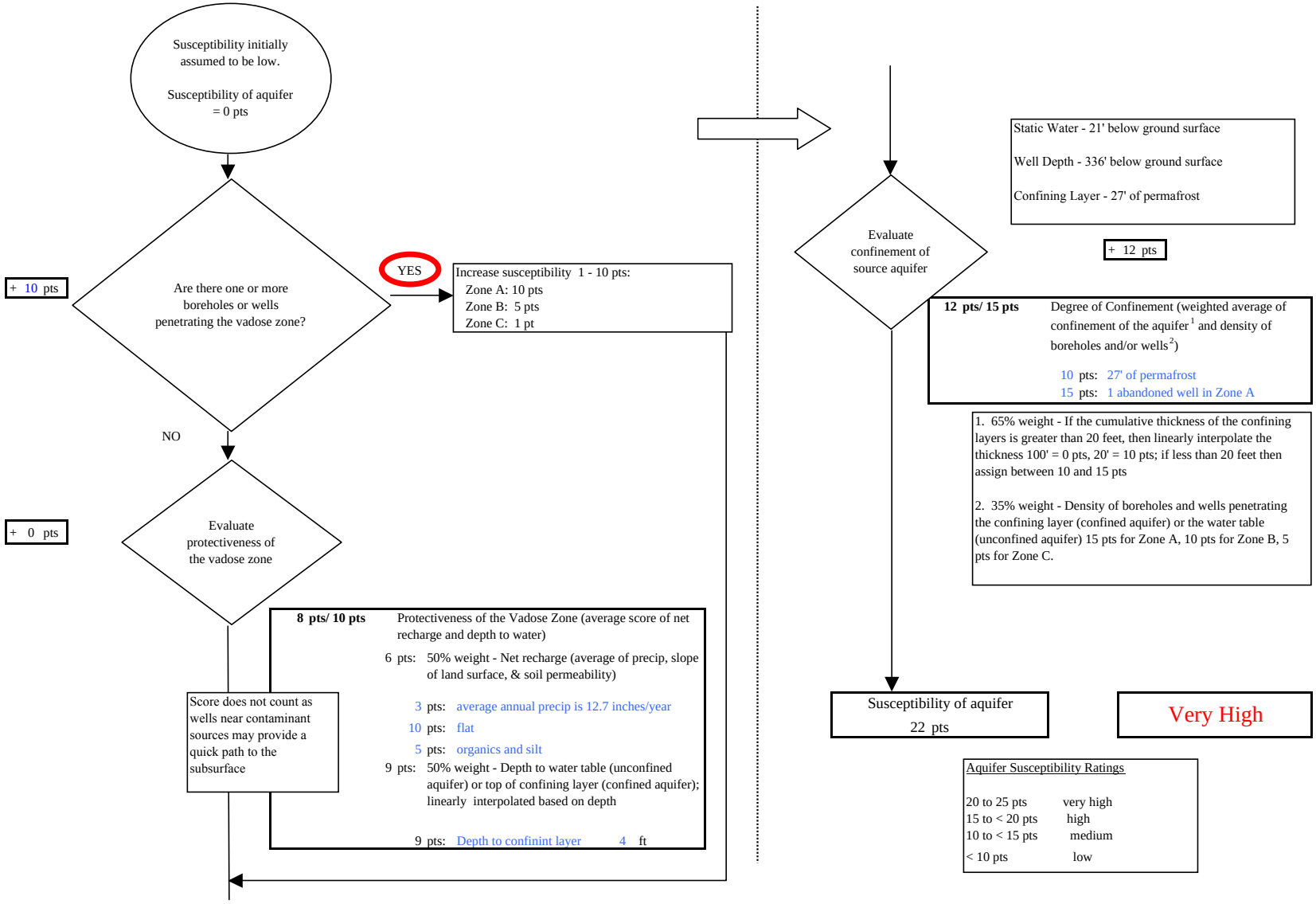
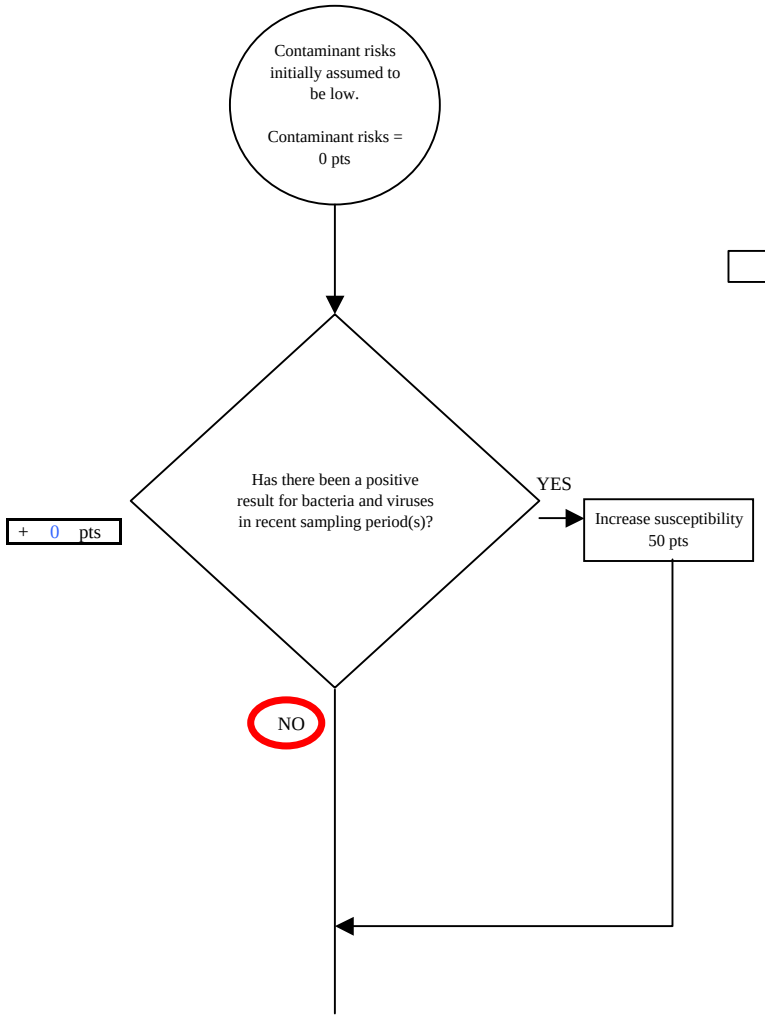
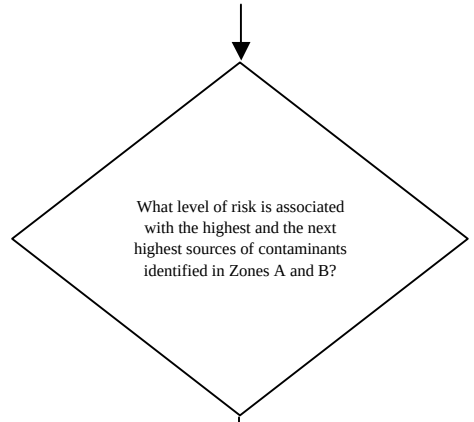


Chart 3. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Bacteria & Viruses





+ 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)	48	40	88
Low(s)	51	9	60

	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 Galena Water Project (PWS No. 360272.001) - Bacteria & Viruses

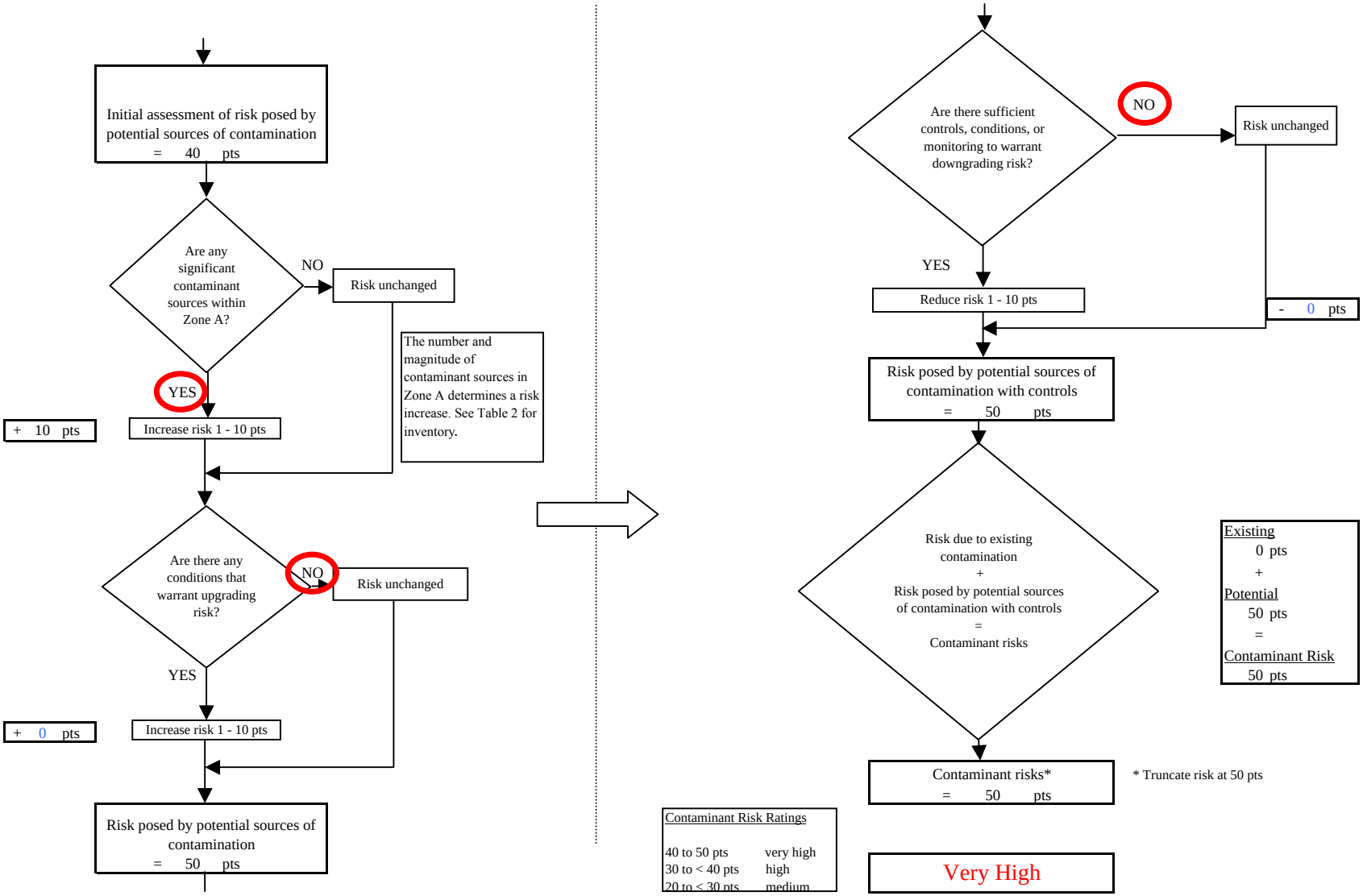


Chart 4. Vulnerability analysis for Galena Water Project (PWS No. 360272.001) - Bacteria & Viruses

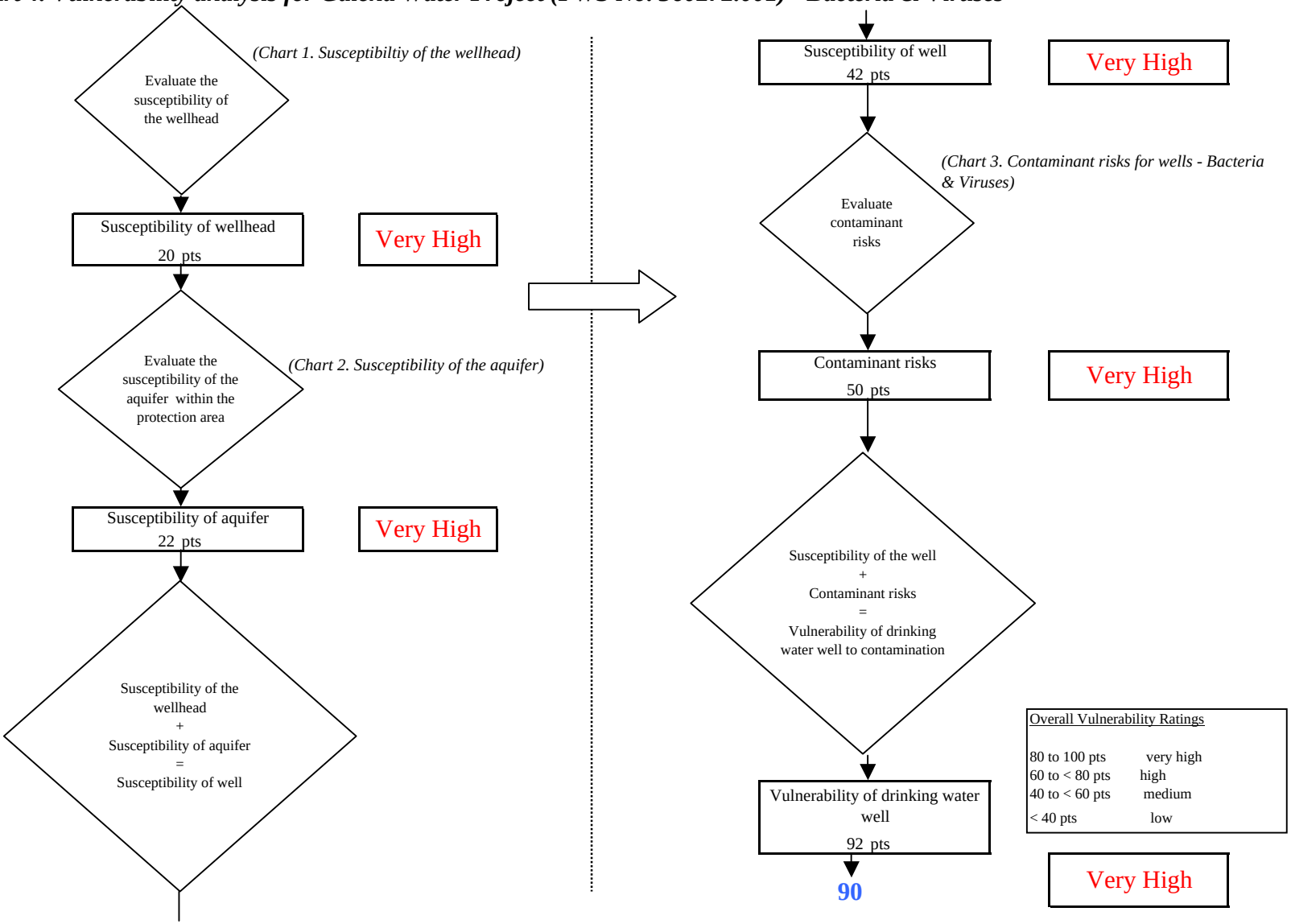


Chart 5. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Nitrates and Nitrites

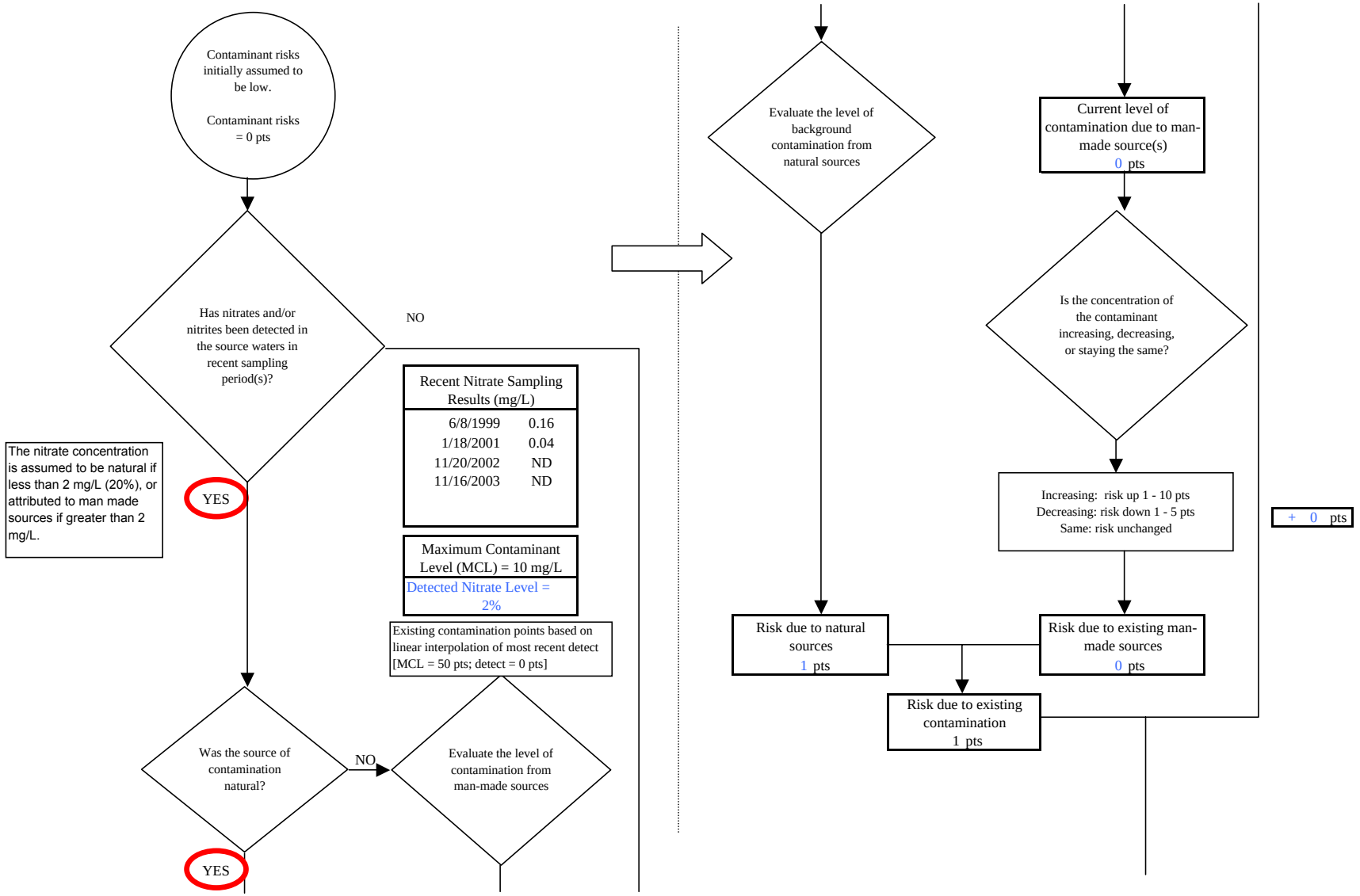


Chart 5. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Nitrates and Nitrites

+ 40 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	3	0	3
Medium(s)	44	40	84
Low(s)	52	9	61

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

Matrix Score 40

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO → Risk unchanged

YES

- 0 pts

Decrease risk 1 - 10 pts

Are any significant sources within Zone A?

NO → Risk unchanged

YES

+ 10 pts

Increase risk 1 - 10 pts

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 3 for inventory.

Chart 5. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Nitrates and Nitrites

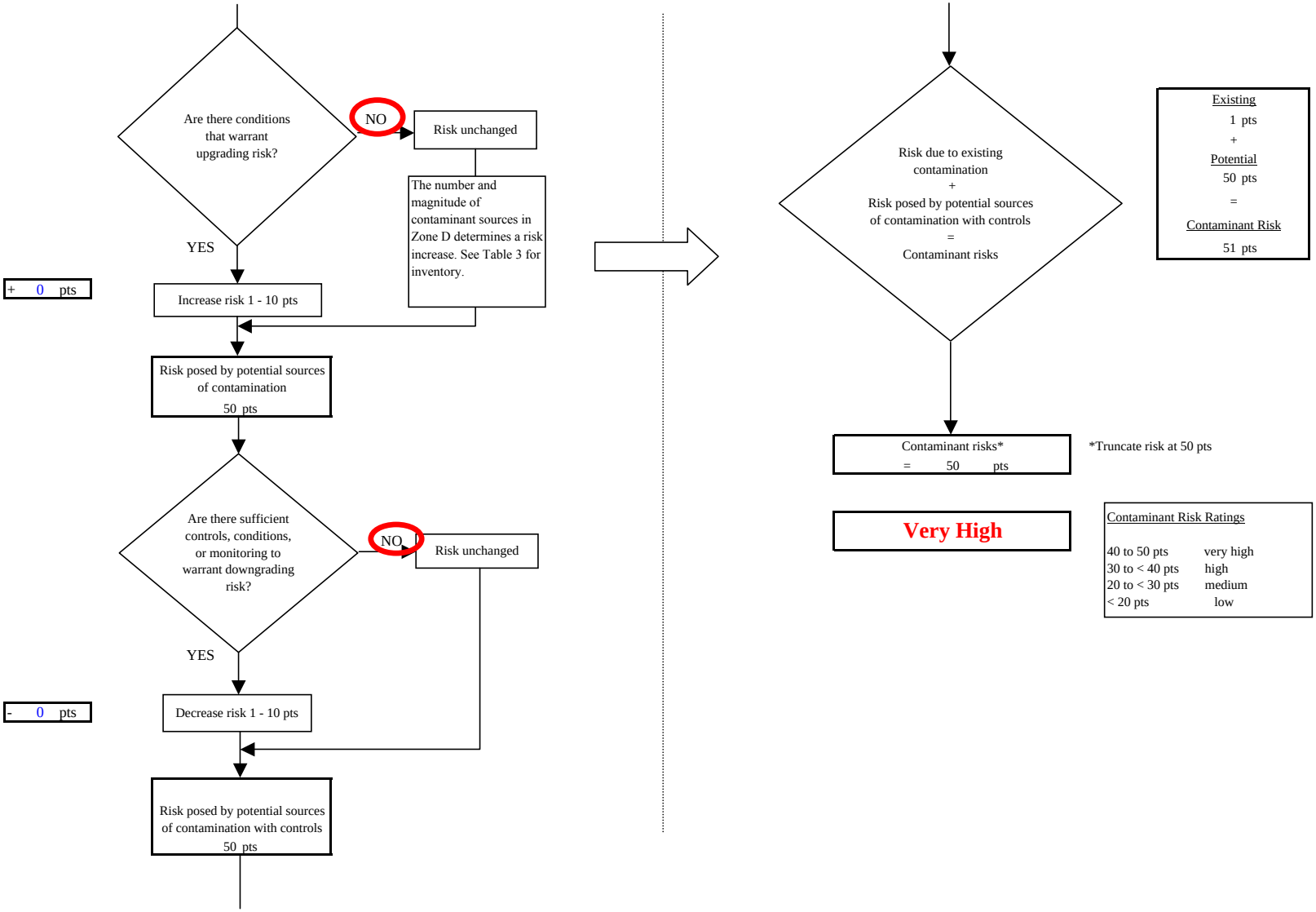


Chart 6. Vulnerability analysis for Galena Water Project (PWS No. 360272.001) - Nitrates and Nitrites

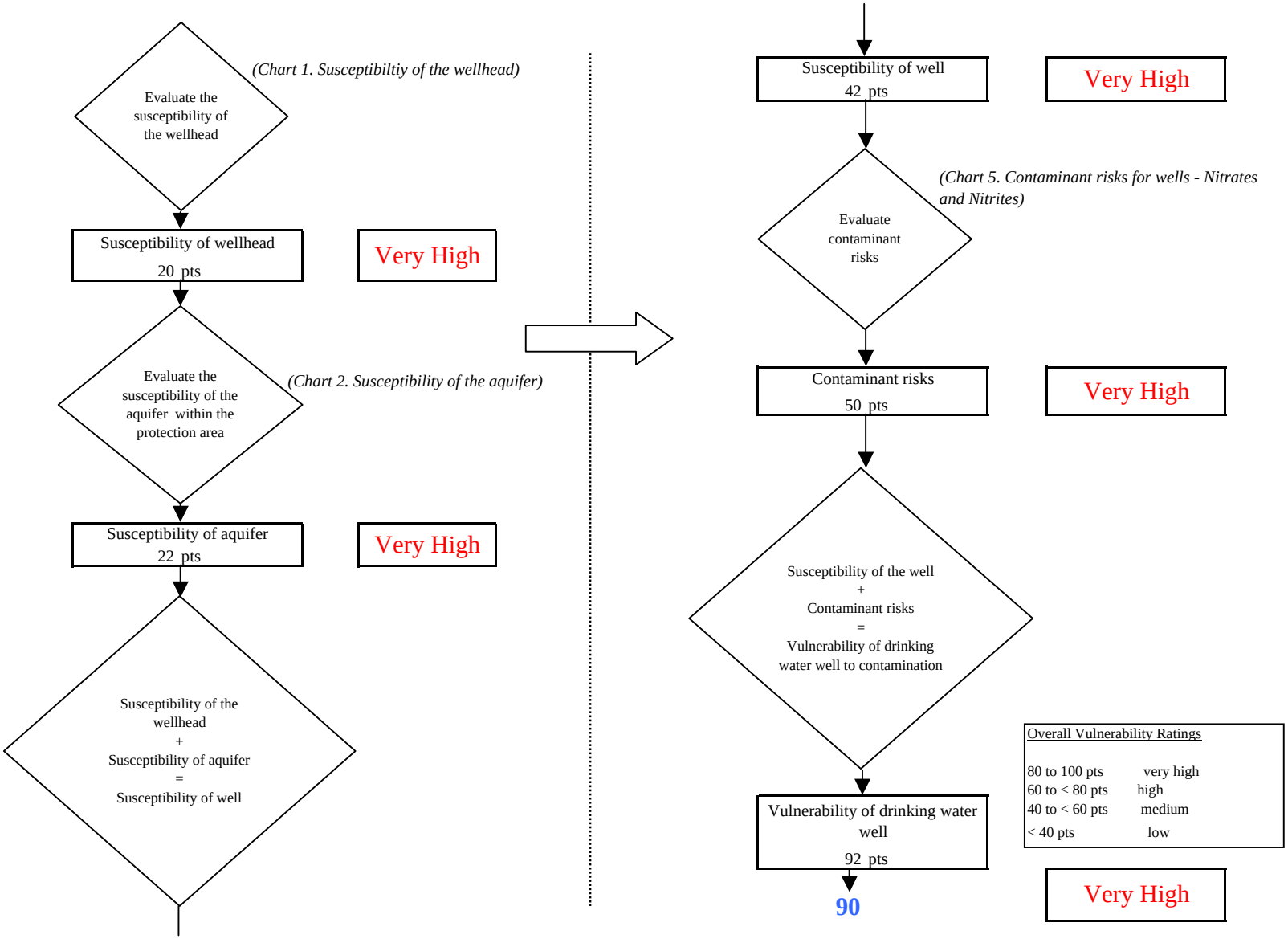


Chart 7. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Volatile Organic Chemicals

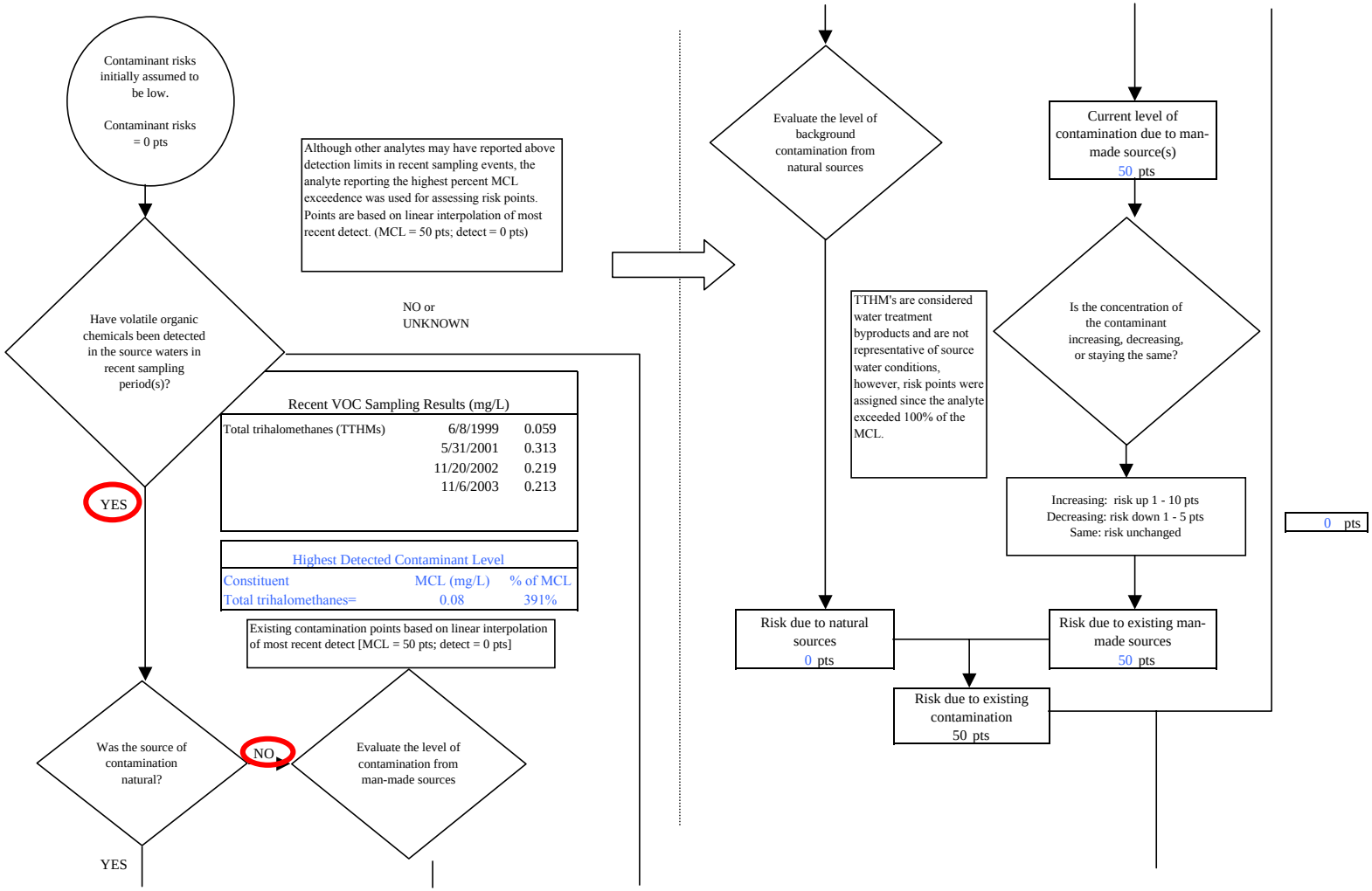


Chart 7. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Volatile Organic Chemicals

+ 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)	1	0	1
High(s)	5	0	5
Medium(s)	69	65	134
Low(s)	50	43	93

	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 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.

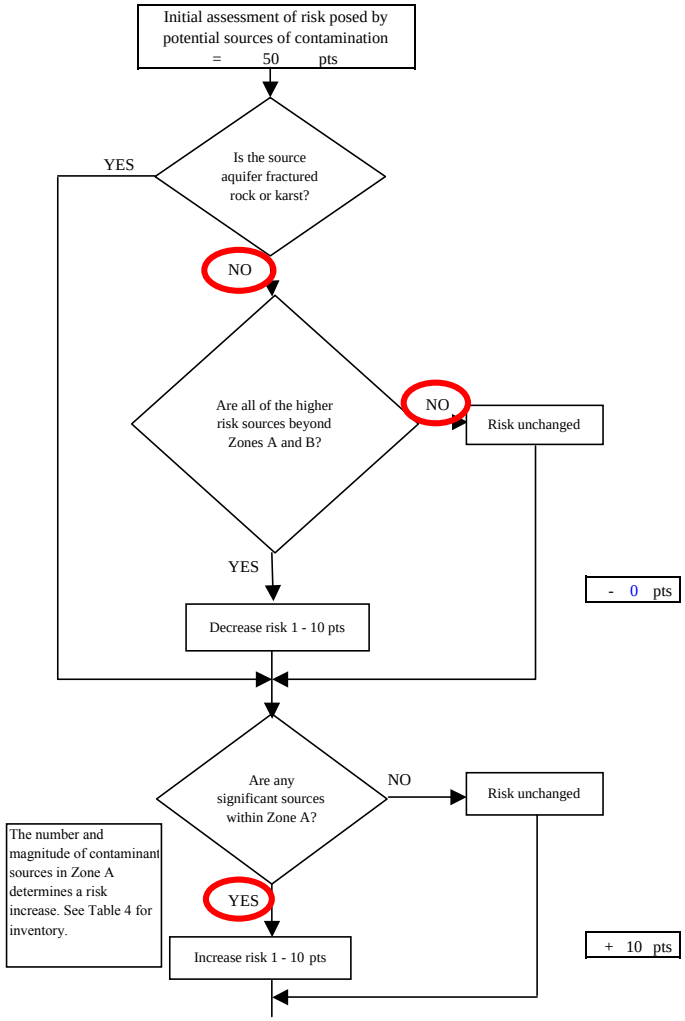


Chart 7. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Volatile Organic Chemicals

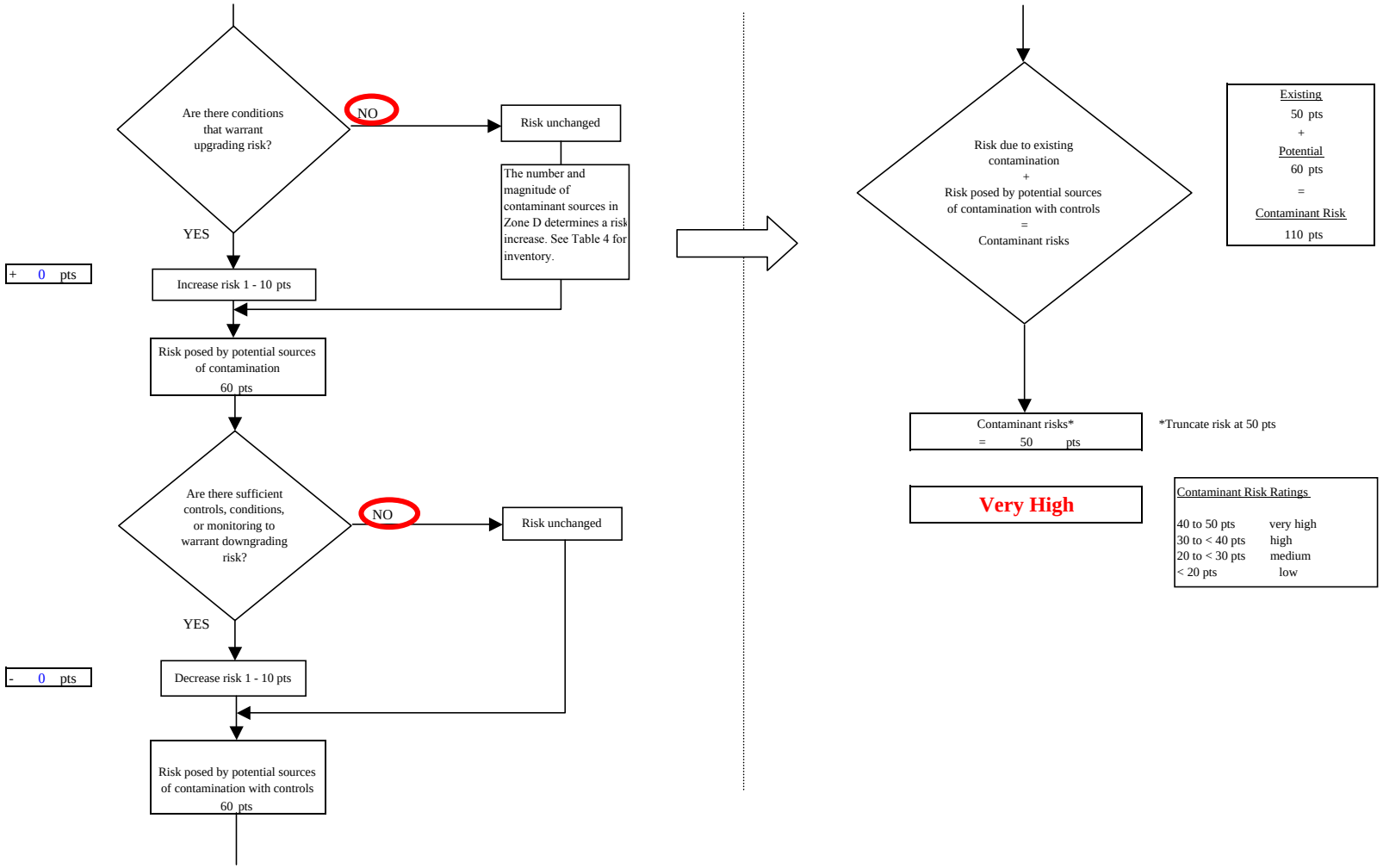


Chart 8. Vulnerability analysis for Galena Water Project (PWS No. 360272.001) - Volatile Organic Chemicals

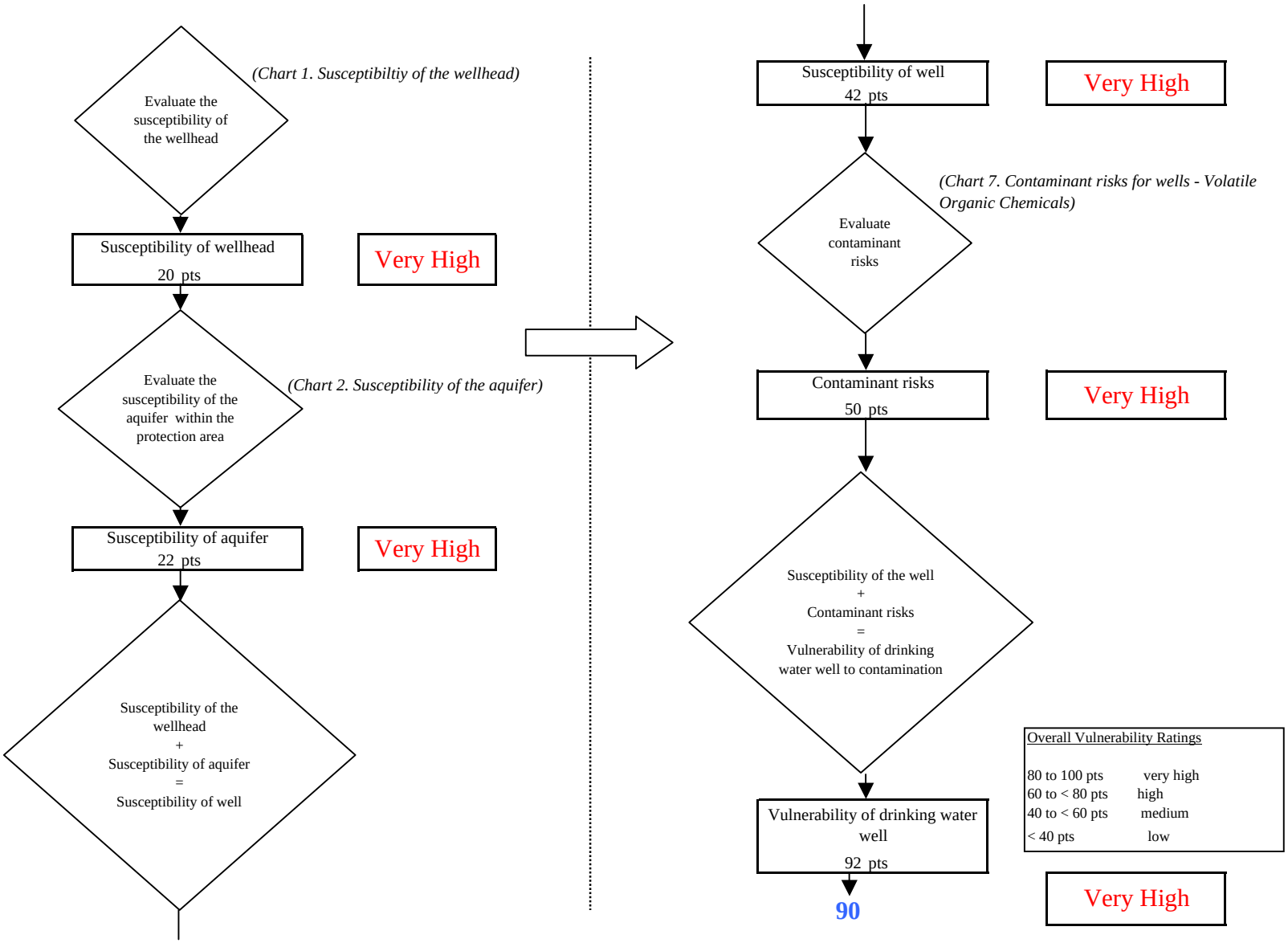


Chart 9. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

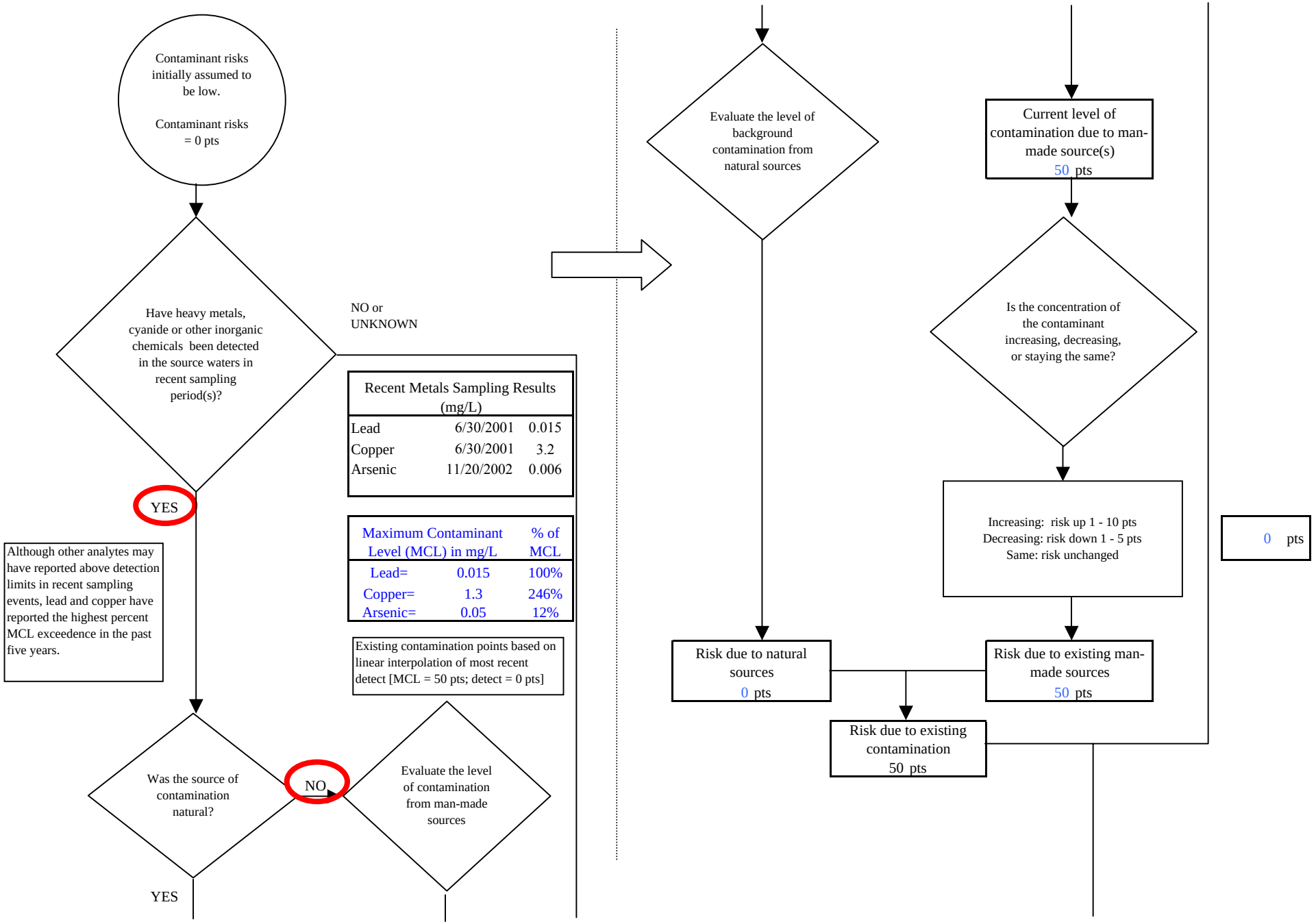


Chart 9. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 40 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	1	0	1
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	53	43	96

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

Matrix Score 40

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 5 for inventory.

YES

Increase risk 1 - 10 pts

+ 10 pts

Chart 9. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

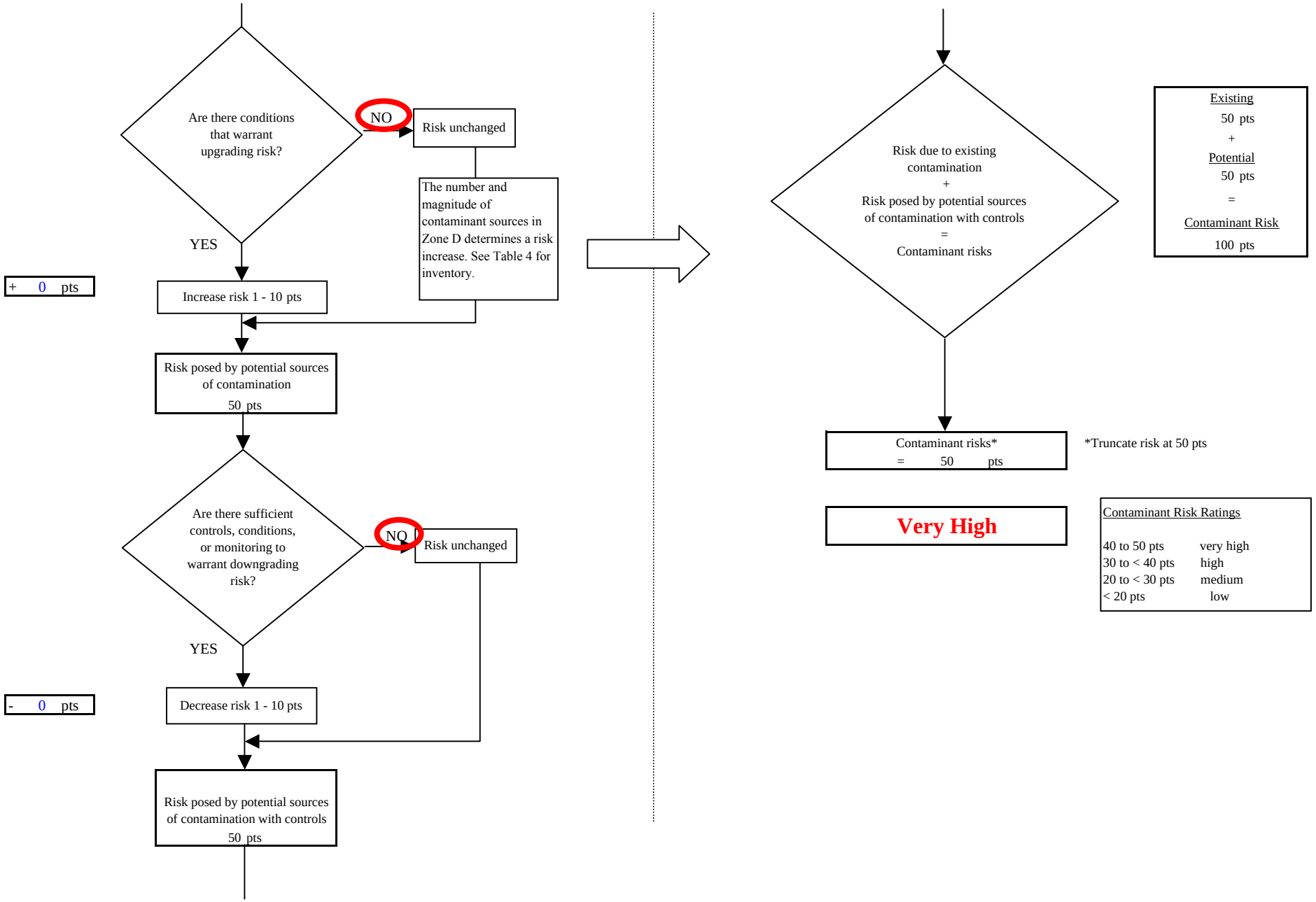


Chart 10. Vulnerability analysis for Galena Water Project (PWS No. 360272.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

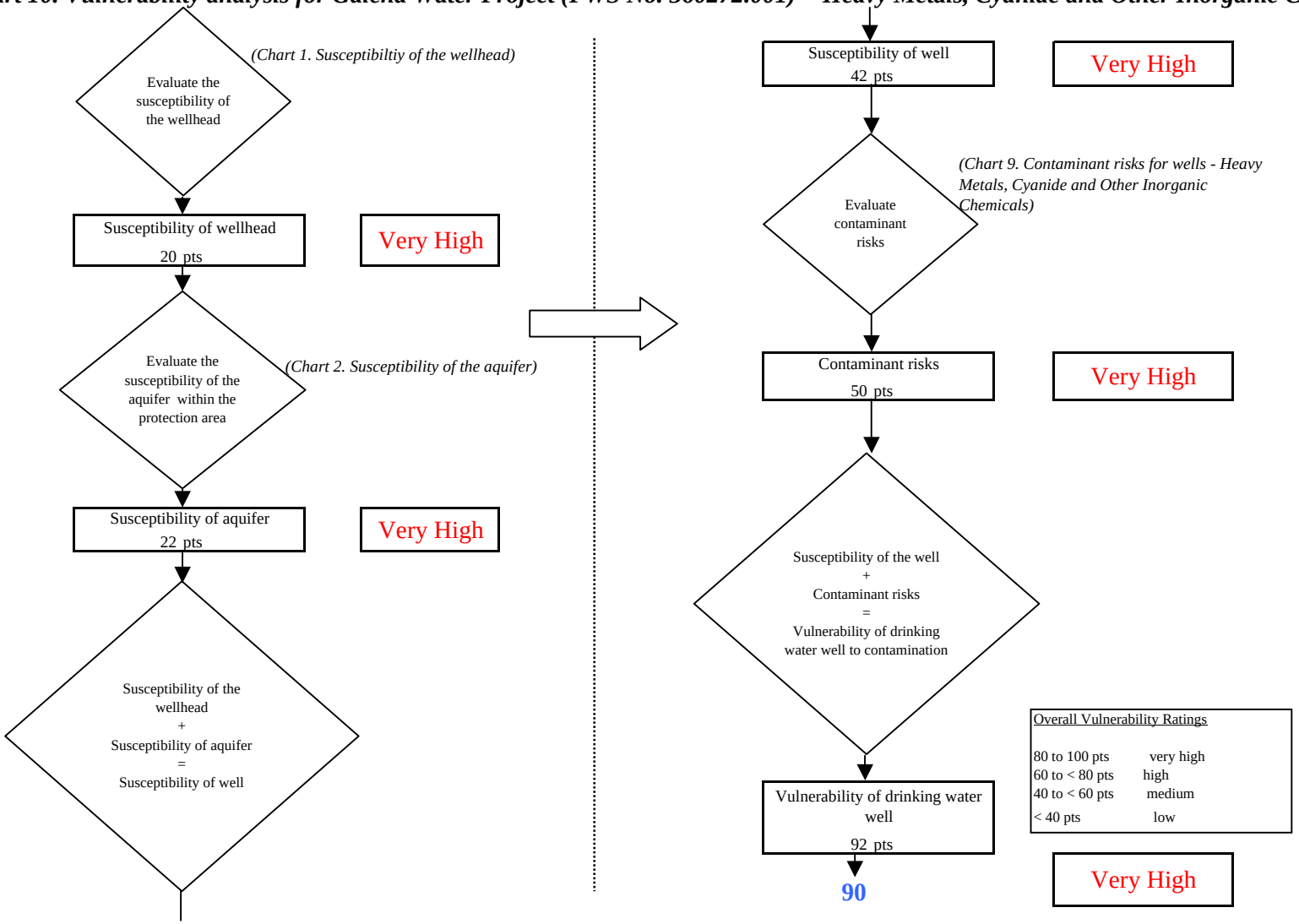


Chart 11. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Synthetic Organic Chemicals

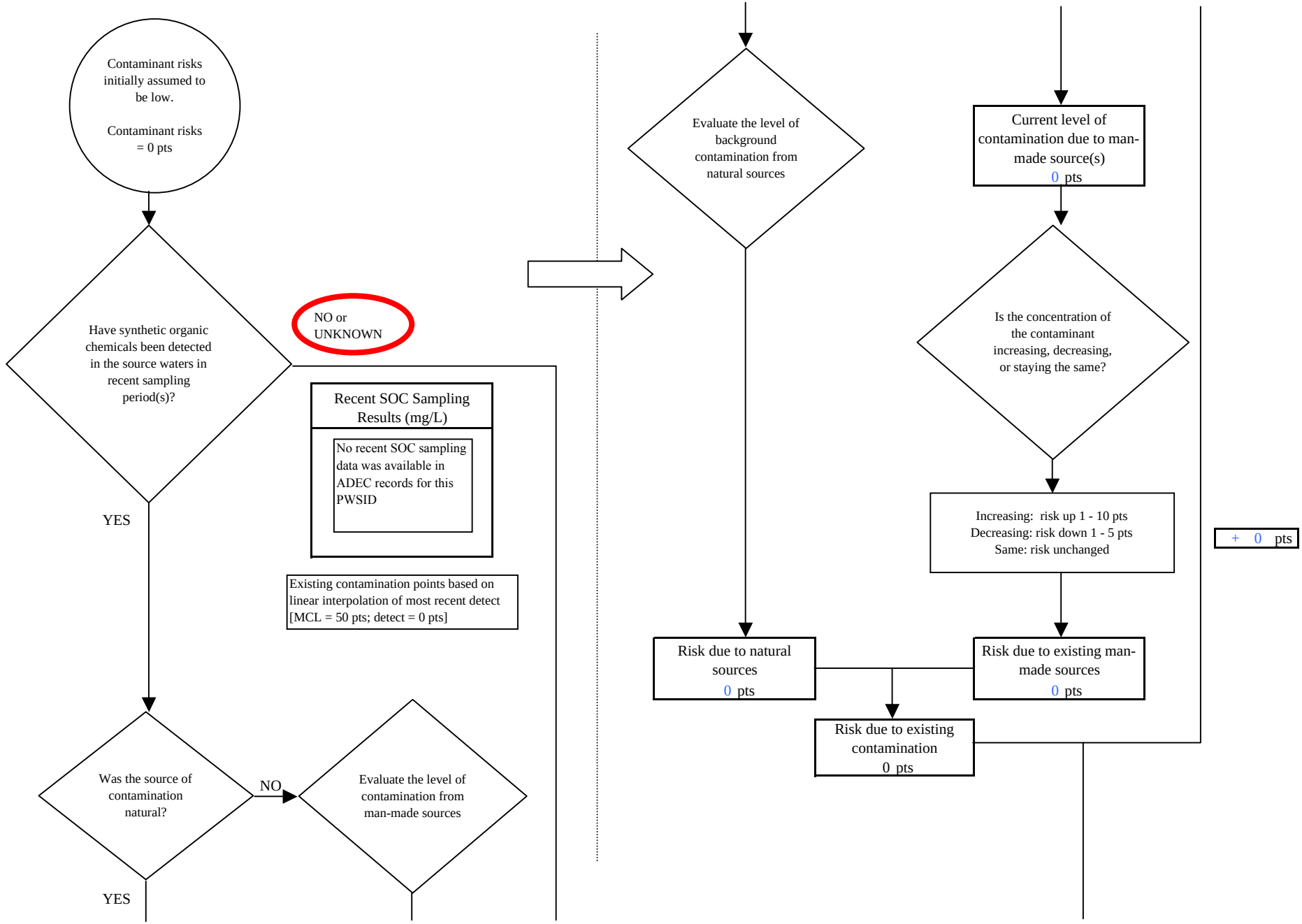


Chart 11. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Synthetic Organic Chemicals

+ 30 pts

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

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	10	2	12

	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	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.

Initial assessment of risk posed by potential sources of contamination = 30 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

+ 10 pts

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 6 for inventory.

Chart 11. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Synthetic Organic Chemicals

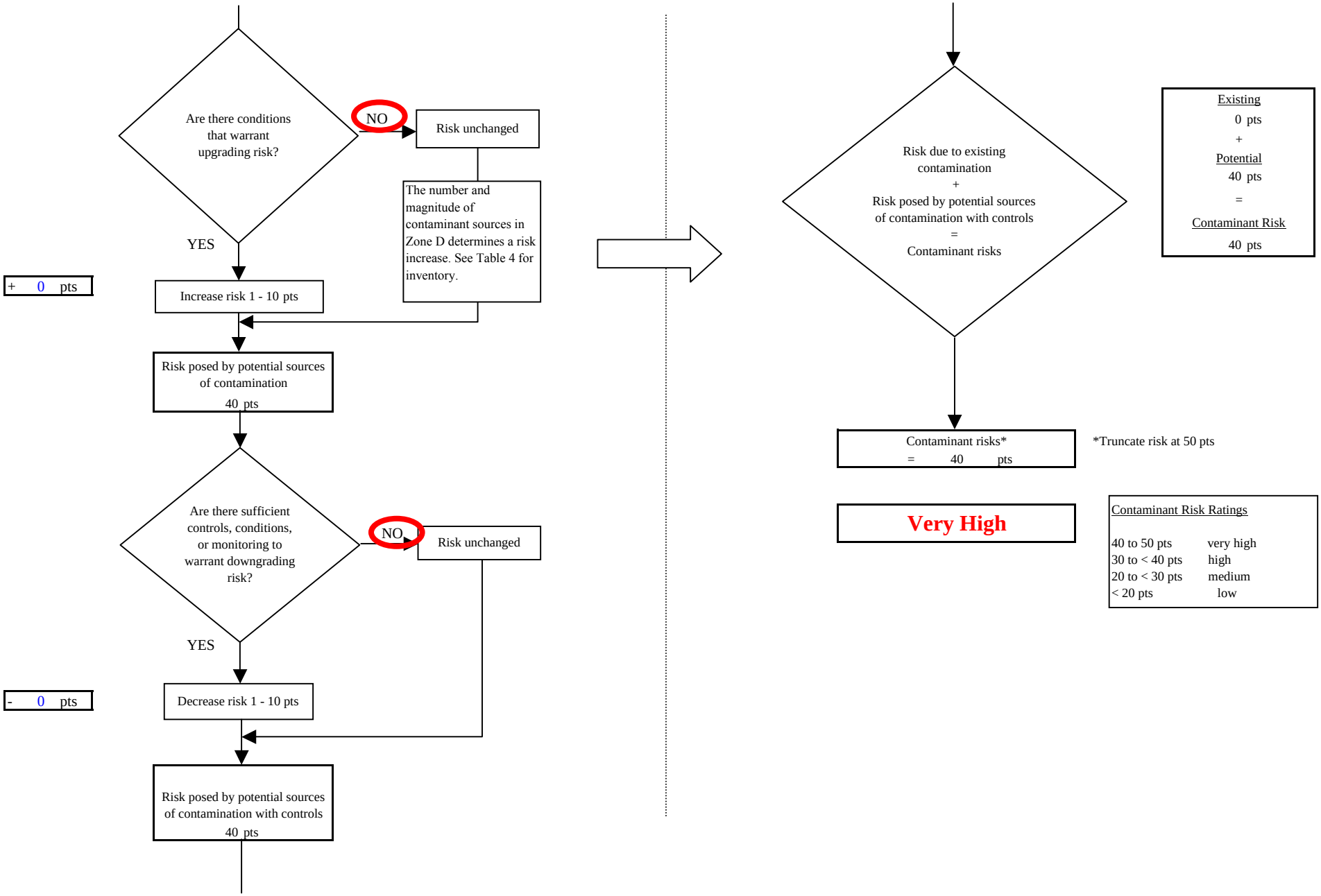


Chart 12. Vulnerability analysis for Galena Water Project (PWS No. 360272.001) - Synthetic Organic Chemicals

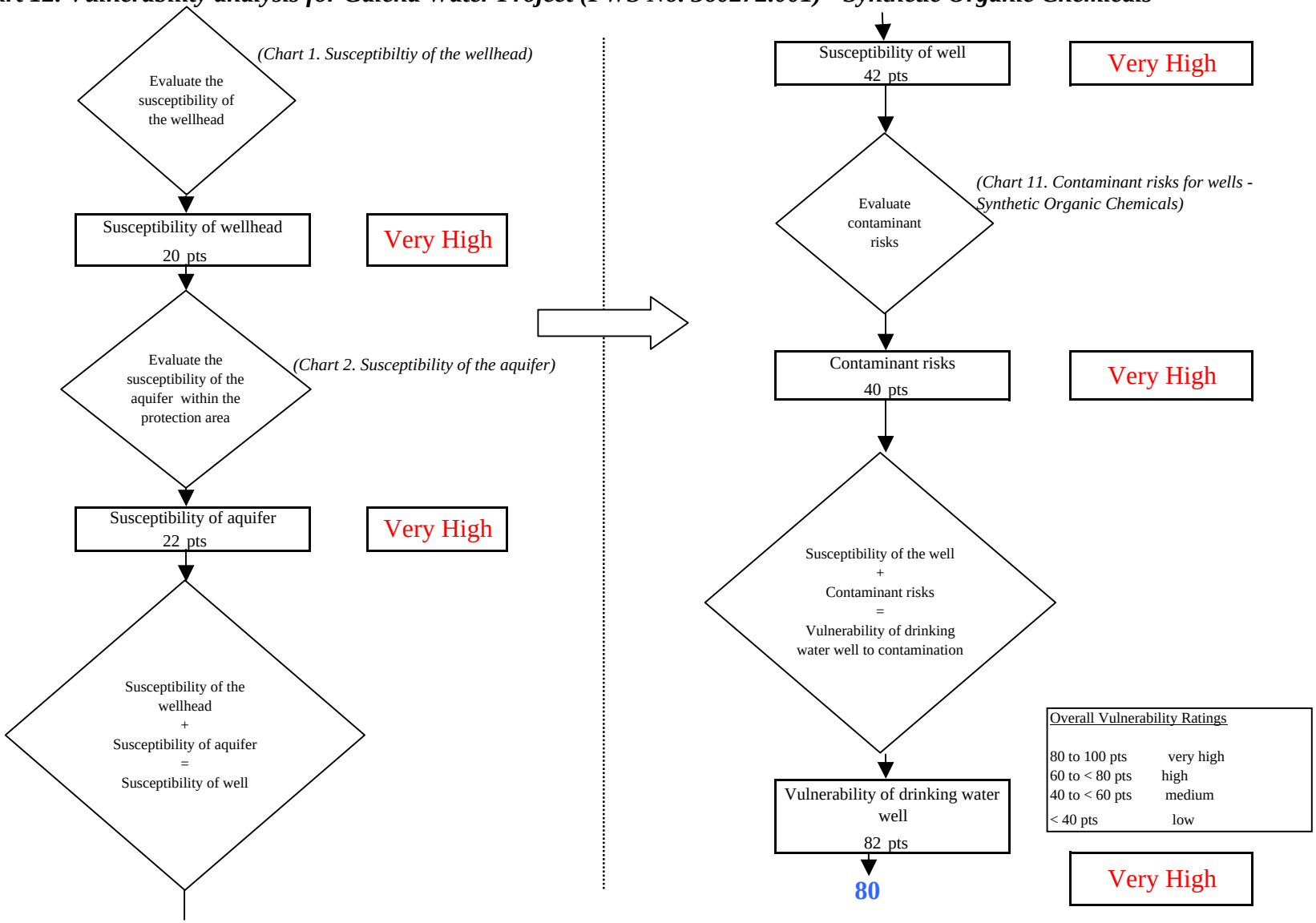


Chart 13. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Other Organic Chemicals

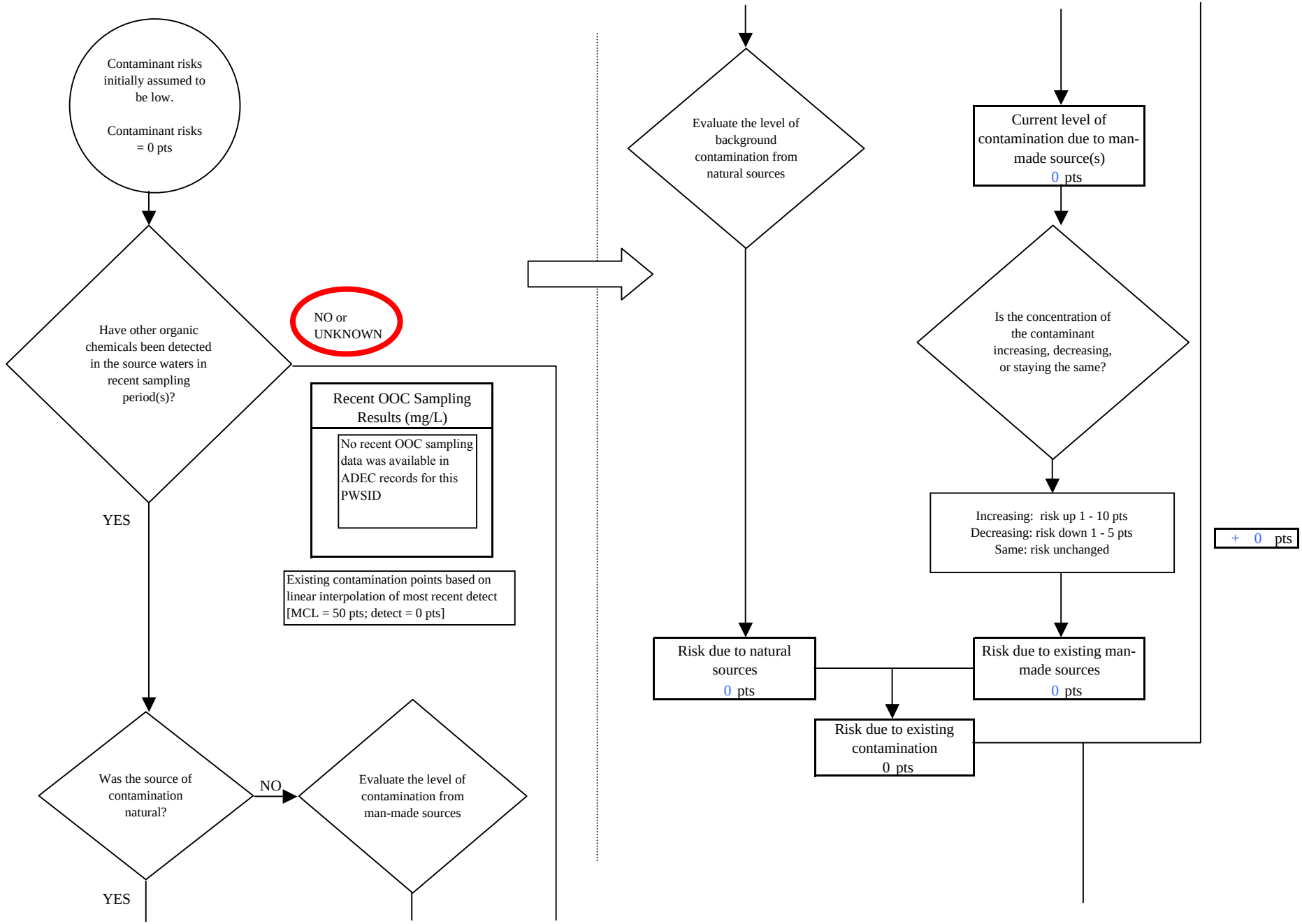


Chart 13. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Other Organic Chemicals

+ 40 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	4	0	4
Medium(s)	1	0	1
Low(s)	9	2	11

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

Matrix Score 40

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 10 pts

The number and magnitude of contaminant sources in Zone A determines a risk increase. See Table 7 for inventory.

Chart 13. Contaminant risks for Galena Water Project (PWS No. 360272.001) - Other Organic Chemicals

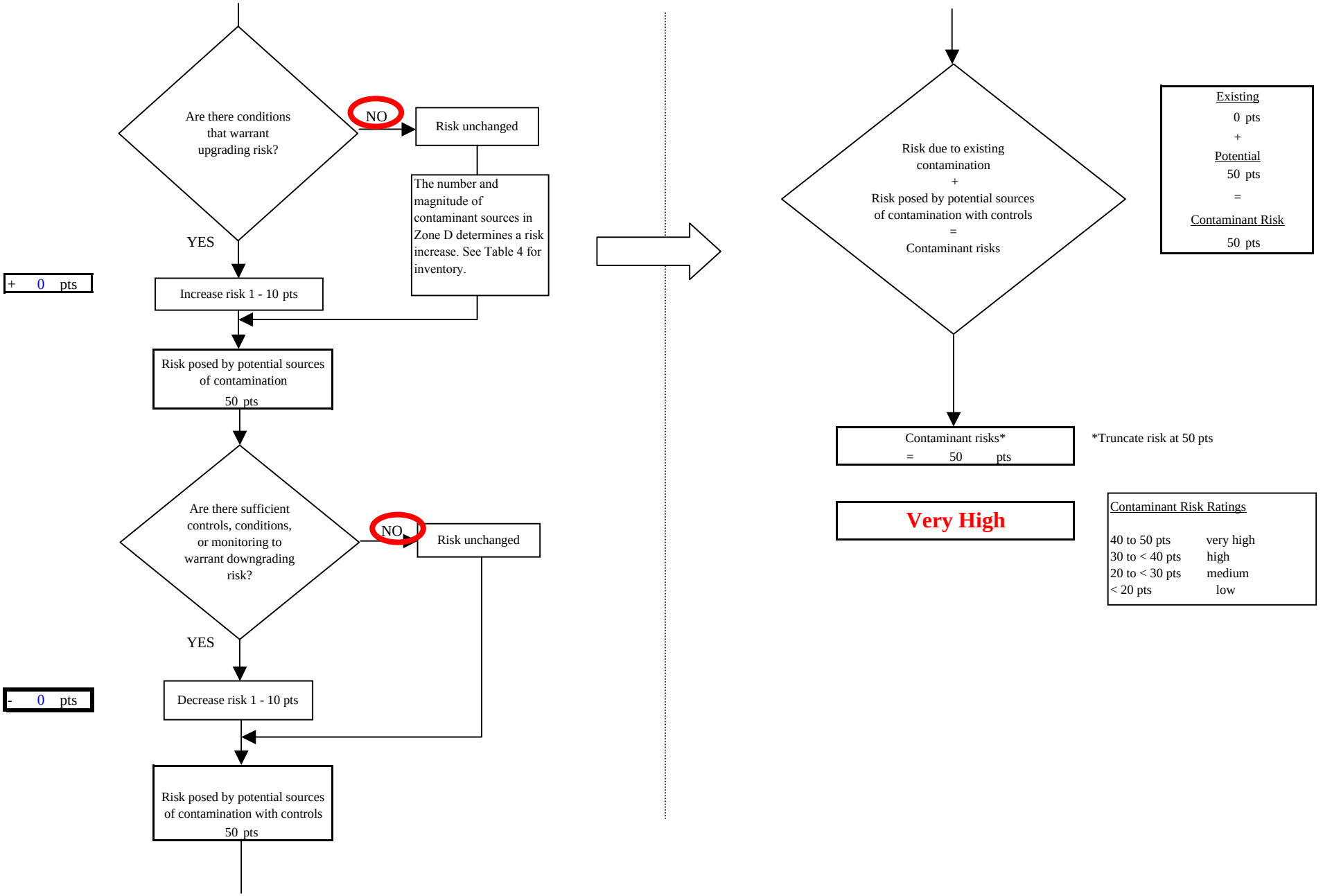


Chart 14. Vulnerability analysis for Galena Water Project (PWS No. 360272.001) - Other Organic Chemicals