Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for The Vallata Drinking Water System, Ester, Alaska Public Water System ID # 310324

DRINKING WATER PROTECTION PROGRAM REPORT Report 447

Alaska Department of Environmental Conservation

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By Sarah A. Bendewald

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The Drinking Water Protection Program 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. 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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Source Water Assessment for The Vallata Source of Public Drinking Water, Ester, Alaska

By Sarah A. Bendewald

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for The Vallata is a Class B (transient/non-community) water system consisting of one well along Goldstream Road 8 miles northeast of Ester, Alaska. Identified potential and current sources of contaminants for The Vallata public drinking water source include: large capacity and residential septic systems, residential heating oil tanks, underground mines, roads, and residential area. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic. Overall, the public water sources for The Vallata received a vulnerability rating of **High** for all three contaminant categories: bacteria and viruses, nitrates and nitrites, and volatile organic chemicals.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all Class A and Class B public drinking water sources in the State of Alaska. The purpose of this assessment is to provide public water system owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system.

This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

DESCRIPTION OF THE FAIRBANKS AREA, ALASKA

Fairbanks Area

The Fairbanks area is located in the Fairbanks North Star Borough which is near the center of Alaska (Please see the inset of Map 1 in Appendix A for location information). The Borough's current population is 82,840 making it the second-largest population center in the state (ADCED, 2002). Communities located within the Borough include : College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers.

The Koyukon Athabascans are native to the Fairbanks area. Non-native population of the area began as a trading post on the Chena River. The discovery of gold in the early 1900s brought more than 6,000 prospectors during the Pedor Dome gold rush (ADCED, 2002). Construction of the Alcan Highway in the 1940s and the Trans-Alaska oil pipeline in the 1970s helped to continue the growth and development of the Fairbanks area.

Ester

Ester is located 8.5 miles west of Fairbanks along the George Parks Highway. Ester originally began as a mining camp established before 1905 and officially became a community in 1936 (ADCED, 2002).

The majority of Ester residents have individual wells and septic systems, and the remainder haul water from a central water point in Ester (ADCED, 2002). Heating oil (stored in both above and below ground 275 to 500-gallon tanks) is used for heating homes and buildings. Electricity is provided by Golden Valley Electric Association. Refuse is transported to the Fairbanks North Star Borough landfill.

Climate

The Fairbanks area experiences extreme weather variations according to season. Temperatures in January vary from –22 to –2 degrees Farenheight and from 50 to 72 degrees in July (ADCED, 2002). Average annual precipitation in the area is 11.3 inches (ADCED, 2002). Ice fog is common during the winter.

Topography and Drainage

The Fairbanks area includes two distinct topographic areas: the floodplain of the Tanana River and the Chena River, and the uplands north of this floodplain. Ester is located in the uplands. Elevation in the uplands varies from about 500 feet to 2500 feet.

The uplands are drained by many small creeks that flow into the Chena, Tanana, and Chatanika Rivers. The hydrology of these streams is greatly affected by the distribution of permafrost. Streams in the upper areas are dry most of the summer with runoff occurring during spring snowmelt and after heavy summer rains.

Geology and Soils

Bedrock under the Fairbanks area is predominanty a metamorphosed marine mud deposit, called a pelitic schist. Calc-mica schist, marble, and quartzite are also found in the area. The schist is locally intruded by granitic rocks – granite and quartz diorite.

Permafrost is common on the lower part of the north-facing slopes and valley bottoms (Nelson, 1978).

Groundwater

Groundwater is principally contained in fractured bedrock of the Yukon-Tanana complex (King, 1969). Groundwater flows through bedrock primarily within the fractures. The capacity of the rocks to yield water to wells depends in part on their ability to hold fractures open against the pressure of overlying rocks. The water wells in the Ester area with the greatest well recharge appear to be in quartz veins, quartzite, and siliceous schist (Nelson, 1978).

Groundwater in the uplands is recharged by local precipitation. Outflow of ground water in the uplands primarily occurs two ways. In areas under artesian pressure (pressure caused by overlying permafrost), water can flow to the surface through thawed conduits within the permafrost. Otherwise groundwater will flow under the permafrost (if present) and out to the groundwater beneath the adjacent flood plain or creek valley (Nelson, 1978).

THE VALLATA PUBLIC DRINKING WATER SYSTEM

The Vallata public water system is a Class B (transient/non-community) water system. The system consists of one well along Goldstream Road 8 miles northeast of Ester, Alaska (T1N, R2W, Section 12) (See Map 1 of Appendix A). This area is at an elevation of approximately 800 feet above sea level.

According to the Sanitary Survey (10/20/99), the depth of the well is 248-250 feet below the ground surface. Although a well log is not available for this well, other wells in the area are screened in bedrock and it is assumed that this well is also. This Sanitary Survey also indicates a sanitary seal is properly installed on the well. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The land surface is appropriately sloped away from the well providing adequate surface water drainage. It is unknown whether the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters.

This system operates year-round and serves approximately 50 non-residents through one service connection.

THE VALLATA 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. Some areas are more likely to allow contamination to reach the well than others. 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 DWPA are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An outline of the immediate watershed was used to determine the size and shape of the DWPA for The Vallata. Available geology was also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA

(Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The DWPAs 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. An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources (*Jokela et. al., 1991*).

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 DWPA zones and the calculated time-of-travel for each:

Table 1. Definition of Zones

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

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

The DWPA for The Vallata is limited by its immediate watershed and includes only Zones A and B (See Map 1 of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within The Vallata 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 Maps 2 through 4 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 sorted and ranked 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. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources 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 VALLATA DRINKING WATER SOURCE

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

- Natural susceptibility; and
- Contaminant risks.

Each of the three categories of drinking water contaminants has been analyzed and an overall vulnerability score of 0 to 100 is ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

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

A score for the Natural Susceptibility is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)

+

Susceptibility of the Aquifer (0 – 25 Points)

=

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

The well for The Vallata is completed in an unconfined aquifer setting. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Susceptibility scores and ratings for The Vallata.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	24	Very High
Natural Susceptibility	29	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data 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. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	45	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	50	Very High

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.

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	75	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	75	High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is very high with large capacity and residential septic systems presenting the most significant risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Large capacity septic systems, designated a type of Class V Injection well by the Environmental Protection Agency (EPA), differ from residential septic systems in that they serve multiple dwellings, businesses, or communities.

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses have not been detected during recent water sampling of the system at The Vallata. 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 high.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is very high with large capacity and residential septic systems, because of their effluent discharge, posing the most significant contaminant risk to this source of public drinking water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for The Vallata well indicates that

concentrations of nitrate have been detected in the drinking water. Existing nitrate concentration is approximately 5.1 mg/L or 51% of the Maximum Contaminant Level (MCL) of 10mg/L. The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. High concentrations of nitrate can come from runoff of fertilizers; leaching from septic tanks, sewage; and erosion of natural deposits. "Blue baby syndrome" in infants under six months is a potential heath effect of ingesting high concentrations of nitrate in water (EPA, 2002). Nitrate concentrations have remained consistent with concentrations of 47 to 61% of the MCL within the past 5 years.

It is unknown how much of the existing nitrate concentration can be attributed to natural or human-made sources. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils [Wang, Strelakos, Jokela, 2000].

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination is high.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is very high with the density of residential heating oil storage tanks within the DWPA creating the most significant risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). Both underground and above ground heating oil storage tanks are the standard way of heating homes and businesses in the Ester area. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Regular system maintenance can help prevent many of these harmful fuel leaks.

Volatile Organic Chemicals have not been sampled for at this water system. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is high.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving The Vallata. The overall vulnerability of this source to contamination is **High** for bacteria and viruses, nitrates and nitrites, and volatile organic chemicals. 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 Vallata 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 Vallata public drinking water source.

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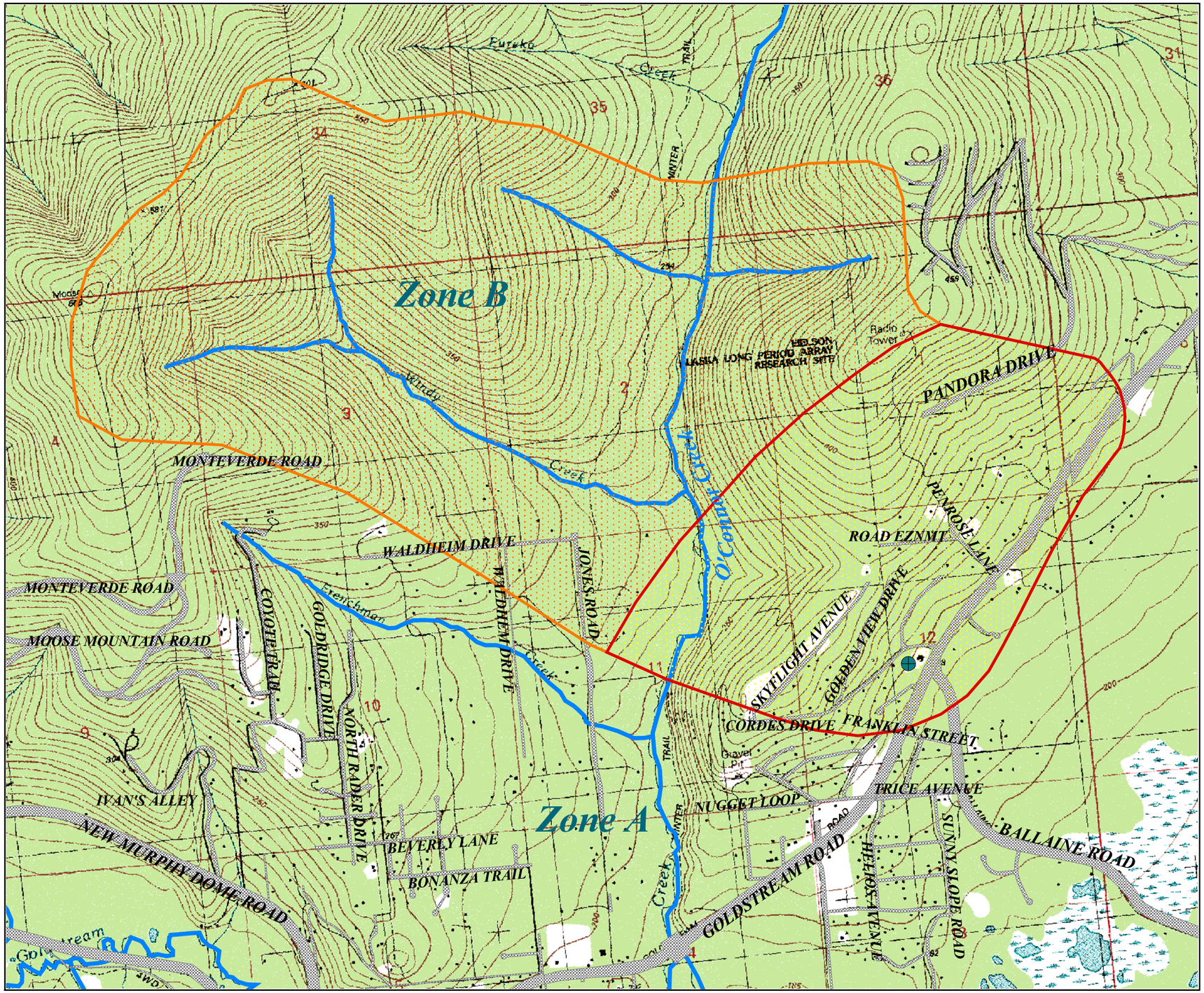
APPENDIX A

The Vallata
Drinking Water Protection Area Location Map
(Map 1)

The Vallata Drinking Water Protection Area



1 0 1 2 Miles

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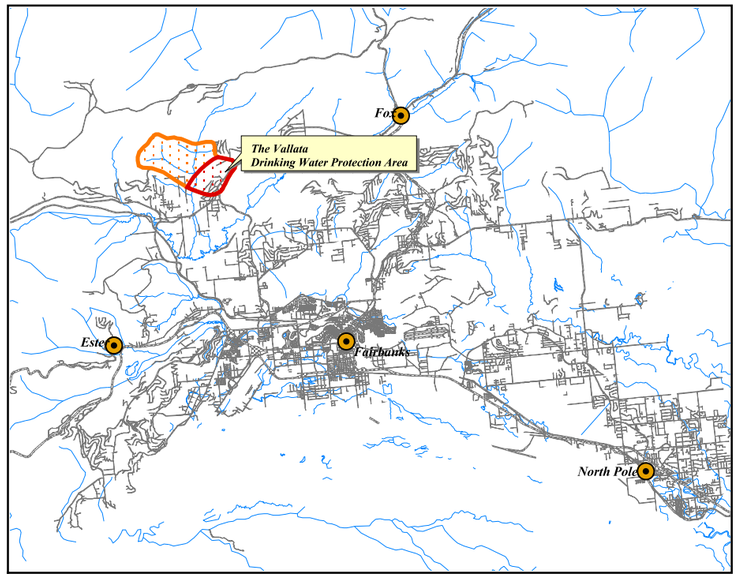
Legend

- The Vallata Well

Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time
- Roads
- Creeks



N W E S

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for The Vallata (Tables 1-4)

Table 1

Contaminant Source Inventory for ***The Vallata***

PWSID 310324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2190 Goldstream Road, The Vallata	2	
Metals mining, underground (active or inactive?)	E05	E05-1	A	O'Connor Creek	2	
Residential Areas	R01	R01-1	A	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Approximately 225 acres of residential area identified within Zone A
Septic systems (serves one single-family home)	R02	R02-1 - 75	A	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Septic systems assumed where primary use of parcel is identified as residential.
Tanks, heating oil, residential (above ground)	R08	R08-1 - 75	A	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Above ground heating oil tanks assumed where primary use of parcel is identified as residential.
Closed tanks, gasoline (underground)	T13	T13-1	A	2021 Goldstream Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Goldstream Road	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Cordes Drive	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Goldpointe Drive	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Golden View Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Skyflight Avenue	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Penrose Lane	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Pandora Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Jones Road	2	
Highways and roads, dirt/gravel	X24	X24-8	A	Waldheim Drive	2	
Residential Areas	R01	R01-2	B	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Approximately 250 acres of residential area within Zone B
Septic systems (serves one single-family home)	R02	R02-75-103	B	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Septic systems assumed where primary use of parcel is identified as residential.
Tanks, heating oil, residential (above ground)	R08	R08-75-103	B	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Above ground heating oil tanks assumed where primary use of parcel is identified as residential

Table 2

Contaminant Source Inventory and Risk Ranking for The Vallata
Sources of Bacteria and Viruses

PWSID 310324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2190 Goldstream Road, The Vallata	2	
Septic systems (serves one single-family home)	R02	R02-1 - 75	A	Low	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Septic systems assumed where primary use of parcel is identified as residential.
Residential Areas	R01	R01-1	A	Low	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Approximately 225 acres of residential area identified within Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Goldstream Road	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	Cordes Drive	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	Goldpointe Drive	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	Golden View Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low	Skyflight Avenue	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Low	Penrose Lane	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Low	Pandora Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Low	Jones Road	2	
Highways and roads, dirt/gravel	X24	X24-8	A	Low	Waldheim Drive	2	
Residential Areas	R01	R01-2	B	Low	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Approximately 250 acres of residential area within Zone B
Septic systems (serves one single-family home)	R02	R02-75-103	B	Low	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Septic systems assumed where primary use of parcel is identified as residential.

Table 3

Contaminant Source Inventory and Risk Ranking for The Vallata
Sources of Nitrates/Nitrites

PWSID 310324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2190 Goldstream Road, The Vallata	2	
Septic systems (serves one single-family home)	R02	R02-1 - 75	A	Low	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Septic systems assumed where primary use of parcel is identified as residential.
Residential Areas	R01	R01-1	A	Low	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Approximately 225 acres of residential area identified within Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Goldstream Road	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	Cordes Drive	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	Goldpointe Drive	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	Golden View Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low	Skyflight Avenue	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Low	Penrose Lane	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Low	Pandora Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Low	Jones Road	2	
Highways and roads, dirt/gravel	X24	X24-8	A	Low	Waldheim Drive	2	
Residential Areas	R01	R01-2	B	Low	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Approximately 250 acres of residential area within Zone B
Septic systems (serves one single-family home)	R02	R02-75-103	B	Low	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Septic systems assumed where primary use of parcel is identified as residential.

Table 4

Contaminant Source Inventory and Risk Ranking for The Vallata
Sources of Volatile Organic Chemicals

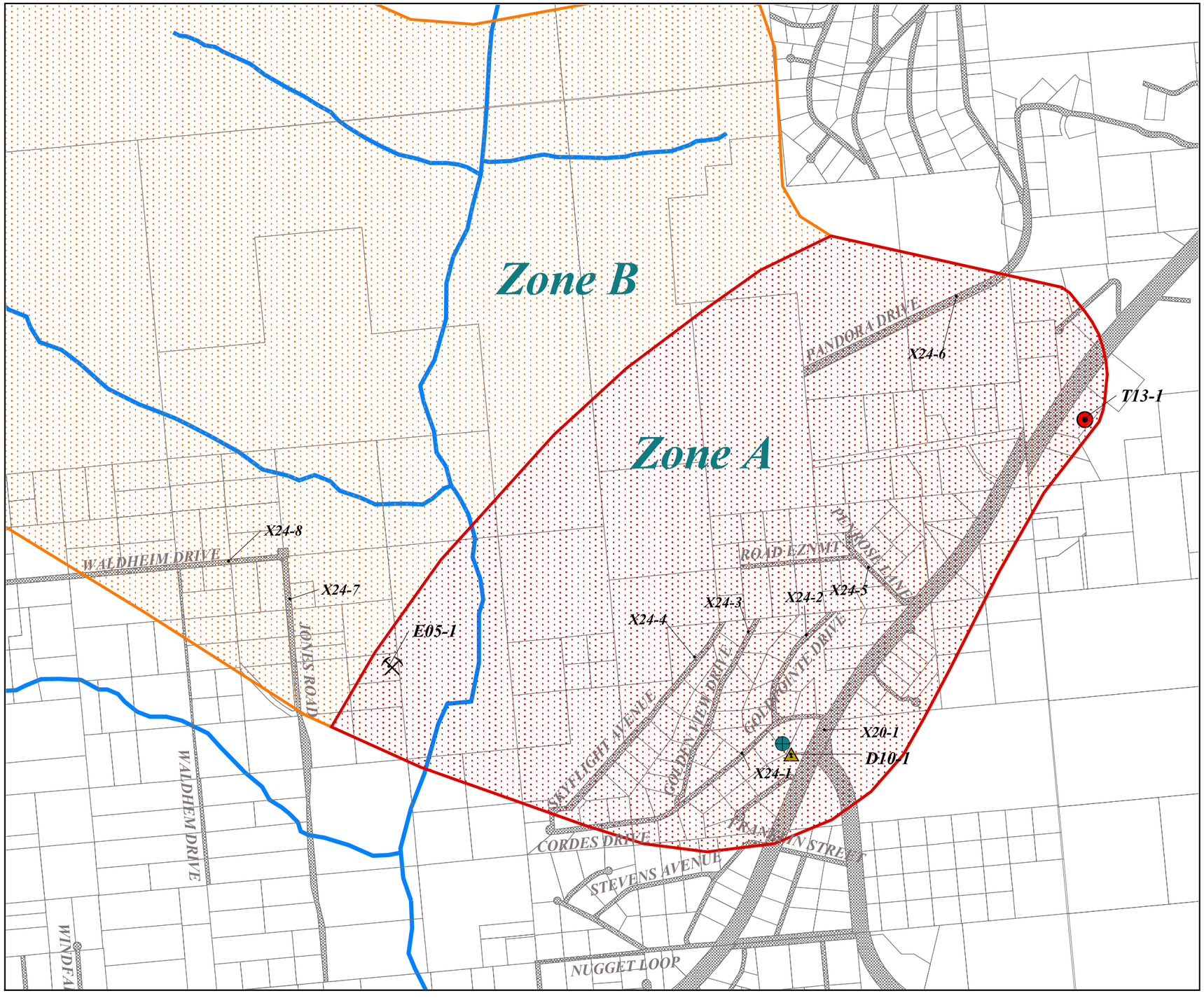
PWSID 310324.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Tanks, heating oil, residential (above ground)	R08	R08-1 - 75	A	Medium	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Above ground heating oil tanks assumed where primary use of parcel is identified as residential.
Metals mining, underground (active or inactive?)	E05	E05-1	A	Medium	O'Connor Creek	2	
Closed tanks, gasoline (underground)	T13	T13-1	A	Medium	2021 Goldstream Road	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2190 Goldstream Road, The Vallata	2	
Residential Areas	R01	R01-1	A	Low	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Approximately 225 acres of residential area identified within Zone A
Septic systems (serves one single-family home)	R02	R02-1 - 75	A	Low	Between Cordas Drive and Pandora Drive along Goldstream Road	3	Septic systems assumed where primary use of parcel is identified as residential.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Goldstream Road	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	Cordes Drive	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	Goldpointe Drive	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	Golden View Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low	Skyflight Avenue	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Low	Penrose Lane	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Low	Pandora Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Low	Jones Road	2	
Highways and roads, dirt/gravel	X24	X24-8	A	Low	Waldheim Drive	2	
Residential Areas	R01	R01-2	B	Low	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Approximately 250 acres of residential area within Zone B
Septic systems (serves one single-family home)	R02	R02-75-103	B	Low	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Septic systems assumed where primary use of parcel is identified as residential.
Tanks, heating oil, residential (above ground)	R08	R08-75-103	B	Medium	Along Monteverde Road, Waldheim Drive, and Jones Road	4	Above ground heating oil tanks assumed where primary use of parcel is identified as residential

APPENDIX C

The Vallata
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps 2-4)

The Vallata Drinking Water Protection Area with Potential & Existing Contaminant Sources

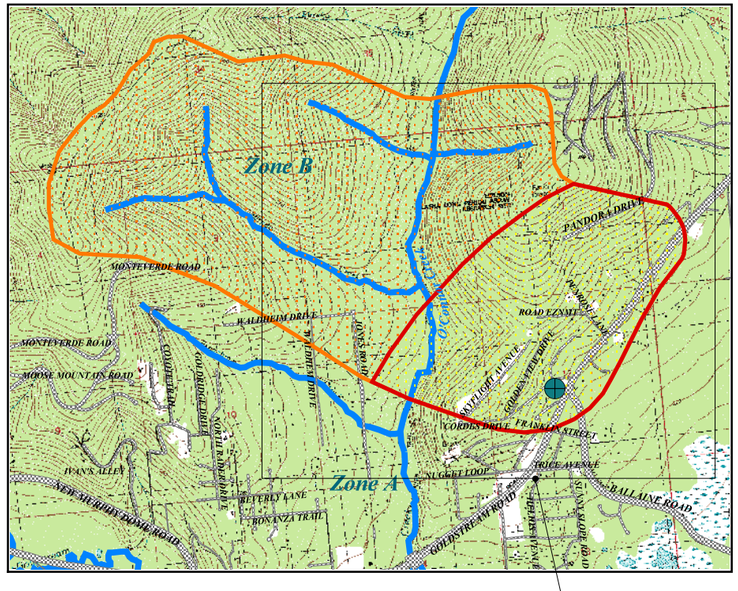


1 0 1 Miles

PWSID 310324.001

Legend

- The Vallata Well
- Zone A Protection Area
  - Several Months Travel Time
- Zone B Protection Area
  - Less Than 2 Years Travel Time
- Parcels
- Creeks
- Potential Contaminant Sources
  - Large Capacity Septic System (D10)
  - Closed Underground Gasoline Tank (T13)
  - Underground Mine (E05)
  - Roads (X20 or X24)



N W E S

Map 2

The Vallata Drinking Water Protection Area with Potential & Existing Contaminant Sources

Zone B

Zone A

Zone A contains
approximately 75 Residential Above Ground Heating Oil Storage Tanks (R08)
approximately 75 Residential Septic Systems (R02)
approximately 225 acres of Residential Area (R01)

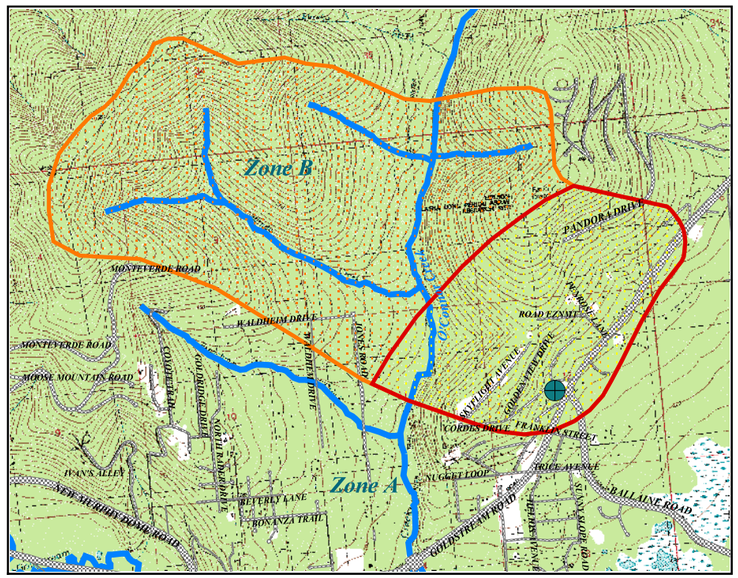
JONES ROAD
CORDES DRIVE
STEVENS AVENUE
GOLDPOINTE DRIVE
MOONLIGHT AVENUE

0.5 0 0.5 Miles

PWSID 310324.001

Legend

- The Vallata Well
- Zone A Protection Area
- Several Months Travel Time
- Zone B Protection Area
- Less Than 2 Years Travel Time
- Residential Above Ground Heating Oil Storage Tanks (R08)
- Residential Septic Systems (R02)
- Residential Area (R01)
- Parcels
- Creeks
- Roads (X20 or X24)



N W E S

Map 3

The Vallata Drinking Water Protection Area with Potential & Existing Contaminant Sources

Zone B contains
approximately 28 Residential Above Ground Heating Oil Storage Tanks (R08)
approximately 28 Residential Septic Systems (R02)
approximately 250 acres of Residential Area (R01)

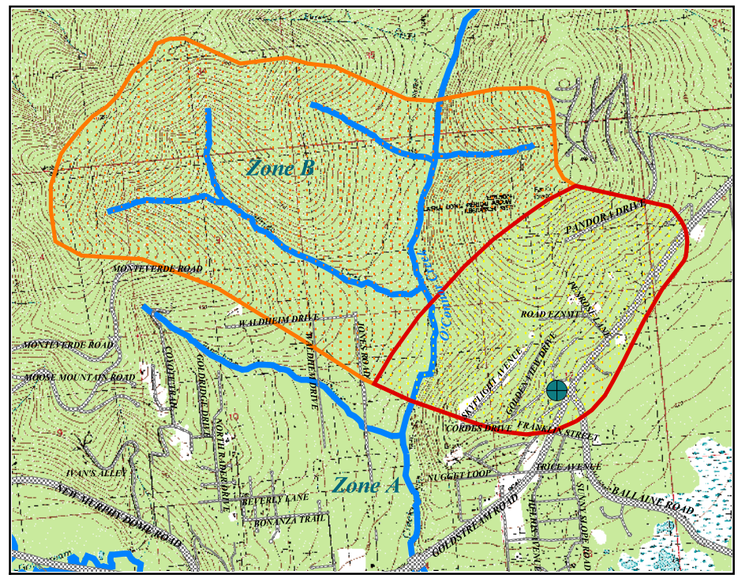
Zone B
Zone A
MONTEVERDE ROAD
WALDHEIM DRIVE
COYOTE TRAIL
GOLDRIDGE DRIVE
NORTH RADER DRIVE
JONES ROAD
SKYFLIGHT AVENUE
CORDES DRIVE
STEVENS AVENUE
ROAD EZNMIT
PANDO

1 0 1 Miles

PWSID 310324.001

Legend

- The Vallata Well
- Zone A Protection Area
- Several Months Travel Time
- Zone B Protection Area
- Less Than 2 Years Travel Time
- Residential Above Ground Heating Oil Storage Tanks (R08)
- Residential Septic Systems (R02)
- Residential Area (R01)
- Parcels
- Roads (X20 or X24)



N
W E
S

Map 4

APPENDIX D

Vulnerability Analysis for The Vallata Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - The Vallata

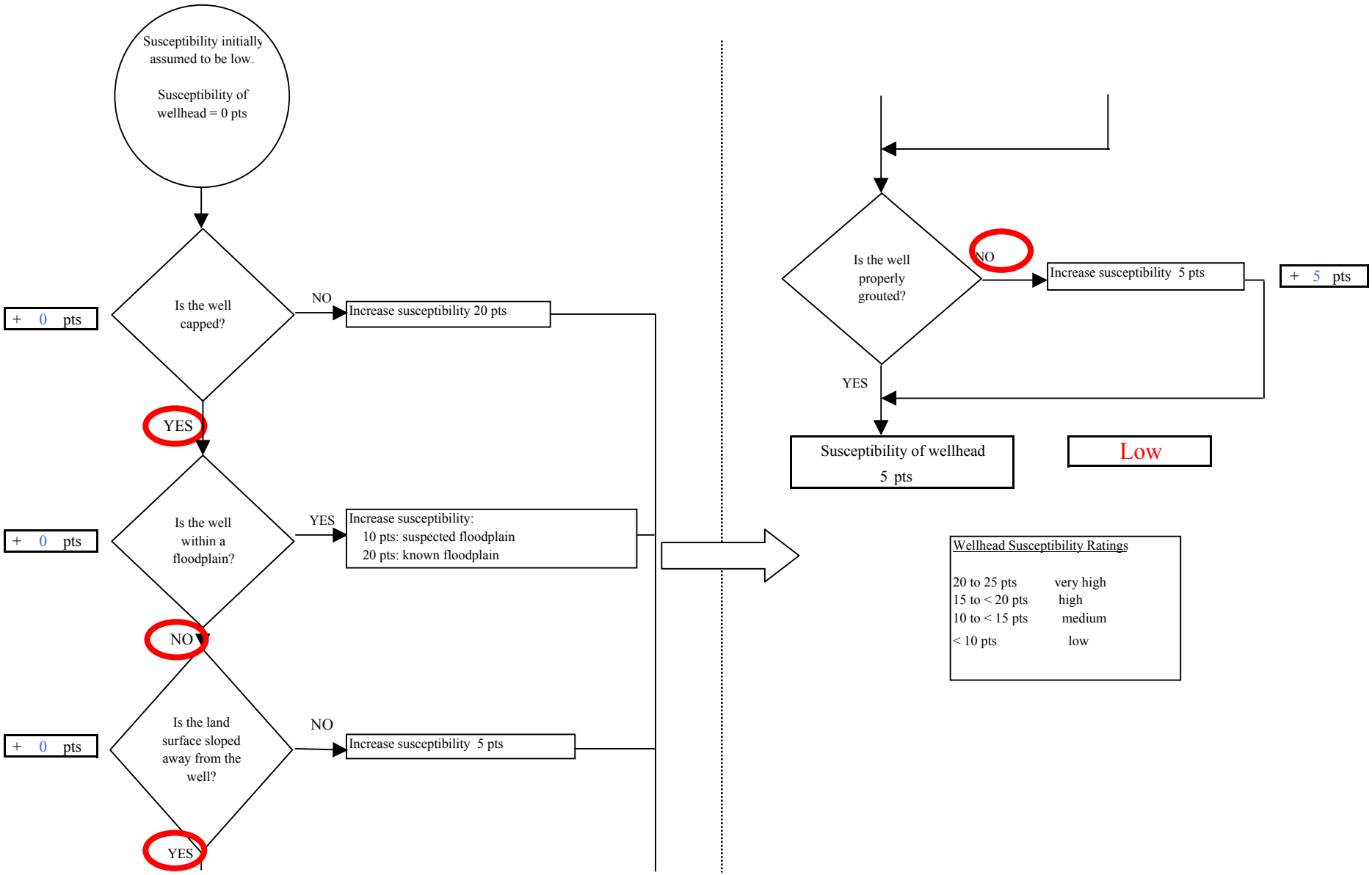


Chart 2. Susceptibility of the aquifer - The Vallata

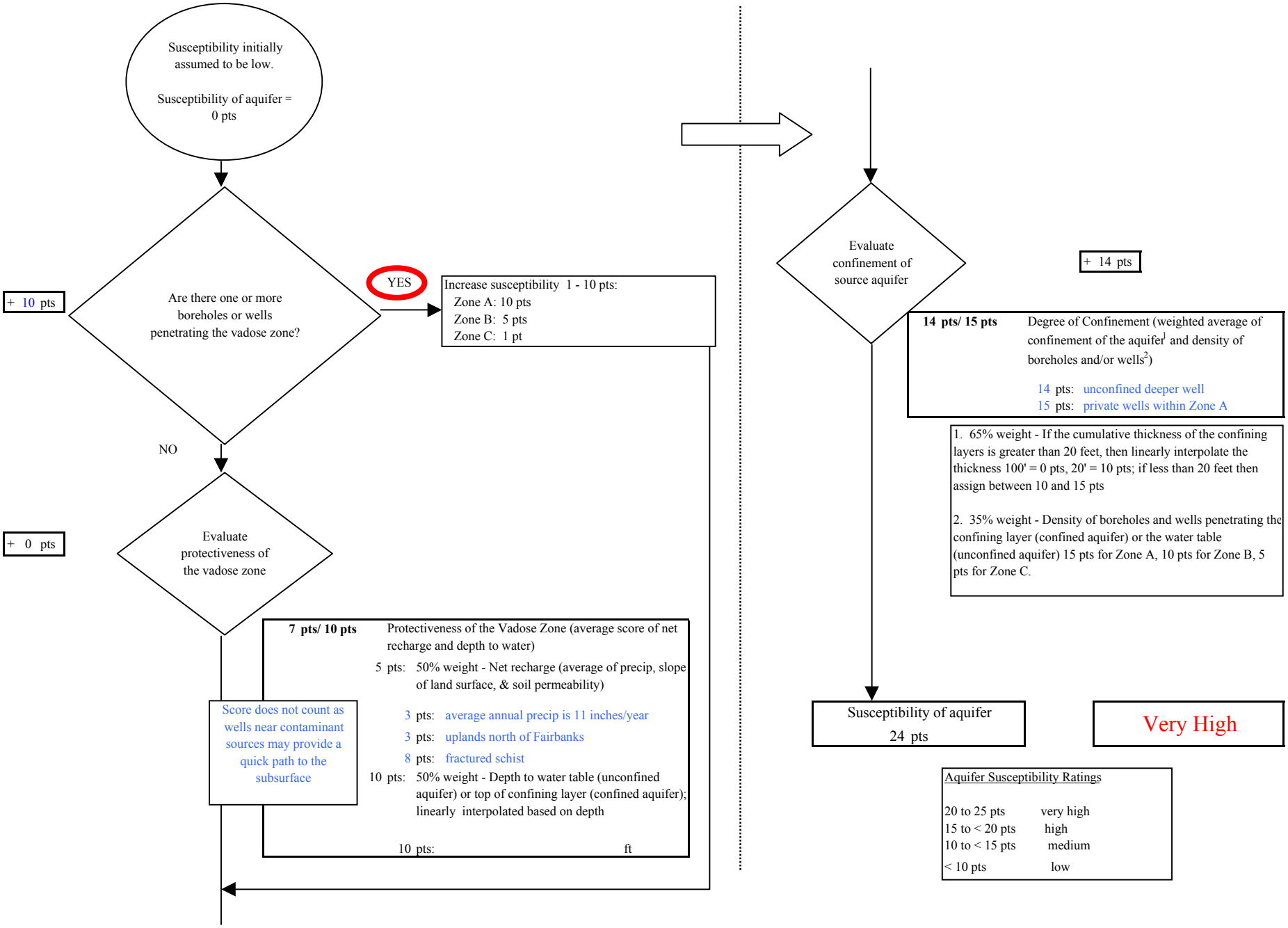
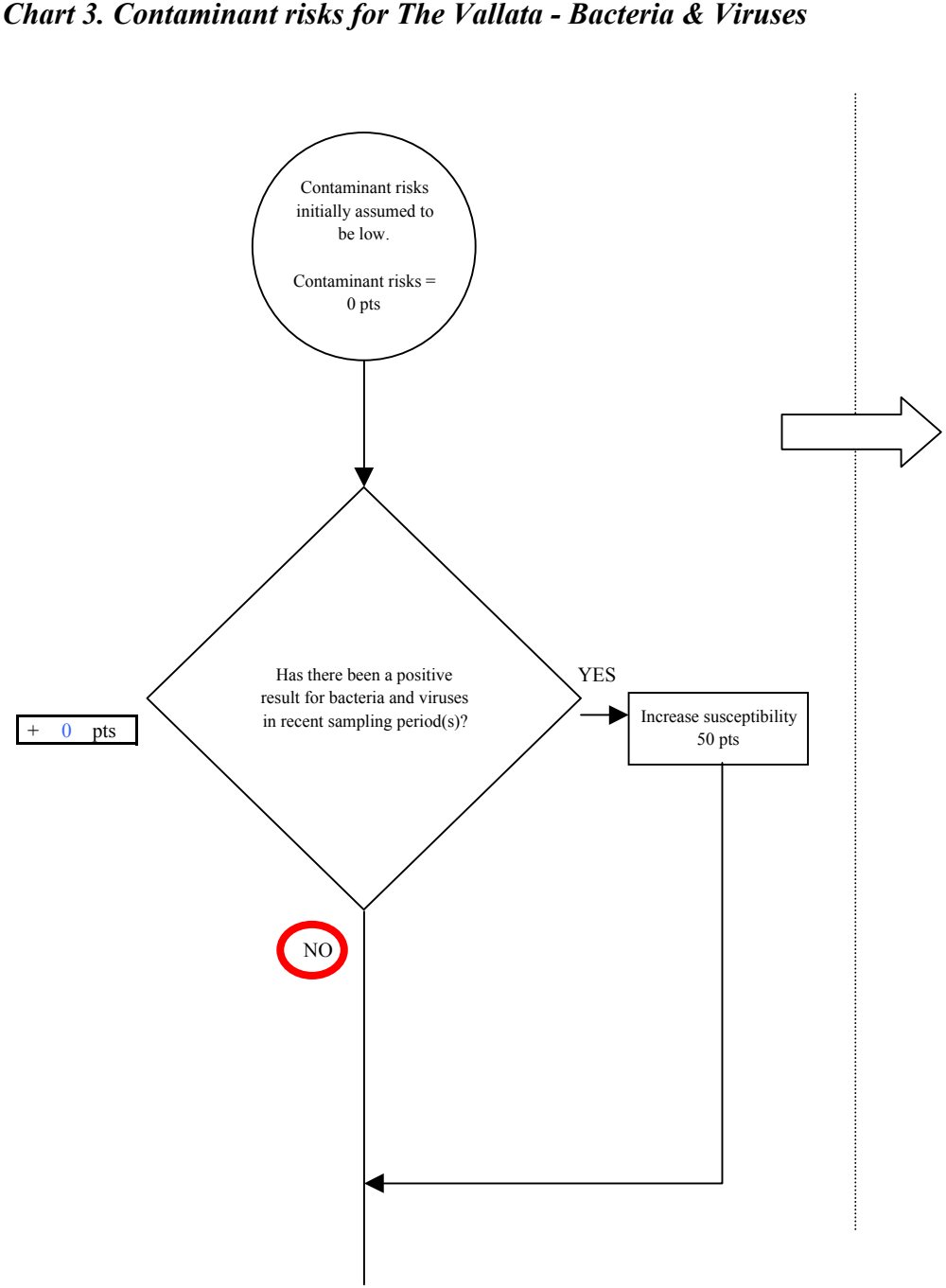
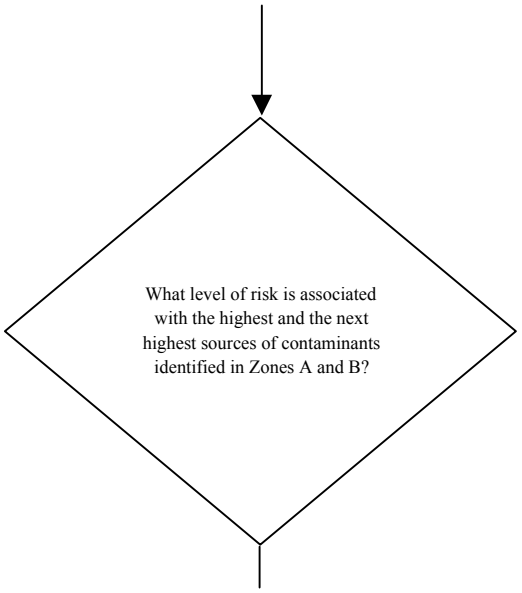


Chart 3. Contaminant risks for The Vallata - Bacteria & Viruses





+ 35 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)	1	0	1
Medium(s)	0	0	0
Low(s)	82	7	89

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

Matrix Score 35

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

Chart 3. Contaminant risks for The Vallata - Bacteria & Viruses

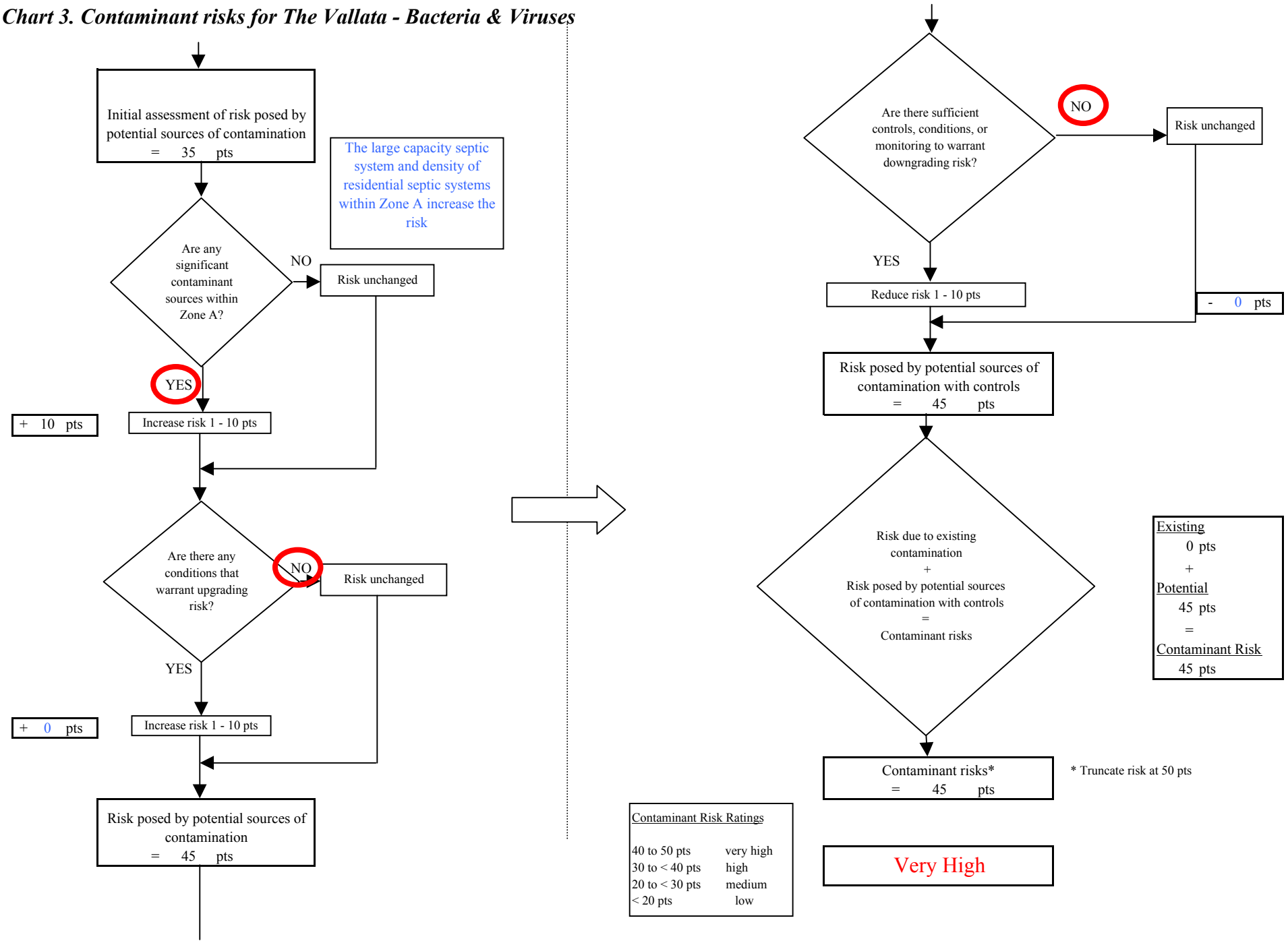


Chart 4. Vulnerability analysis for The Vallata - Bacteria & Viruses

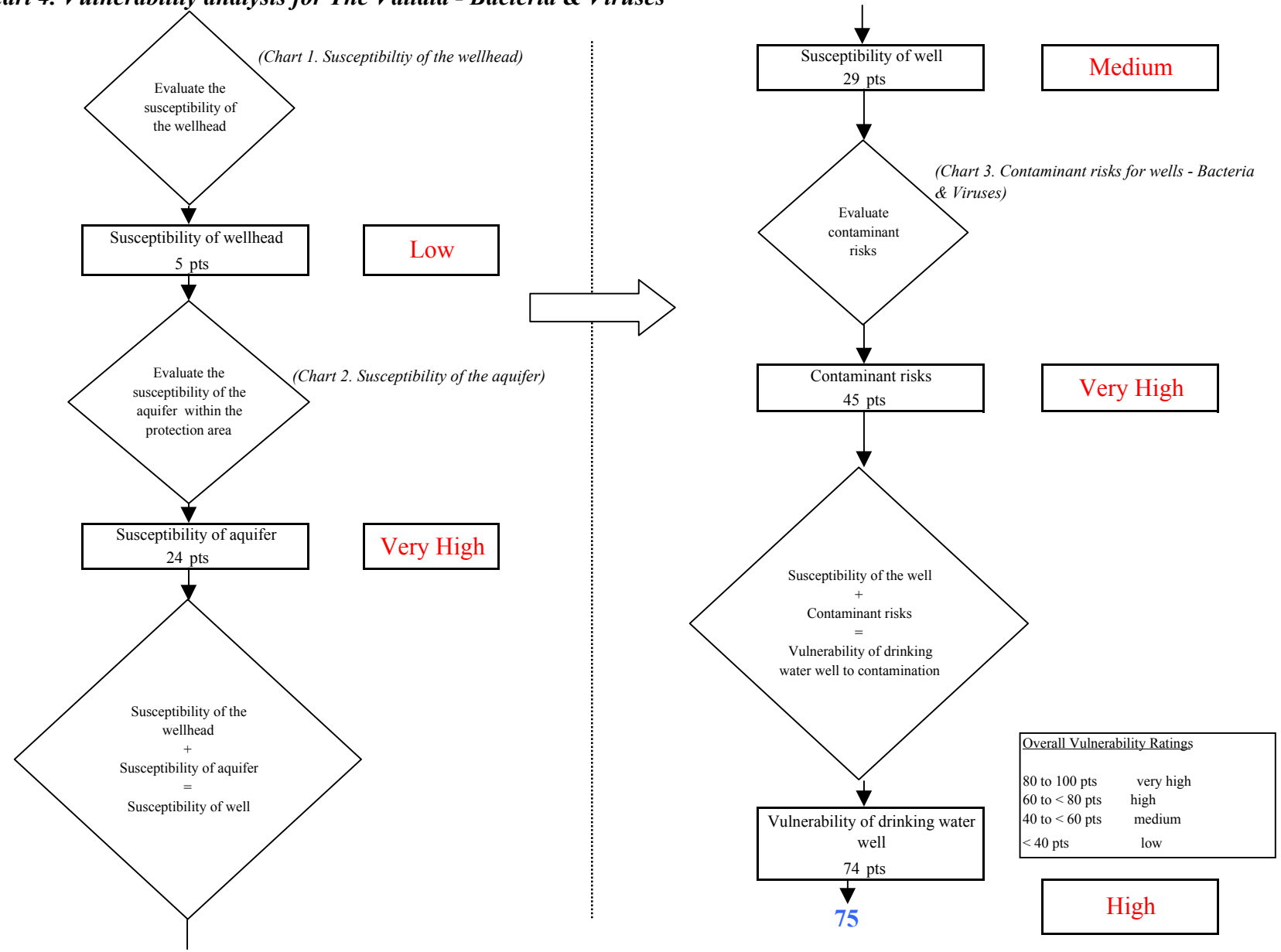


Chart 5. Contaminant risks for The Vallata - Nitrates and Nitrites

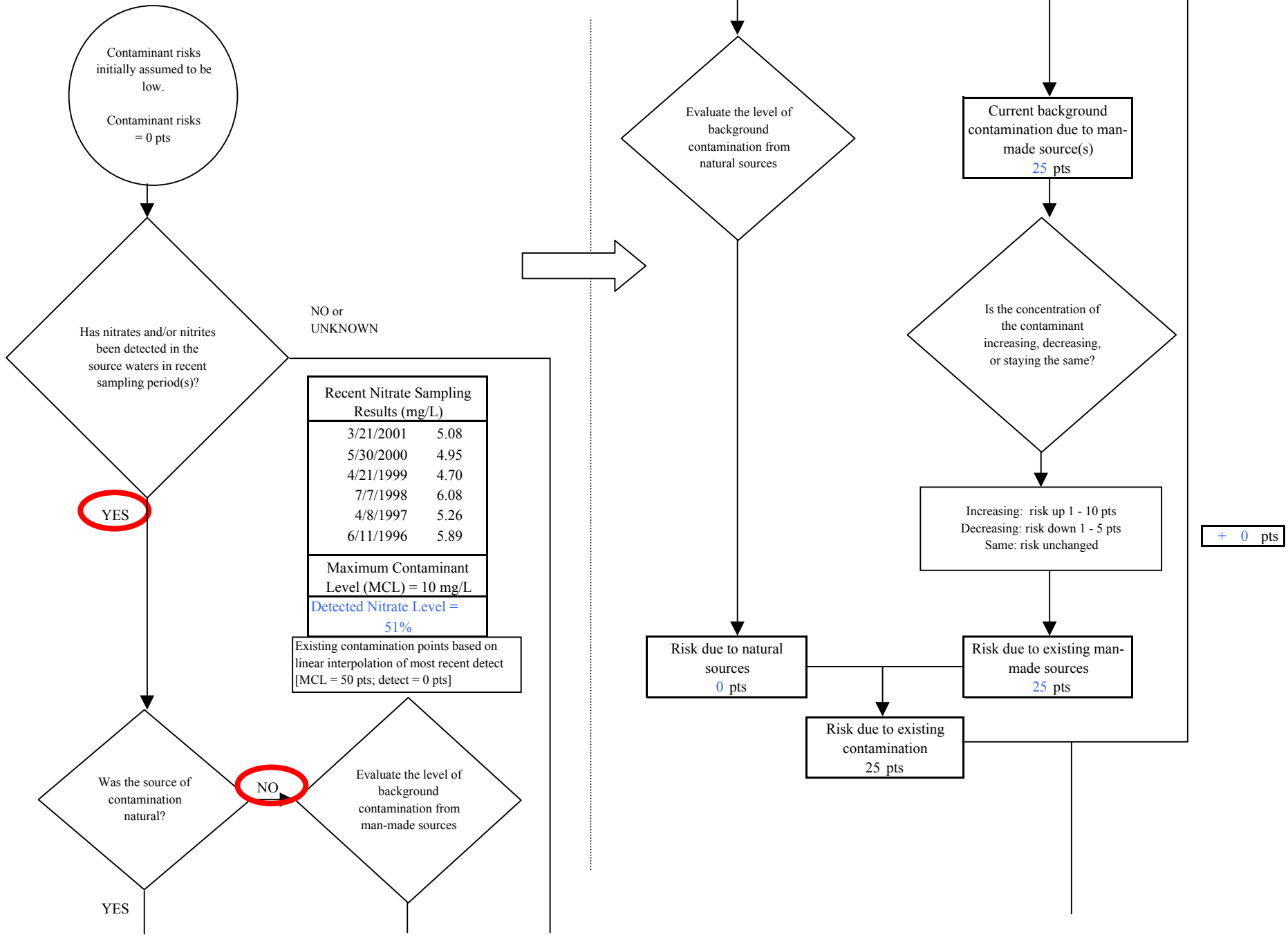


Chart 5. Contaminant risks for The Vallata - Nitrates and Nitrites

+ 35 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)	82	14	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 35

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

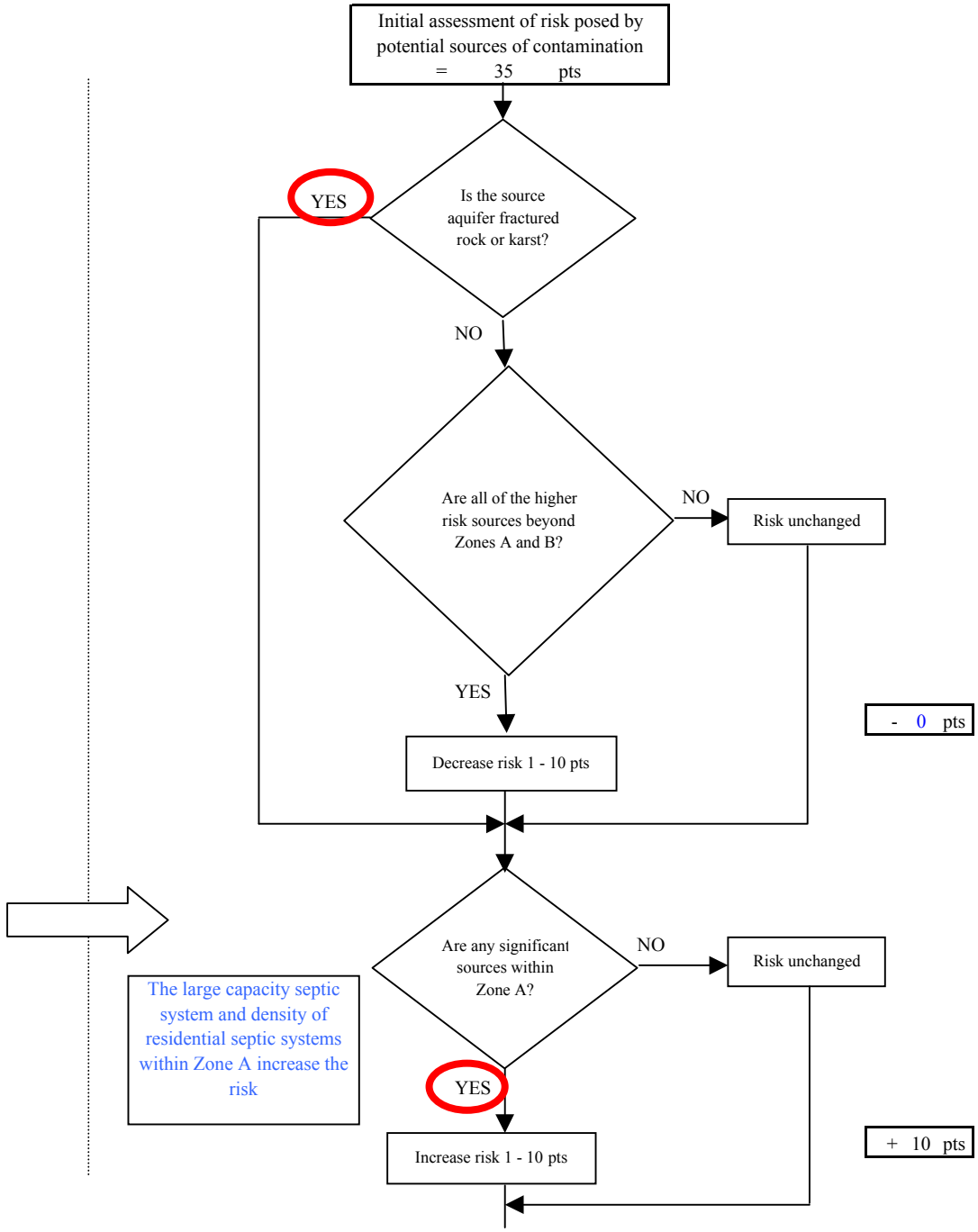


Chart 5. Contaminant risks for The Vallata - Nitrates and Nitrites

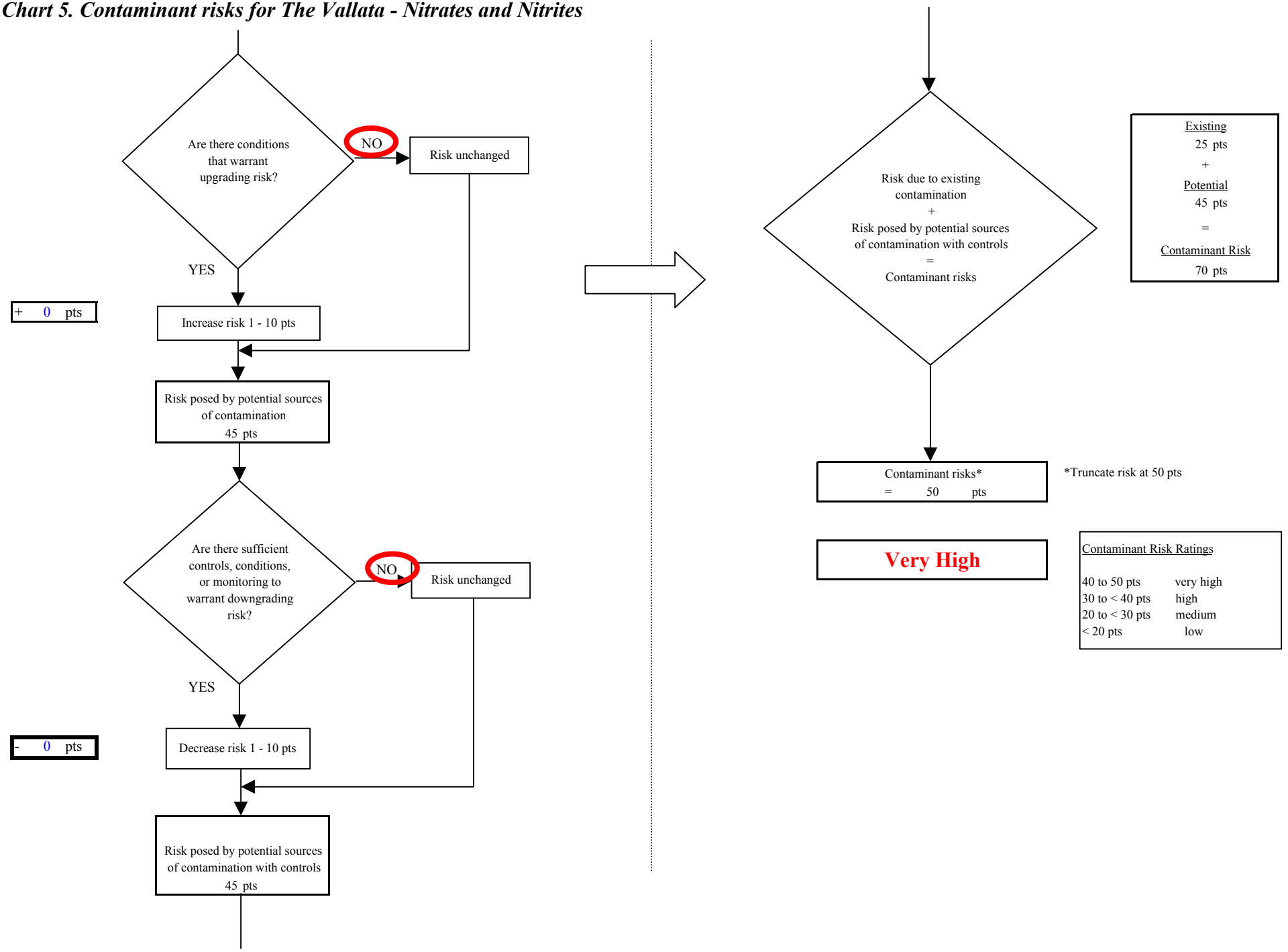


Chart 6. Vulnerability analysis for The Vallata - Nitrates and Nitrites

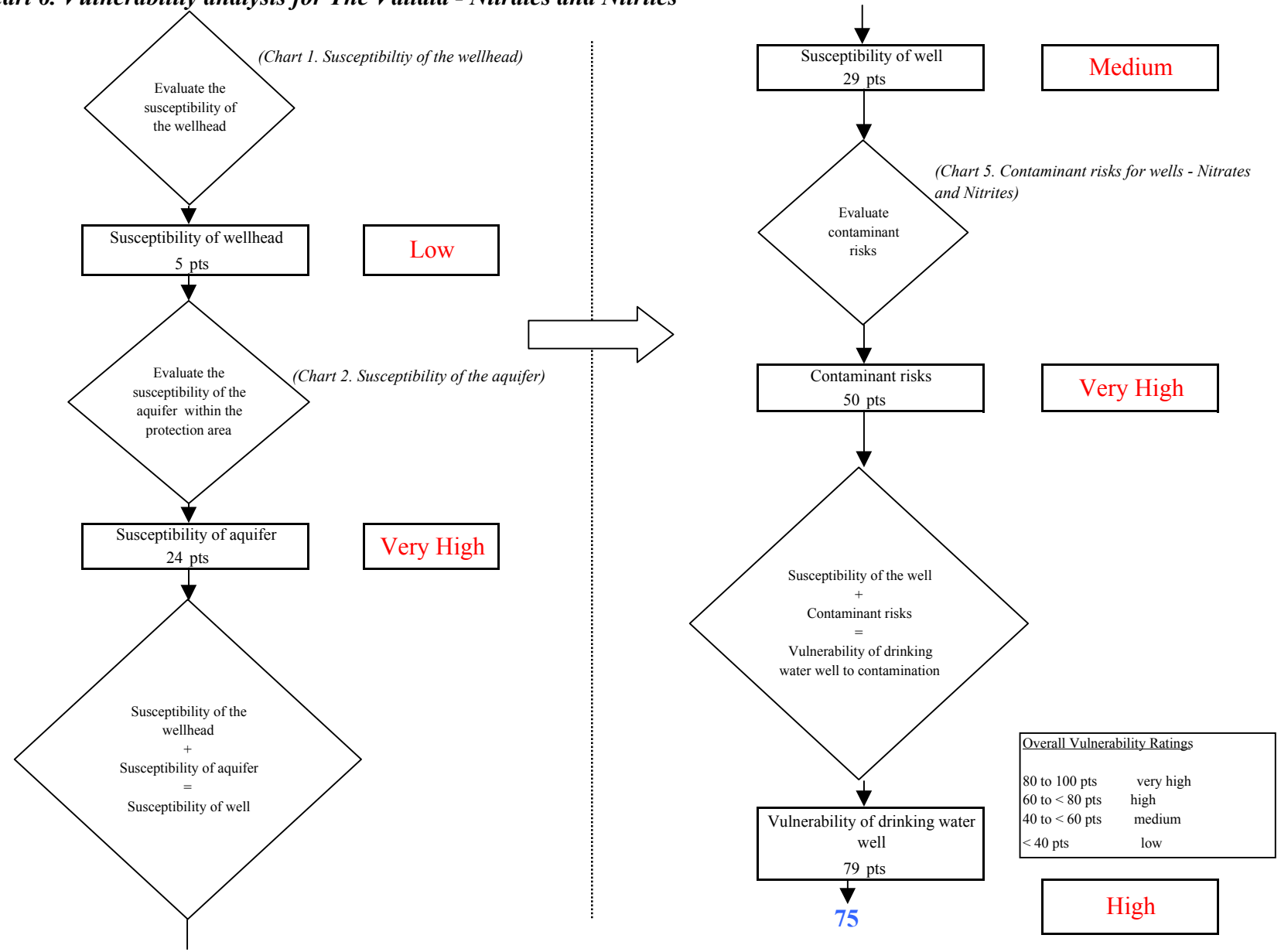


Chart 7. Contaminant risks for The Vallata - Volatile Organic Chemicals

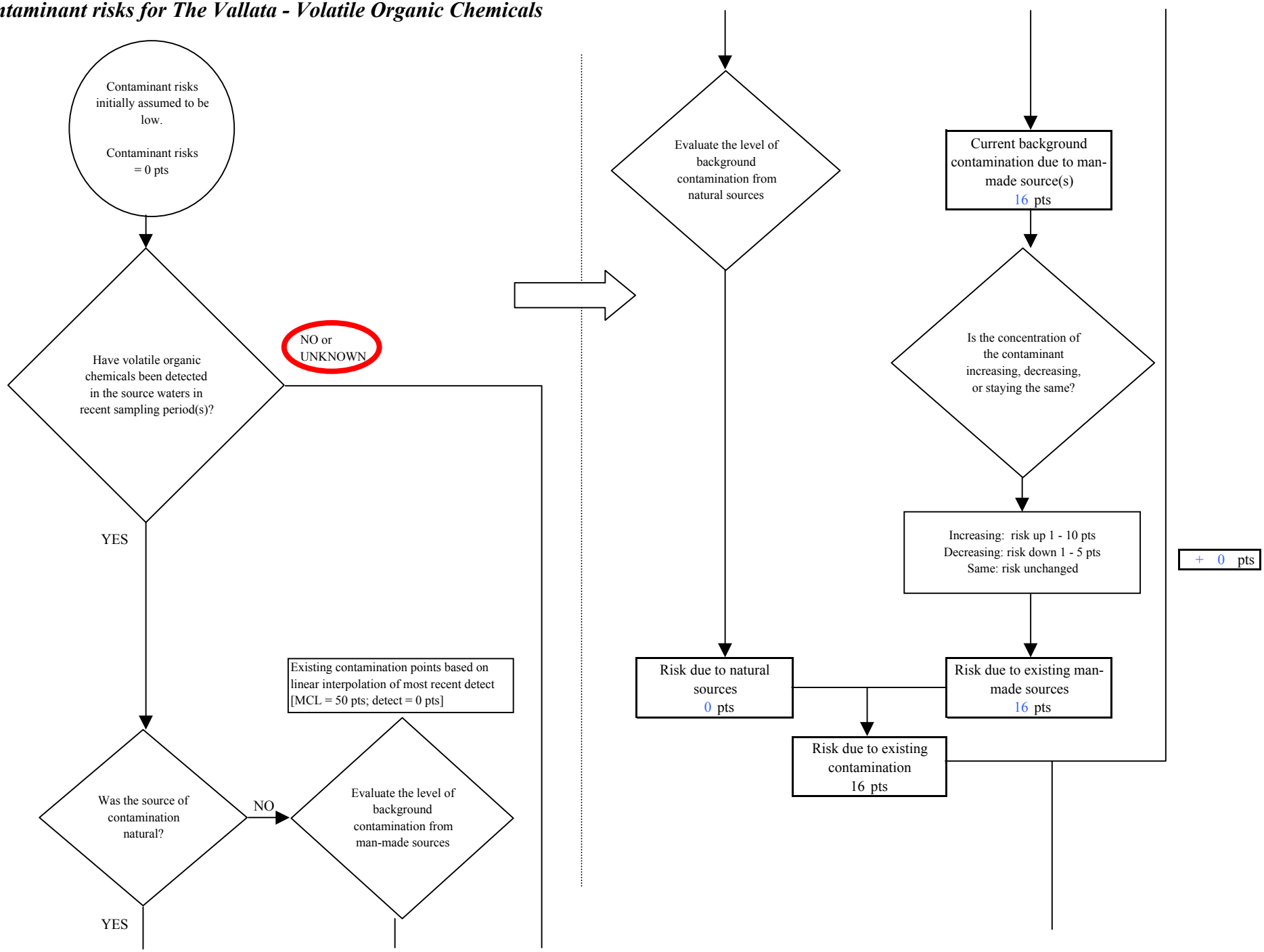
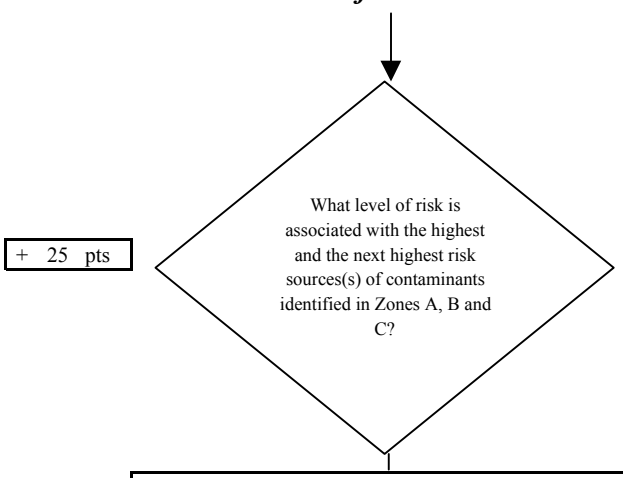


Chart 7. Contaminant risks for The Vallata - Volatile Organic Chemicals



+ 25 pts

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	78	29	107
Low(s)	12	5	17

	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 25

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.

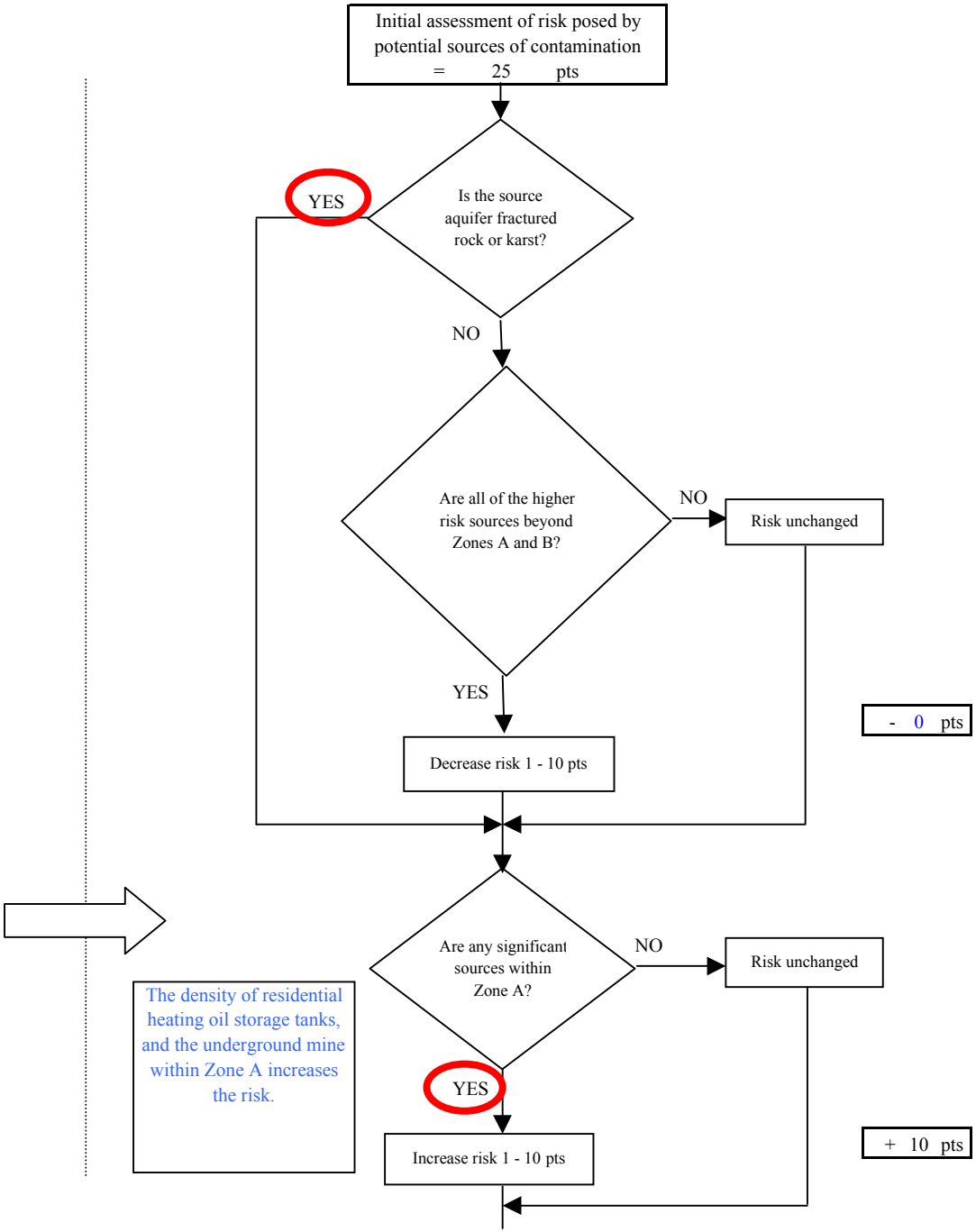


Chart 7. Contaminant risks for The Vallata - Volatile Organic Chemicals

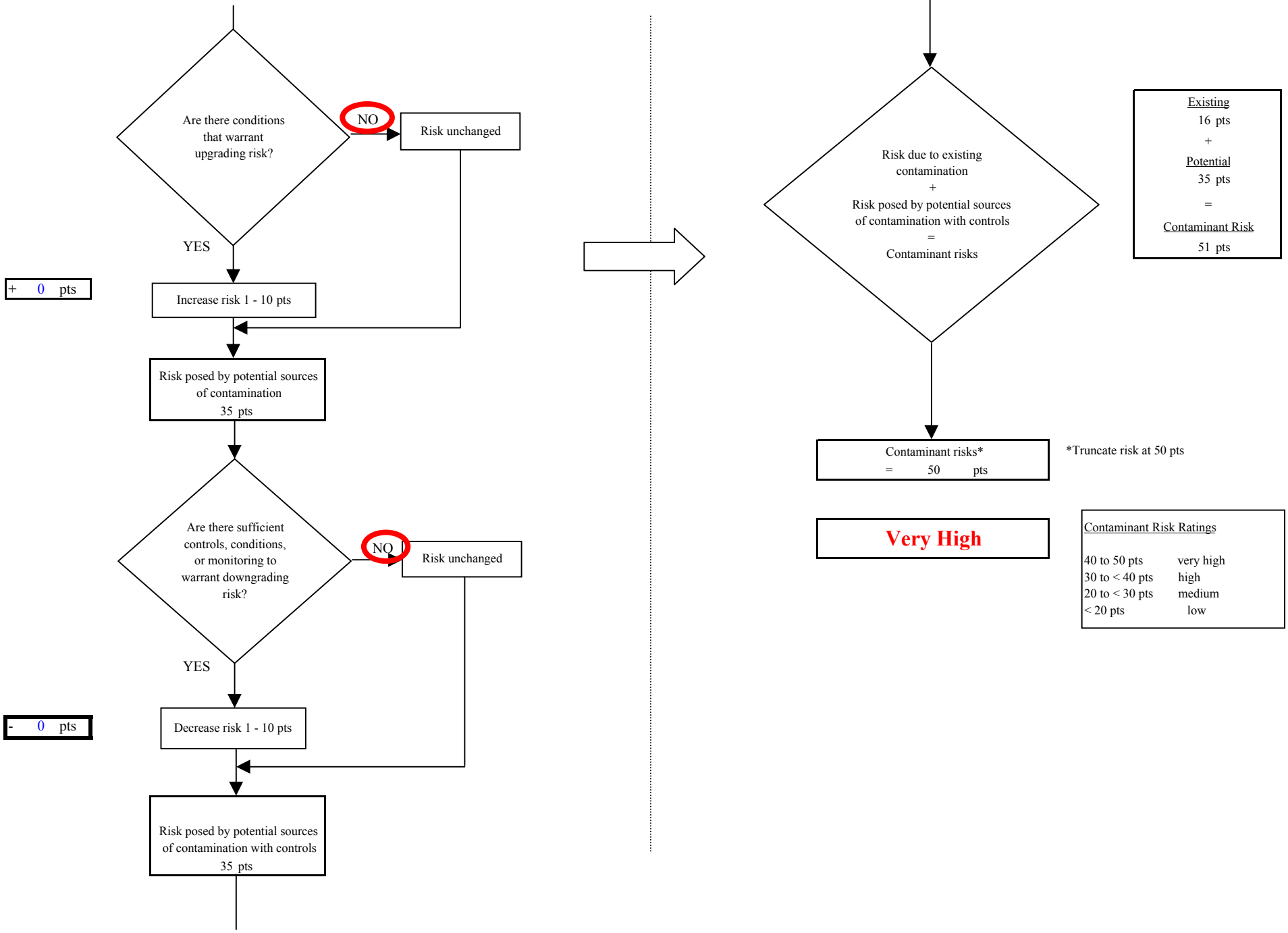


Chart 8. Vulnerability analysis for The Vallata - Volatile Organic Chemicals