Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Waugaman Village RV Park Drinking Water System, Healy, Alaska PWSID # 391003

DRINKING WATER PROTECTION PROGRAM REPORT # 322
Alaska Department of Environmental Conservation

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By Ecology & Environment, Inc.

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August 2002

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 Waugaman Village RV Park Source of Public Drinking Water, Healy, Alaska

By Ecology & Environment, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Waugaman Village RV Park is a Class B (transient/non-community) water system consisting of one well in Healy, Alaska. Identified potential and current sources of contaminants for Waugaman Village RV Park public drinking water source include: paved and gravel roads. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Waugaman Village RV Park received a vulnerability rating of **Low** for bacteria and viruses, **Low** for nitrates and nitrites, and **Low** for volatile organic chemicals.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide 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. Ecology and Environment, Inc. has been contracted to perform these assessments under the supervision of ADEC.

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 HEALY AREA

Location

The community of Healy (pop. 1,000) is located at approximately 78 miles southwest of Fairbanks, on the George Parks Highway, a few miles north of the entrance to Denali National Park (Figure 1).

Figure 1

Precipitation

The Healy area averages over 15 inches of precipitation per year, with approximately 73 inches of annual snowfall (ACRC 2002).

Topography and Drainage

Healy is located near the confluence of Healy Creek and the Nenana River. The area is dominated by several steep peaks to the south, including Mount Healy, with somewhat gentler terrain to the north. The town itself has relatively flat topography. Drainage is typically towards the Nenana River or one of its tributaries.

Groundwater Use

The majority of residents in Healy have private water wells and septic systems; others haul water from a

community well source. There are no municipal water or sewage facilities (ADCED 2002).

Geology and Soils

The surficial geology of the Healy area consists mainly of glacial outwash gravel of various ages, together with some recent river terrace gravels. Nenana Gravel, a poorly-consolidated conglomerate and coarse standstone with interbedded mudflow deposits and thin claystone and lignite, is found in the mountainous terrain northeast of Healy (Wahrhaftig 1970).

WAUGAMAN VILLAGE RV PARK PUBLIC DRINKING WATER SYSTEM

Waugaman Village RV Park is a Class B (transient/non-community) water system. The system consists of one well off the Parks Highway on Healy Spur Road mile 3.9.

There is no well log on file for this well; if one could be located, it would help improve the accuracy of this report. The most recent Sanitary Survey (6/13/94) indicates the well was installed to an estimated depth of 375 feet. It has a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The land surface is also appropriately sloped away from the well providing adequate surface water drainage. The well apparently was grouted according to ADEC regulations. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters. The aquifer is assumed to be confined based on the lithologies encountered during drilling of a nearby well.

This system operates from May to September and serves approximately 15 residents and more than 12 non-residents.

WAUGAMAN VILLAGE RV PARK 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 a release 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 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 et al. 1989*). Additional methods were also used 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 Water Systems for additional information).

The DWPAs established for wells by the ADEC are separated into four zones. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. 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 to the 2-year 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 most likely 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.

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 Waugaman Village RV Park 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 water system assessments, three categories of drinking water contaminants were inventoried. They include:

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

Inventoried potential sources of contamination within Zones A through Zone D were associated with residential and light industrial type activities. The sources are summarized in the tables in Appendix B of the Guidance Manual.

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.

VULNERABILITY OF WAUGAMAN VILLAGE RV Park 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)

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 2 shows the Overall Susceptibility score and rating for Waugaman Village RV Park (see Charts 1 and 2).

Table 2. Natural Susceptibility - Susceptibility of the Wellhead and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	8	Low
Natural Susceptibility	8	Low

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 or 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 (see Charts 3, 5, and 7).

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	12	Low
Volatile Organic Chemicals	12	Low

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the three categories of drinking water contaminants. Note: scores are rounded off to the nearest five (see Charts 4, 6, and 8).

Table 4. Overall Vulnerability of Waugaman Village RV Park to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	20	Low
Nitrates and Nitrites	20	Low
Volatile Organic Chemicals	20	Low

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

Only a small amount of bacteria and viruses are required to endanger public health. If bacteria and viruses have been detected during recent water sampling of the system at Waugaman Village RV Park, the result is a maximum score on Chart 3.

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]. Existing nitrate concentration in Waugaman Village RV Park well is approximately 0.0 mg/L or 0% 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. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Class B Public Water systems are not required to test for volatile organic chemicals (VOCs); therefore, no score for pre-existing contamination has been assigned. The vulnerability score for VOCs reflects the potential for contamination from the sources indicated on Table 4 in Appendix B.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Waugaman Village RV Park. The overall vulnerability of this source to contamination is **Low** for bacteria and viruses, **Low** for nitrates and nitrites, and **Low** for 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 Waugaman Village RV Park 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 Waugaman Village RV Park public drinking water source.

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Wahrhaftig, C., 1970, *Geologic Map of the Healy D-4 Quadrangle, Alaska*, Department of the Interior, United States Geological Survey, Geologic Quadrangle Maps of the United States series, Map GQ-806, Washington, DC.

Wang, B., Strelakos, P.M., and Jokela, B., 2000, Nitrate Source Indicators In Groundwater of the Scimitar Subdivision, Peters Creek Area, Anchorage Alaska: U.S. Geological Survey Water-Resources Investigations Report 00-4137, 25p.

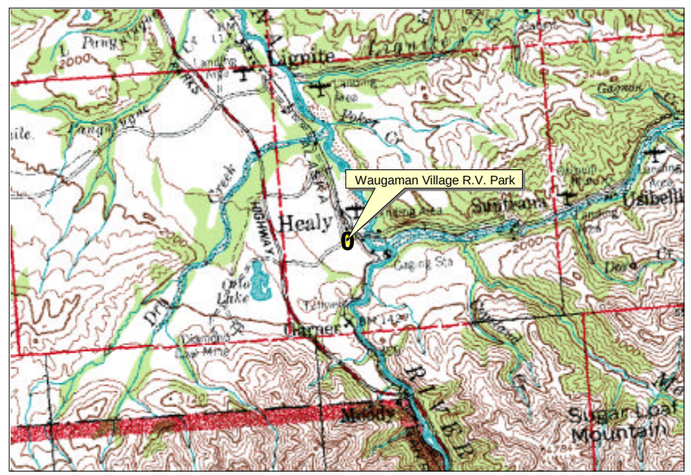
APPENDIX A

Waugaman Village RV Park
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Area for Waugaman Village RV Park

0 Waugaman Village RV Park Well
Zone A (Few Months Travel Time)
Zone B (Less Than 2 Years Travel Time)
Zone C (Less Than 5 Years Travel Time)

N
W E
S



1 0 1 2 3 4 5 Miles

PWSID 391003.001 ***Map 1***

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Waugaman Village RV Park (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Waugaman Village R.V. Park***

PWSID 391003.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	LOCAL ROAD	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	C	GEORGE PARK'S HWY	2	

Table 2

Contaminant Source Inventory and Risk Ranking for Waugaman Village R.V. Park Sources of Bacteria and Viruses

PWSID 391003.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Location	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-1	A	Low	LOCAL ROAD	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	C	Low	GEORGE PARK'S HWY	2	

Table 3

Contaminant Source Inventory and Risk Ranking for Waugaman Village R.V. Park Sources of Nitrates/Nitrites

PWSID 391003.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-1	A	Low	LOCAL ROAD	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	C	Low	GEORGE PARK'S HWY	2	

Table 4

Contaminant Source Inventory and Risk Ranking for Waugaman Village R.V. Park Sources of Volatile Organic Chemicals

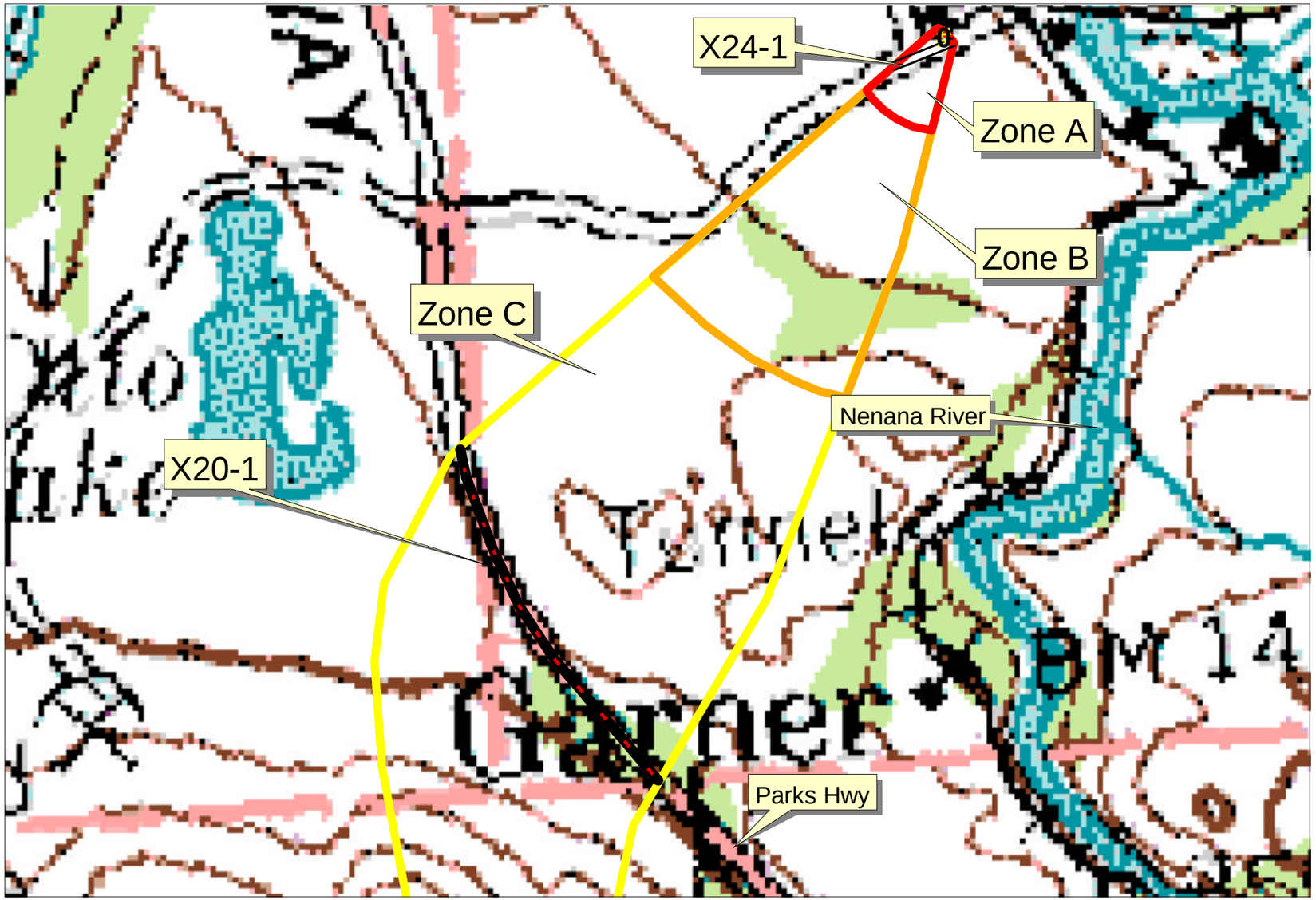
PWSID 391003.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Location	Map Number	Comments
Highways and roads, dirt/gravel	X24	X24-1	A	Low	LOCAL ROAD	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	C	Low	GEORGE PARK'S HWY	2	

APPENDIX C

Waugaman Village RV Park
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Drinking Water Protection Area for Waugaman Village RV Park and Potential and Existing Sources of Contamination



0 Waugaman Village RV Park Well

Paved Road-X20
Dirt Road-X24
Zone A (Few Months Travel Time)
Zone B (Less Than 2 Years Travel Time)
Zone C (Less Than 5 Years Travel Time)

N
W E
S

1 0 1 2 Miles

PWSID 391003.001

Map 2

APPENDIX D

Vulnerability Analysis for Waugaman Village RV Park Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - Waugaman Village RV Park

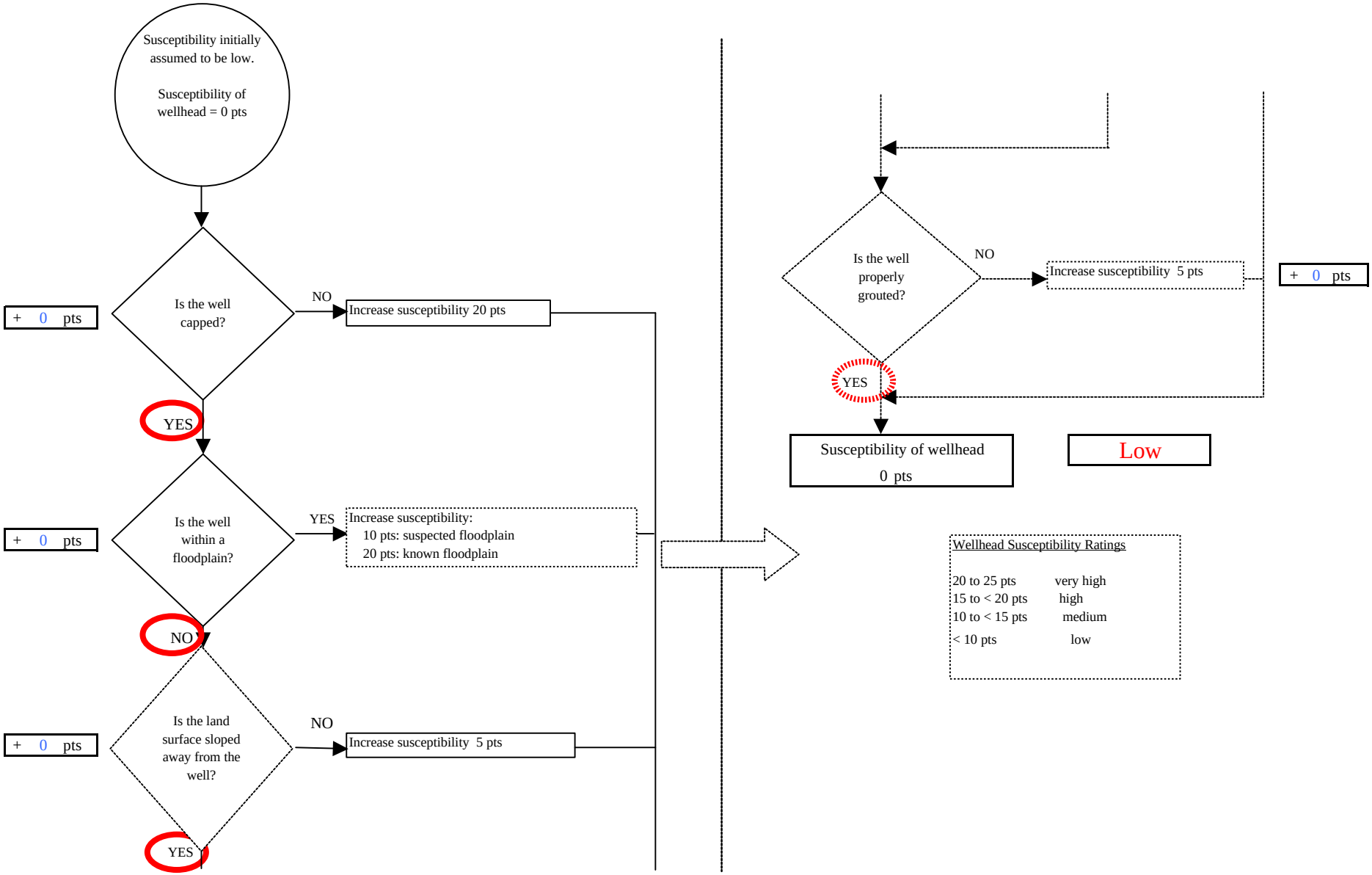


Chart 2. Susceptibility of the aquifer - Waugaman Village RV Park

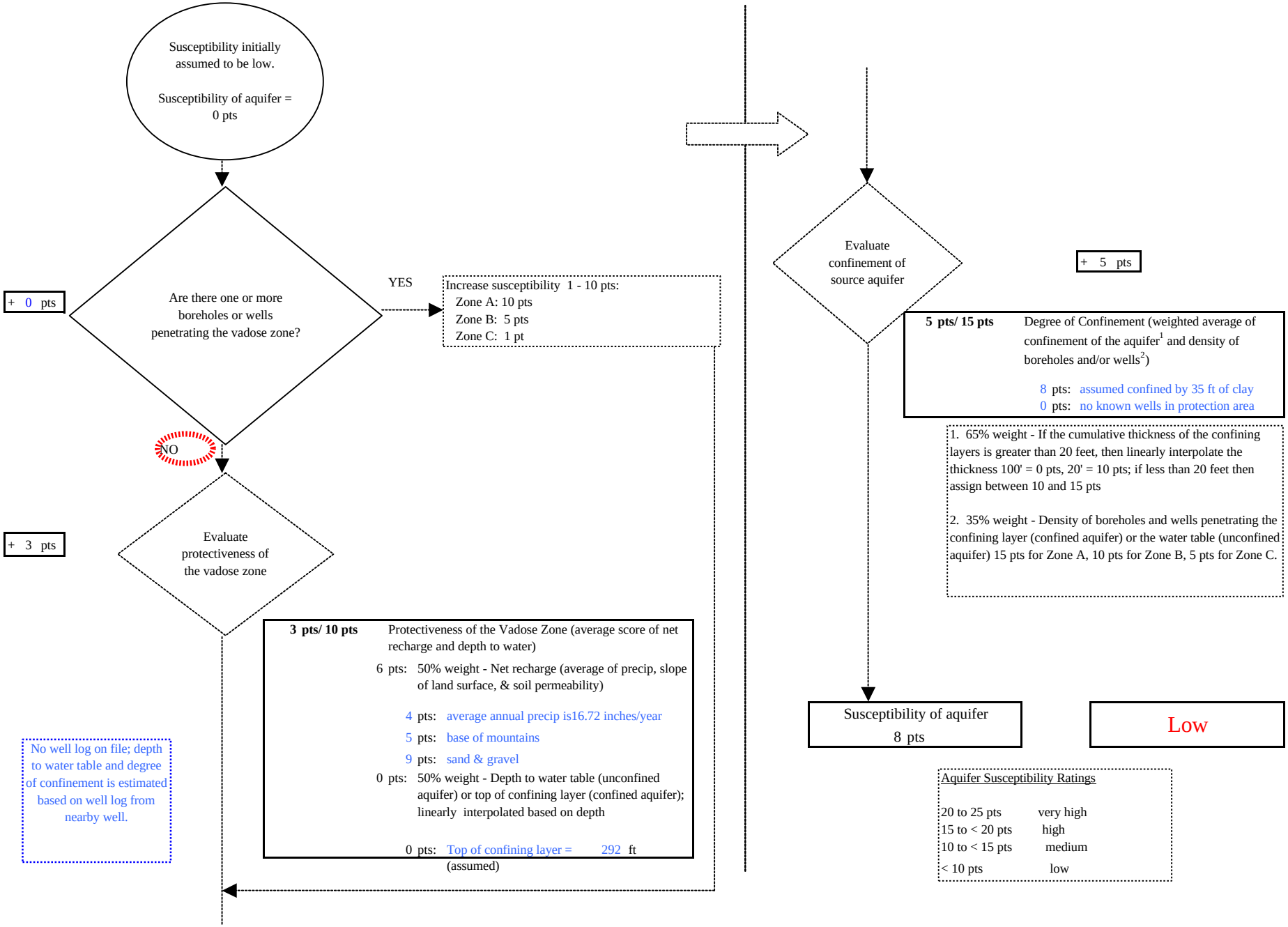
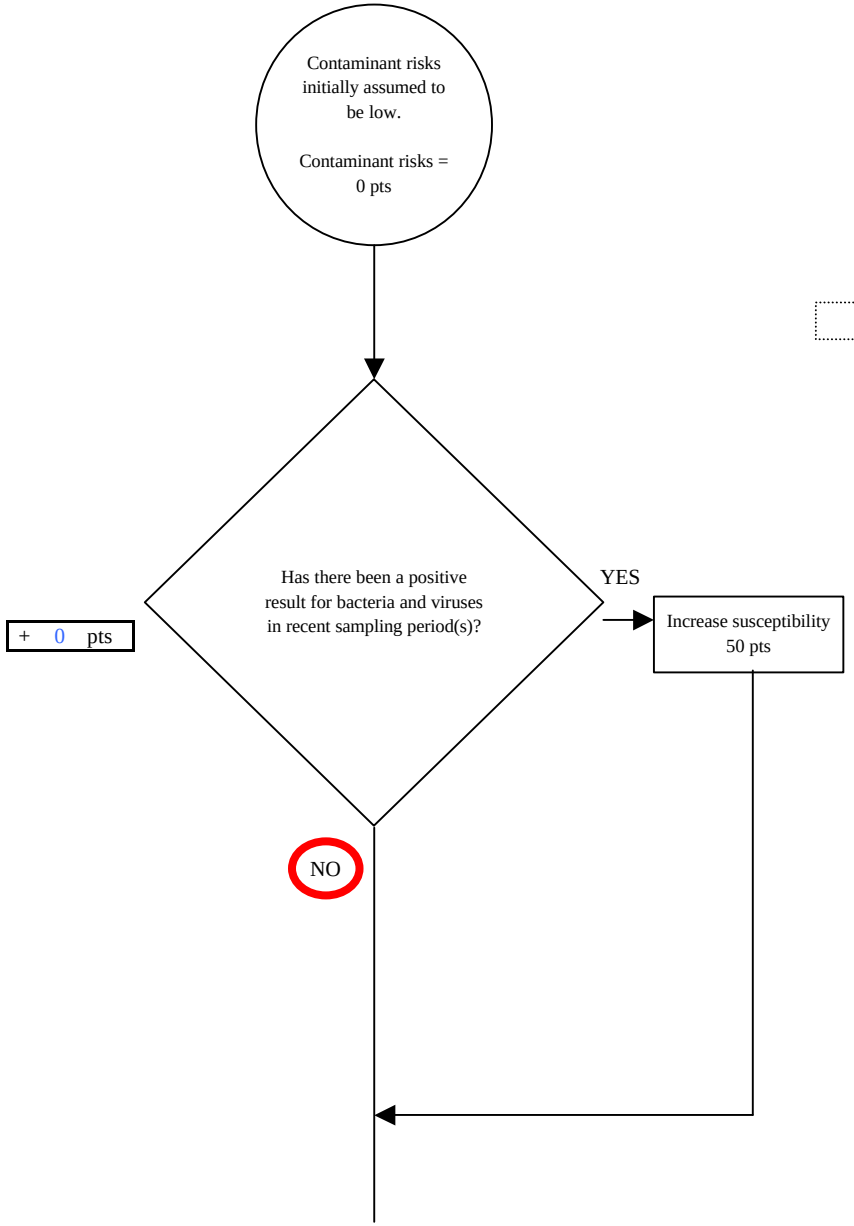
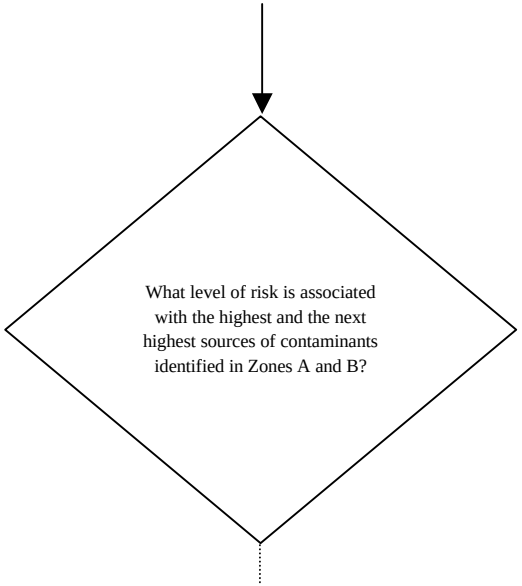


Chart 3. Contaminant risks for Waugaman Village RV Park - Bacteria & Viruses





+ 10 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

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

	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 10

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

Chart 3. Contaminant risks for Waugaman Village RV Park - Bacteria & Viruses

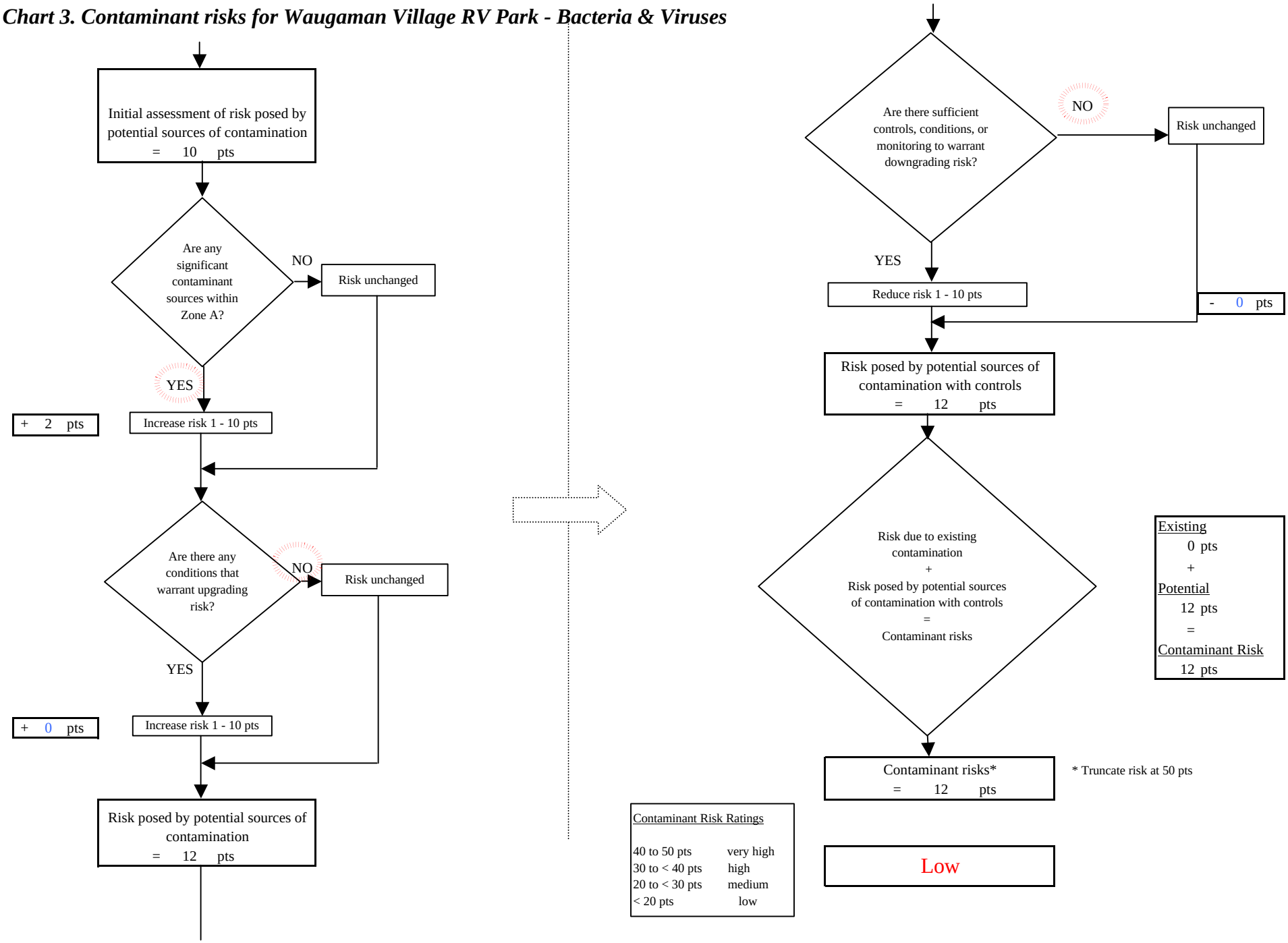


Chart 4. Vulnerability analysis for Waugaman Village RV Park - Bacteria & Viruses

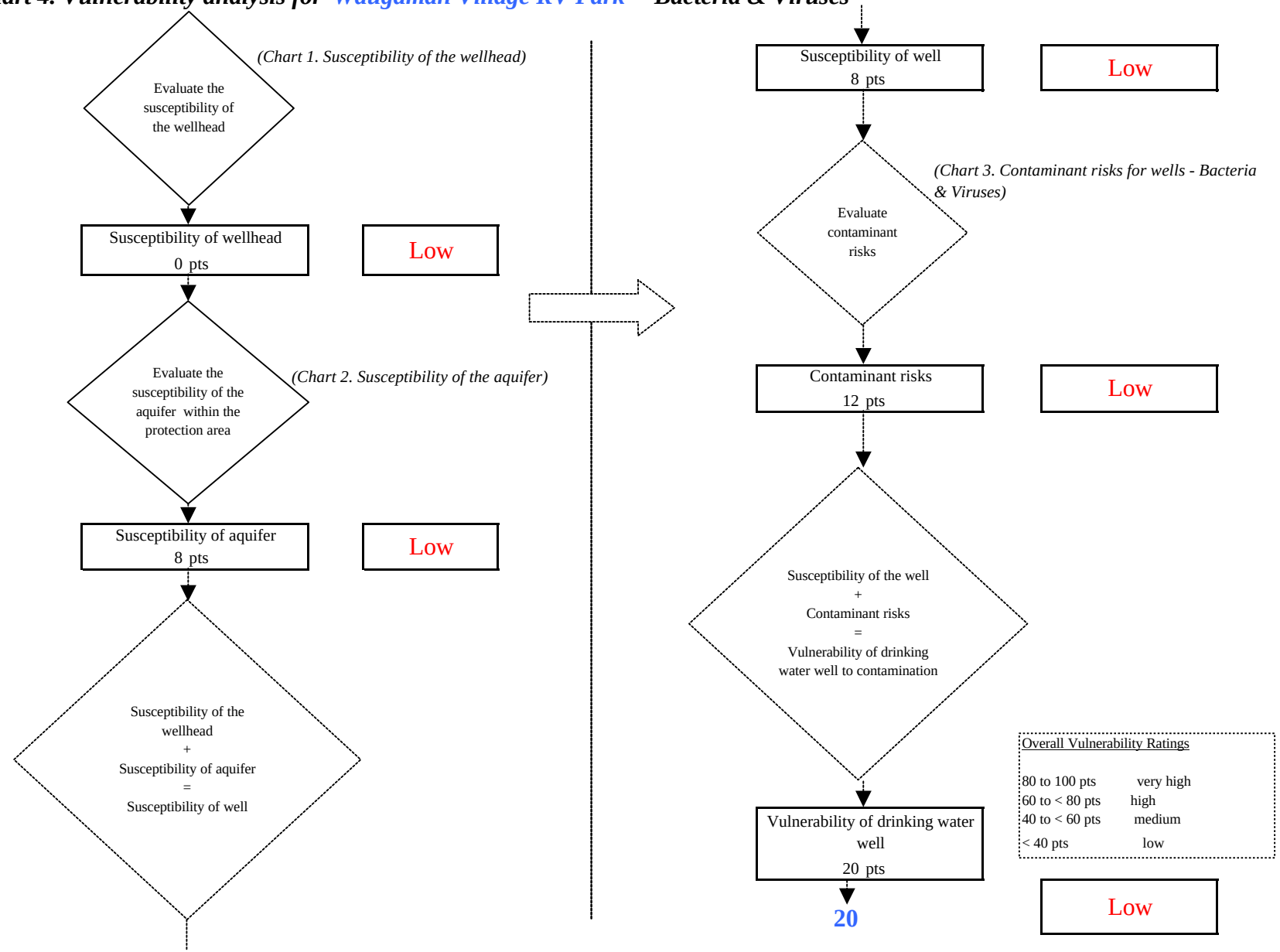


Chart 5. Contaminant risks for Waugaman Village RV Park - Nitrates and Nitrites

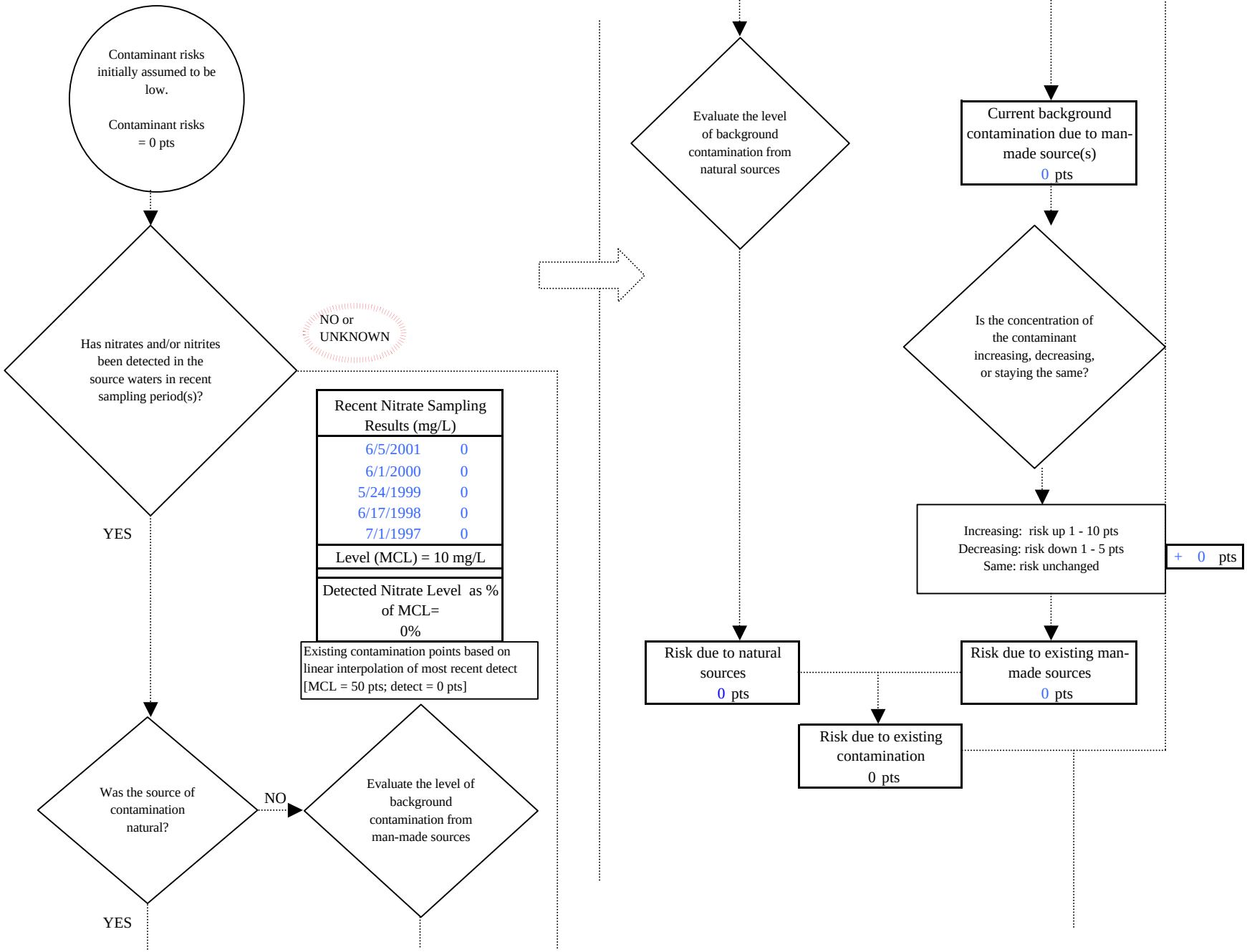


Chart 5. Contaminant risks for Waugaman Village RV Park - Nitrates and Nitrites

+ 10 pts

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

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

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

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 10

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

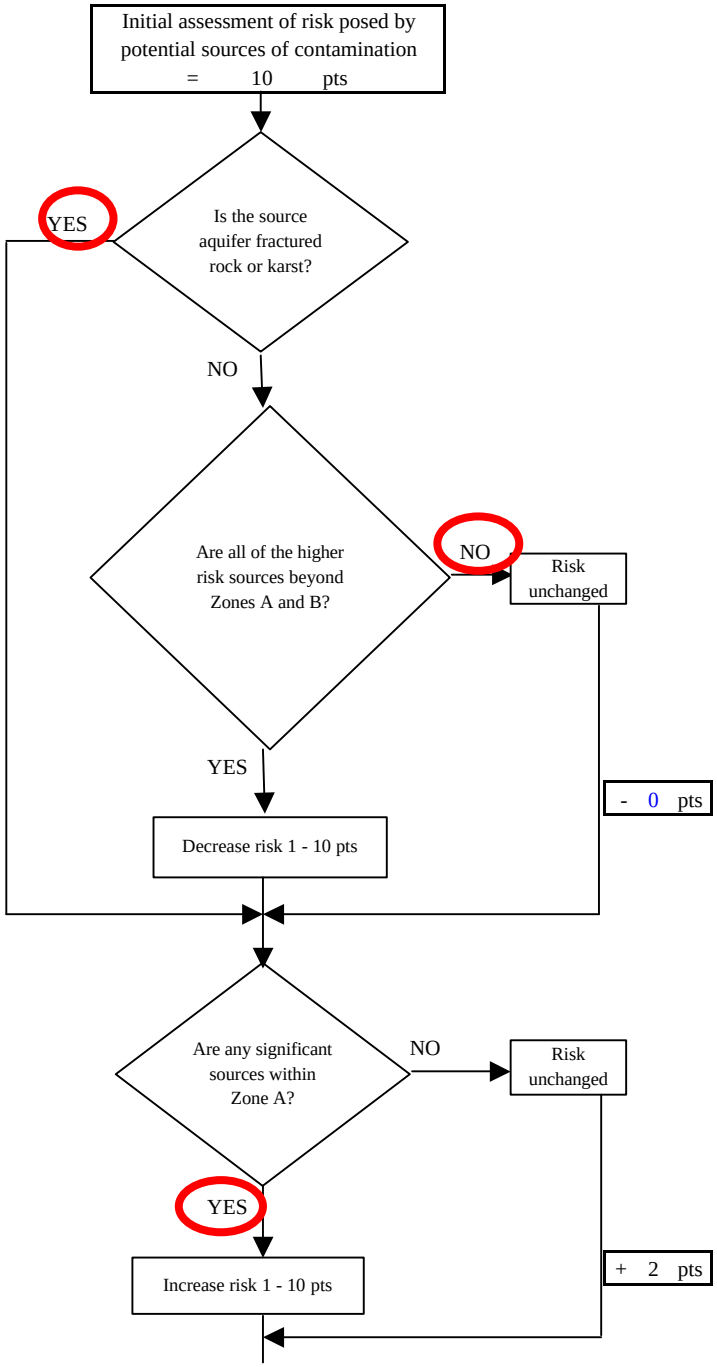


Chart 5. Contaminant risks for Waugaman Village RV Park - Nitrates and Nitrites

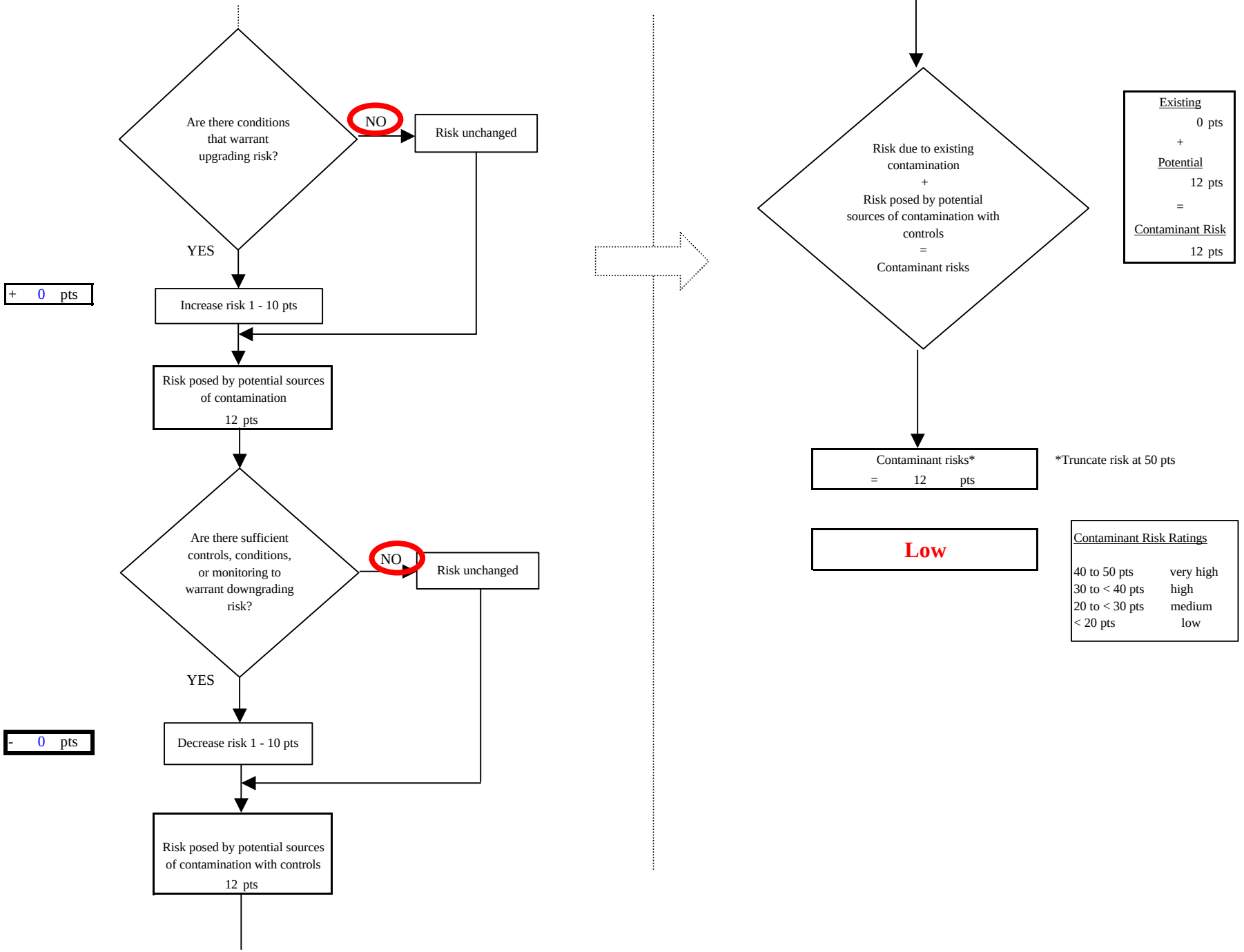


Chart 6. Vulnerability analysis for Waugaman Village RV Park - Nitrates and Nitrites

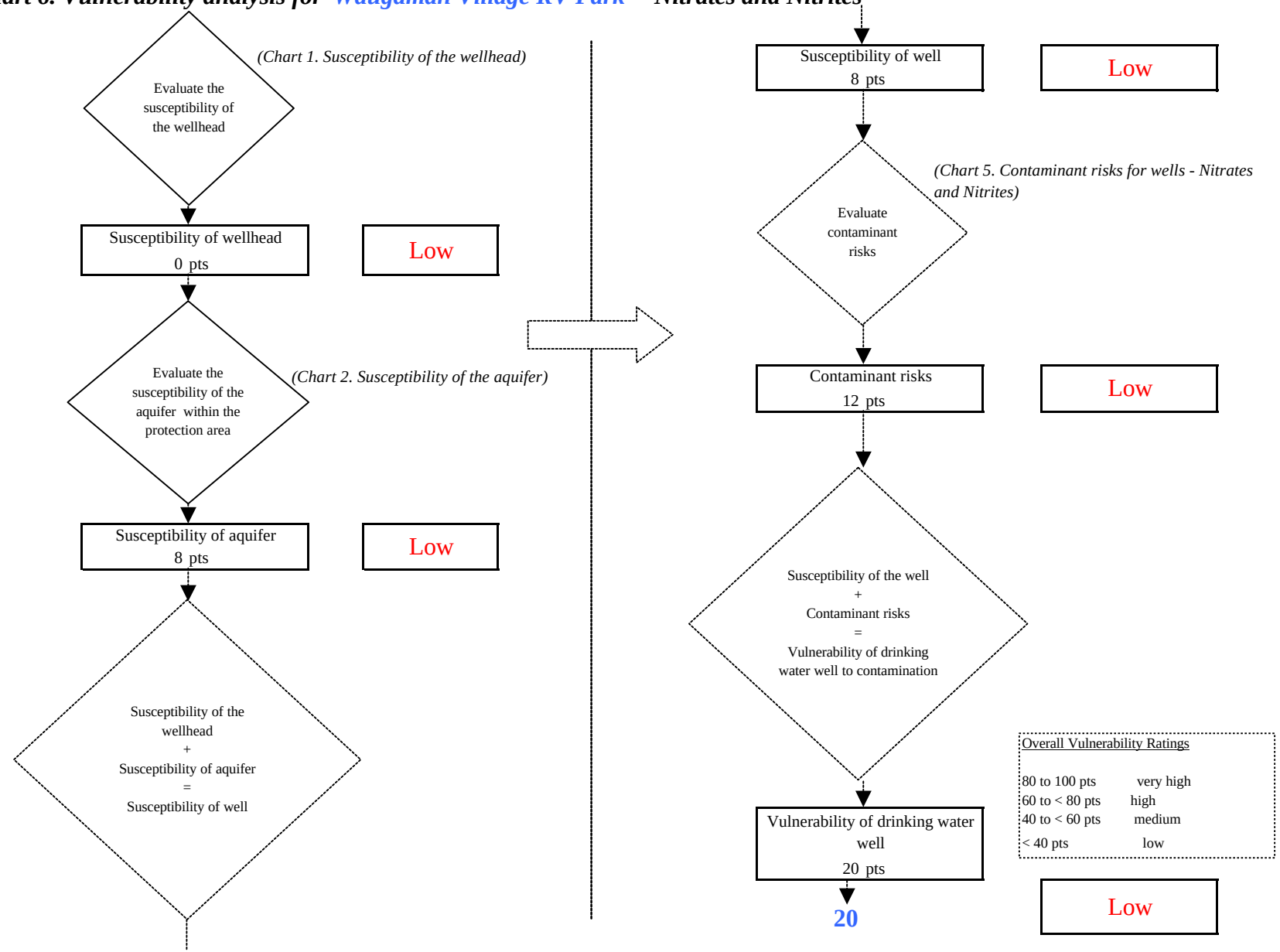


Chart 7. Contaminant risks for Waugaman Village RV Park - Volatile Organic Chemicals

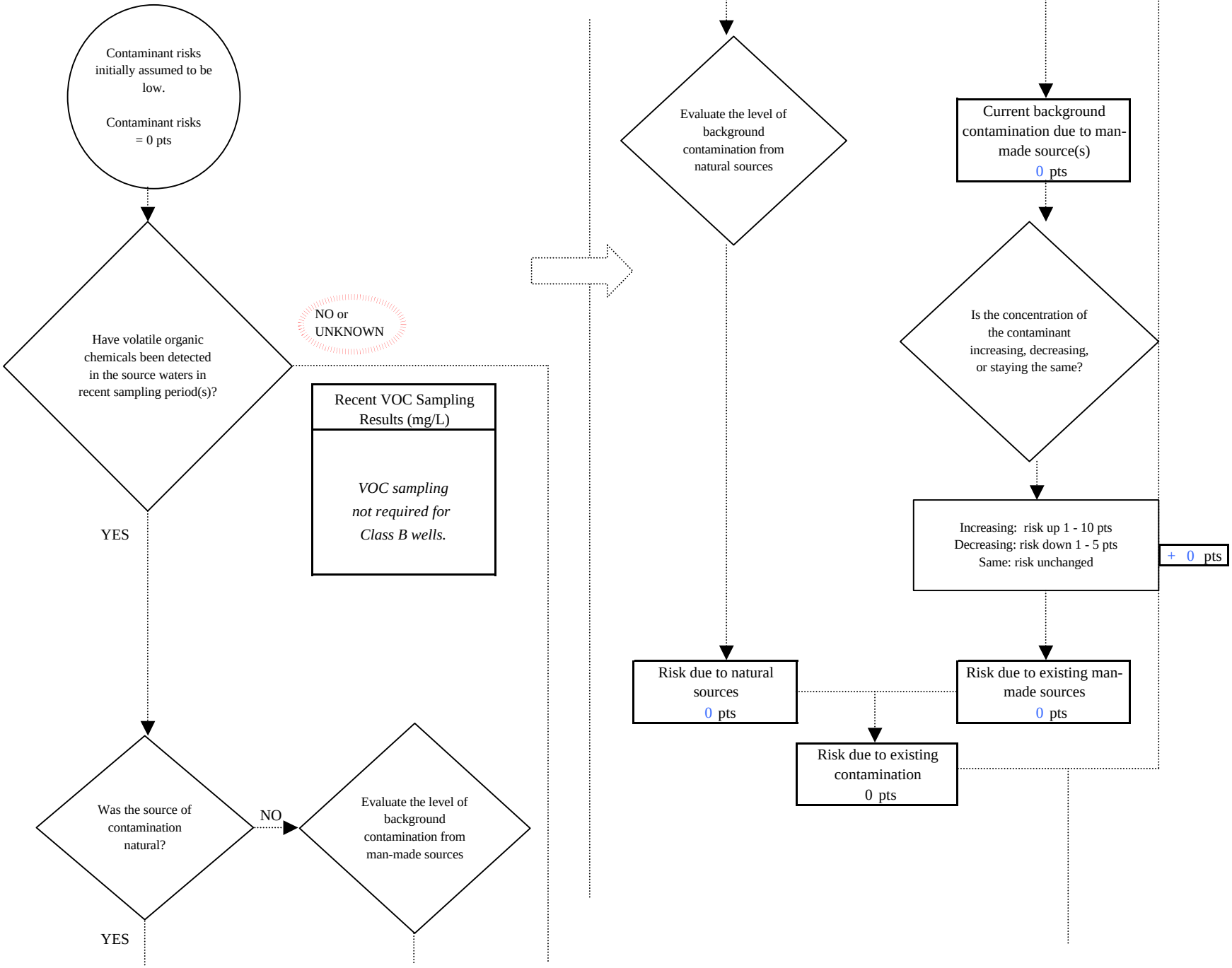


Chart 7. Contaminant risks for Waugaman Village RV Park - Volatile Organic Chemicals

+ 10 pts

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

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

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

	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 10

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

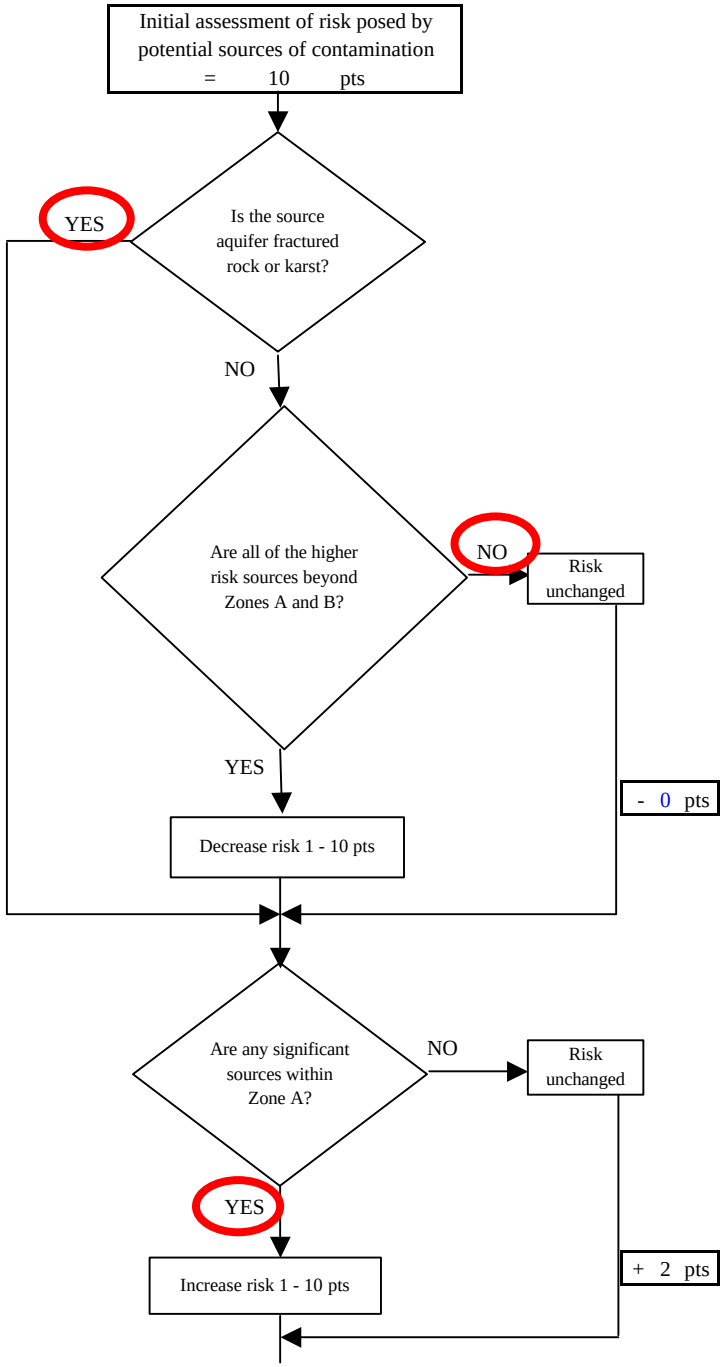


Chart 7. Contaminant risks for Waugaman Village RV Park - Volatile Organic Chemicals

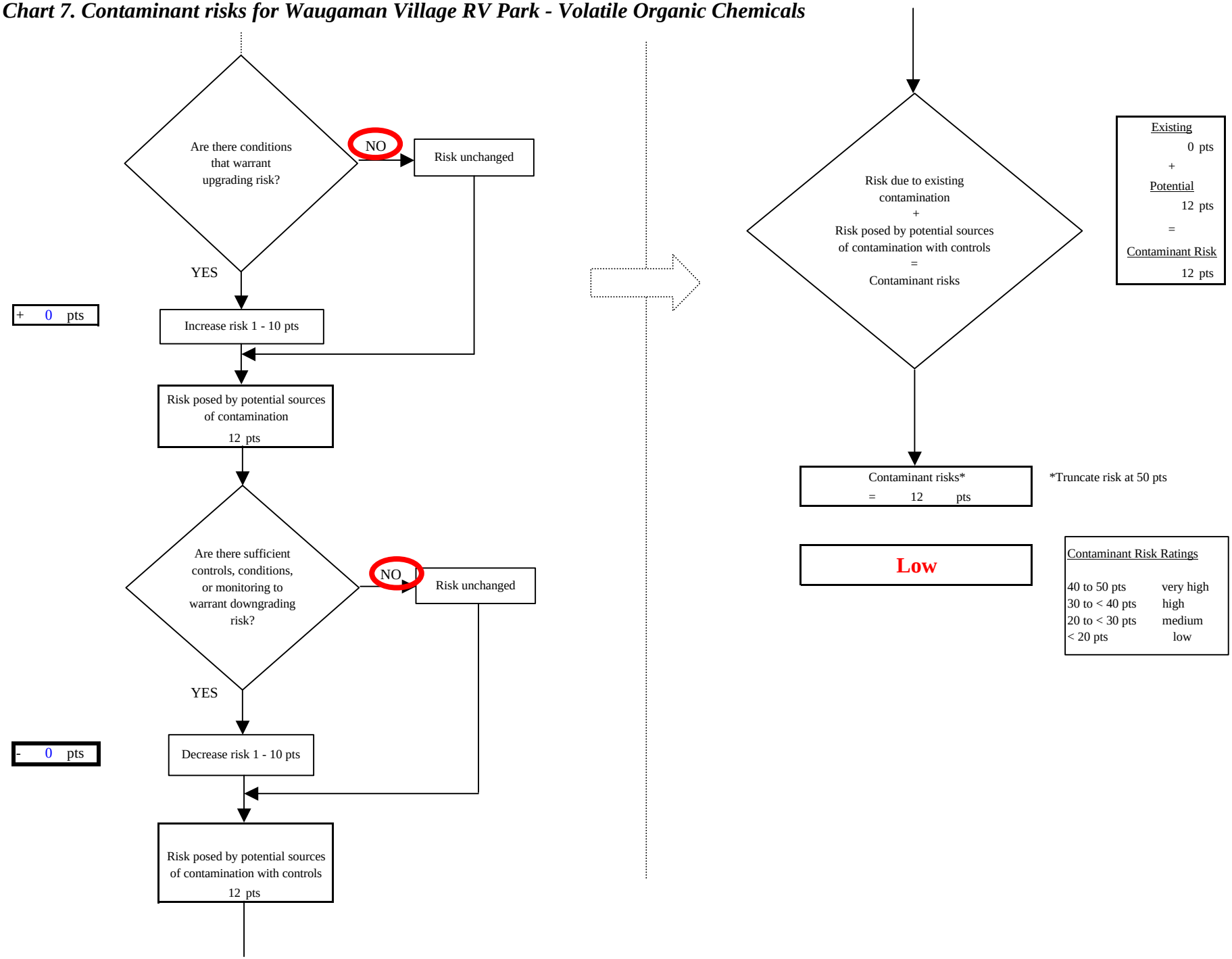


Chart 8. Vulnerability analysis for Waugaman Village RV Park - Volatile Organic Chemicals