# Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for
Bingle Memorial Camp
Drinking Water System,
Salcha area, Alaska
PWSID # 310099

DRINKING WATER PROTECTION PROGRAM REPORT #937

Alaska Department of Environmental Conservation

November 2003

# Source Water Assessment for Bingle Memorial Camp Drinking Water System Salcha area, Alaska PWSID# 310099

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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.

November 2003

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# Source Water Assessment for Bingle Memorial Camp Source of Public Drinking Water
# Salcha area, Alaska

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**Drinking Water Protection Program**
Alaska Department of Environmental Conservation

## EXECUTIVE SUMMARY

The public water system for Bingle Memorial Camp is a Class B (transient/non-community) water system consisting of two wells in the Salcha area, Alaska. The wellheads received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **High**. Combining these two ratings produces a **Medium** rating for the natural susceptibility of the wells. Identified potential and current sources of contaminants for Bingle Memorial Camp public drinking water source include: a septic system and a road. 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 source for Bingle Memorial Camp received a vulnerability rating of **High** 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 continuing efforts on the part of the system owner/operator to protect public health.

## 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 the owner/operator of Bingle Memorial Camp, 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 & 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.

## BINGLE MEMORIAL CAMP PUBLIC DRINKING WATER SYSTEM

Bingle Memorial Camp public water system is a Class B (transient/non-community) water system. The system consists of two wells located on Salcha Drive on the southern shore of Harding Lake near Salcha (see Map 1 of Appendix A). The community of Salcha is located at mouth of the Salcha River, on the Richardson Highway approximately 33 miles southeast of Fairbanks. The estimated 2002 population was 934 residents (ADCED 2003).

Approximately two-thirds of residences and businesses in the Salcha area are served by individual wells and septic systems; the remainder hauls water and use outhouses. Refuse is collected in dumpsters and transported to the Fairbanks North Star Borough landfill (ADCED 2003). Approximately one-third of the residences are used only seasonally.

Surficial deposits in the Salcha area generally are composed of alluvium – silt, sand, and gravel – along the river and mixed alluvium and colluvium elsewhere. The latter comprises boulders, sand, silt, gravel, and rock fragments. It may include perennially frozen silt and peat in the river valley. These deposits are underlain by schist, gneiss and quartzite, which outcrop along the southern, southeastern, and western shores of Harding Lake (Weber et al. 1978).

The general groundwater flow direction is expected to be towards the northwest, towards the Salcha River.

The depths of the Bingle Memorial Camp wells are unknown.

The most recent Sanitary Survey (6/23/2000) for the water system indicates the land surface is appropriately sloped away from the wells. Sloping of the ground surface around the well provides drainage of surface water away from the well casing. Also, the wells are not grouted according to ADEC regulations. Proper

grouting provides added protection against contaminants traveling along the well casing and into source waters. It generally is assumed that wells drilled prior to 1993 are not grouted, unless otherwise stated in the well log.

This system operates year-round and serves approximately 80 non-residents.

## BINGLE MEMORIAL CAMP DRINKING WATER PROTECTION AREA (DWPA)

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

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area. 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.

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. An outline of the immediate watershed was used to determine the size and shape of the protection area. Additional methods were considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area. (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

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

**Table 1. Definition of Zones**

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

The DWPA may be limited by its immediate watershed and therefore may not include all four zones (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 Bingle Memorial Camp DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

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

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

The sources are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

## RANKING OF CONTAMINANT RISKS

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

- Low;
- Medium;
- High; and
- Very High.

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

Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with

respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

**VULNERABILITY OF BINGLE MEMORIAL CAMP DRINKING WATER SYSTEM**

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

- Natural susceptibility; and
- Contaminant risks.

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

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

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

+

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

=

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

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

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

The wells for Bingle Memorial Camp are completed in an unconfined aquifer. Because unconfined aquifers are recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to impact this aquifer adversely. Table 2 shows the Susceptibility scores and ratings for Bingle Memorial Camp.

**Table 2. Susceptibility**

| | Score | Rating |
|---|---|---|
| Susceptibility of the Wellhead | 5 | Low |
| Susceptibility of the Aquifer | 17 | High |
| Natural Susceptibility | 22 | Medium |

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 | 16 | Low |
| Volatile Organic Chemicals | 12 | Low |

Finally, an overall vulnerability score is assigned for each water system by combining each of the contaminant risk scores with the natural susceptibility score:

Natural Susceptibility (0 – 50 points)
+
Contaminant Risks (0 – 50 points)
=
Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

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

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the 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 | 70 | High |
| Nitrates and/or Nitrites | 35 | Low |
| Volatile Organic Chemicals | 35 | Low |

**Bacteria and Viruses**

The contaminant risk for bacteria and viruses is Very High, with the septic system and road representing the greatest risk to the drinking water wells (see Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Residents and businesses in the area generally dispose of wastewater in private septic systems. Such systems can pose a risk of bacteria/virus and nitrate/nitrite contamination to drinking water sources. Proper design and maintenance of septic systems is the best safeguard against such contamination. Only a small amount of bacteria and viruses are required to endanger public health. Due to the detection of bacteria and viruses during recent water sampling, the score on Chart 2 is the maximum score. However, that score has been downgraded to reflect that the last positive test occurred in 2001, and that subsequent tests have showed nondetectable concentrations of bacteria and viruses.

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

**Nitrates and Nitrites**

The contaminant risk for nitrates and nitrites is Low, with the septic system and road representing the highest 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.

The last five years' sampling history for Bingle Memorial Camp public water source indicates the most recent concentration detected was 0.820 mg/L on 5/27/2002, which represents 8.2% of the Maximum Contaminant Level (MCL). While nitrates and nitrites can occur naturally in groundwater, a level of 20% of the MCL or more is considered to be due to manmade sources. Water with levels of nitrates and nitrites below 100% of the MCL is considered safe to drink by the U.S. Environmental Protection Agency (EPA 2003). After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the wells, the overall vulnerability of the wells to contamination by nitrates and nitrites is Low.

**Volatile Organic Chemicals**

The contaminant risk for volatile organic chemicals is Low, with the septic system and road representing the highest risk for volatile organic chemicals (see Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Residents in the area typically heat their homes with various types of on-site fuel sources, including propane and heating oil stored in aboveground or underground storage tanks. Although this report does not address heating oil tanks (unless their location is known), they can pose a risk of volatile organic chemical contamination to drinking water sources. 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. Secondary containment around the tank and regular system maintenance can help prevent many of these harmful fuel leaks and help protect the drinking water supply.

Class B water systems generally are not required to test for volatile organic chemicals. After combining the potential contaminant risk for volatile organic chemicals with the natural susceptibility of the wells, the overall vulnerability of the wells to contamination by volatile organic chemicals is Low.

# REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2003, Alaska Community Database [WWW database]. URL http://www.dced.state.ak.us/cbd/commdb/CF_BLOCK.cfm

Freeze, R.A. and Cherry, J.A., 1979, *Groundwater*, Upper Saddle River, NJ: Prentice Hall, Inc.

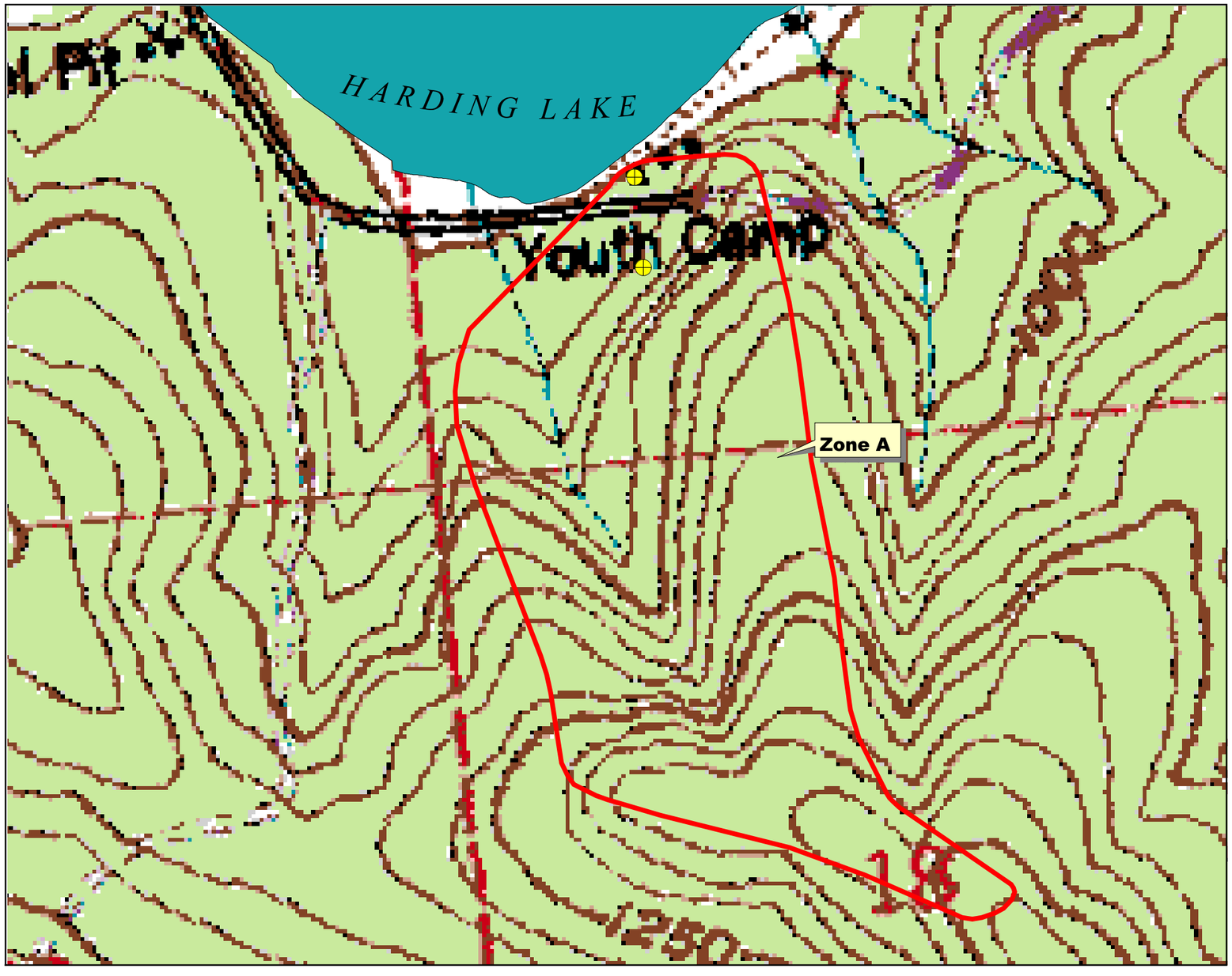
United States Environmental Protection Agency (EPA), 2003, *Consumer Fact Sheet on Nitrates/Nitrites*, http://www.epa.gov/OGWDW/contaminants/dw_contamfs/nitrates.html.

Weber, Florence R., Foster, Helen L., Keith, Terry E.C., and Dusel-Bacon, Cynthia, 1978, *Preliminary Geologic Map of the Big Delta Quadrangle, Alaska*, Anchorage, AK: Department of the Interior, United States Geological Survey.

# APPENDIX A

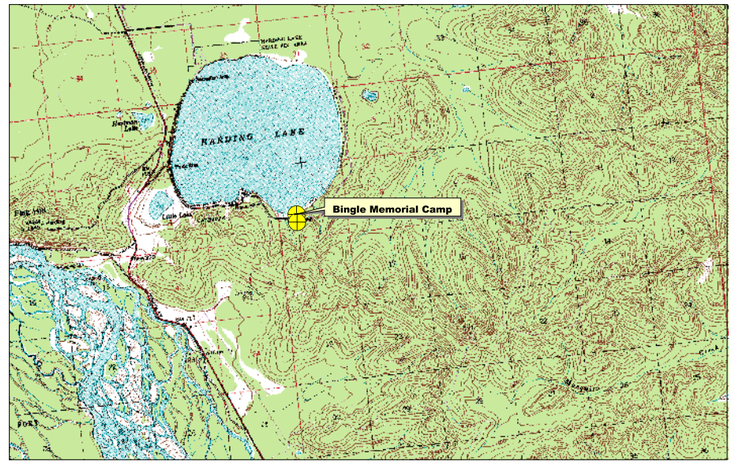
## Bingle Memorial Camp
## Drinking Water Protection Area Location Map
## (Map 1)

# Drinking Water Protection Area for Bingle Memorial Camp




Bingle Memorial Camp Wells
Zone A (Few Months Travel Time)

N
W
E
S




0.25 0 0.25 0.5 0.75 Miles

**PWSID 310099.001, .002**

***Map 1***

# APPENDIX B

## Contaminant Source Inventory and Risk Ranking for Bingle Memorial Camp (Tables 1-4)

***Table 1***

# *Contaminant Source Inventory for* ***Bingle Memorial Camp***

***PWSID 310099.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Map Number* | *Comments* |
|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R2-1 | A | 2 | Bingle Memorial Camp |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | 2 | Salcha Drive |

***Table 2***

# *Contaminant Source Inventory and Risk Ranking for Bingle Memorial Camp Sources of Bacteria and Viruses*

***PWSID 310099.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 2 | Bingle Memorial Camp |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | 2 | Salcha Drive |

***Table 3***

# *Contaminant Source Inventory and Risk Ranking for Bingle Memorial Camp Sources of Nitrates/Nitrites*

***PWSID 310099.001***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 2 | Bingle Memorial Camp |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | 2 | Salcha Drive |

***Table 4***

# *Contaminant Source Inventory and Risk Ranking for Bingle Memorial Camp*
## *Sources of Volatile Organic Chemicals*

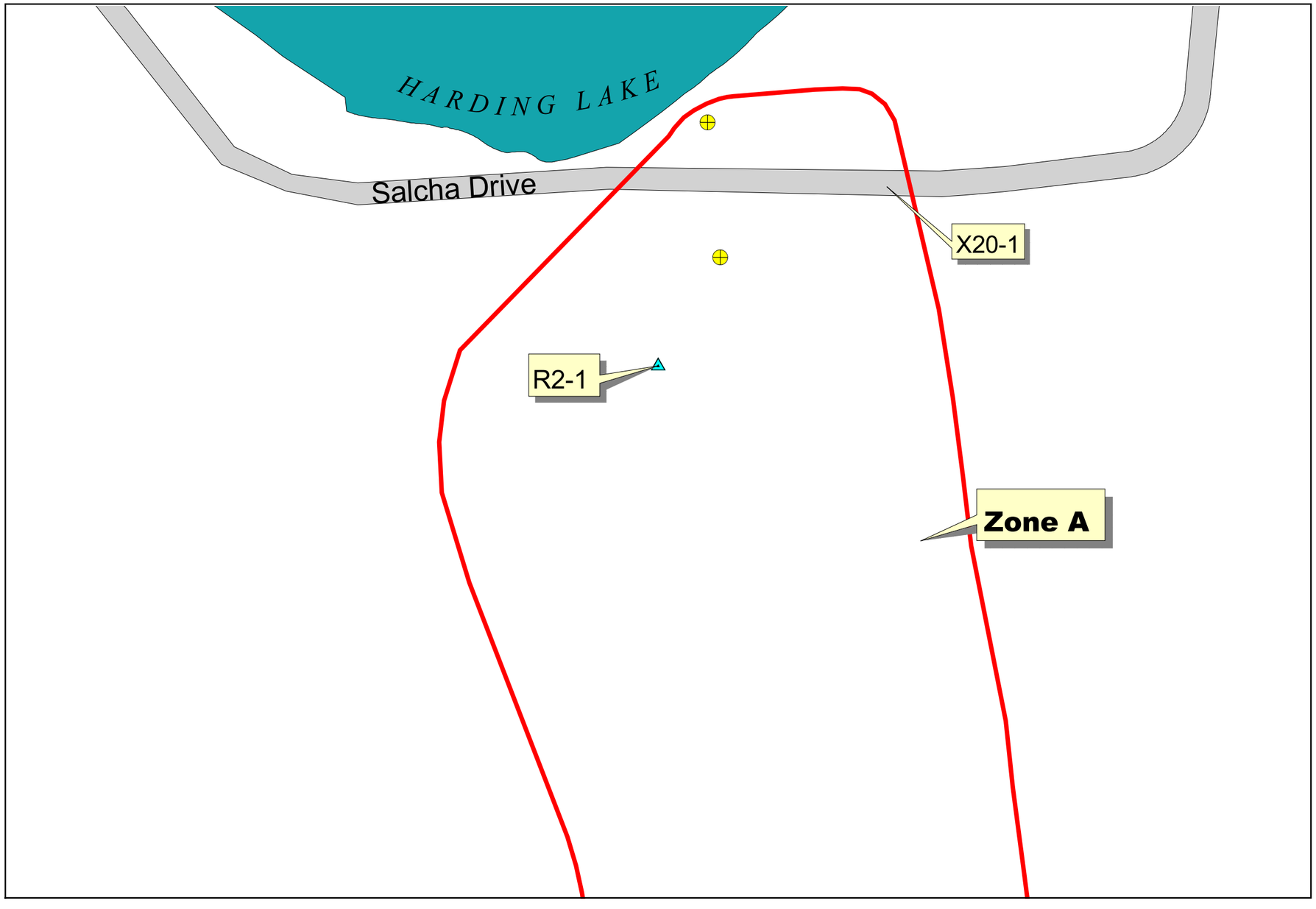
***PWSID 310099.001***

| ***Contaminant Source Type*** | ***Contaminant Source ID*** | ***CS ID tag*** | ***Zone*** | ***Risk Ranking for Analysis*** | ***Map Number*** | ***Comments*** |
|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R2-1 | A | Low | 2 | Bingle Memorial Camp |
| Highways and roads, paved (cement or asphalt) | X20 | X20-1 | A | Low | 2 | Salcha Drive |

# APPENDIX C

## Bingle Memorial Camp
## Drinking Water Protection Area
## and Potential and Existing Contaminant Sources
## (Map 2)

# Drinking Water Protection Area for Bingle Memorial Camp and Potential and Existing Sources of Contamination




Bingle Memorial Camp Wells
Septic-R2
Roads-X20
Zone A (Few Months Travel Time)

N
W
E
S

0 0.25 0.5 Miles

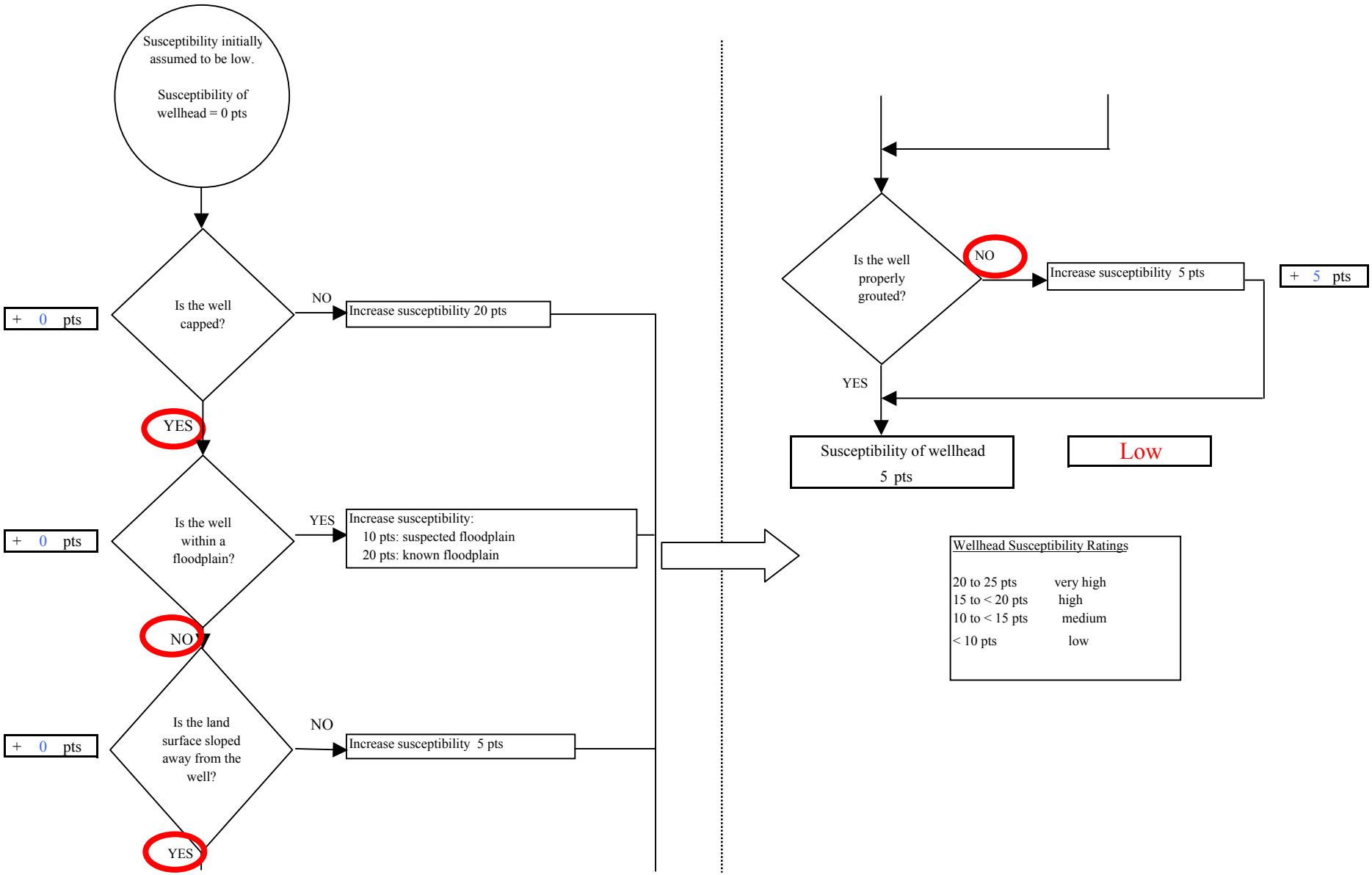
**PWSID 310099.001, .002**

***Map 2***

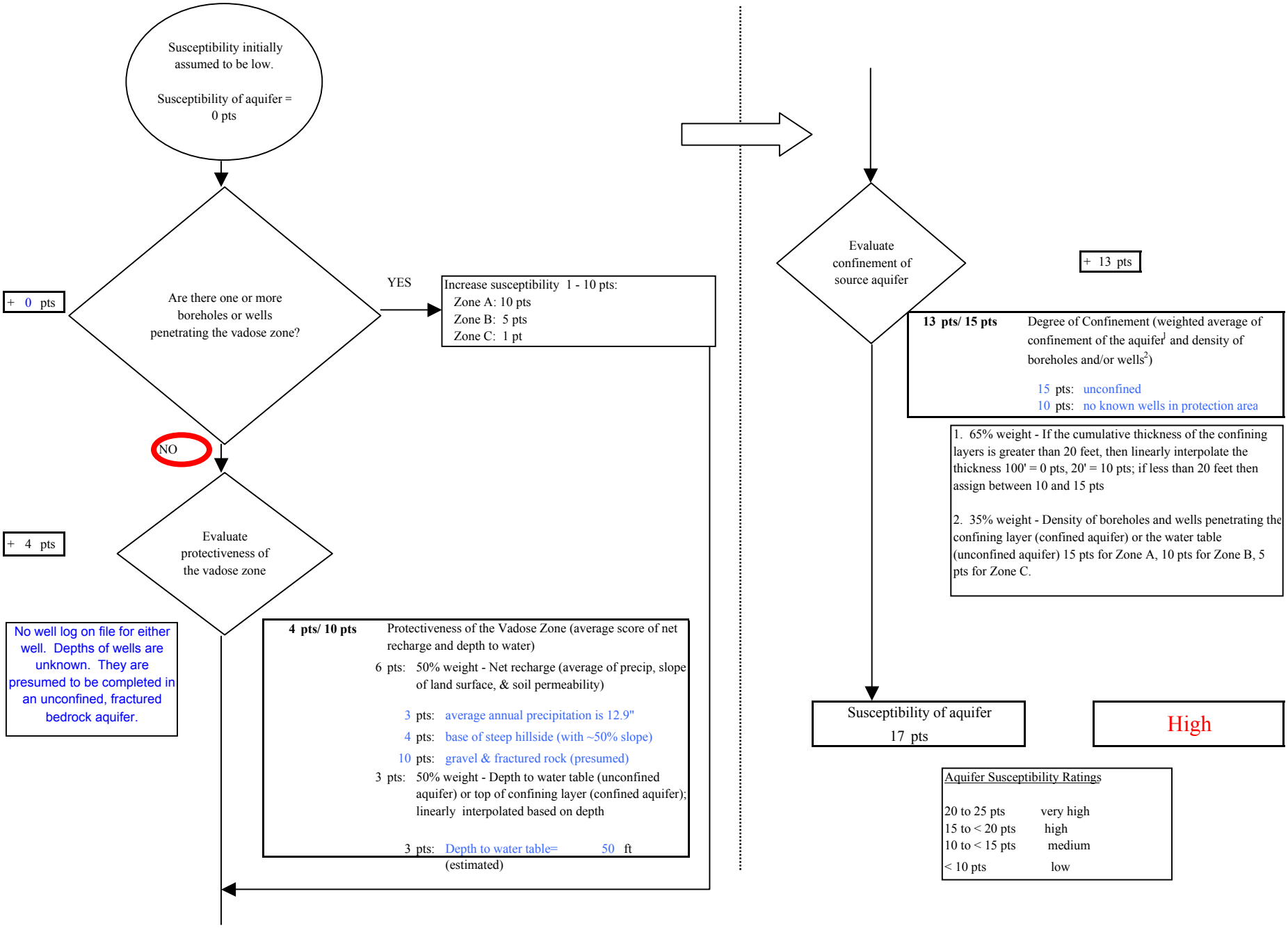
# APPENDIX D

# Vulnerability Analysis for Bingle Memorial Camp Public Drinking Water Source (Charts 1-8)

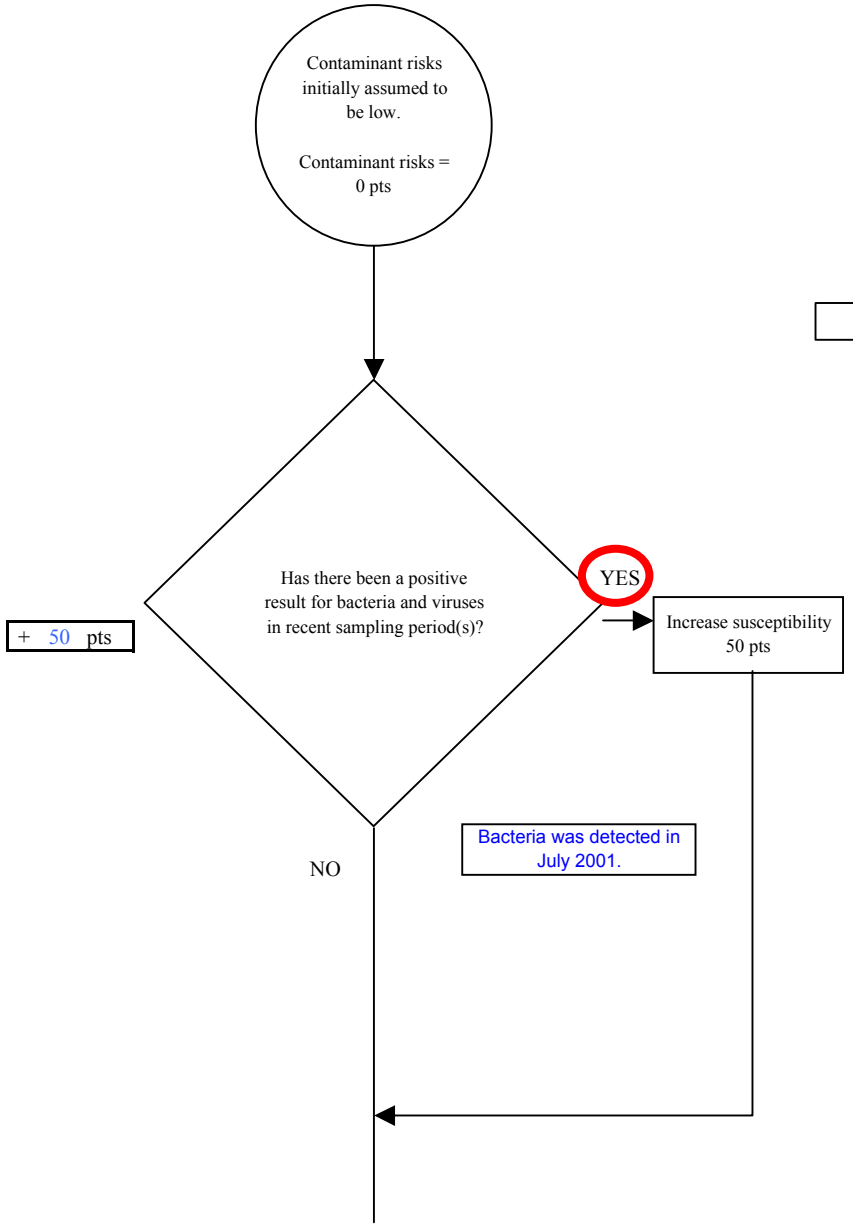
## *Chart 1. Susceptibility of the wellhead - Bingle Memorial Camp*

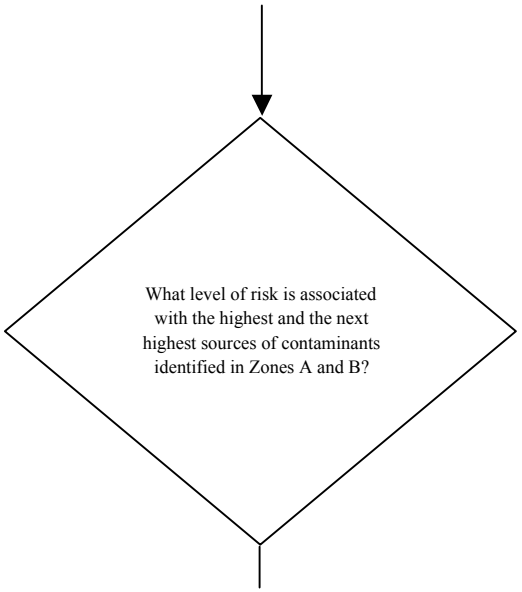


## *Chart 2. Susceptibility of the aquifer - Bingle Memorial Camp*



## *Chart 3. Contaminant risks for Bingle Memorial Camp - Bacteria & Viruses*




+ 10 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

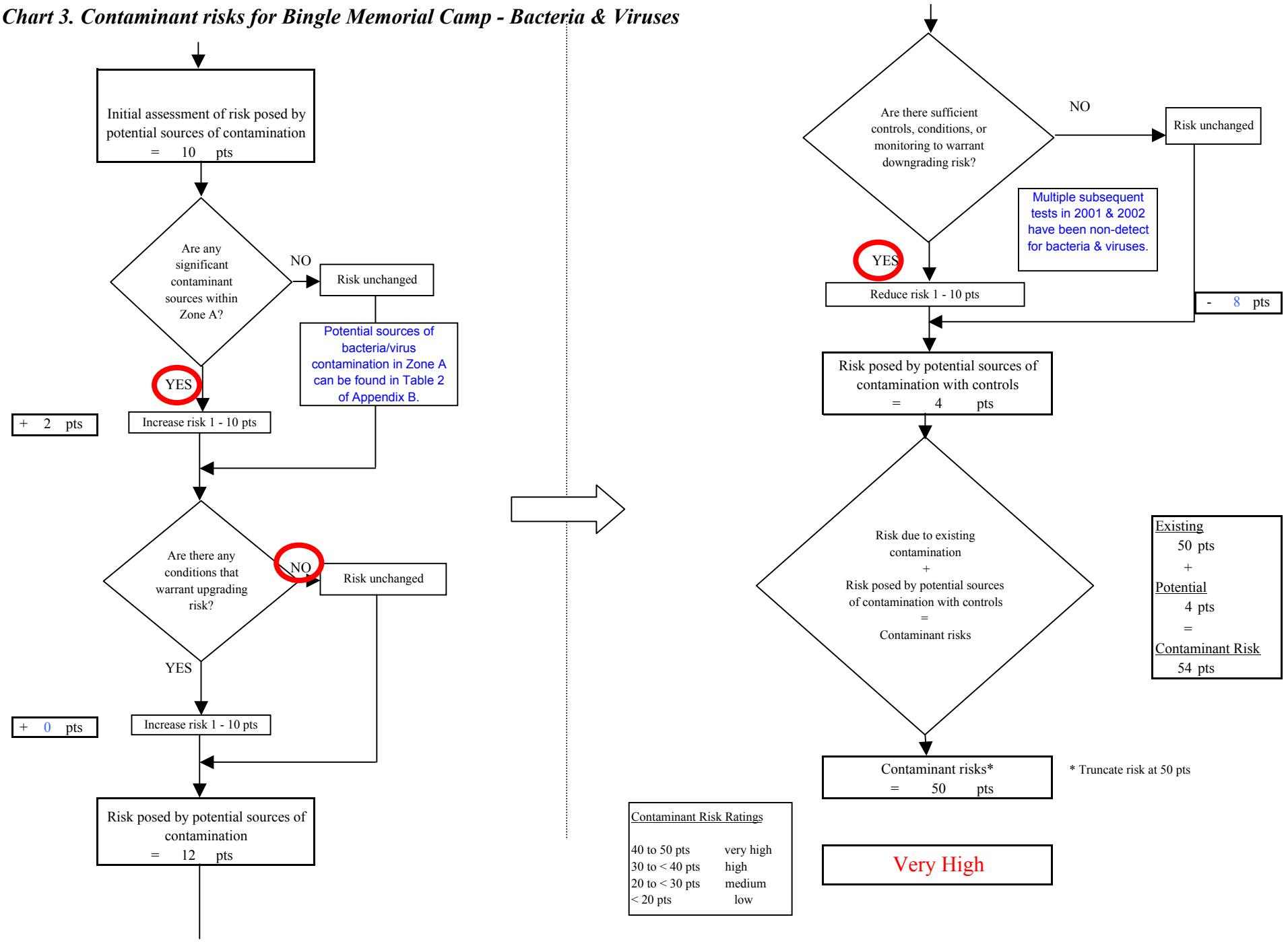
| | Zone A | Zone B | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 2 | 0 | 2 |

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

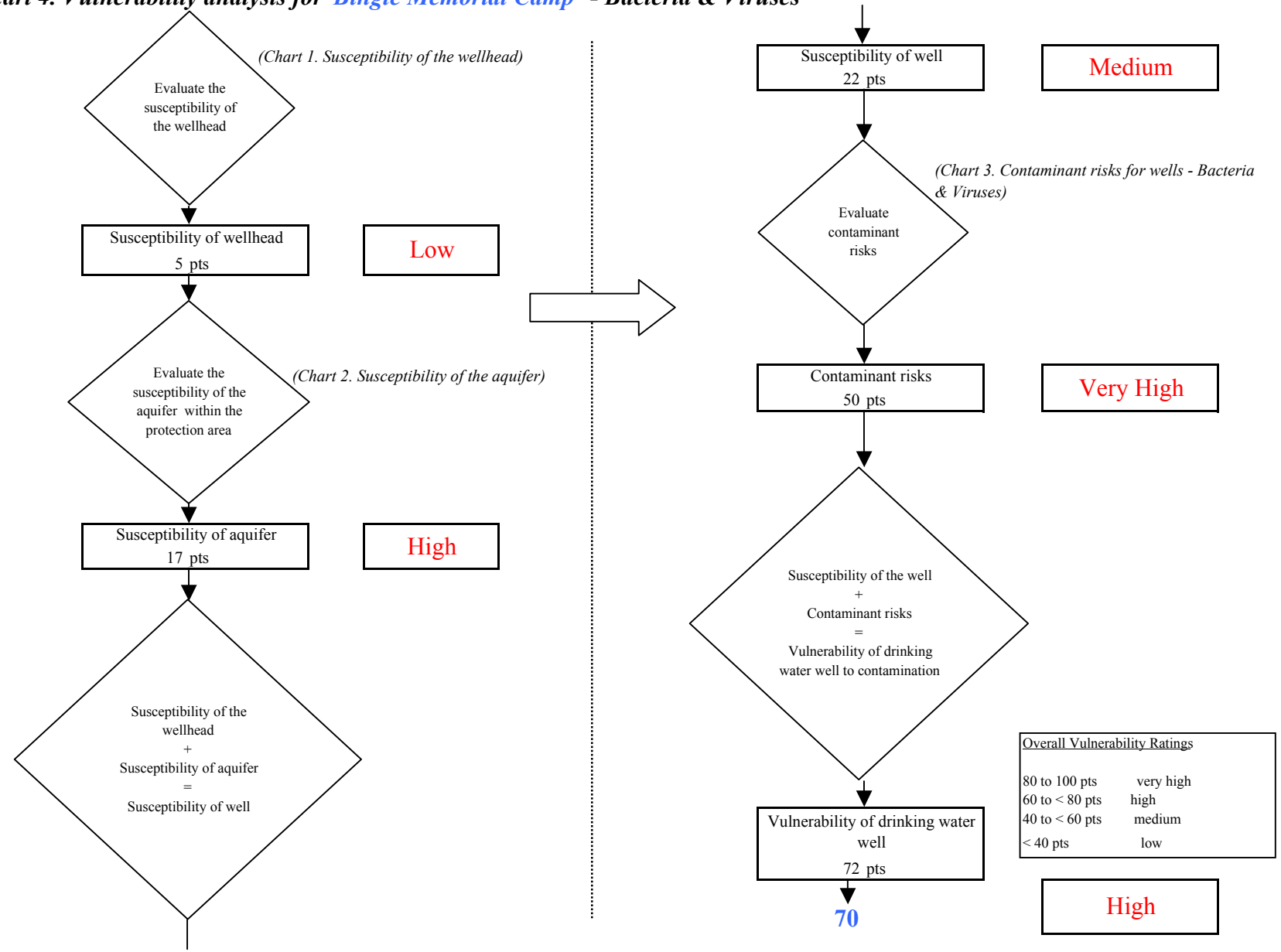
Matrix Score 10

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

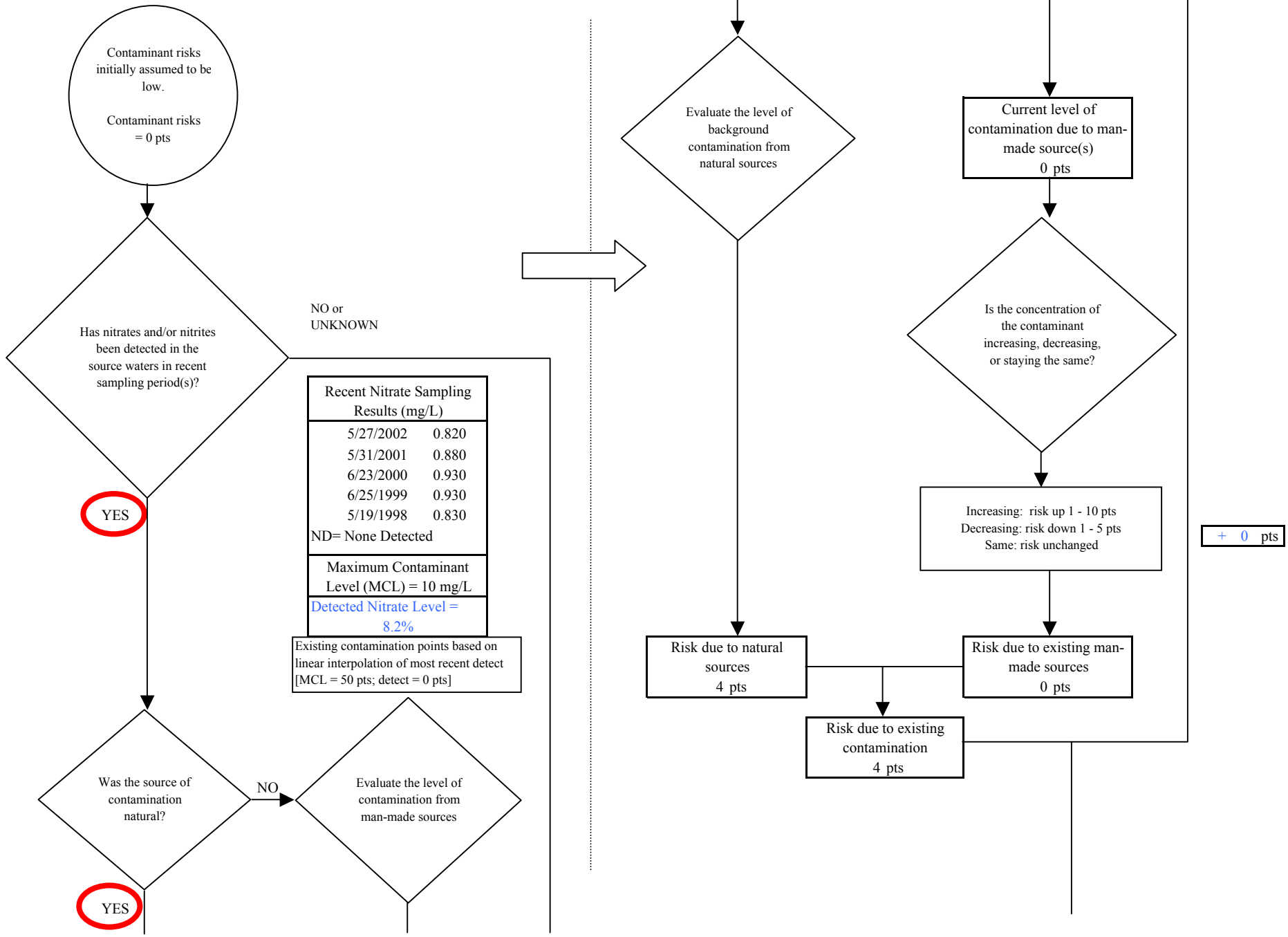
## *Chart 3. Contaminant risks for Bingle Memorial Camp - Bacteria & Viruses*



## *Chart 4. Vulnerability analysis for Bingle Memorial Camp - Bacteria & Viruses*



## *Chart 5. Contaminant risks for Bingle Memorial Camp - Nitrates and Nitrites*



## *Chart 5. Contaminant risks for Bingle Memorial Camp - 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) | 2 | 0 | 2 |

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

Matrix Score 10

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

Initial assessment of risk posed by potential sources of contamination = 10 pts

YES

Is the source aquifer fractured rock or karst?

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

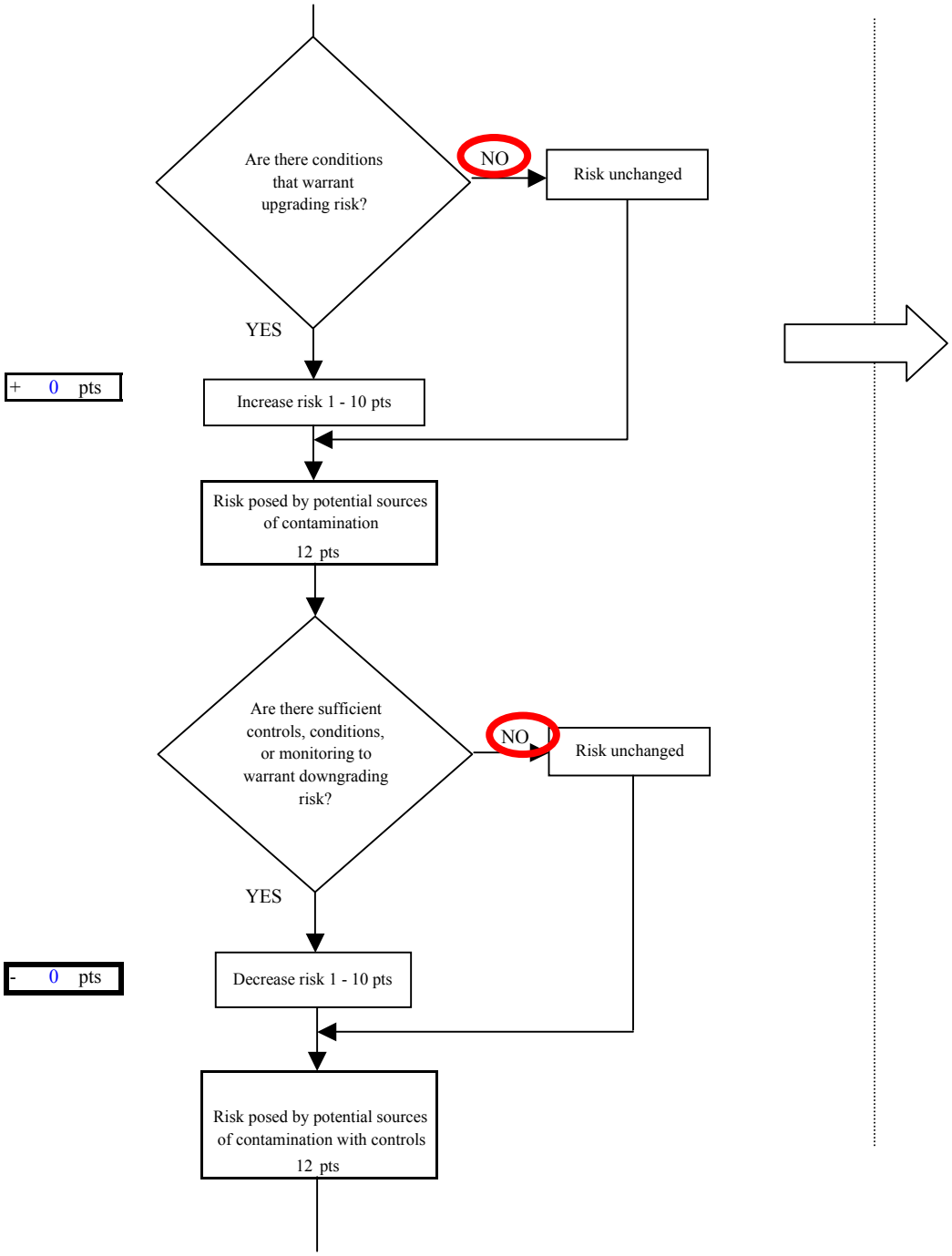
YES

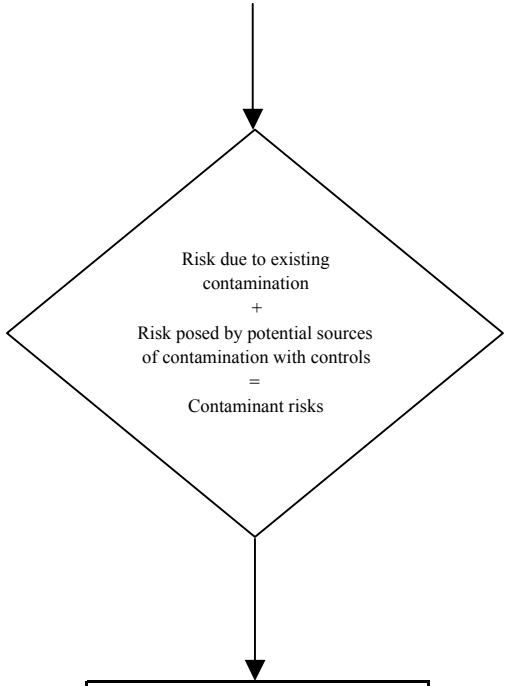
Increase risk 1 - 10 pts

+ 2 pts

Potential sources of nitrate/nitrite contamination in Zone A can be found in Table 3 of Appendix B.

## *Chart 5. Contaminant risks for Bingle Memorial Camp - Nitrates and Nitrites*




Existing
4 pts
+
Potential
12 pts
=
Contaminant Risk
16 pts

Contaminant risks*
= 16 pts

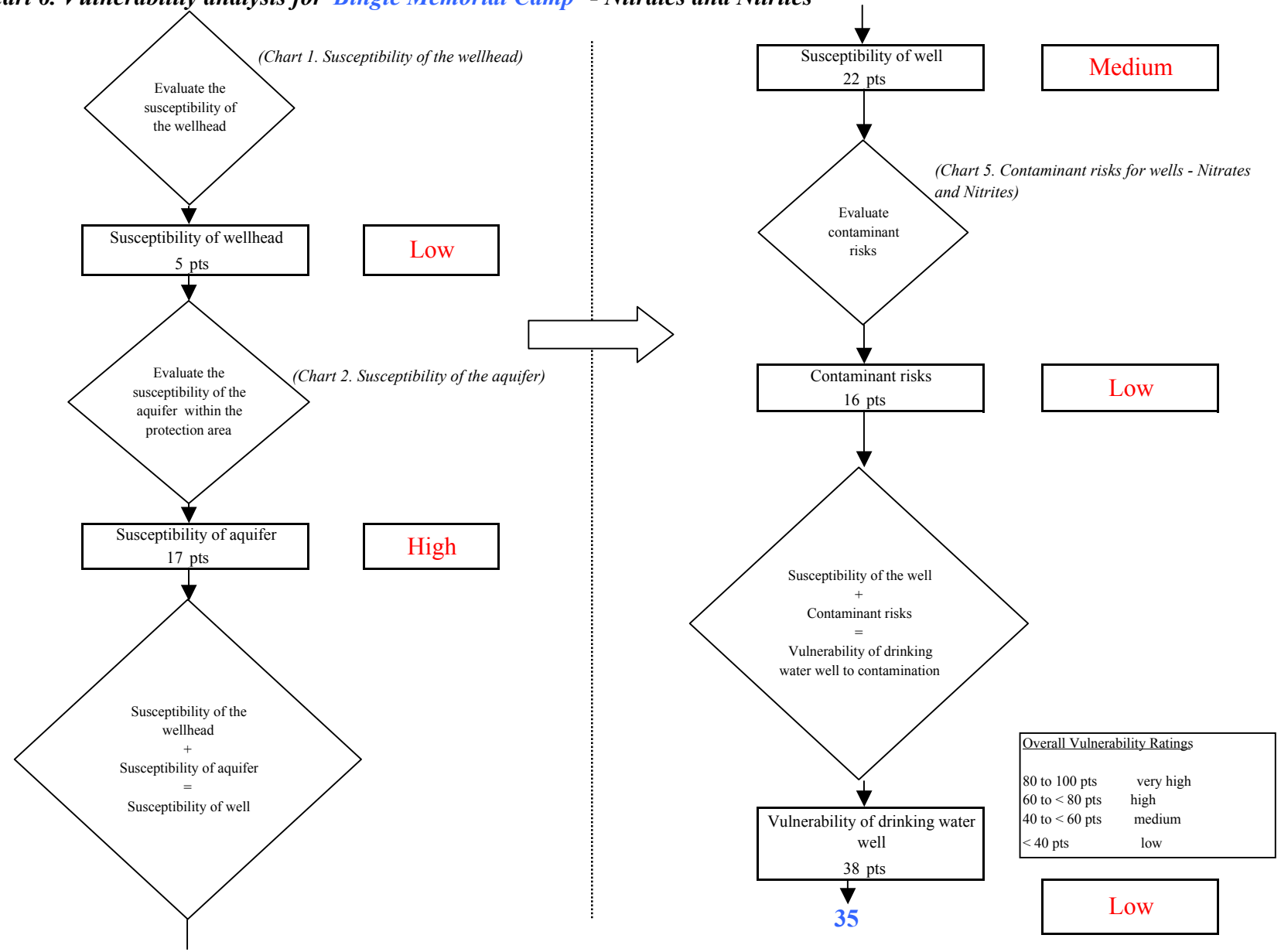
*Truncate risk at 50 pts

**Low**

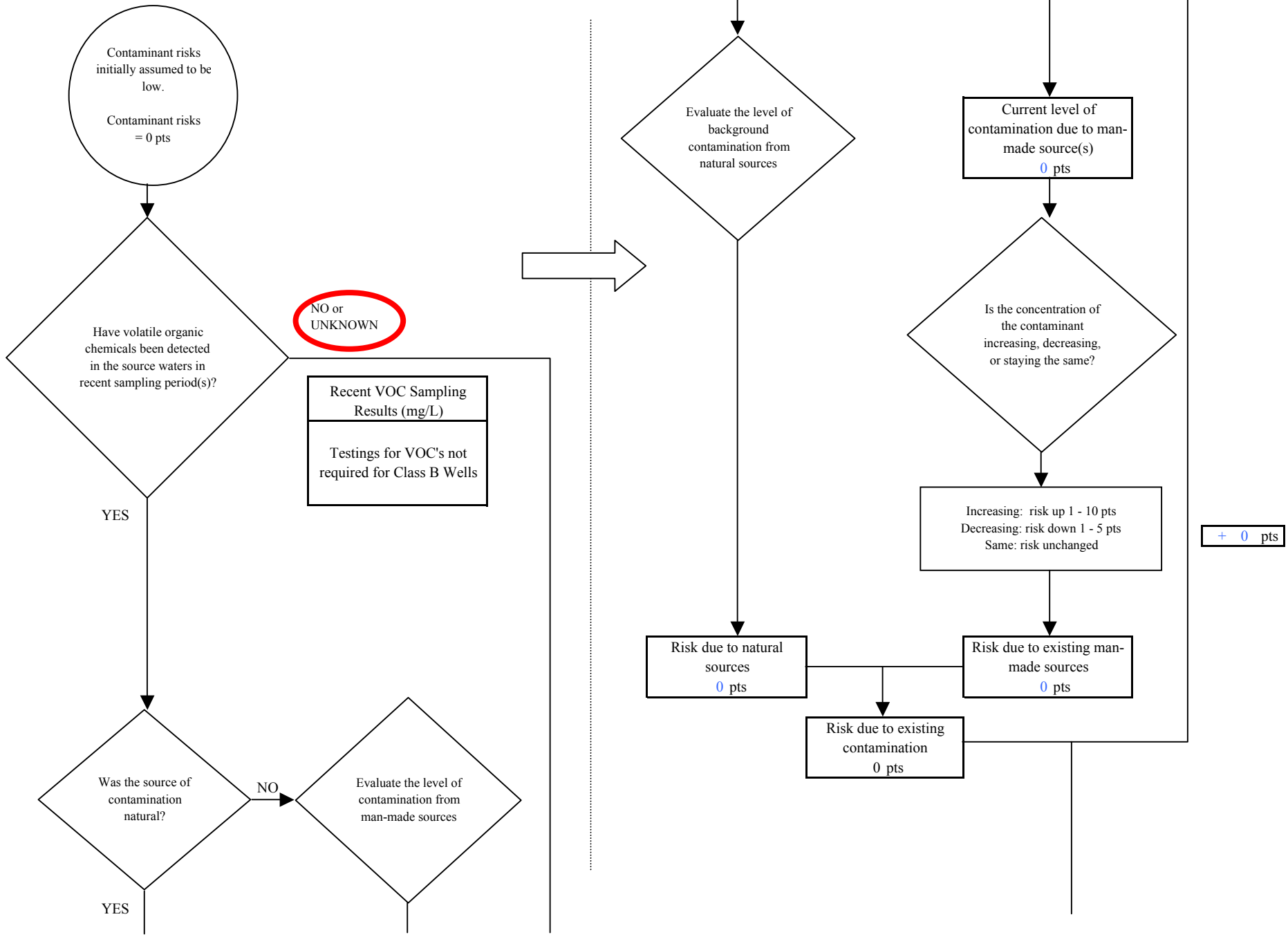
Contaminant Risk Ratings

| | |
|---|---|
| 40 to 50 pts | very high |
| 30 to < 40 pts | high |
| 20 to < 30 pts | medium |
| < 20 pts | low |

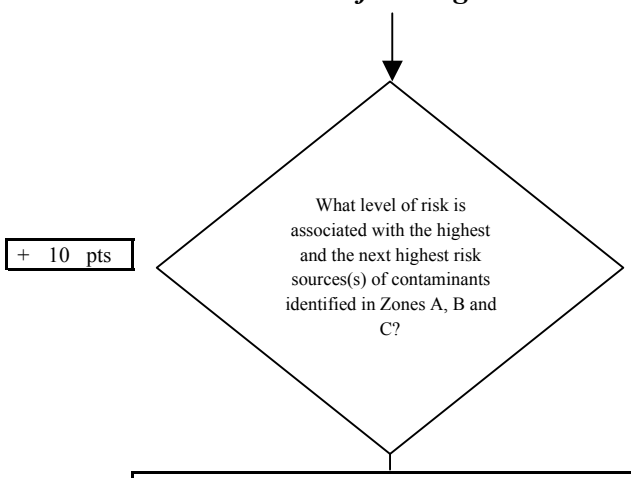
## *Chart 6. Vulnerability analysis for Bingle Memorial Camp - Nitrates and Nitrates*



## *Chart 7. Contaminant risks for Bingle Memorial Camp - Volatile Organic Chemicals*



## *Chart 7. Contaminant risks for Bingle Memorial Camp - Volatile Organic Chemicals*




+ 10 pts

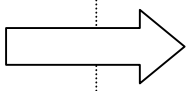
Risk Levels for Contaminant Sources identified in Zones A, B and C

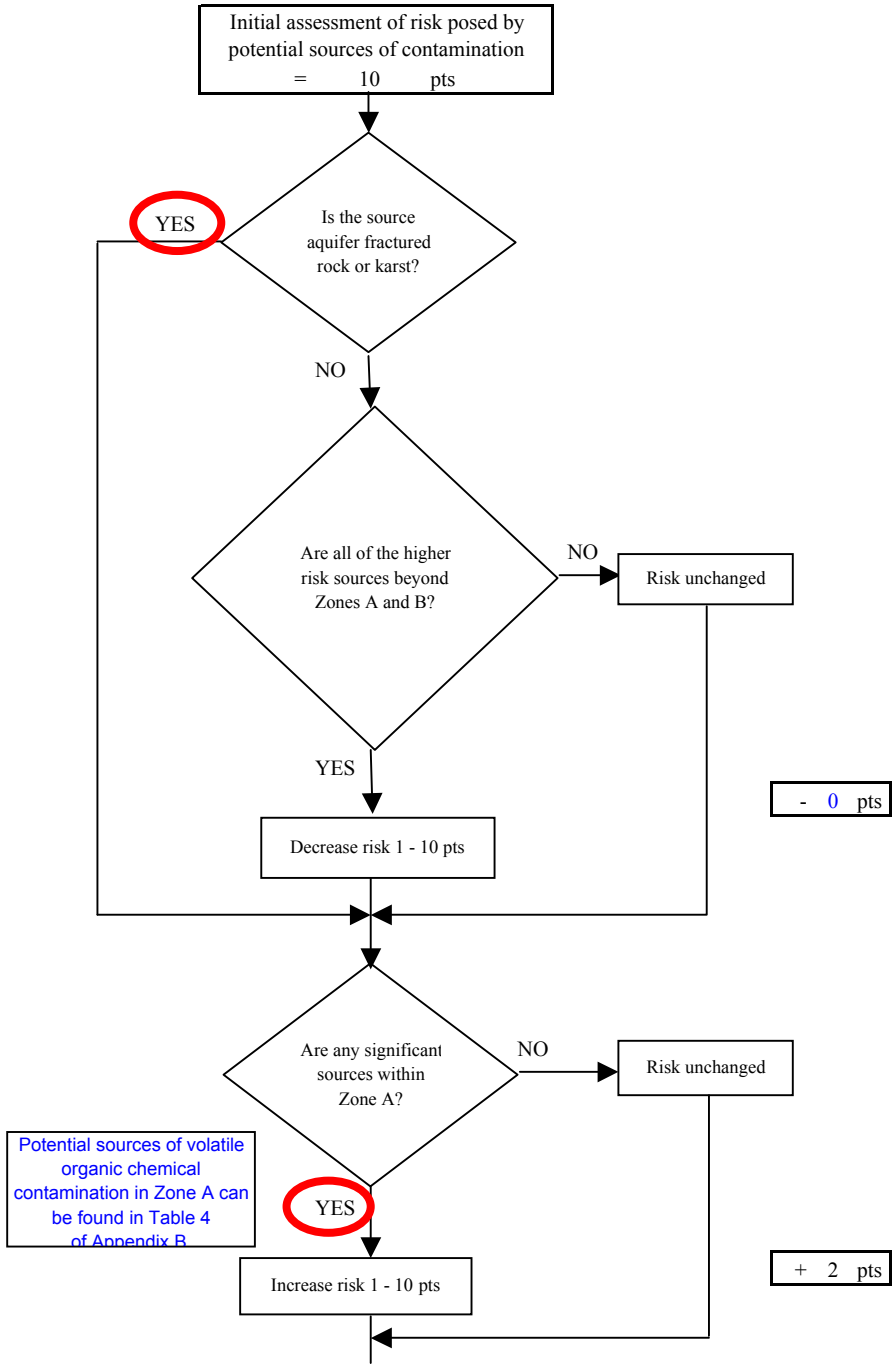
| | Zone A | Zones B&C | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 0 | 0 | 0 |
| Low(s) | 2 | 0 | 2 |

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

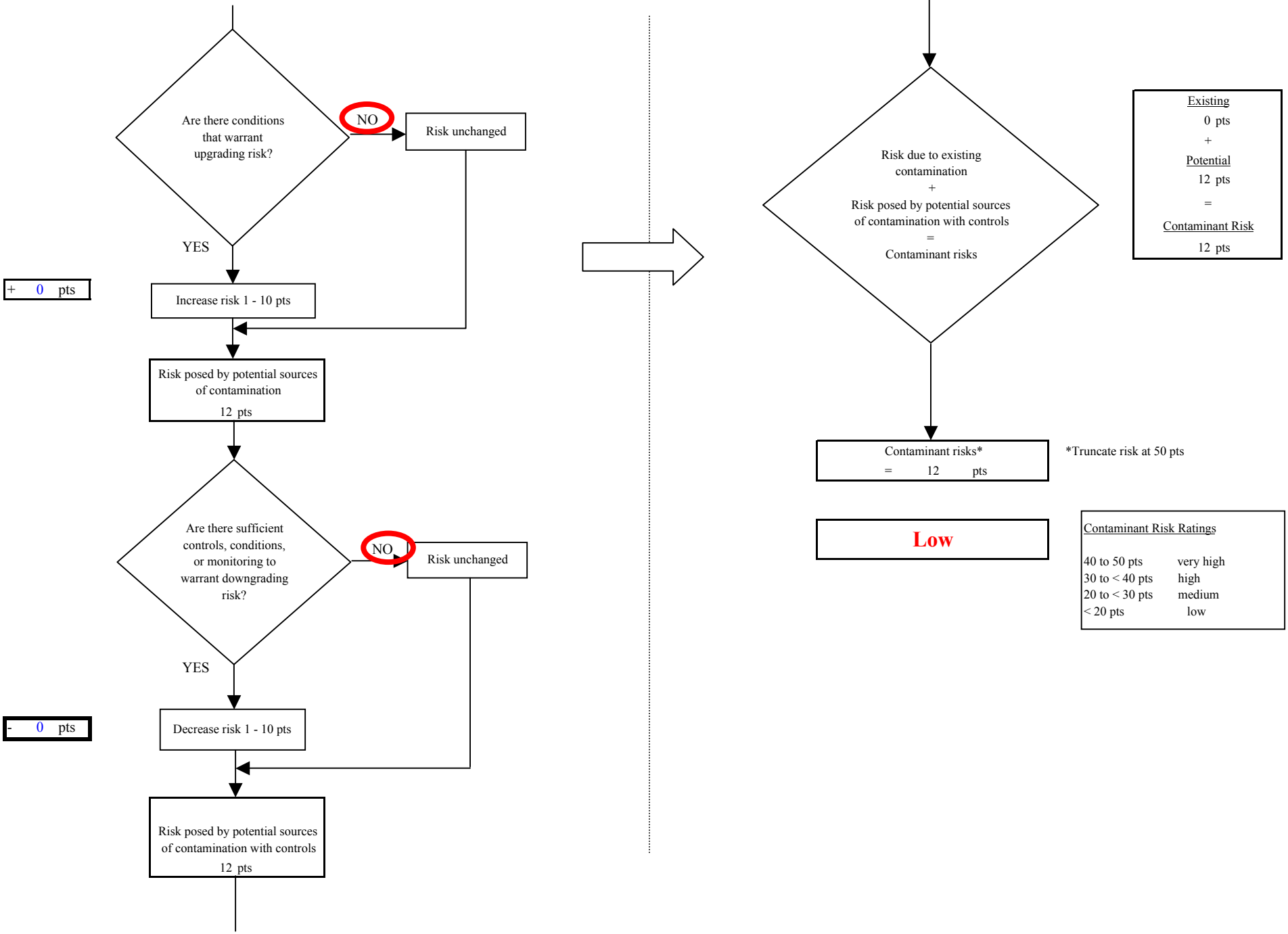
Matrix Score 10

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





## *Chart 7. Contaminant risks for Bingle Memorial Camp - Volatile Organic Chemicals*



## *Chart 8. Vulnerability analysis for Bingle Memorial Camp - Volatile Organic Chemicals*