



Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
The Point Lodge
Drinking Water System,
Lake Louise, Alaska
The Point Lodge # 227723

DRINKING WATER PROTECTION PROGRAM REPORT 266
Alaska Department of Environmental Conservation

AUGUST 2002

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By Shannon & Wilson, Inc.

DRINKING WATER PROTECTION PROGRAM REPORT 266

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 Point Lodge Source of Public Drinking Water, Lake Louise, Alaska

By Shannon & Wilson, Inc.

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Point Lodge is a Class B (transient/non-community) water system consisting of one well, on the southern shore of Lake Louise, Alaska. Identified potential and current sources of contaminants for The Point Lodge public drinking water source include: large-capacity septic system; aboveground heating oil tank; and 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 The Point Lodge received a vulnerability rating of **Low** for volatile organic chemicals, **Medium** for bacteria and viruses, and **Medium** for nitrates and nitrites.

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. Shannon & Wilson has been contracted to perform these assessments under the supervision of ADEC.

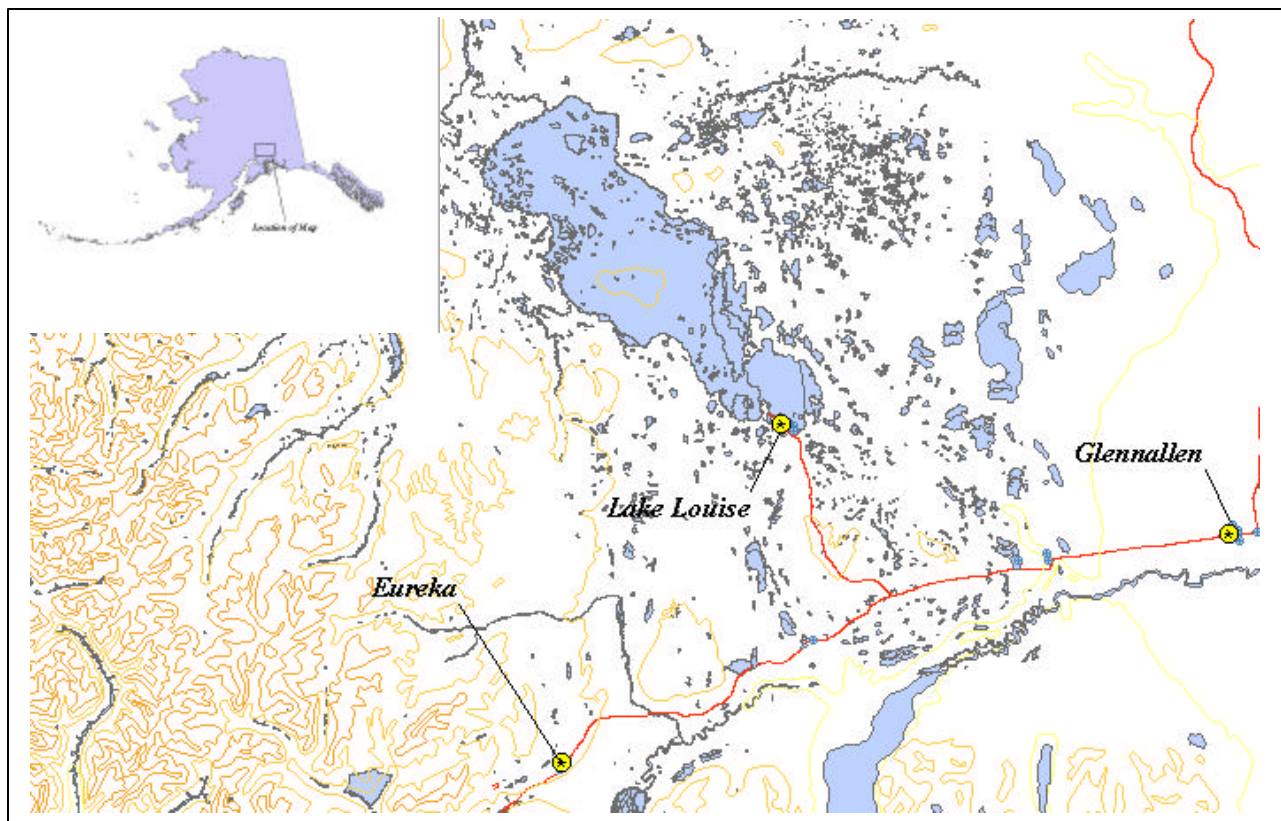


Figure 1. Index map showing the location of the Western Copper River Basin.

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 WESTERN COPPER RIVER BASIN

Location

The western portion of the Copper River Basin encompasses the headwaters of the Nelchina, Little Nelchina, Tazlina and Gulkana Rivers and generally includes Lake Louise. The area is located west of the community of Glennallen, as shown in Figure 1. While Lake Louise is located in the Matanuska-Susitna (Mat-Su) Borough, other portions of the Copper River Basin are not located within the Mat-Su Borough.

A large lake occupied the Copper River Basin before the Copper River cut an outlet through the Chugach Mountains and entered the Gulf of Alaska east of Cordova. The former lake and glaciers that reached the lake margins, coupled with recent alluvial forces, have shaped the landforms of the Copper River Basin. Landforms common in the western portion of the Copper River Basin include gentle undulating terrain and low ridges, terraces, and numerous lakes and streams.

Precipitation

Glennallen averages about 12 inches of precipitation per year.

Topography and Drainage

The area topography varies from about 3,000 feet at Tahnetta Pass (separating the Matanuska and Copper river drainage basins) to 2,000 feet at Tolsona Creek, due west of Glennallen. Drainages along the Glenn Highway in this area generally flow south into the Tazlina Lake or river and then on into the Copper River.

Groundwater

Although the quality can vary significantly in a short distance, groundwater supplies are generally abundant in the area. Many homes and businesses in the area rely on individual wells for their water supply. Most of these wells are shallow with depths of less than 100 feet to 200 feet. Static water levels in many of these wells are less than 15 feet below the surface. The coarse, alluvial, sandy gravel in the floodplains of the areas streams and rivers provides a large aquifer even in the winter when infiltration is low.

Geology and Soils

The unconsolidated soils in the western Copper River Basin include fine-grained lacustrine deposits (silts and clays deposited in a lake depositional environment), fine to coarse-grained soils deposited at the margins of the glaciers, and reworked sands and gravels along the streams and rivers. Much of the soils in the area provide good sources of sand, gravel.

THE POINT LODGE PUBLIC DRINKING WATER SYSTEM

The Point Lodge is a Class B (transient/non-community) water system. The system consists of one well near Mile 17.2 Lake Louise Road.

According to the well log completed for the water system, installation of the well occurred on July 15, 1999, to a total depth of approximately 112 feet below ground surface and was completed with 6-inch well casing. The most recent ADEC correspondence (8/26/99) indicates the well was installed with a cap providing 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. A concrete pad was installed around the well in lieu of 10 feet of continuous grout. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year-round and serves 2 residents and more than 48 non-residents through one service connection.

THE POINT LODGE 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, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources. 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 Public Water Systems for additional information).

The DWPA's 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 TOT for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for 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 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 Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the The Point Lodge 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; 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.

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 THE POINT LODGE 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:

$$\begin{aligned}
 &\text{Natural Susceptibility (0 – 50 points)} \\
 &+ \\
 &\text{Contaminant Risks (0 – 50 points)} \\
 &= \\
 &\text{Vulnerability of the} \\
 &\text{Drinking Water Source to Contamination (0 – 100).}
 \end{aligned}$$

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

$$\begin{aligned}
 &\text{Susceptibility of the Wellhead (0 – 25 Points)} \\
 &+ \\
 &\text{Susceptibility of the Aquifer (0 – 25 Points)} \\
 &= \\
 &\text{Natural Susceptibility (Susceptibility of the Well)} \\
 &\text{(0 – 50 Points)}
 \end{aligned}$$

The well for The Point Lodge is completed in a confined aquifer setting. The soil stratum encountered within this well consists of clay, blue clay, sand and gravel. The sequences of clay are inferred to indicate aquicludes or aquitards (impermeable or semi-

impermeable layers) which suggest that the underlying sand and gravel is a confined aquifer. Table 2 shows the Overall Susceptibility score and rating for The Point Lodge.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	7	Low
Natural Susceptibility	12	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.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	40	Very High
Nitrates and/or Nitrites	40	Very High
Volatile Organic Chemicals	12	Low

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 of The Point Lodge to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	25	Low

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.

The large-capacity septic system; aboveground heating oil tank; and roads create a risk increase for the bacteria and viruses, nitrates and nitrites, and volatile organic compounds.

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 Point Lodge.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. 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, adopted from the U.S. Geological Survey (Wang, et al., 2000).

Sampling history for The Point Lodge well indicates that nitrate samples were not detected during recent sample events (see Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). The Maximum Contaminant Level (MCL) for nitrates/nitrites is 10 mg/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.

The large-capacity septic system; aboveground heating oil tank; and roads located in Zones A, B, and C, form the greatest risk for volatile organic chemicals.

SUMMARY

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

REFERENCES CITED

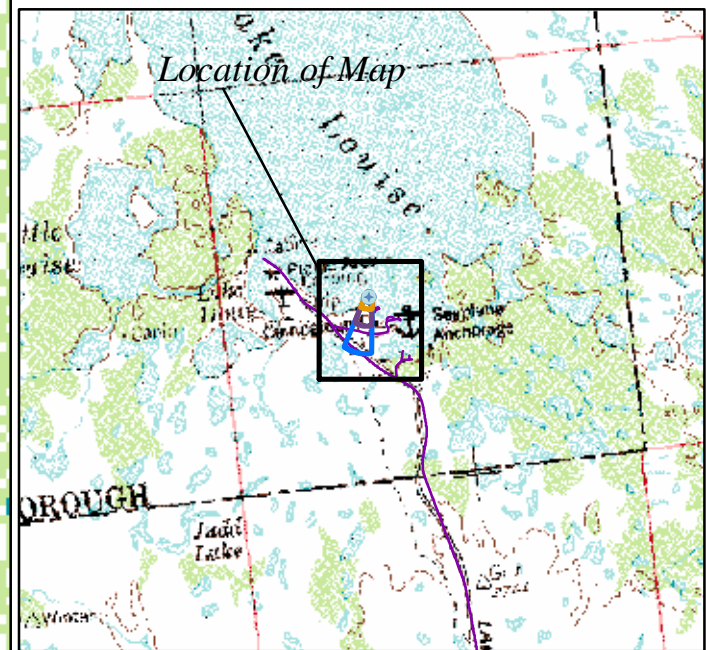
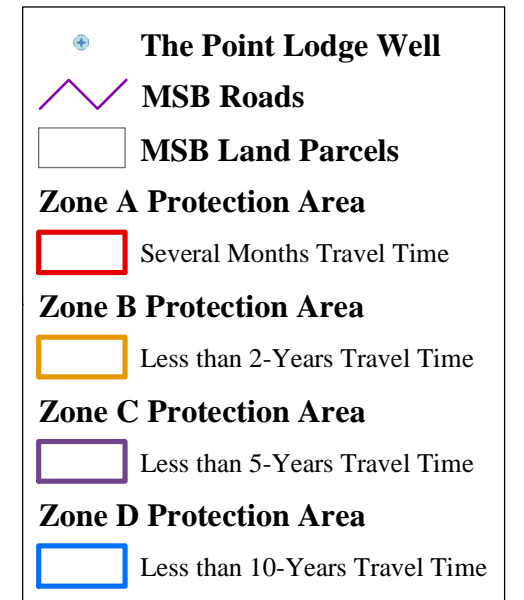
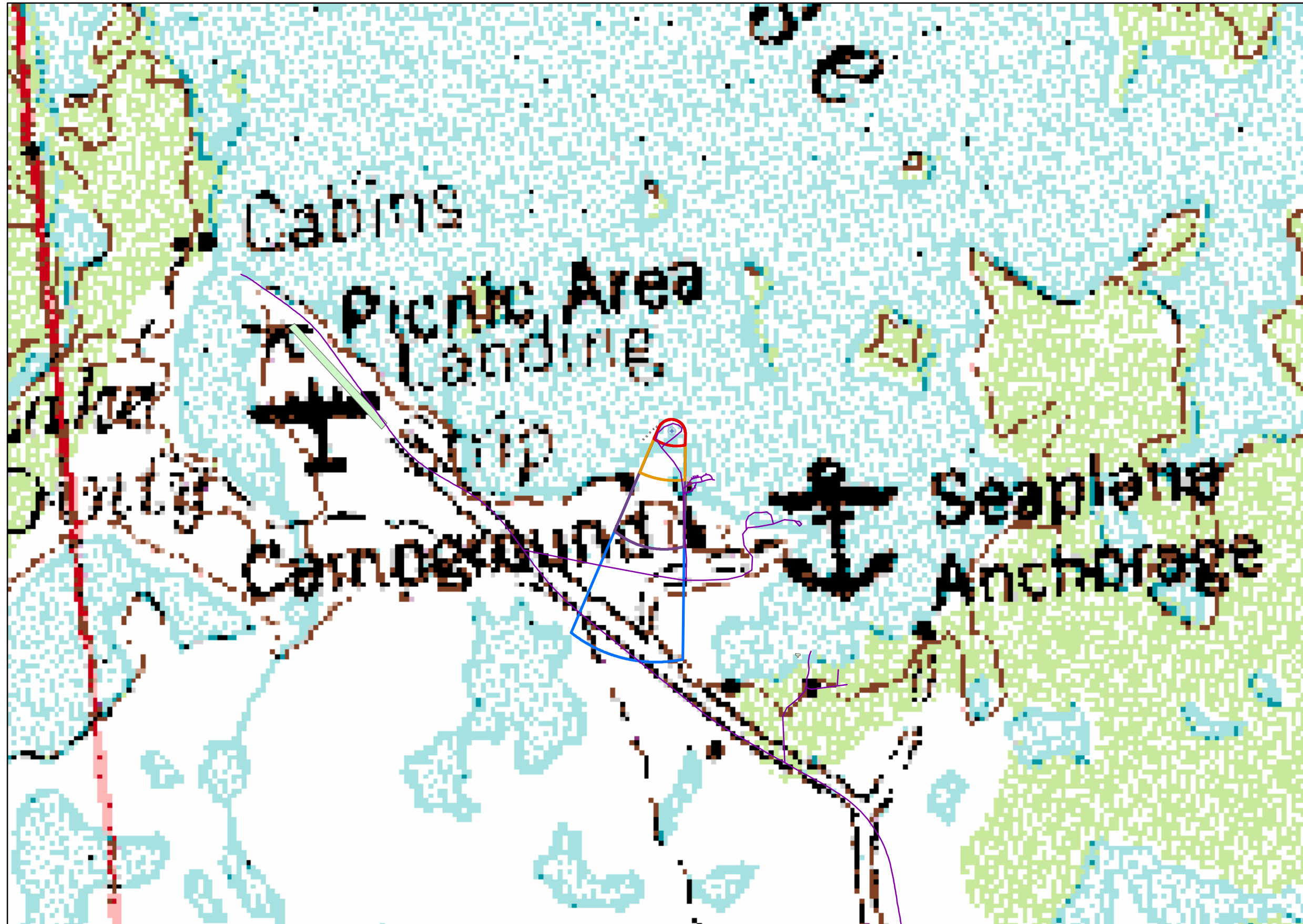
Wang, B., Strelakos, P.M., and Jokela, J.B., 2000, Nitrate source indicators in ground water of the scimitar subdivision, Peters Creek Area, Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 00-4137.

Weather Underground, June 18, 2002, Web extension to the *Western Regional Climate Center* [WWW document]. URL <http://www.wunderground.com>

APPENDIX A

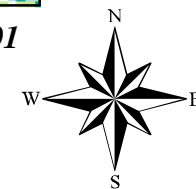
The Point Lodge Drinking Water Protection Area (Map 1)

Drinking Water Protection Areas for The Point Lodge



3,600 1,800 0 3,600 Feet

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Map 1

APPENDIX B

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

Table 1

**Contaminant Source Inventory for
The Point Lodge**

PWSID 227723.001

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	North of The Point Lodge	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	South of The Point Lodge	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	South of The Point Lodge	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	B	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	C	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	C	Access Road 4	2	

Contaminant Source Inventory and Risk Ranking for

PWSID 227723.001

The Point Lodge

Sources of Bacteria and Viruses

Table 2

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Overall Rank after Analysis</i>	<i>Location</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	North of The Point	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	B	Low	3	Access Road 2	2	

Contaminant Source Inventory and Risk Ranking for

PWSID 227723.001

The Point Lodge

Sources of Nitrates/Nitrites

Table 3

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Overall Rank after Analysis</i>	<i>Location</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	North of The Point	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	B	Low	3	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	C	Low	4	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	C	Low	5	Access Road 4	2	

Contaminant Source Inventory and Risk Ranking for

PWSID 227723.001

Table 4

The Point Lodge

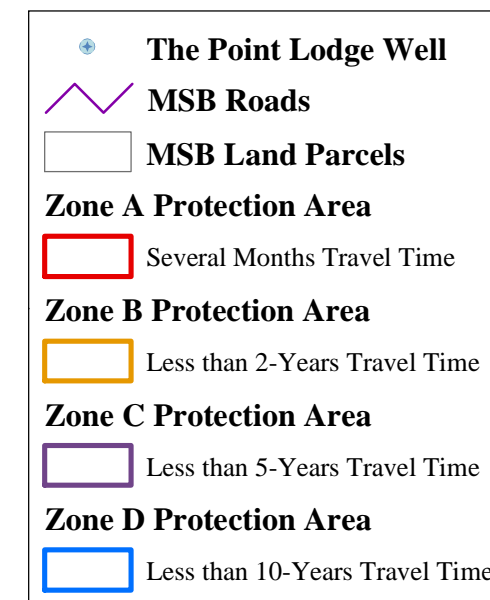
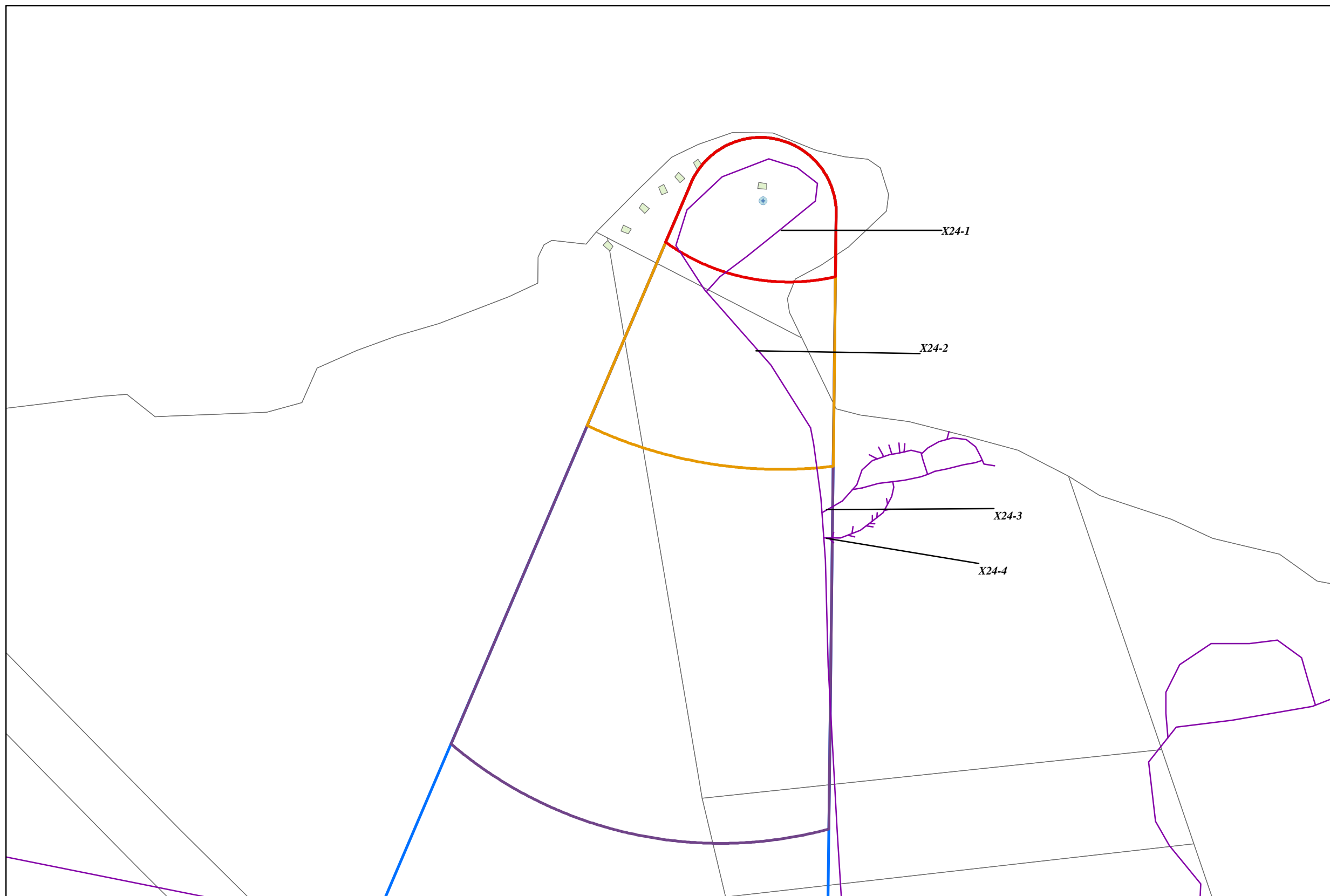
Sources of Volatile Organic Chemicals

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Risk Ranking for Analysis</i>	<i>Overall Rank after Analysis</i>	<i>Location</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	1	North of The Point	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	2	Access Road 1	2	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	3	South of The Point	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	Low	4	South of The Point	3	
Highways and roads, dirt/gravel	X24	X24-2	B	Low	5	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	C	Low	6	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	C	Low	7	Access Road 4	2	

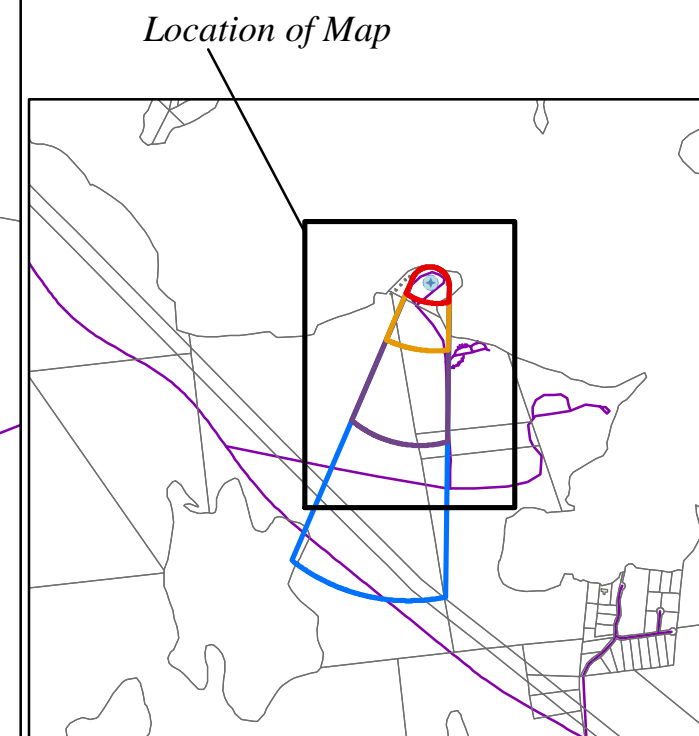
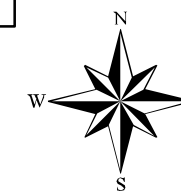
APPENDIX C

The Point Lodge Drinking Water Protection Area and Potential and Existing Contaminant Sources (Maps 2-3)

Drinking Water Protection Areas for The Point Lodge and Potential and Existing Sources of Contamination

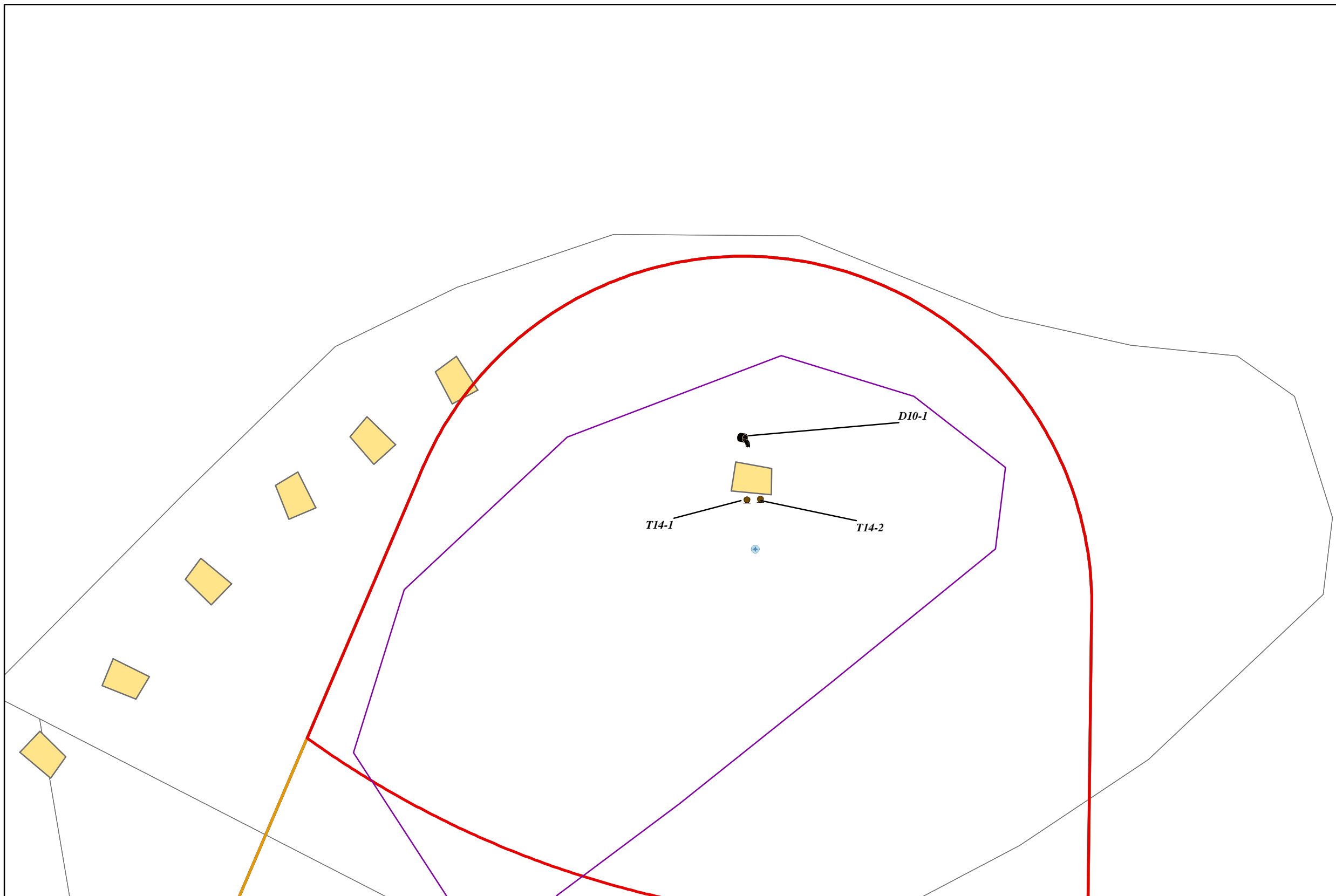


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Map 2

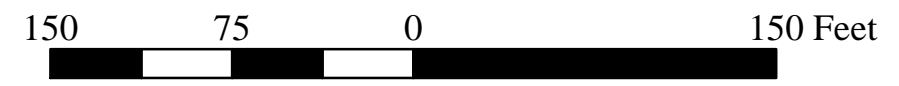
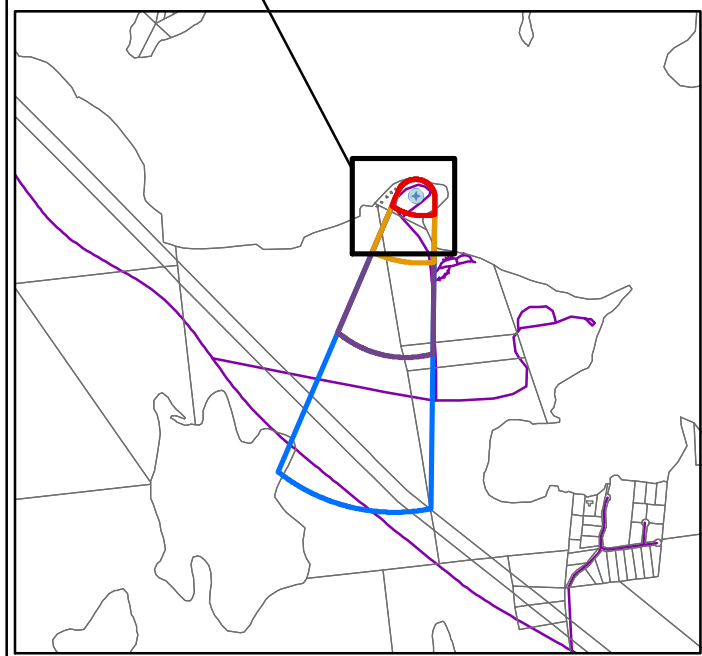
Drinking Water Protection Areas for The Point Lodge and Potential and Existing Sources of Contamination



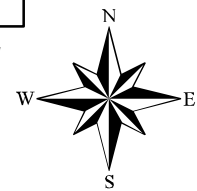
	The Point Lodge Well
	Large Capacity Septic System (D10)
	Tanks, heating oil, nonresidential (aboveground) (T14)
	MSB Roads
	MSB Land Parcels
Zone A Protection Area	
	Several Months Travel Time
Zone B Protection Area	
	Less than 2-Years Travel Time
Zone C Protection Area	
	Less than 5-Years Travel Time
Zone D Protection Area	
	Less than 10-Years Travel Time

D10-1
T14-1
T14-2

Location of Map



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Map 3

APPENDIX D

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

Chart 1. Susceptibility of the Wellhead - The Point Lodge

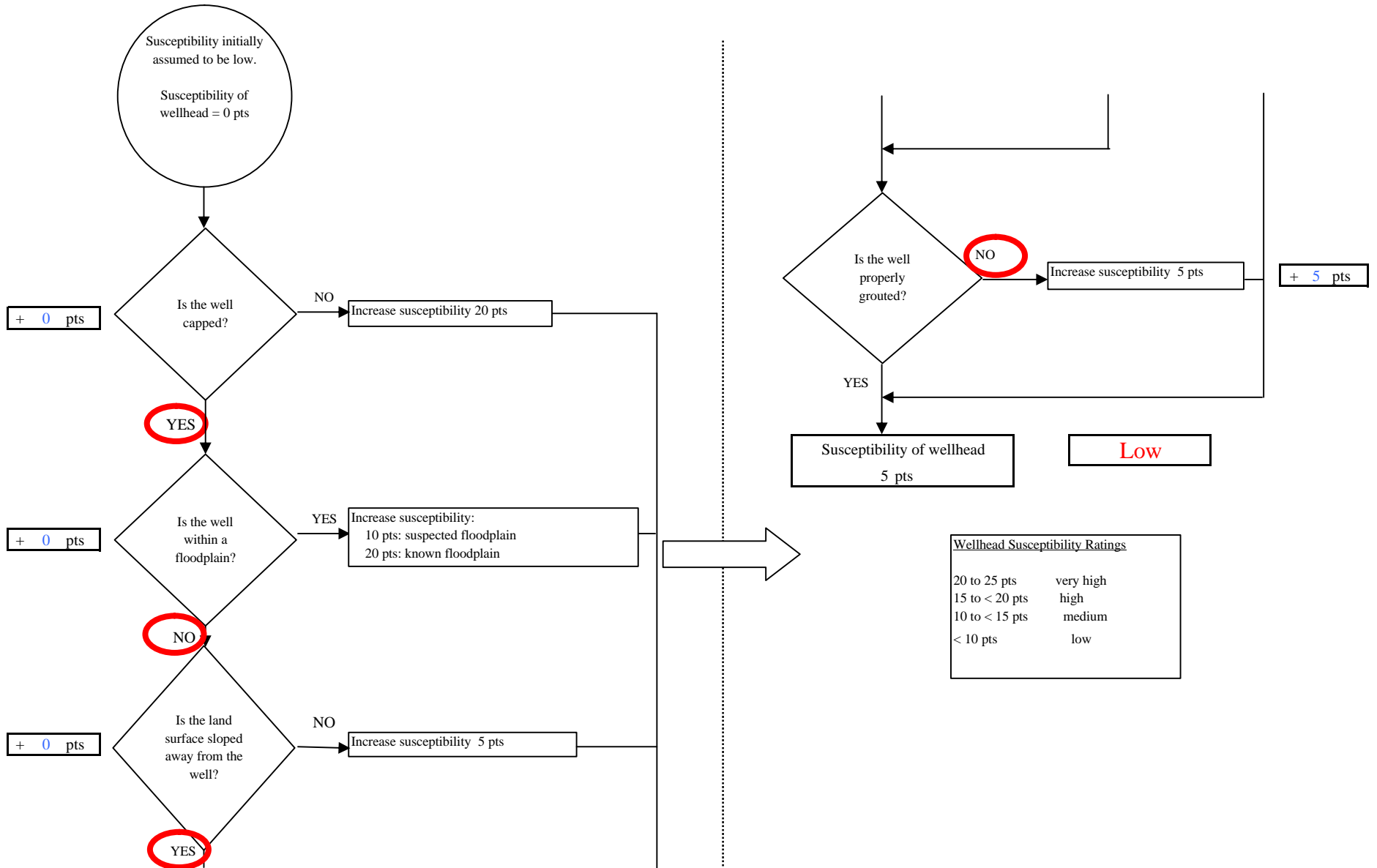


Chart 2. Susceptibility of the Aquifer - The Point Lodge

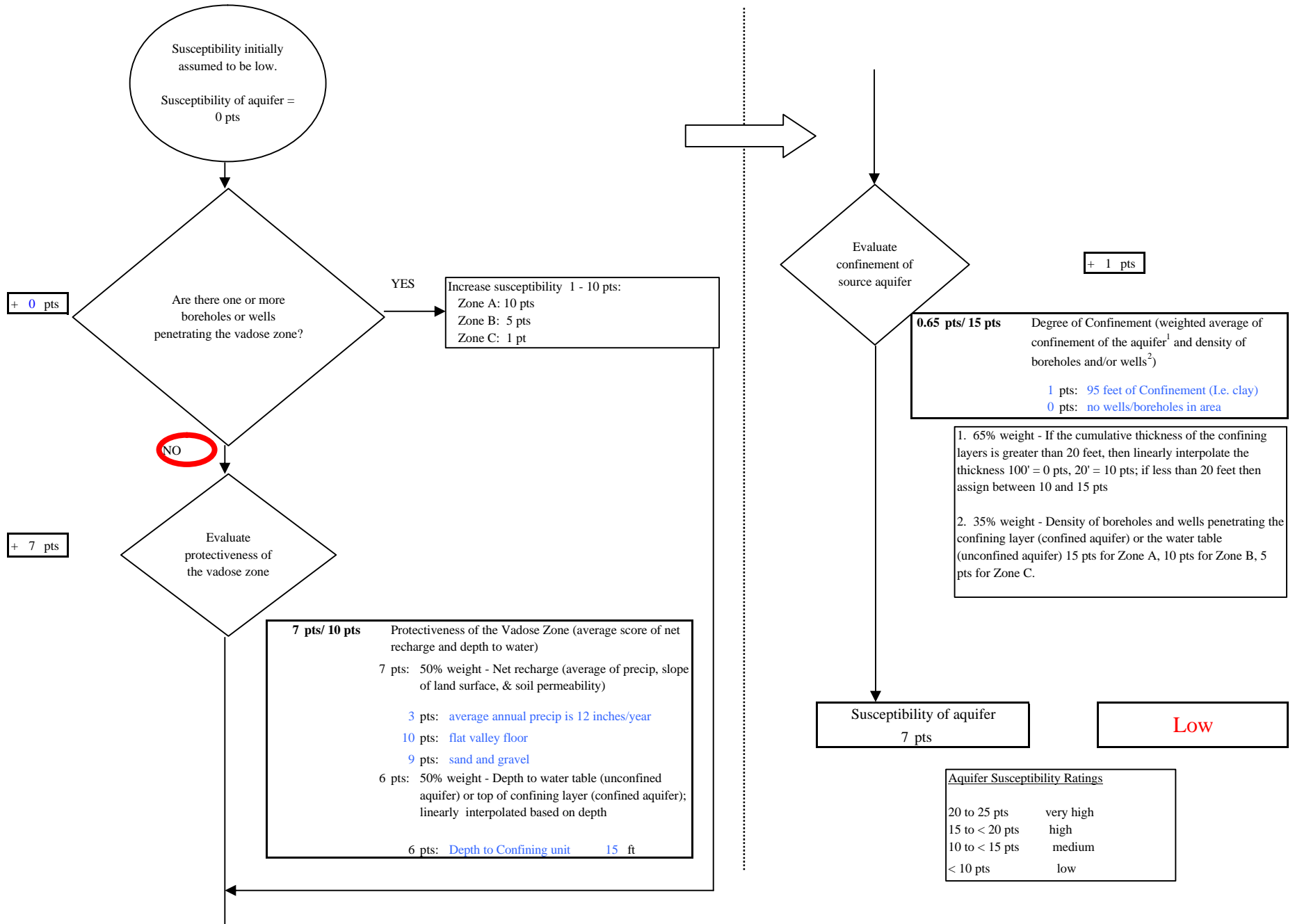
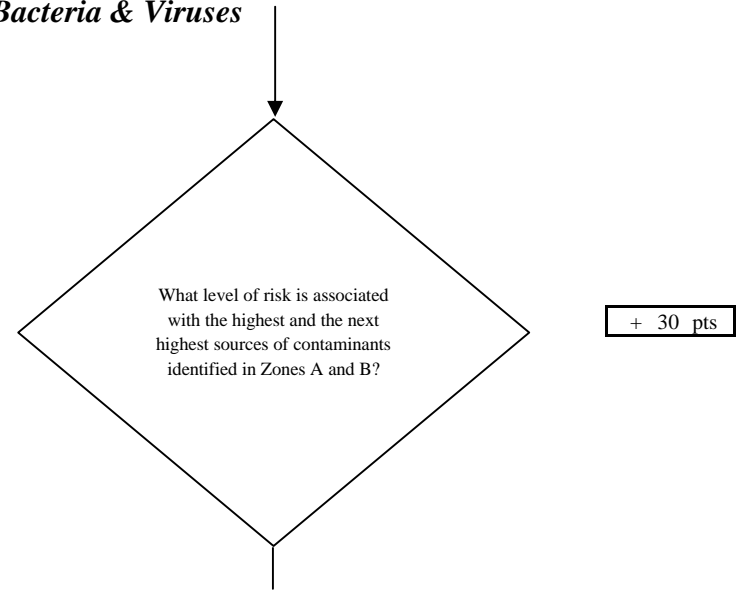
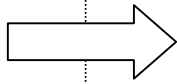
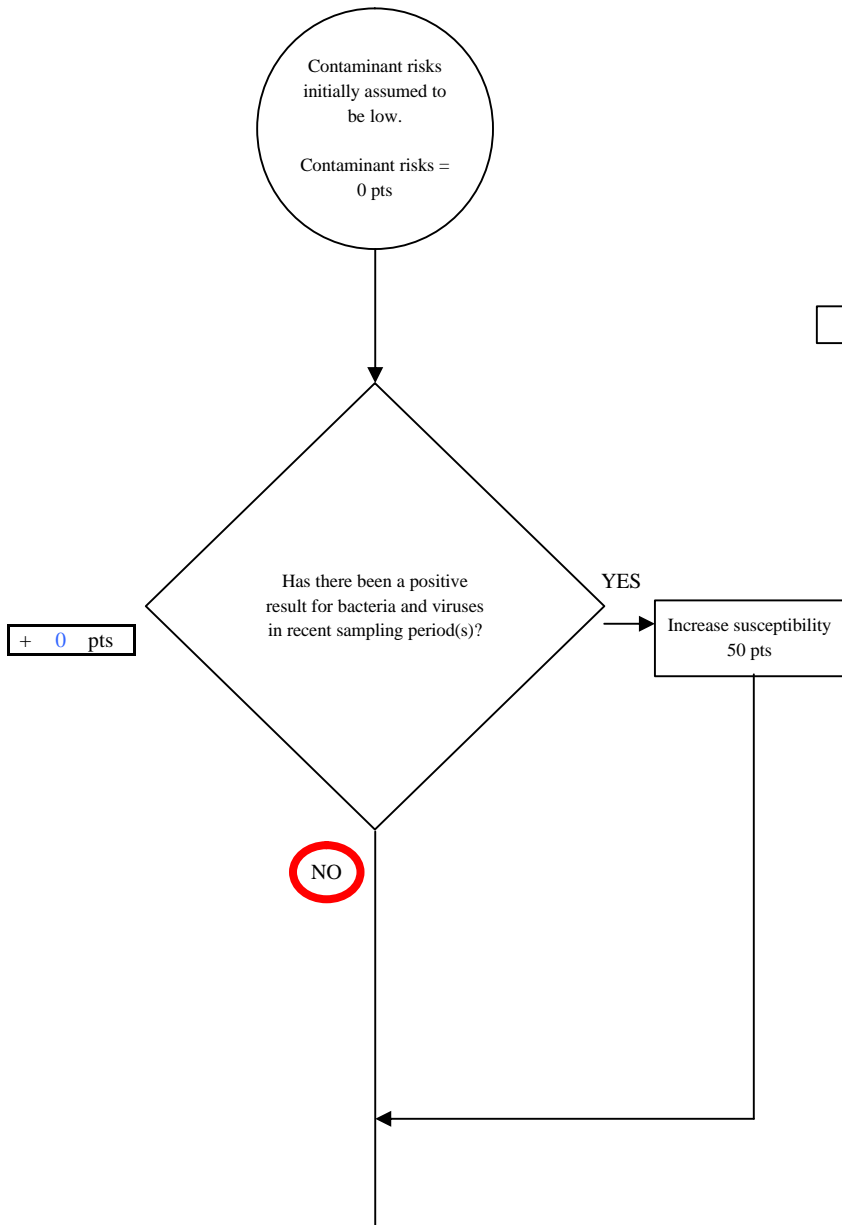


Chart 3. Contaminant Risks for The Point Lodge - Bacteria & Viruses



Risk Rankings for Contaminant Sources Identified in Zones A and B

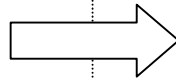
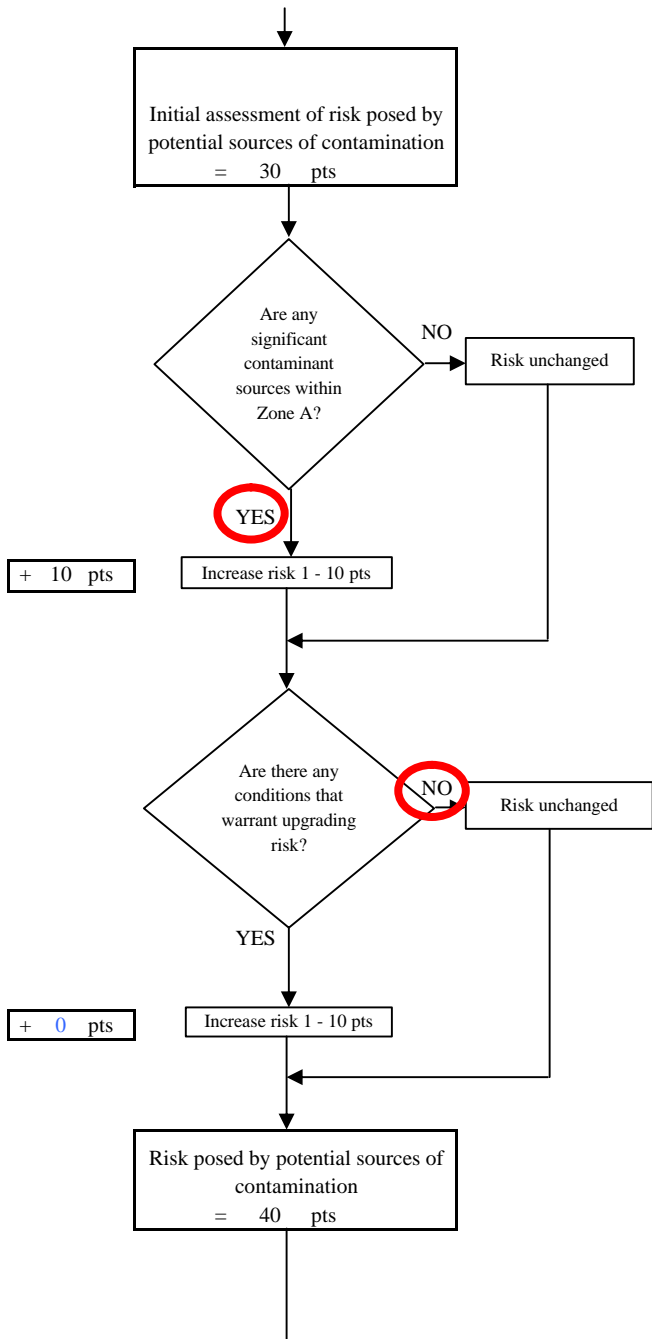
	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	1	1	2

	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

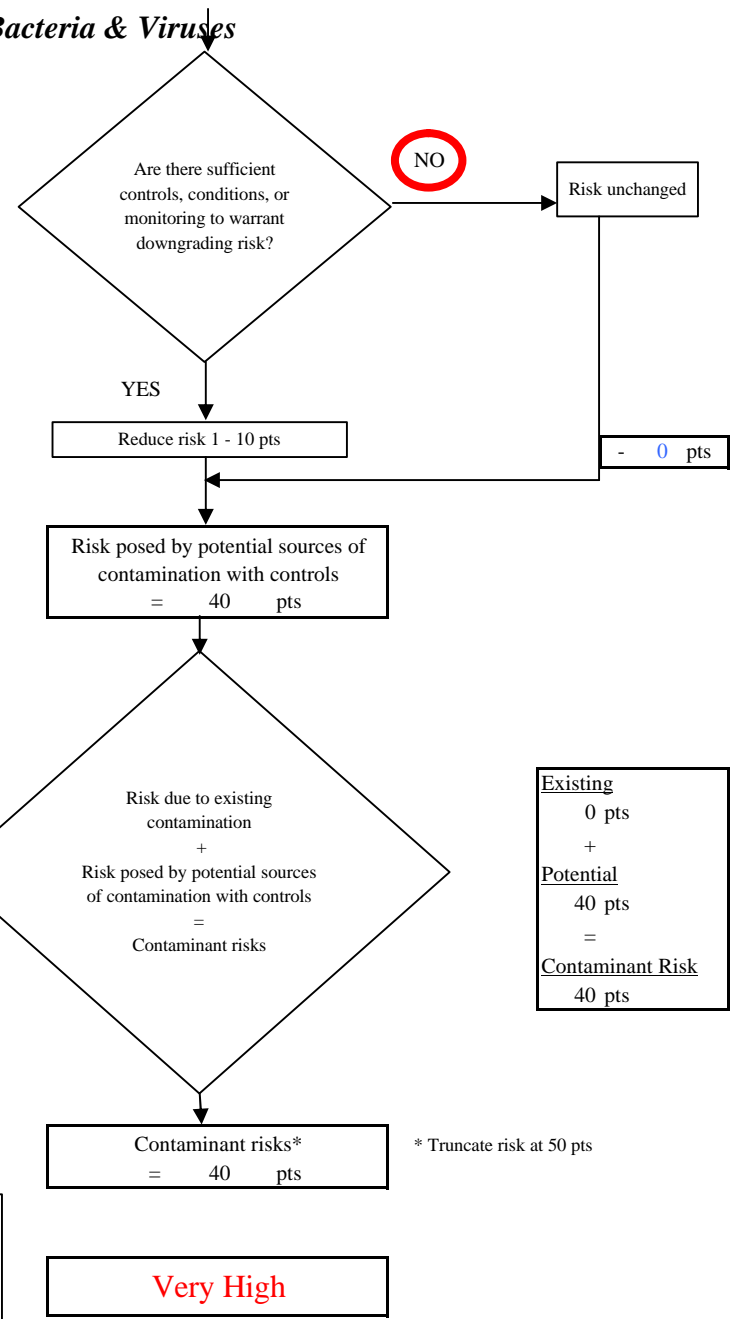
Matrix Score 30

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

Chart 3. Contaminant Risks for The Point Lodge - Bacteria & Viruses



Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low



Existing	0 pts
+	
Potential	40 pts
=	
Contaminant Risk	40 pts

* Truncate risk at 50 pts

Chart 4. Vulnerability Analysis for The Point Lodge - Bacteria & Viruses

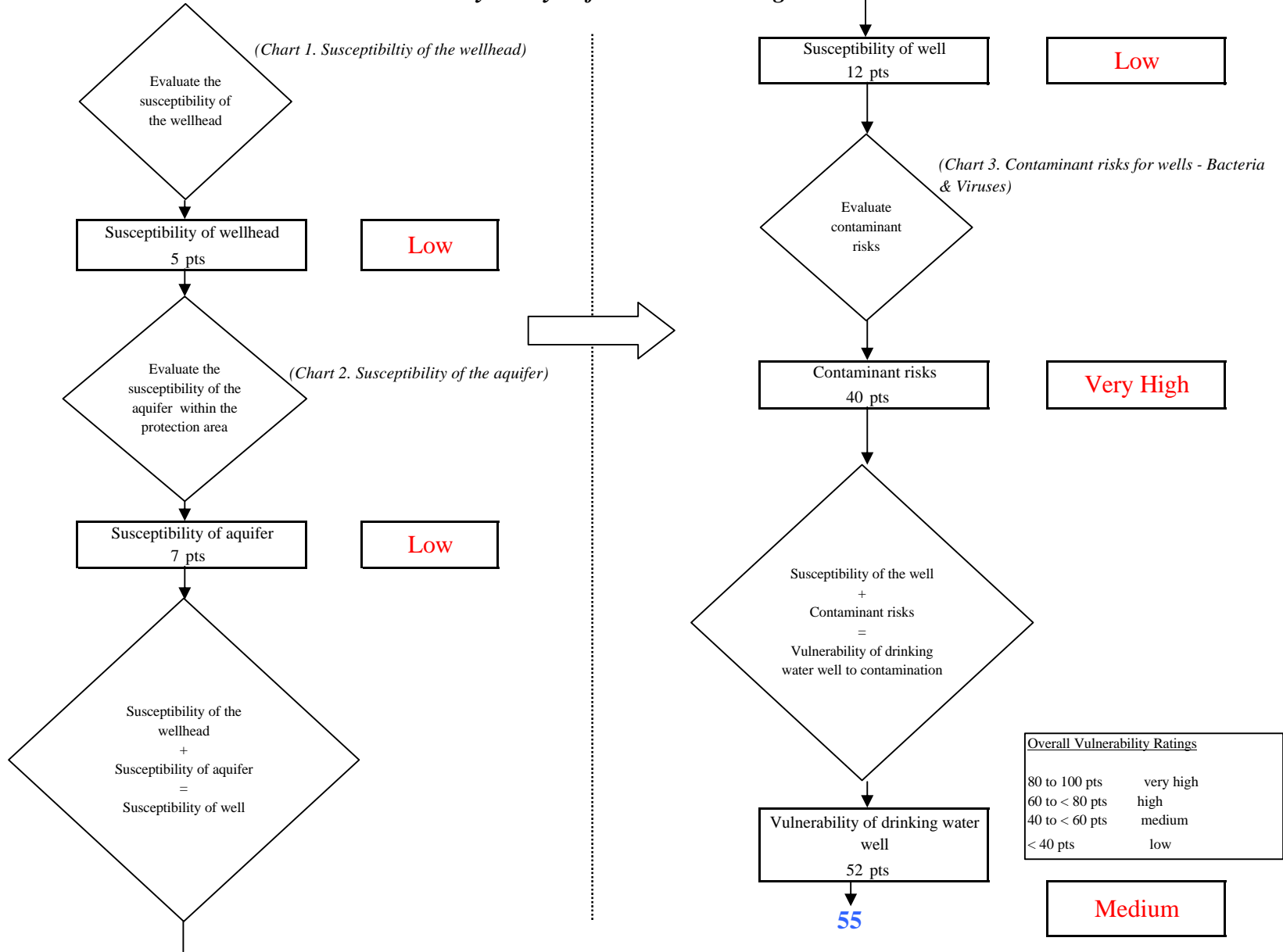


Chart 5. Contaminant Risks for The Point Lodge - Nitrates and Nitrites

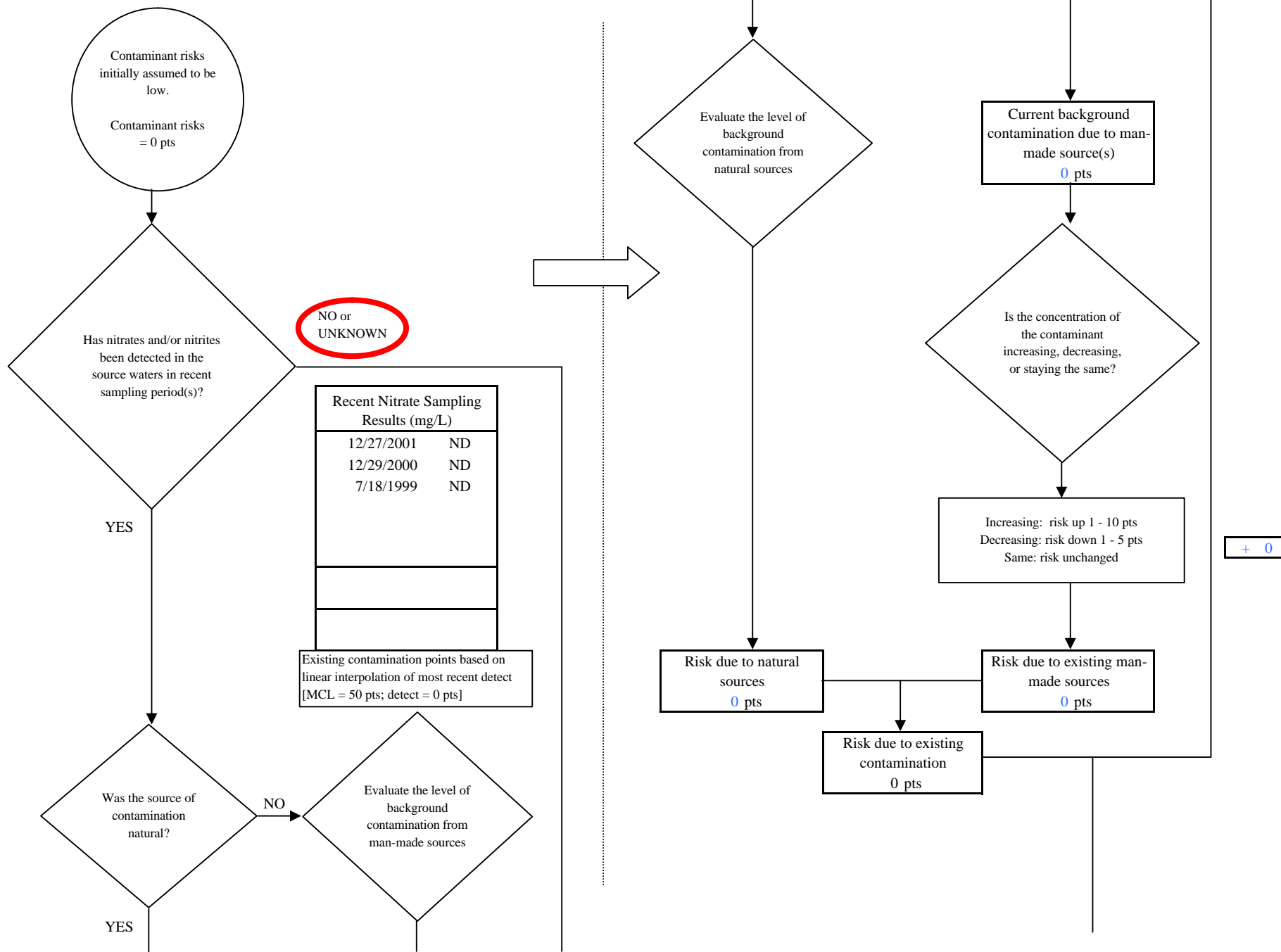
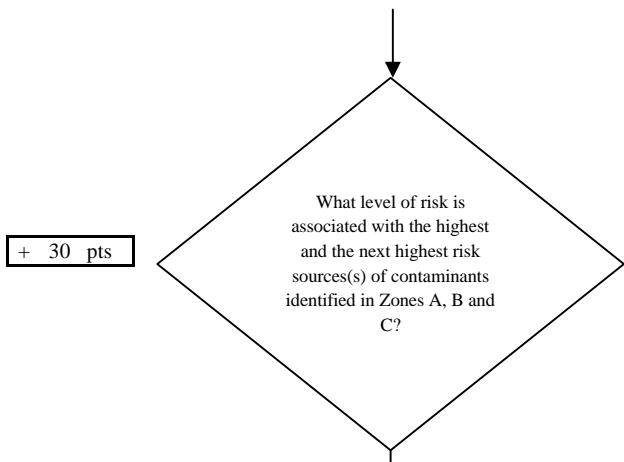


Chart 5. Contaminant Risks for The Point Lodge - Nitrates and Nitrites



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)	1	1	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 30

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

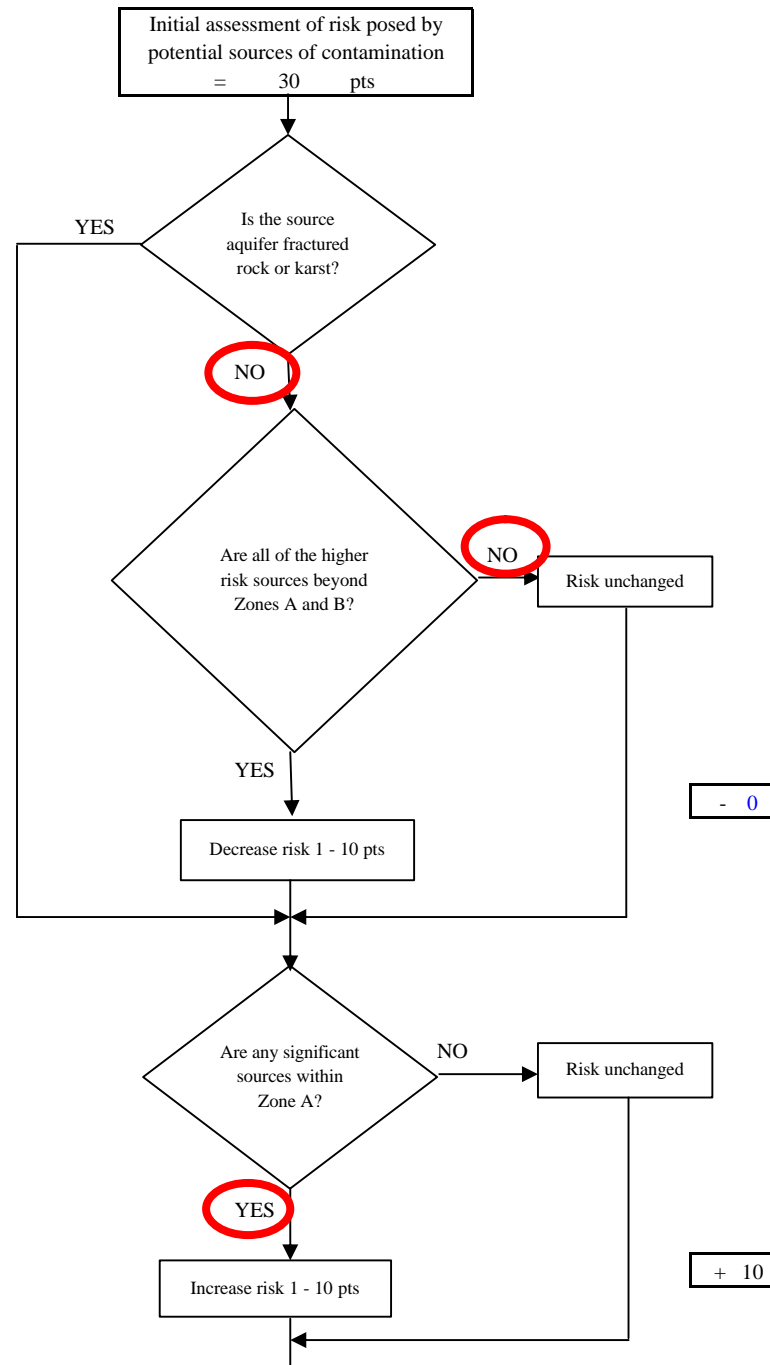
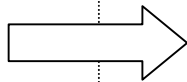


Chart 5. Contaminant Risks for The Point Lodge - Nitrates and Nitrites

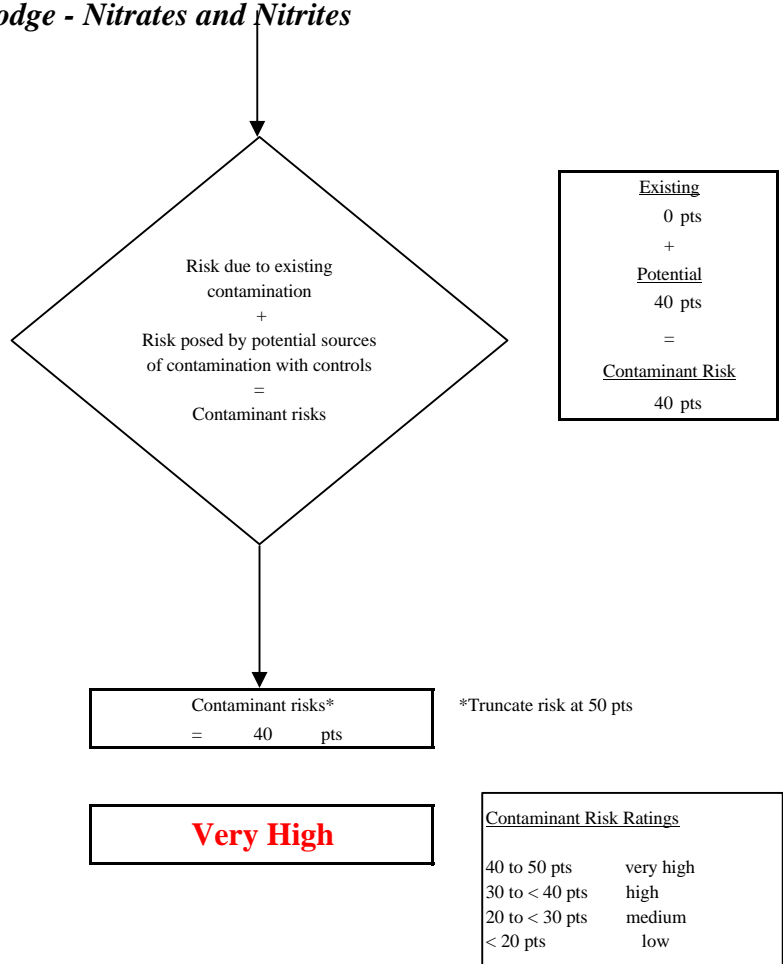
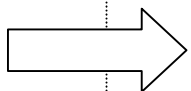
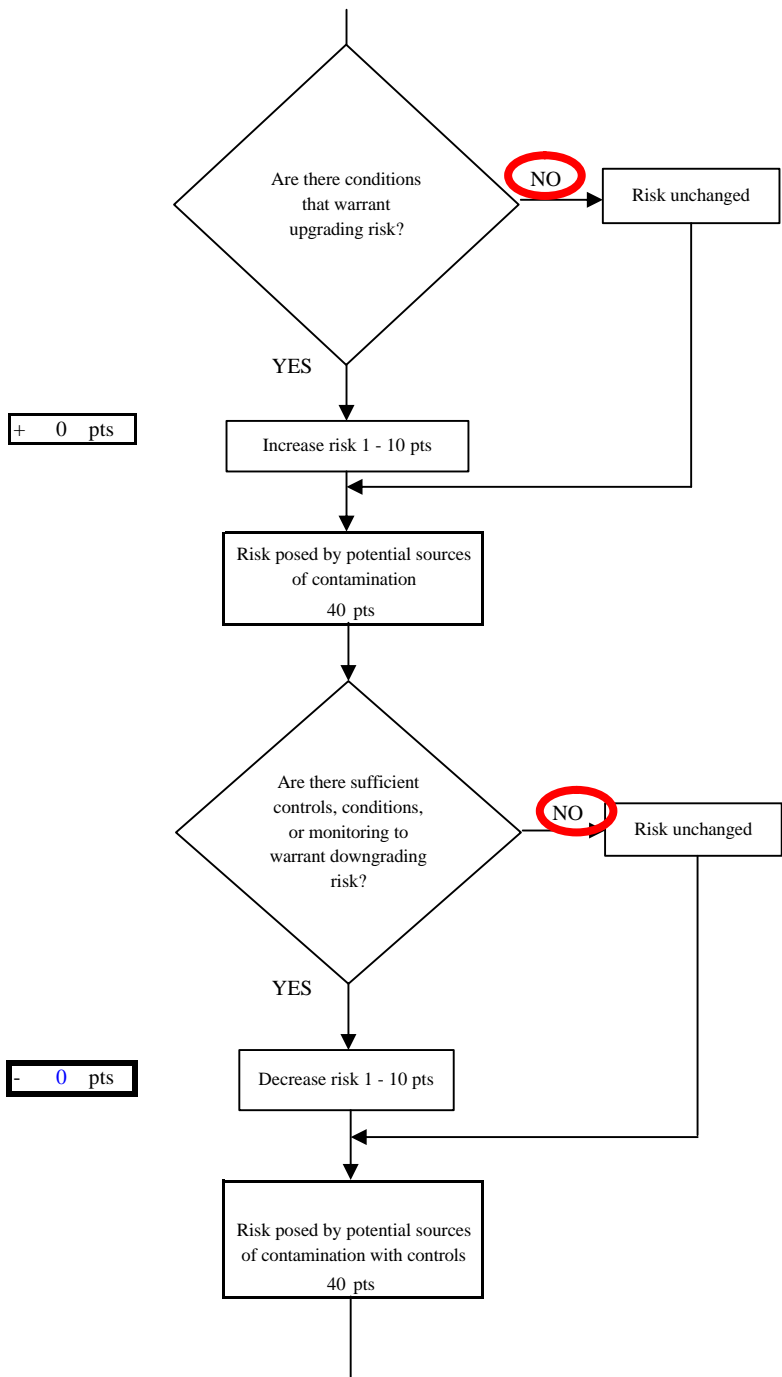


Chart 6. Vulnerability Analysis for The Point Lodge - Nitrates and Nitrites

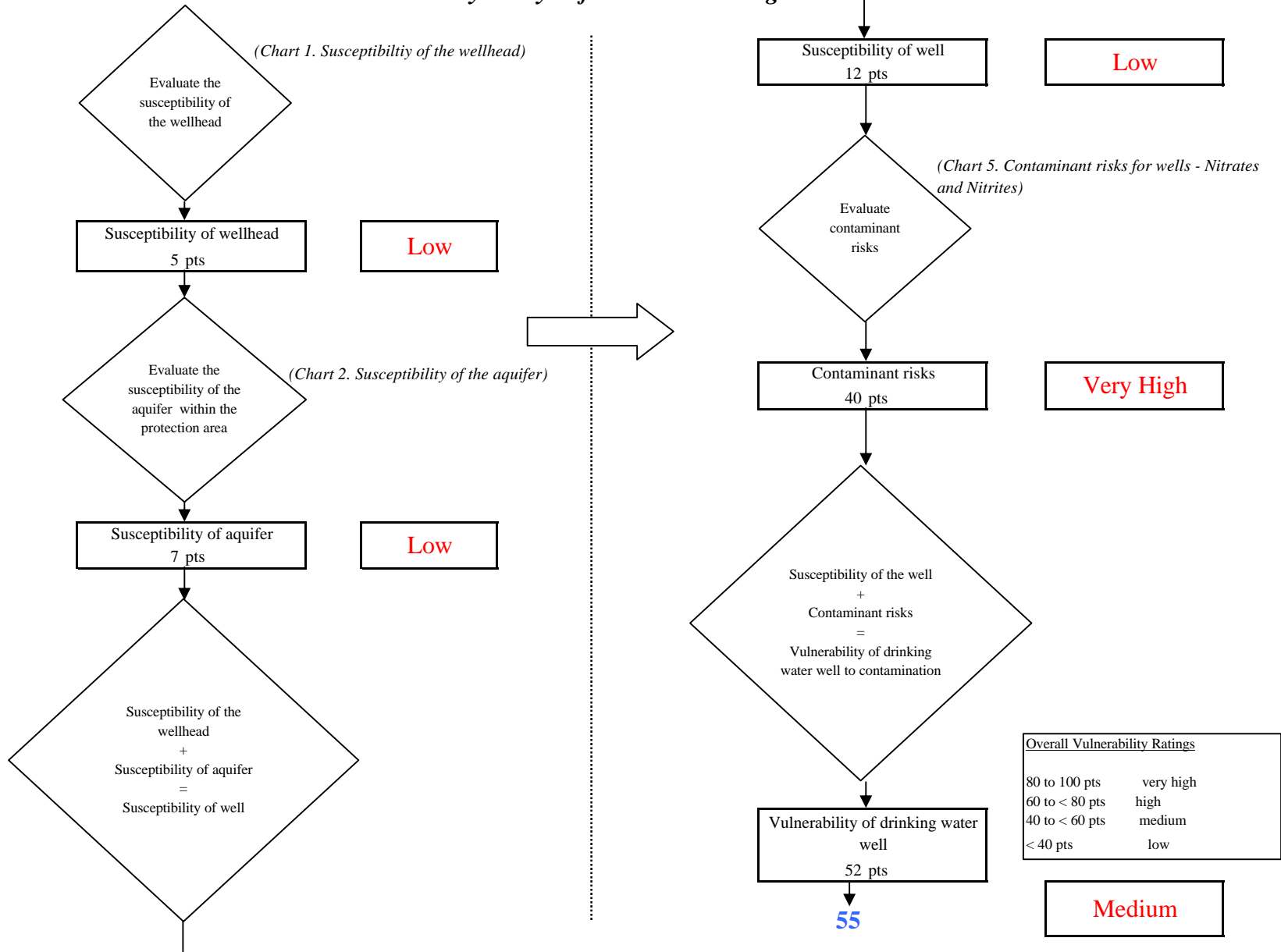


Chart 7. Contaminant Risks for The Point Lodge - Volatile Organic Chemicals

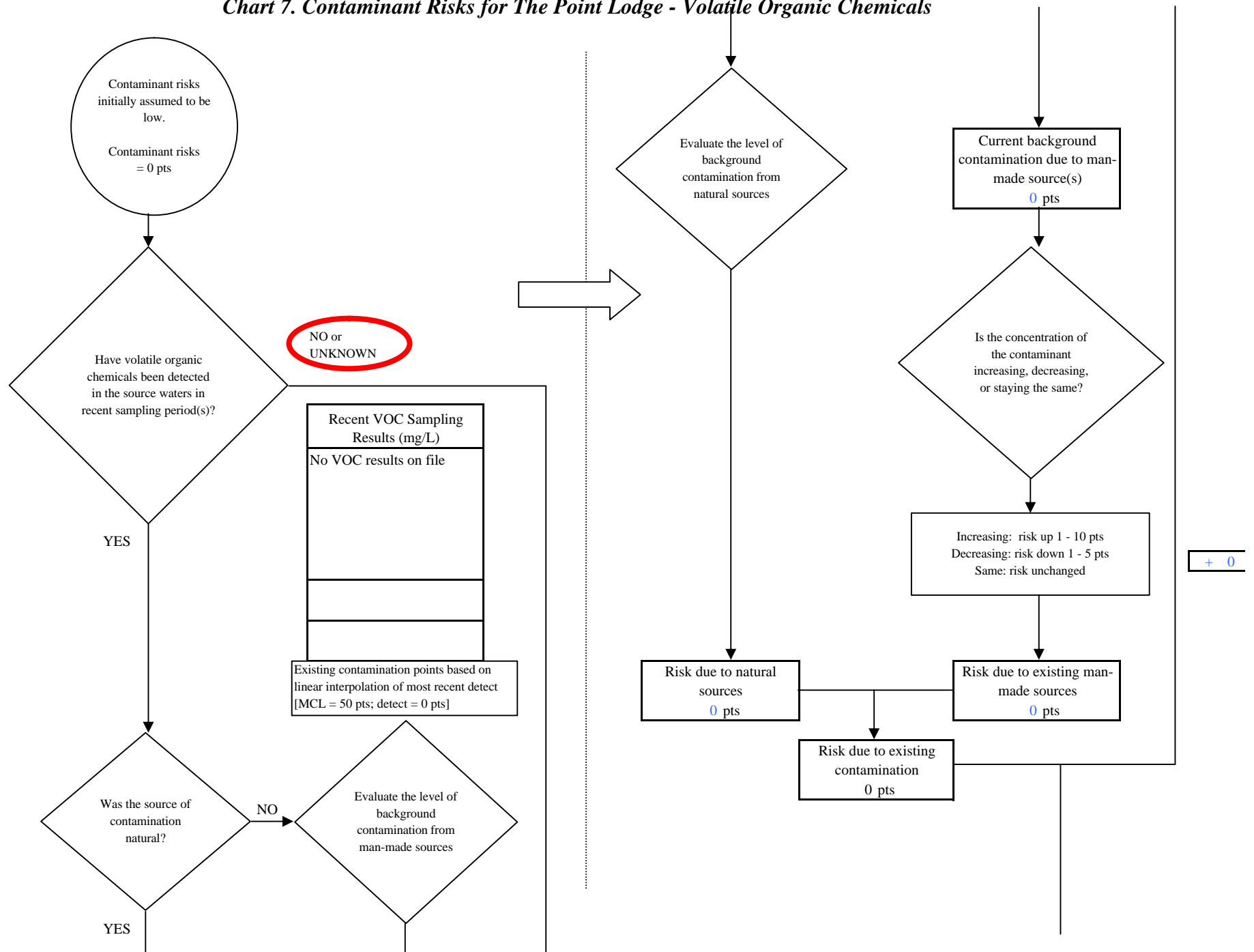
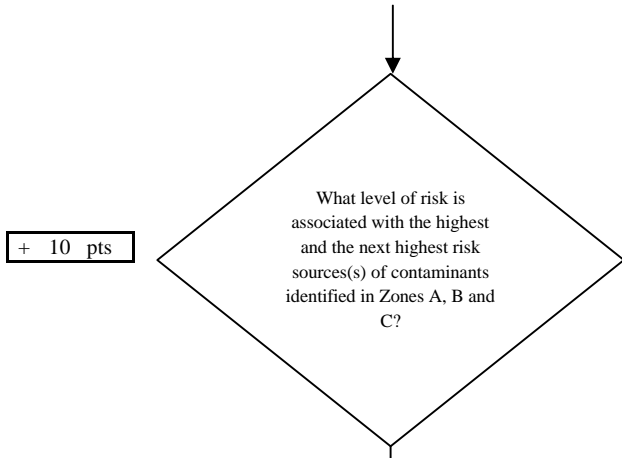


Chart 7. Contaminant Risks for The Point Lodge - Volatile Organic Chemicals



Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very High(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	4	1	5

	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.

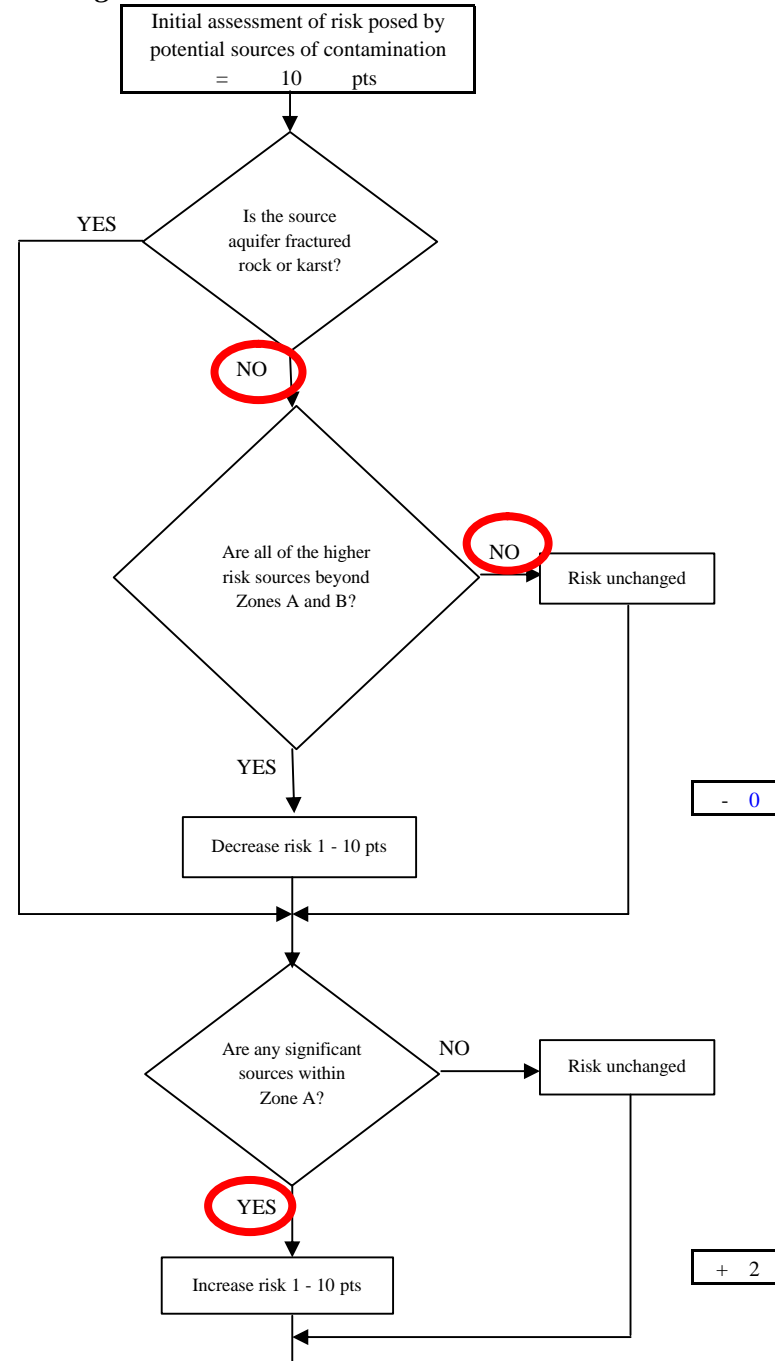
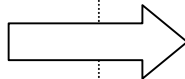


Chart 7. Contaminant Risks for The Point Lodge - Volatile Organic Chemicals

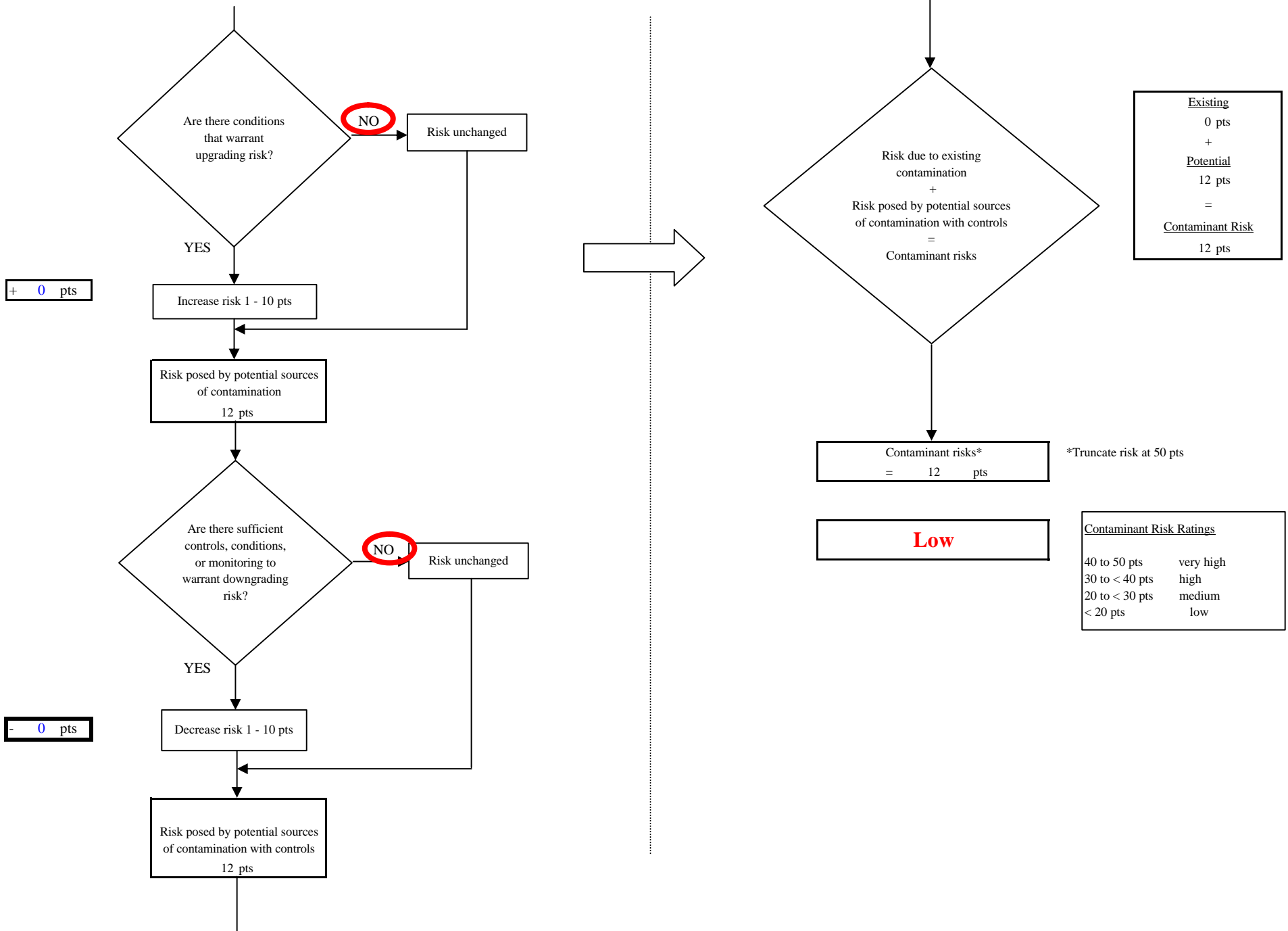


Chart 8. Vulnerability Analysis for The Point Lodge - Volatile Organic Chemicals

