

Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Peters Creek Terrace Apartments Drinking
Water System,
Chugiak, Alaska

PWSID # 213530.001, .002, and .003

DRINKING WATER PROTECTION PROGRAM REPORT #995

Alaska Department of Environmental Conservation

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By Suzan J. Hill

DRINKING WATER PROTECTION PROGRAM REPORT 995

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 Peters Creek Terrace Apartments Source of Public Drinking Water, Chugiak, Alaska

By Suzan J. Hill

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Peters Creek Terrace Apartments is a Class A (community) water system consisting of three wells in the Chugiak, Alaska area. Identified potential and current sources of contaminants for Peters Creek Terrace Apartments public drinking water source include large capacity and residential septic systems, a motor vehicle dealership, roads, and approximately 19 acres of residential area. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals and other organic chemicals. Overall, the public water source for Peters Creek Terrace Apartments received a vulnerability rating of **Medium** for bacteria and viruses, and nitrates and nitrites; and **Low** for volatile organic chemicals, heavy metals, synthetic organic chemicals, and other 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 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 CHUGACH MOUNTAIN FRONT EAST OF ANCHORAGE

Location

Between the Chugach Mountain Front east of Anchorage and Knik Arm lie the communities of Eagle River, Chugiak, Peters Creek, and Eklutna. The Eagle River Valley is one of the largest valleys in the western Chugach Mountains. Eagle River and the neighboring communities are located in the Municipality of Anchorage Borough.

Glacial and alluvial forces have shaped the Eagle River Valley and Chugach Mountain front in this area. These forces have resulted in the U-shaped river valleys and moraine-mantled mountain flanks of the mountain front and lakes, streams and undulating ridges and hills of the glaciated lowlands extending to Knik Arm.

Precipitation

Eagle River averages between 20 and 25 inches of precipitation per year, including about 68 inches of snowfall.

Topography and Drainage

The area topography varies from sea level to about 400 feet in the area surrounding Knik Arm to several thousand feet on the surrounding ridges and mountain flanks.

Groundwater

Although the quality can vary significantly in a short distance, groundwater supplies are generally abundant in the area, except for some reported well failures that have occurred within the city limits of Eagle River. Groundwater occurs within both confined and unconfined aquifers and from both unconsolidated and bedrock aquifers. 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.

Geology and Soils

Most of the soils in the area provide good sources of sand, gravel and topsoil. The deposition of silt, clay and organic muck in old lakes, oxbows and depressions means that some areas have soil conditions that vary over relatively short distances.

PETERS CREEK TERRACE APARTMENTS PUBLIC DRINKING WATER SYSTEM

Peters Creek Terrace Apartments is a Class A (community) water system. The system consists of one well and is located at 22116 Old Glenn Highway. (See Map 1 of Appendix A). This area is at an elevation of approximately 425 feet above sea level.

There are no Well Logs available for the three wells serving Peters Creek Terrace Apartments. According to the information provided by the system’s operator, Well #1 has a total depth of 407 feet with a static water level of 100 feet and was drilled on 8/5/83. Well # 2 has a total depth of 281 feet with a static water level of 101 feet and was drilled 9/22/89. Well # 3 has a total depth of 221 feet with a static water level of 103 feet and was drilled 8/9/89. The Sanitary Survey (8/25/00) indicates the wells were 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 wells providing adequate surface water drainage. The wells are 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 36 residents through 1 service connection.

PETERS CREEK TERRACE APARTMENTS WELL 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. (Please refer to the Guidance Manual for Class A 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. 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 down-gradient 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 Peters Creek Terrace Apartments contain three zones: Zone A, Zone B, and Zone C (see Map 1 in 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 Peters Creek Terrace Apartments DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

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

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

The sources are displayed on Maps 2 and 3 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.

Tables 2 through 7 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF PETERS CREEK TERRACE APARTMENTS 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 six 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 Peters Creek Terrace Apartments is completed in a confined aquifer setting. The aquifer that is utilized by the well is protected from surface contamination by relatively impermeable clay. Table 2 shows the Susceptibility scores and ratings for Peters Creek Terrace Apartments.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	14	Medium
Natural Susceptibility	14	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 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	40	Very High
Nitrates and/or Nitrites	40	Very High
Volatile Organic Chemicals	22	Medium
Heavy Metals, Cyanide, and Other Inorganic Chemicals	12	Low

Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	22	Low

Appendix D contains fourteen charts, which together form the ‘Vulnerability Analysis’ for a source water assessment for a public drinking water source. Chart 1 analyzes the ‘Susceptibility of the Wellhead’ to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the ‘Susceptibility of the Aquifer’ to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes ‘Contaminant Risks’ for the drinking water source with respect to bacteria and viruses. The ‘Contaminant Risks’ portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the ‘Vulnerability Analysis for Bacteria and Viruses’. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

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

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	35	Low
Heavy Metals, Cyanide and Other Inorganic Chemicals	25	Low
Synthetic Organic Chemicals	25	Low
Other Organic Chemicals	35	Low

Bacteria and Viruses

The contaminant risk for bacteria and viruses is very high with a large capacity septic systems in Zone A presenting the most significant risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Recent sampling of Peters Creek Terrace Apartments shows no detection of Bacteria and Viruses. 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 Medium.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is very high with a large capacity septic system in Zones A 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 Peters Creek Terrace Apartments well indicates that no concentrations of nitrate have been detected.

It is unknown how much of 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 Medium.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is medium with no contaminant sources presenting a significant risk to the drinking water well (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). Recent sampling history of Peters Creek Terrace Apartments did not detect any chemicals in the Volatile Organic Chemicals category. 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 Low.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The contaminant risk for heavy metals is low with no contaminant sources posing significant risk to the drinking water well (See Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). Monitoring samples analyzing chemicals within the Heavy Metals, Cyanide and Other Inorganic Chemicals collected on 11/17/99 did not detect any chemicals within this category.

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

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is low with no contaminant sources representing a significant risk. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability to synthetic organic chemicals of the well is Low.

Other Organic Chemicals

The contaminant risk for other organic chemicals is low with no contaminant sources posing a significant risk. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability to other organic chemicals of the well is Low.

Review of the historical sampling data indicates that no synthetic organic chemicals or other organic chemicals were detected in Peters Creek Terrace Apartments' drinking water the last time it was sampled (See Charts 11 and 13 – Contaminant Risks for Synthetic Organic Chemicals and Other Organic Chemicals in Appendix D, respectively).

SUMMARY

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 Peters Creek Terrace Apartments 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 Peters Creek Terrace Apartments public drinking water source.

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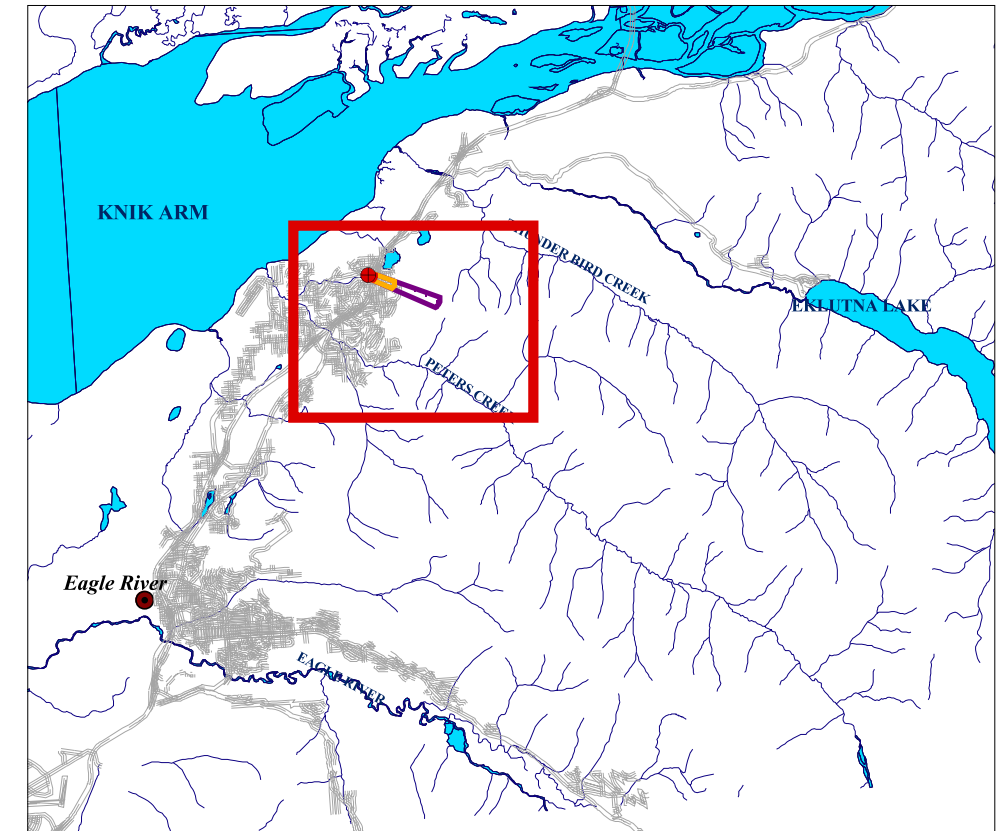
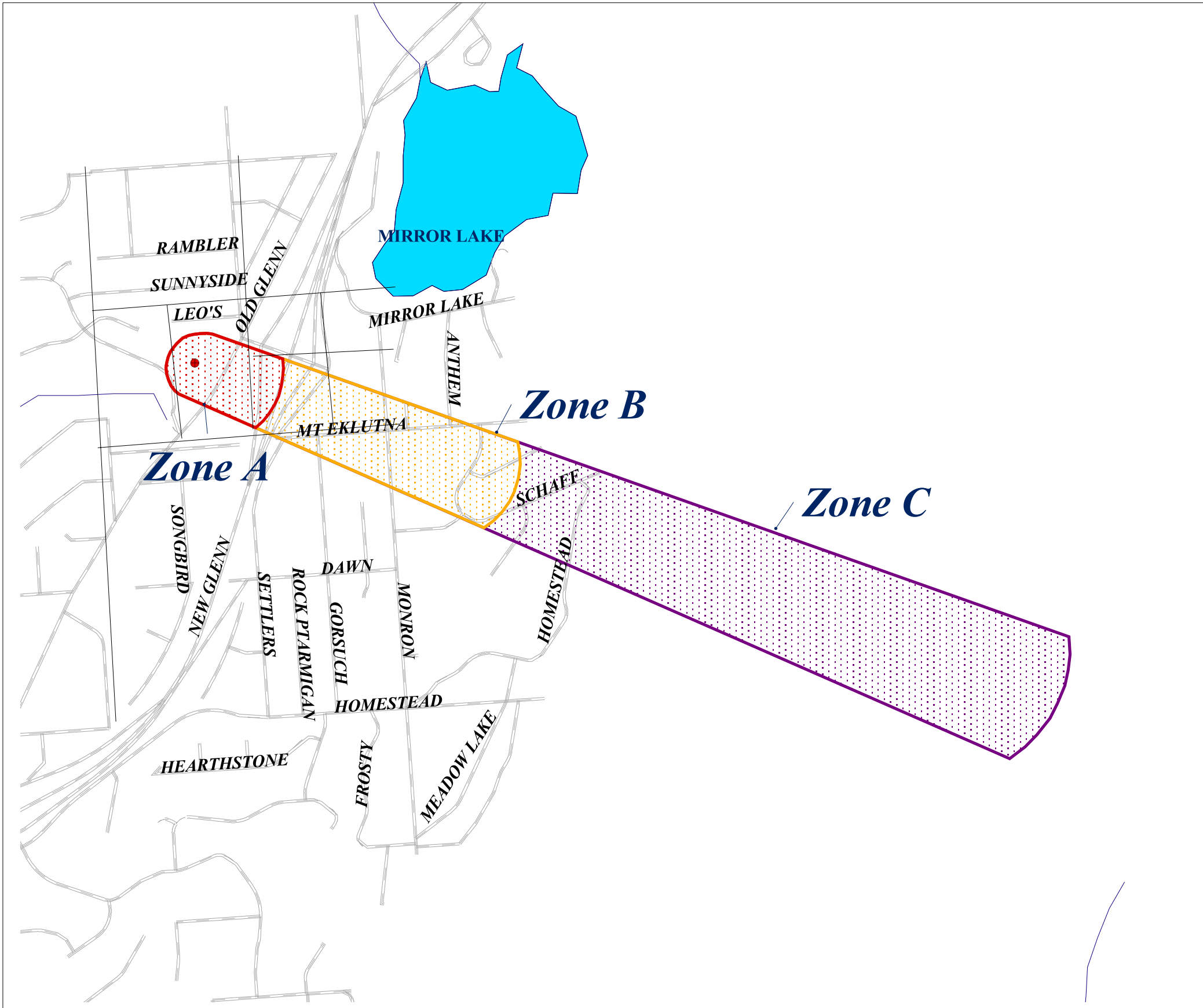
APPENDIX A

Peters Creek Terrace Apartments Wells #1, #2, and #3 Drinking Water Protection Area Location Map (Map 1)

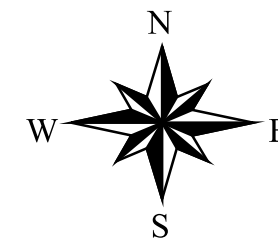
Peters Creek Terrace Apts. Protection Area - #213530.001, .002 & .003

Legend

- Peters Creek Terrace Apts Well Location
- Zone A**
- ▨ Several Months Travel Time
- Zone B**
- ▨ Less Than Two Years Time of Travel
- Zone C**
- ▨ Less Than Five Years Time of Travel
- Roads
- Rivers or Streams
- Lakes



600 0 600 1200 1800 2400 Yards



Map One

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Peters Creek Terrace Apartments Wells #1, #2 and #3 (Tables 1-7)

Table 1

***Contaminant Source Inventory for
Peter's Creek Terrace Apartments***

PWSID 213530.001

<i>Contaminant Source Type</i>	<i>Contaminant Source ID</i>	<i>CS ID tag</i>	<i>Zone</i>	<i>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	
Residential Areas	R01	R01-1	A	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	2	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27-1	B	2	
Residential Areas	R01	R01-2	B	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	2	
Residential Areas	R01	R01-3	C	3	6 Acres
Septic systems (serves one single-family home)	R02	R02-12-22	C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-7-9	C	3	

Table 2

*Contaminant Source Inventory and Risk Ranking for
Peter's Creek Terrace Apartments
Sources of Bacteria and Viruses*

PWSID 213530.001

<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>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	
Residential Areas	R01	R01-1	A	Low	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	2	
Residential Areas	R01	R01-2	B	Low	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	2	

Table 3

*Contaminant Source Inventory and Risk Ranking for
Peter's Creek Terrace Apartments
Sources of Nitrates/Nitrites*

PWSID 213530.001

<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>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	
Residential Areas	R01	R01-1	A	Low	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	2	
Residential Areas	R01	R01-2	B	Low	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	2	
Residential Areas	R01	R01-3	C	Low	3	6 Acres
Septic systems (serves one single-family home)	R02	R02-12-22	C	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-7-9	C	Low	3	

Table 4

*Contaminant Source Inventory and Risk Ranking for
Peter's Creek Terrace Apartments
Sources of Volatile Organic Chemicals*

PWSID 213530.001

<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>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	
Residential Areas	R01	R01-1	A	Low	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	2	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27-1	B	Medium	2	
Residential Areas	R01	R01-2	B	Low	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	2	
Residential Areas	R01	R01-3	C	Low	3	6 Acres
Septic systems (serves one single-family home)	R02	R02-12-22	C	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-7-9	C	Low	3	

Table 5

*Contaminant Source Inventory and Risk Ranking for
 Peter's Creek Terrace Apartments
 Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

PWSID 213530.001

<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>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	
Residential Areas	R01	R01-1	A	Low	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	2	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27-1	B	Low	2	
Residential Areas	R01	R01-2	B	Low	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	2	
Residential Areas	R01	R01-3	C	Low	3	6 Acres
Septic systems (serves one single-family home)	R02	R02-12-22	C	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-7-9	C	Low	3	

Table 6

*Contaminant Source Inventory and Risk Ranking for
Peter's Creek Terrace Apartments
Sources of Synthetic Organic Chemicals*

PWSID 213530.001

<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>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	
Residential Areas	R01	R01-1	A	Low	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	Low	2	
Residential Areas	R01	R01-2	B	Low	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	Low	2	
Residential Areas	R01	R01-3	C	Low	3	6 Acres
Septic systems (serves one single-family home)	R02	R02-12-22	C	Low	3	

Table 7

*Contaminant Source Inventory and Risk Ranking for
Peter's Creek Terrace Apartments
Sources of Other Organic Chemicals*

PWSID 213530.001

<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>Map Number</i>	<i>Comments</i>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	
Residential Areas	R01	R01-1	A	Low	2	6 Acres
Septic systems (serves one single-family home)	R02	R02-1-2	A	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1-2	A	Low	2	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27-1	B	Medium	2	
Residential Areas	R01	R01-2	B	Low	2	7 Acres
Septic systems (serves one single-family home)	R02	R02-3-11	B	Low	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3-6	B	Low	2	
Residential Areas	R01	R01-3	C	Low	3	6 Acres
Septic systems (serves one single-family home)	R02	R02-12-22	C	Low	3	
Highways and roads, paved (cement or asphalt)	X20	X20-7-9	C	Low	3	

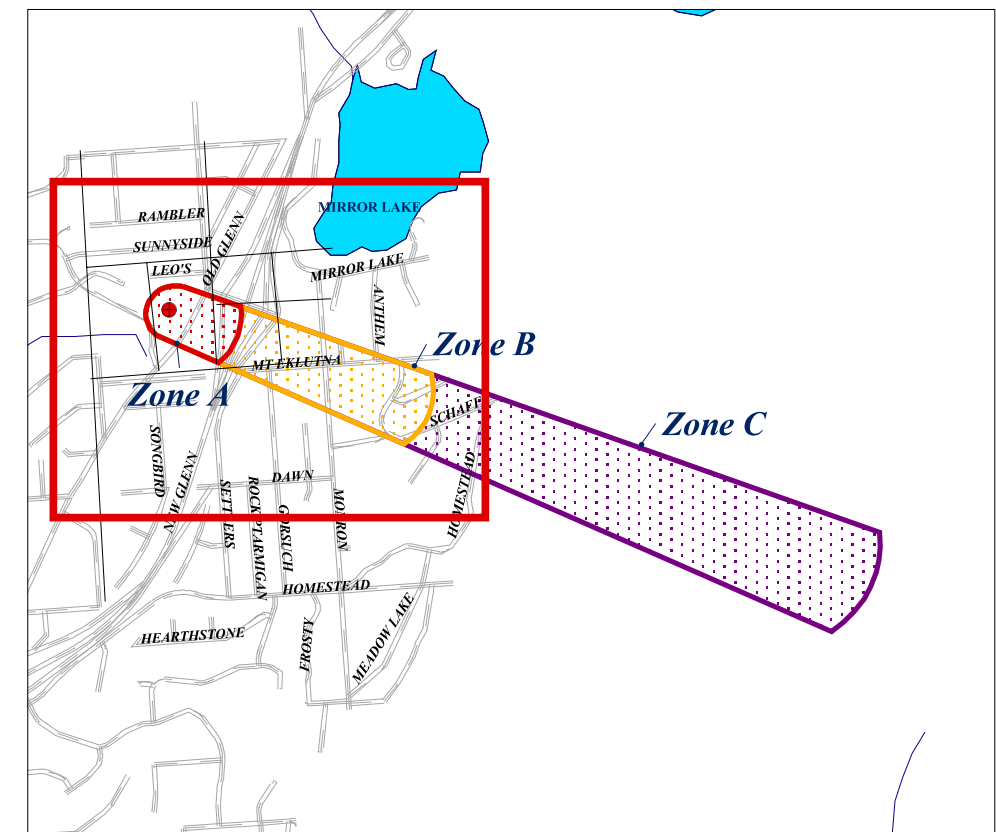
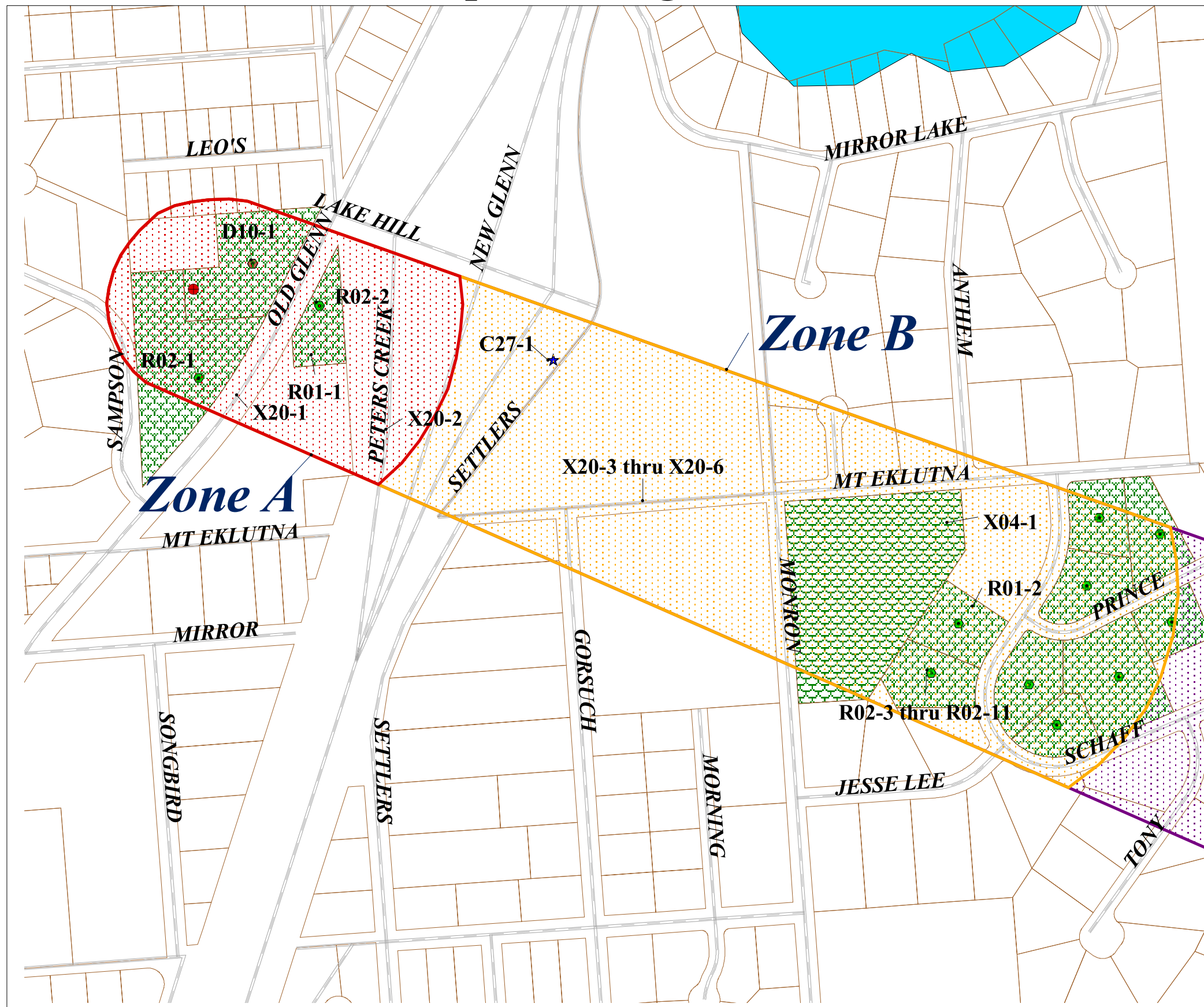
APPENDIX C

Peters Creek Terrace Apartments Wells #1, #2, and #3 Drinking Water Protection Area and Potential and Existing Contaminant Sources (Maps 2-3)

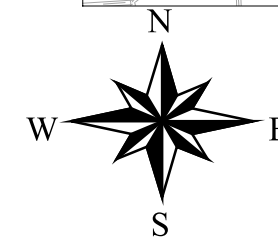
Peters Creek Terrace Apt. Existing and Potential Contaminant Sources

Legend

- Peters Creek Terrace Apts Well Location
- Zone A**
- ▨ Several Months Travel Time
- Zone B**
- ▨ Less Than Two Years Time of Travel
- Zone C**
- ▨ Less Than Five Years Time of Travel
- ⊃ Roads (X20)
- ▭ Land Parcels
- ▭ Lakes
- ▨ Residential Areas (R01)
- Septic Systems**
- Large Capacity Septic Systems (D10)
- Residential Septic Systems (R02)
- ★ Motor Vehicle Dealership (C27)
- ▨ Tonjess Park (X04)



200 0 200 400 600 800 Yards

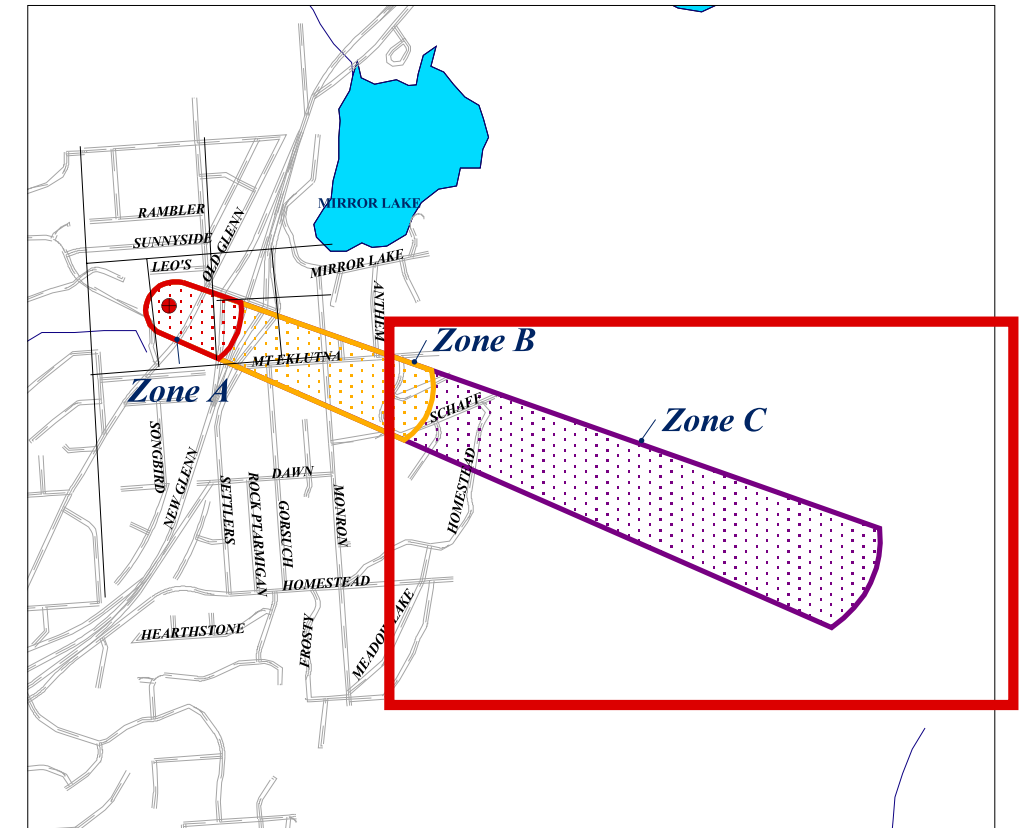
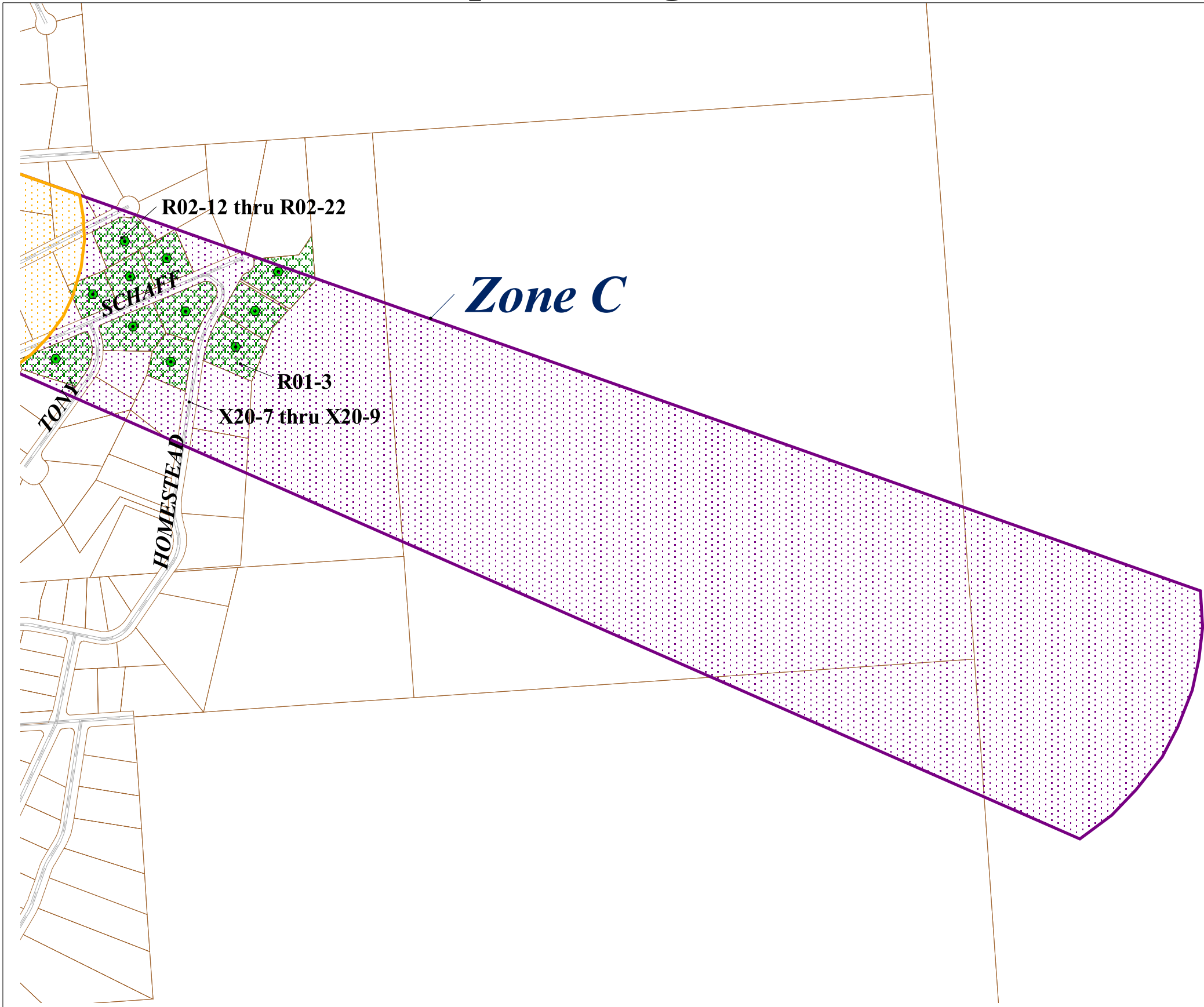


Map Two

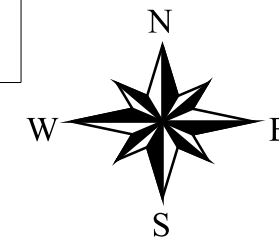
Peters Creek Terrace Apt. Existing and Potential Contaminant Sources

Legend

- Peters Creek Terrace Apts Well Location
- Zone A**
- ▨ Several Months Travel Time
- Zone B**
- ▨ Less Than Two Years Time of Travel
- Zone C**
- ▨ Less Than Five Years Time of Travel
- ▭ Roads (X20)
- ▭ Land Parcels
- Residential Septic Systems (R02)
- ▨ Residential Areas (R01)



300 0 300 600 900 1200 Yards



Map Three

APPENDIX D

Vulnerability Analysis for Peters Creek Terrace Apartments Wells #1, #2, And #3 Public Drinking Water Source (Charts 1-14)

Chart 1. Susceptibility of the wellhead - Peters Creek Terrace Apartments

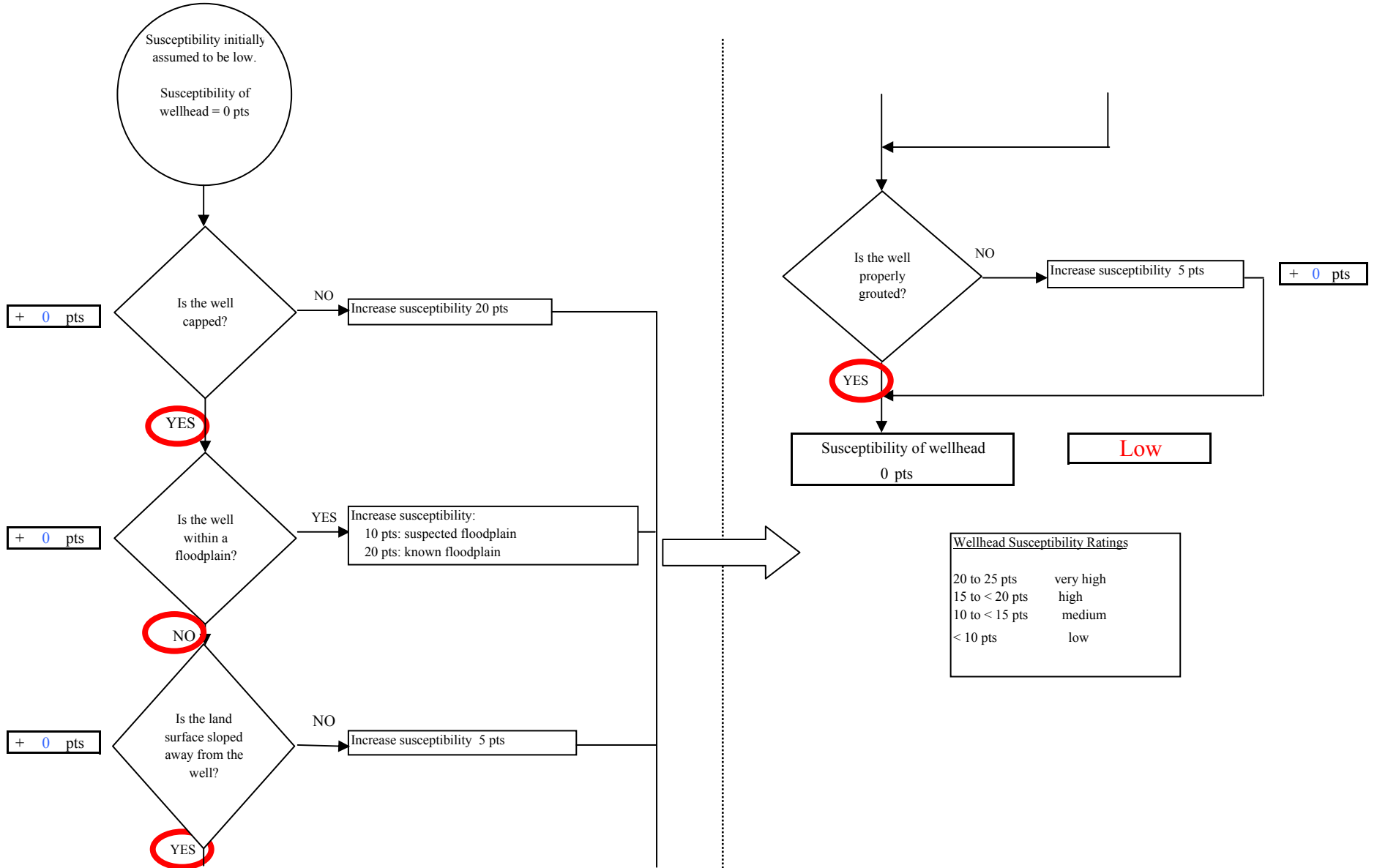


Chart 2. Susceptibility of the aquifer - Peters Creek Terrace Apartments

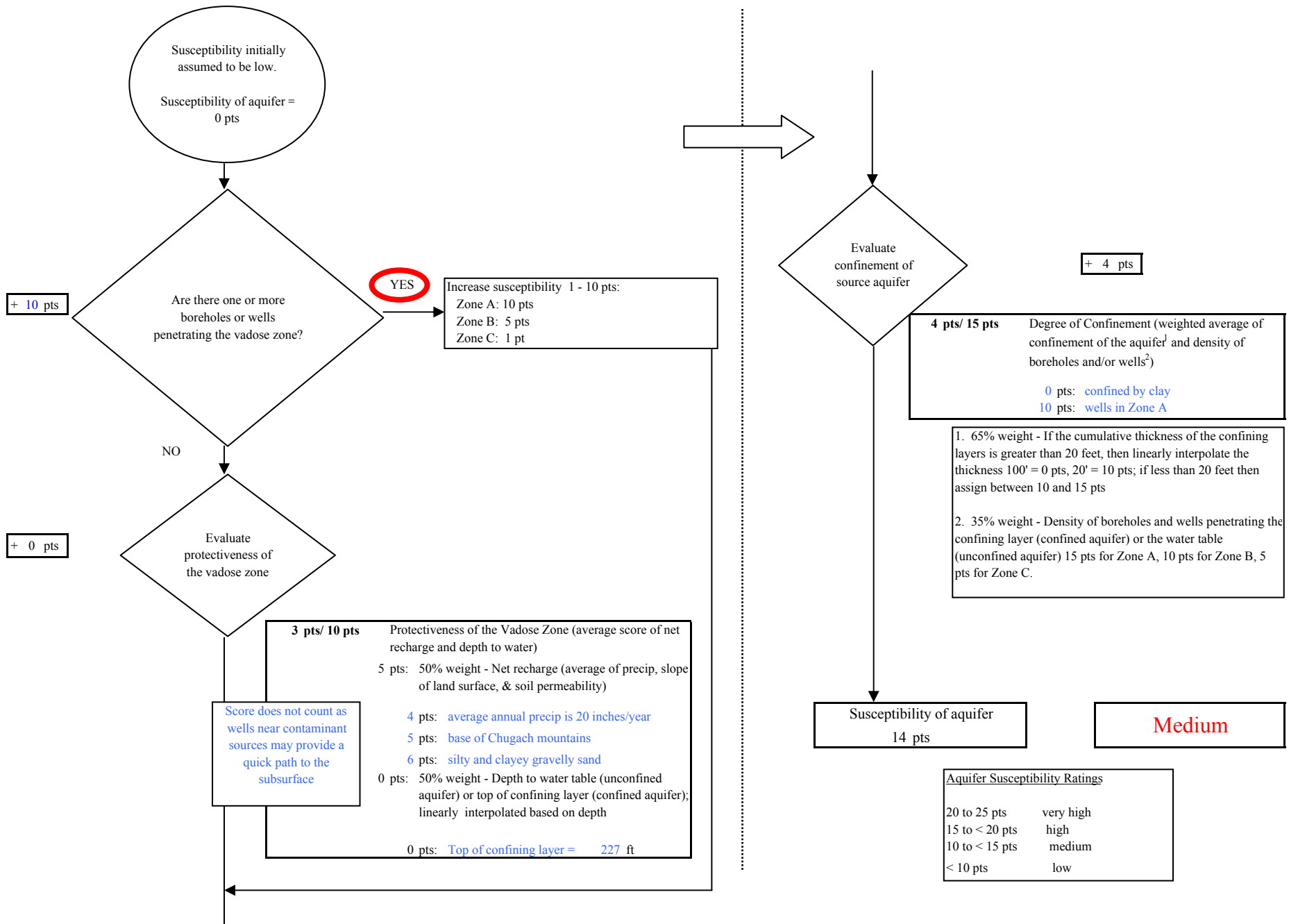
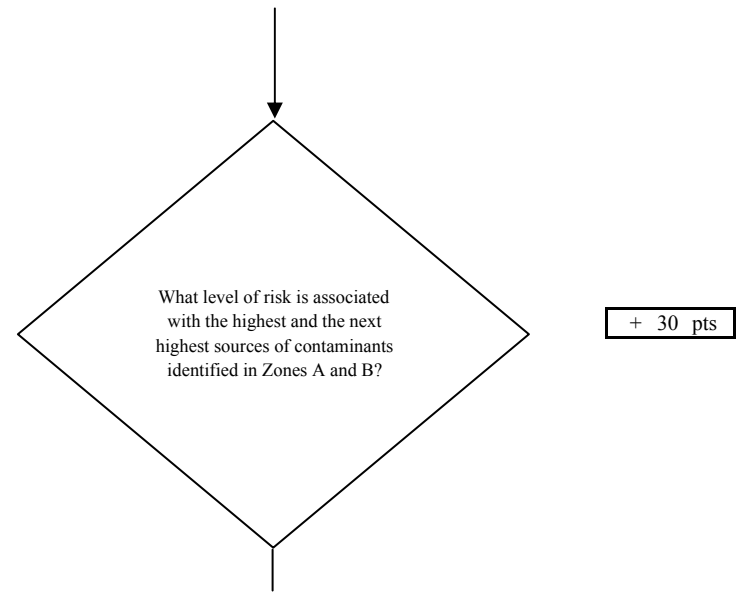
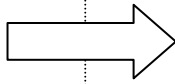
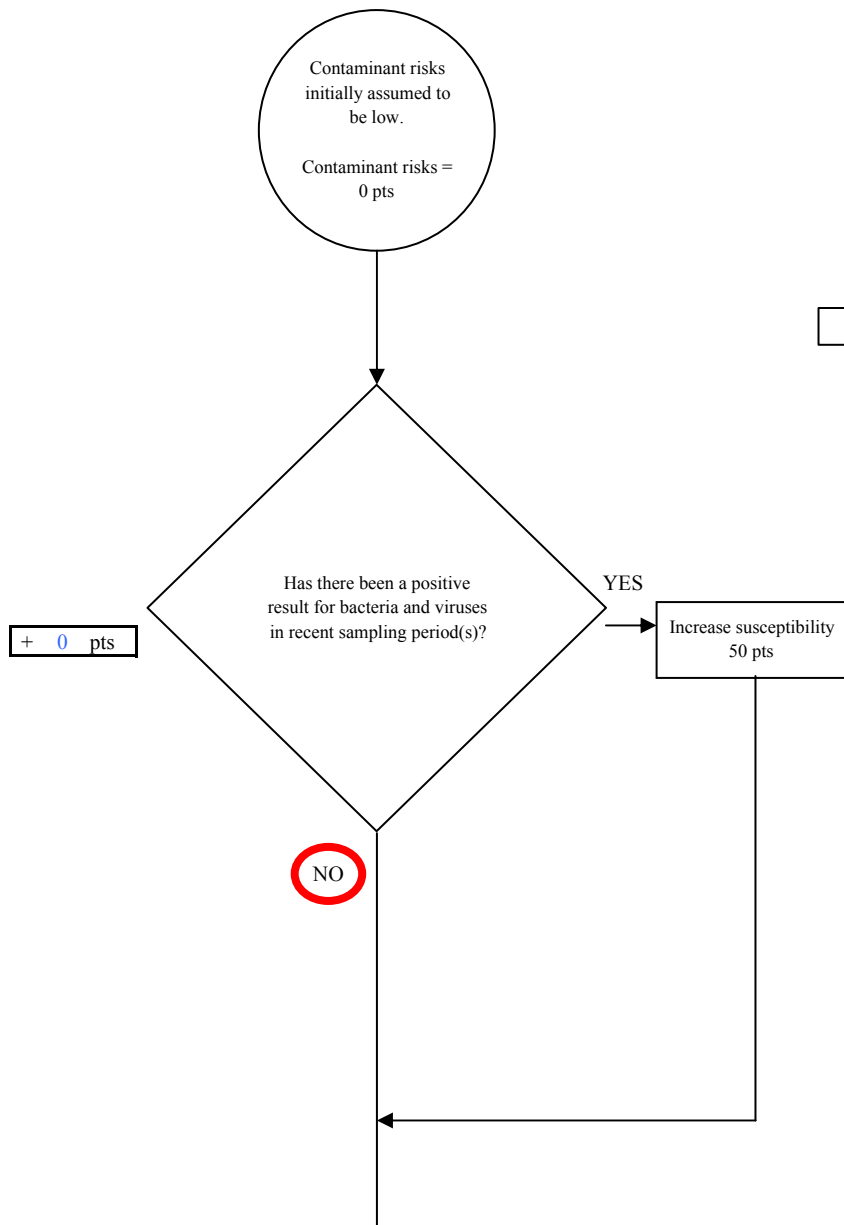


Chart 3. Contaminant risks for Peters Creek Terrace Apartments - Bacteria & Viruses



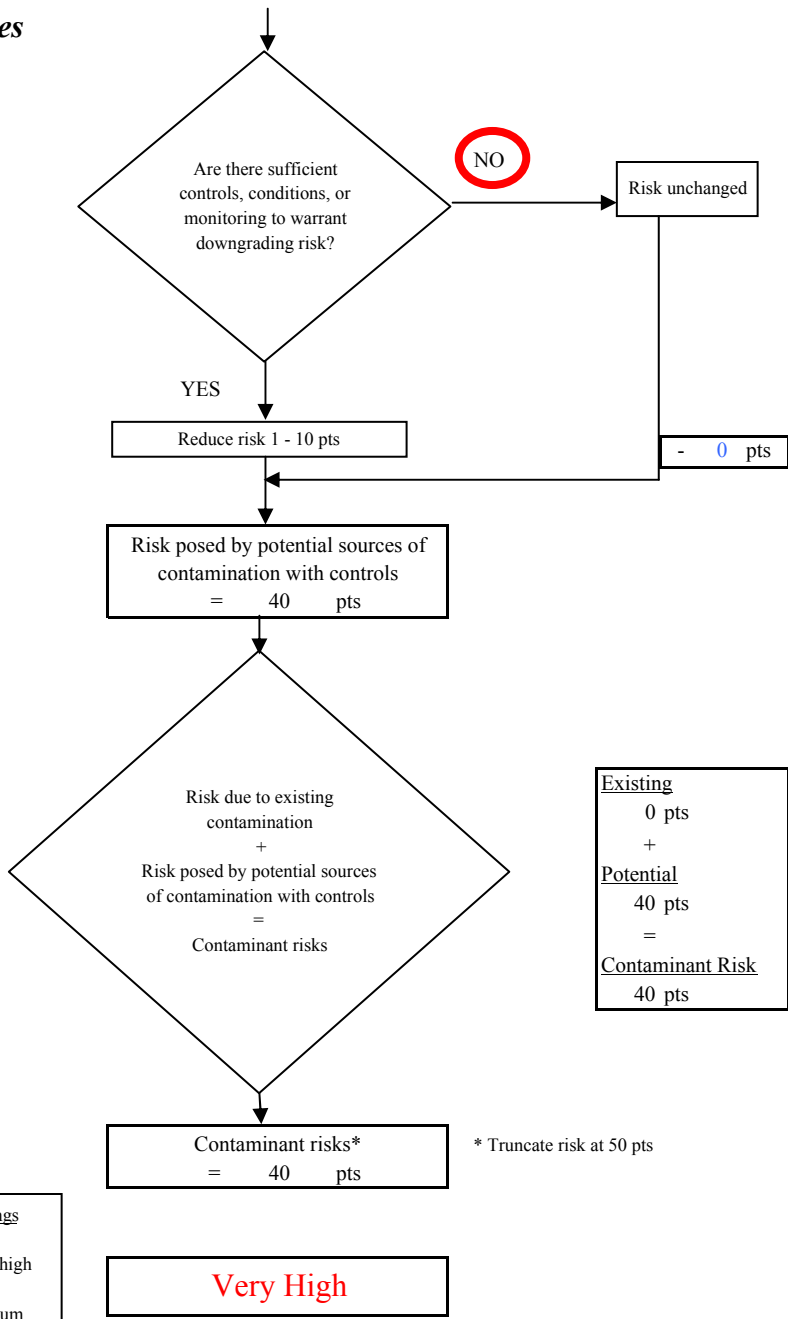
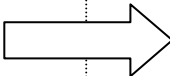
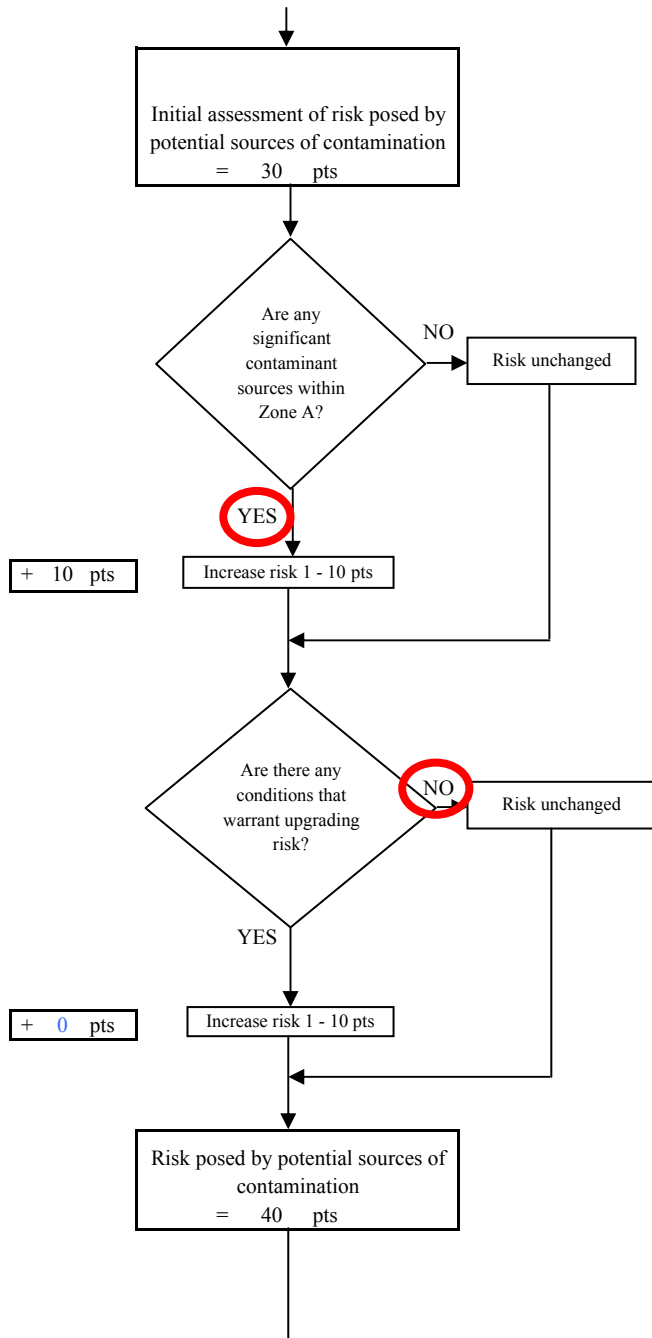
Risk Rankings for Contaminant Sources Identified in Zones A and B			
	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	4	3	7

	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 3. Contaminant risks for Peters Creek Terrace Apartments - Bacteria & Viruses



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

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

* Truncate risk at 50 pts

Chart 4. Vulnerability analysis for Peters Creek Terrace Apartments - Bacteria & Viruses

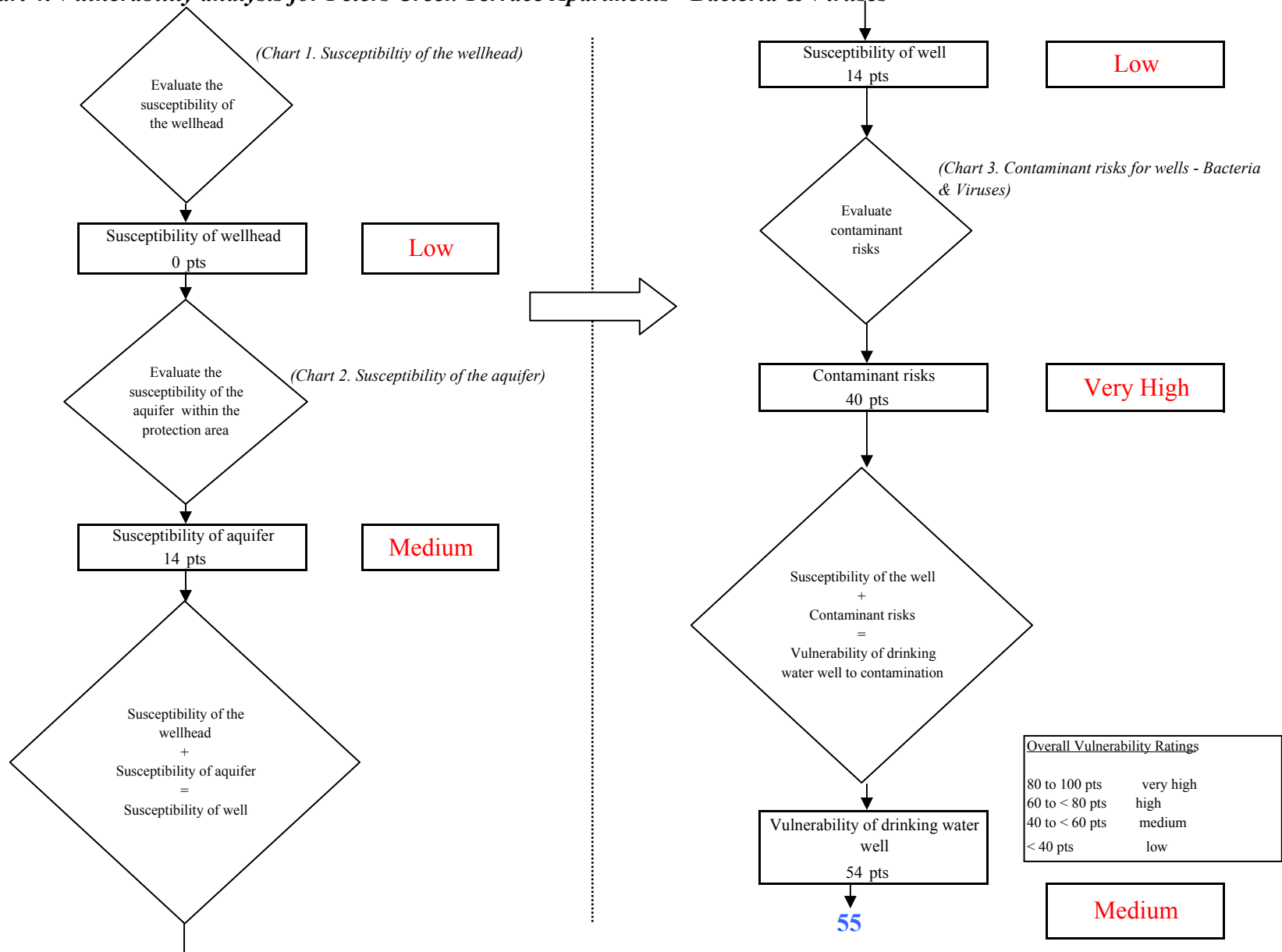


Chart 5. Contaminant risks for Peters Creek Terrace Apartments - Nitrates and Nitrites

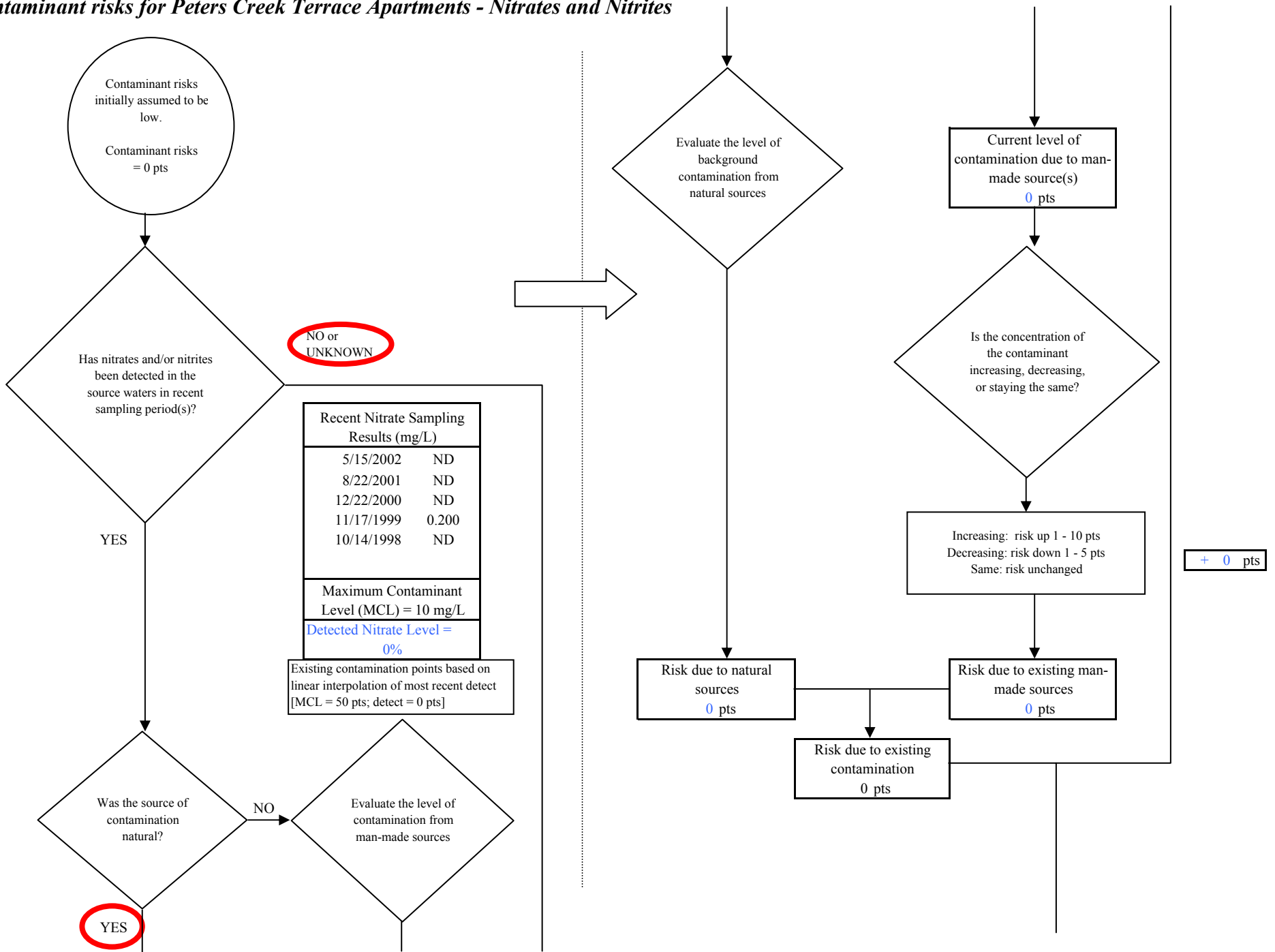
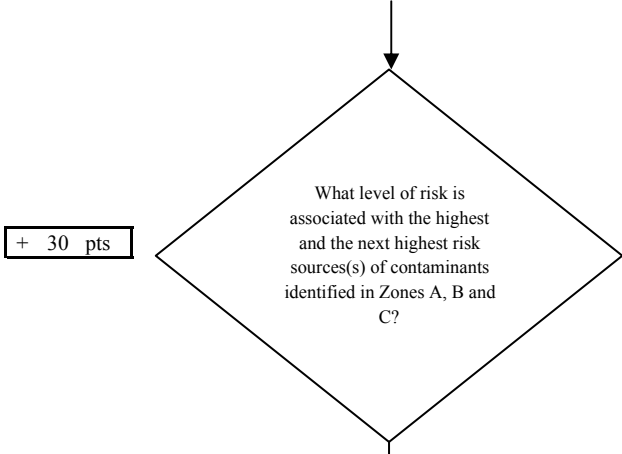


Chart 5. Contaminant risks for Peters Creek Terrace Apartments - Nitrates and Nitrites



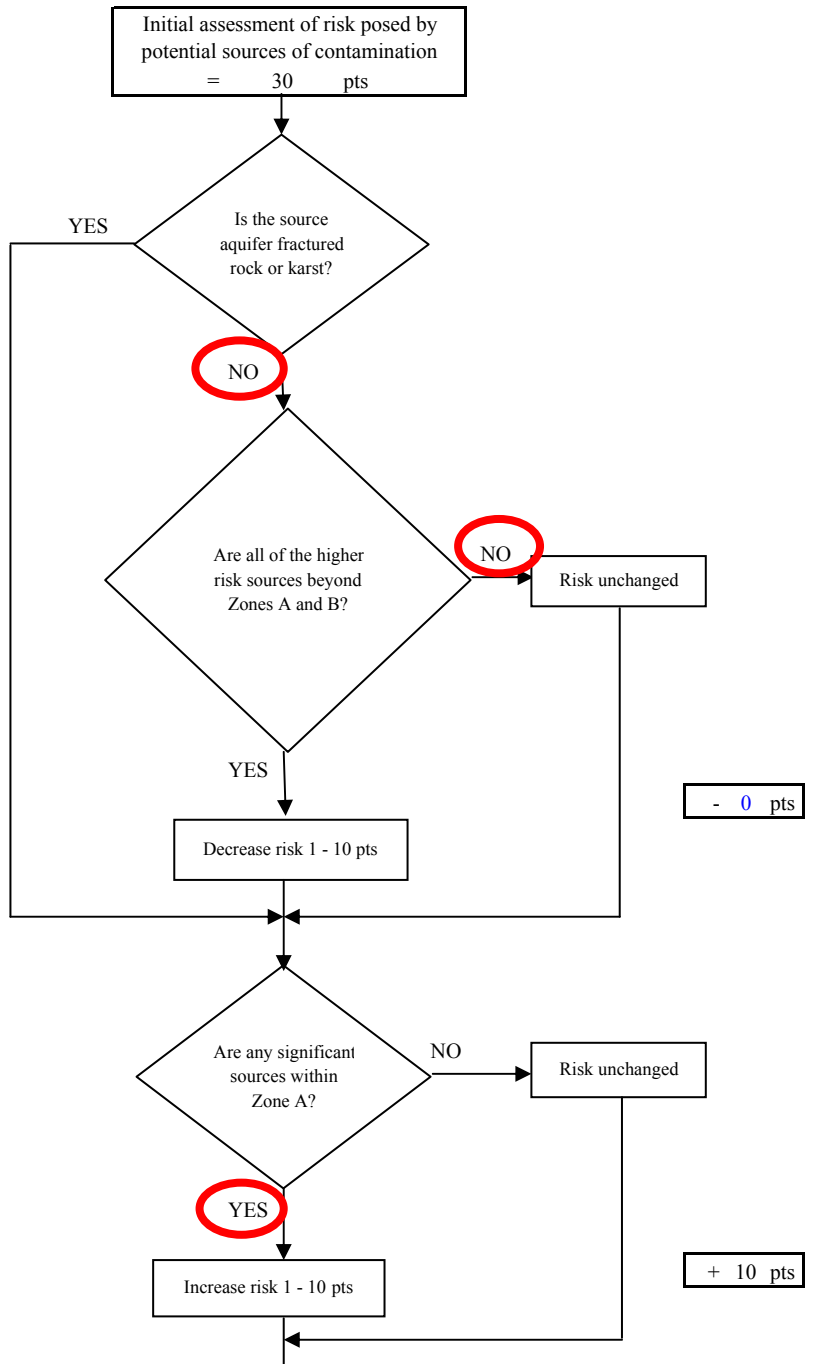
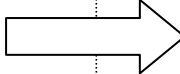
+ 30 pts

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)	1	0	1
Medium(s)	0	0	0
Low(s)	4	4	8

	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.



- 0 pts

+ 10 pts

Chart 5. Contaminant risks for Peters Creek Terrace Apartments - Nitrates and Nitrites

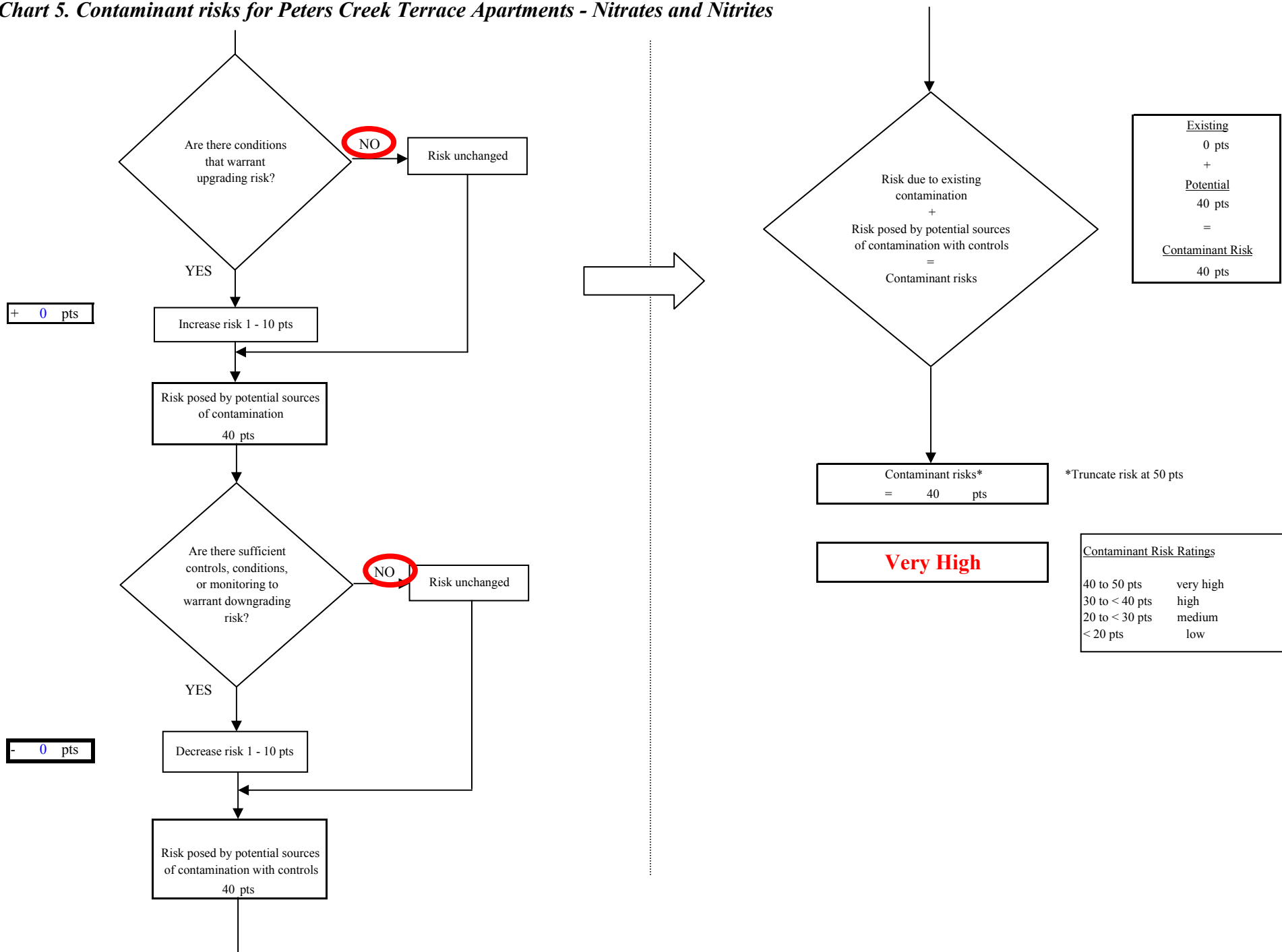


Chart 6. Vulnerability analysis for Peters Creek Terrace Apartments - Nitrates and Nitrites

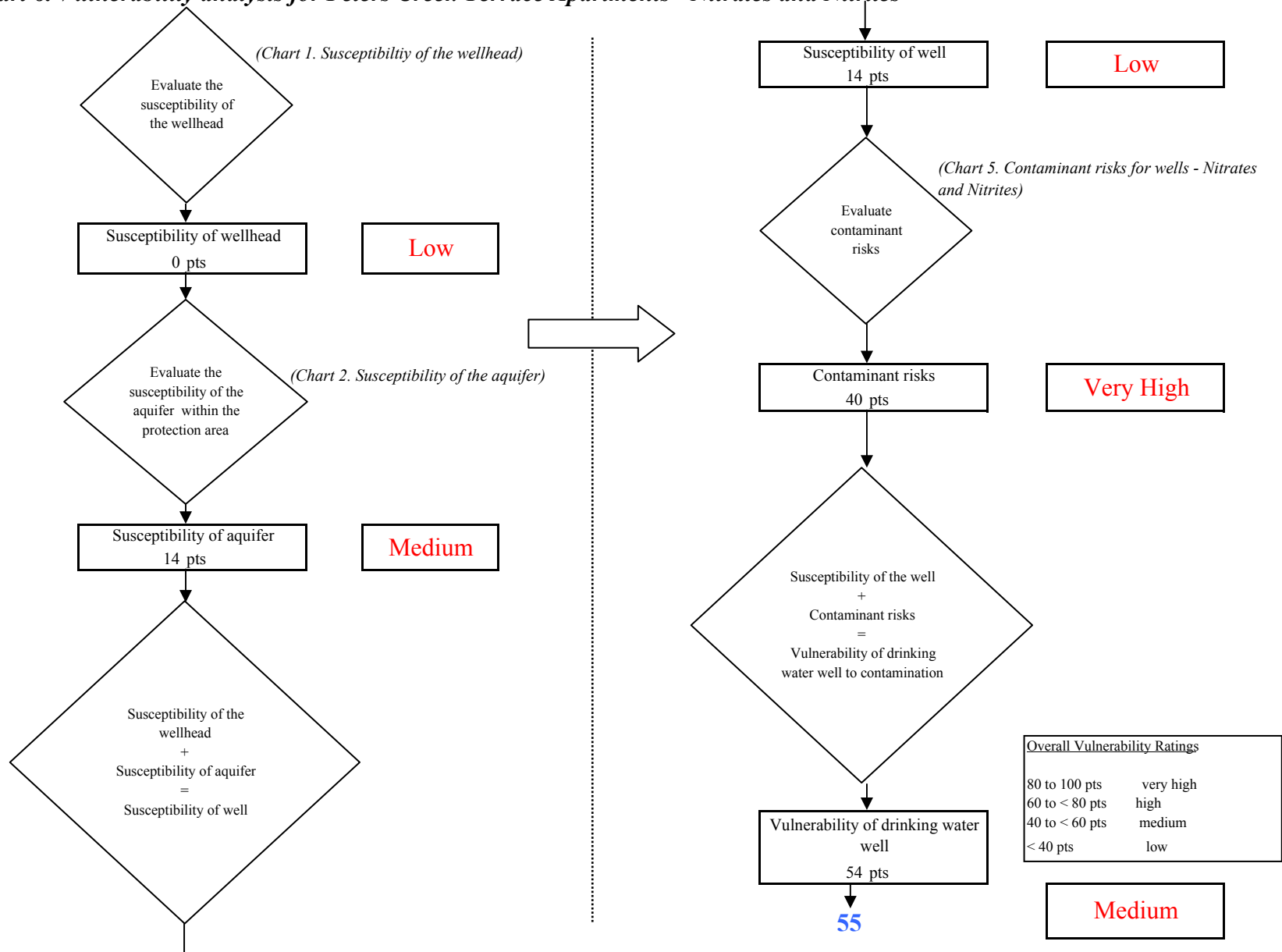


Chart 7. Contaminant risks for Peters Creek Terrace Apartments - Volatile Organic Chemicals

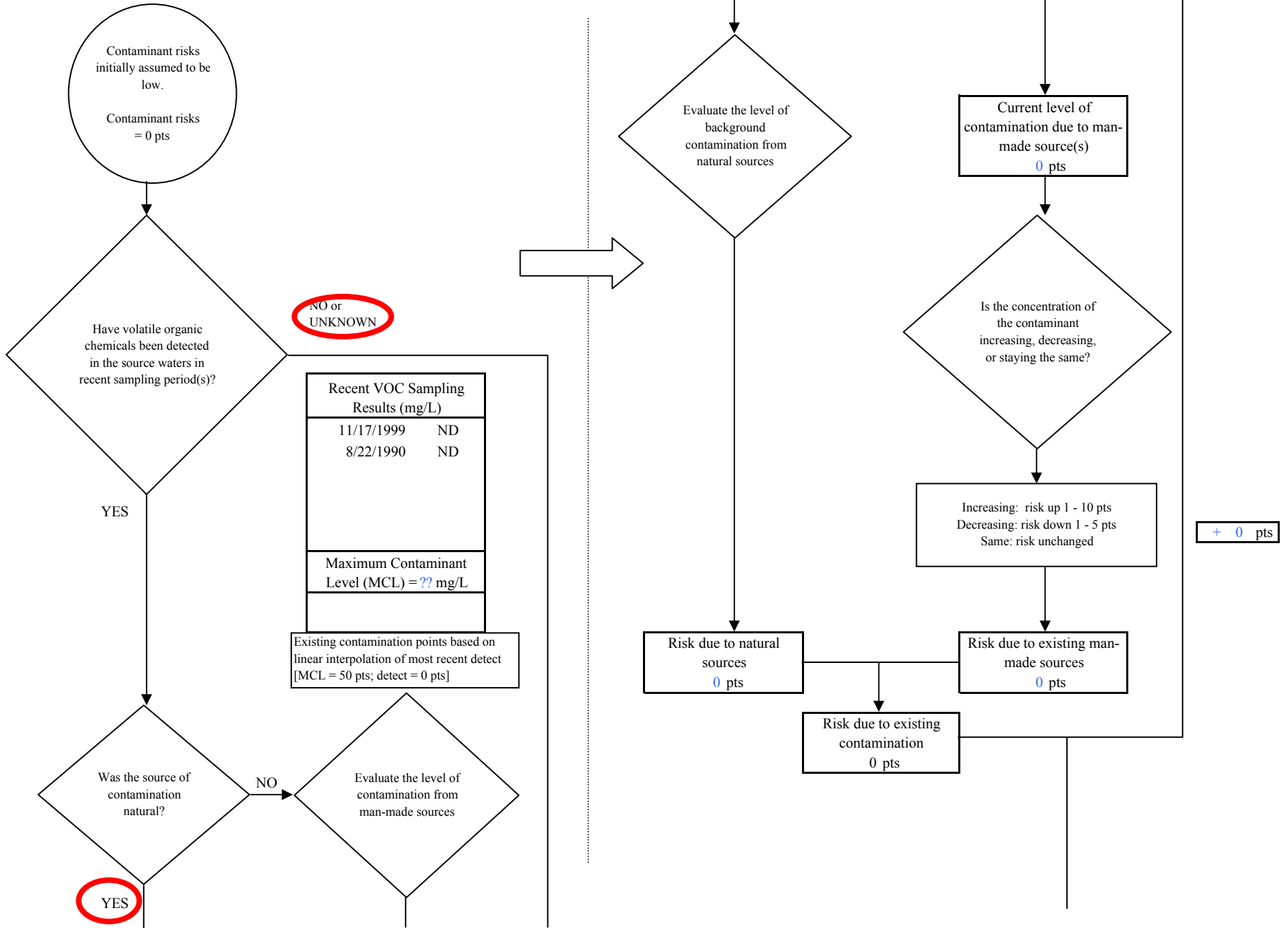
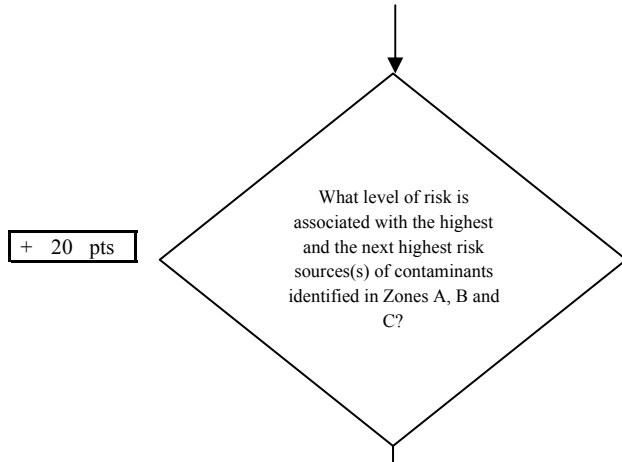


Chart 7. Contaminant risks for Peters Creek Terrace Apartments - Volatile Organic Chemicals



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	1	1
Low(s)	4	3	7

	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 20

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.

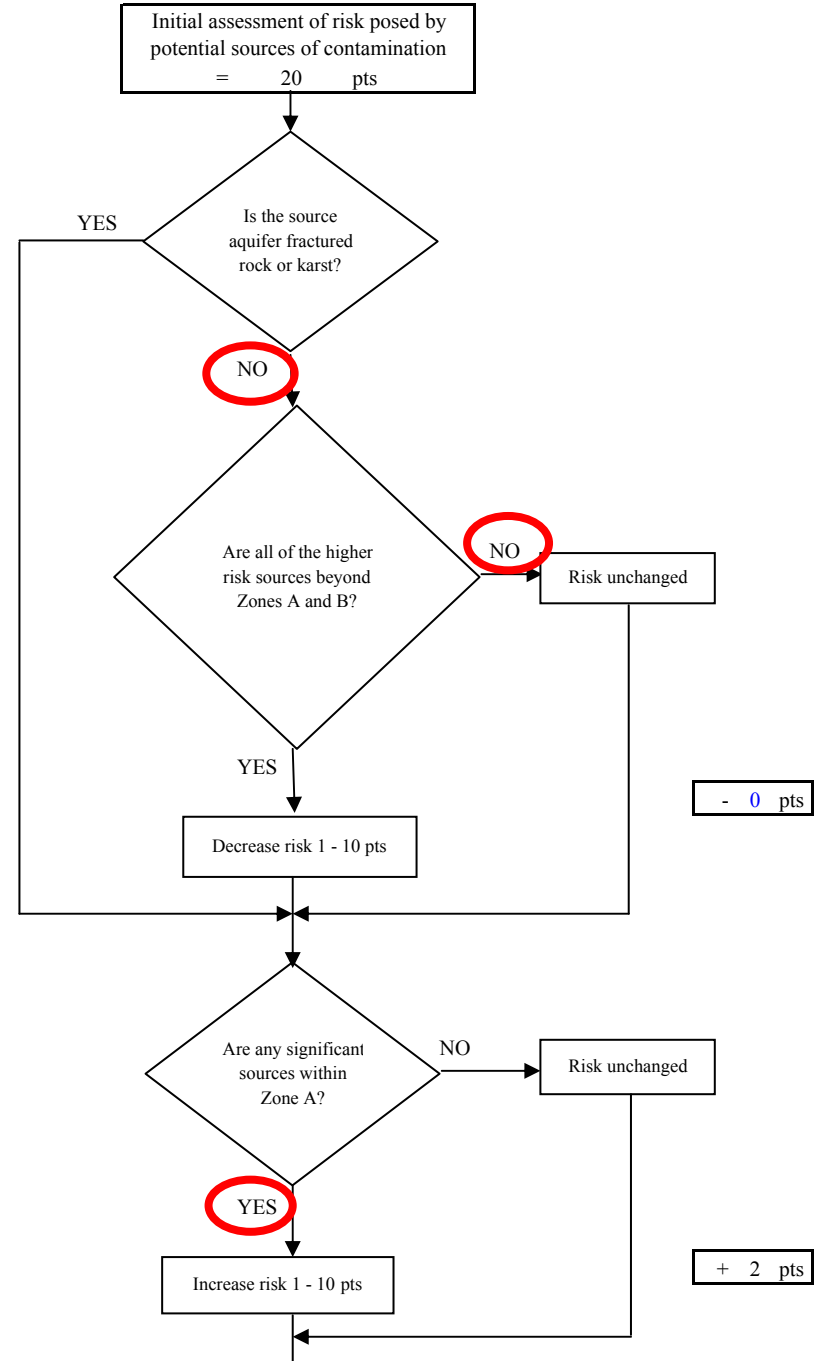
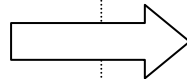


Chart 7. Contaminant risks for Peters Creek Terrace Apartments - Volatile Organic Chemicals

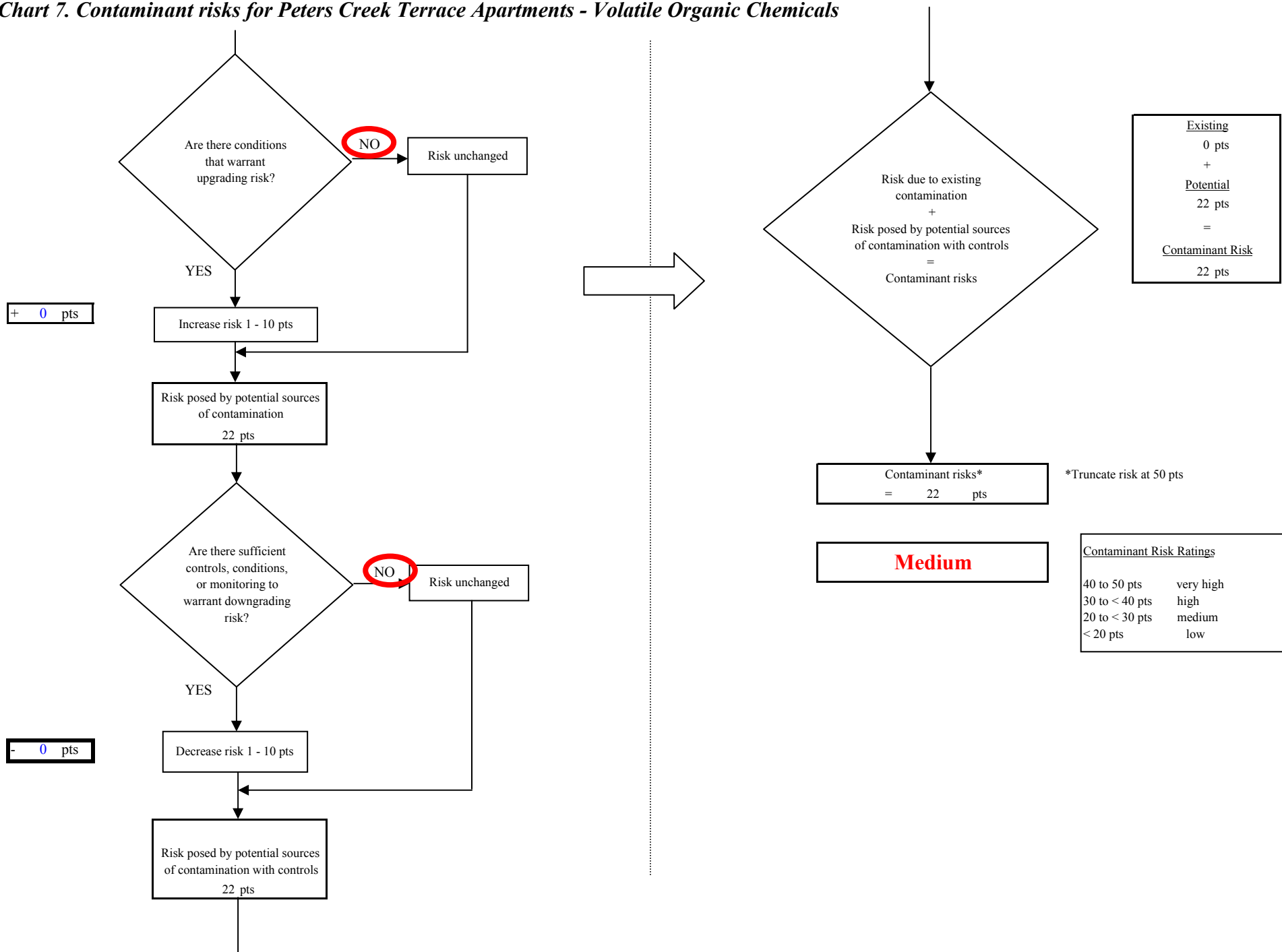


Chart 8. Vulnerability analysis for Peters Creek Terrace Apartments - Volatile Organic Chemicals

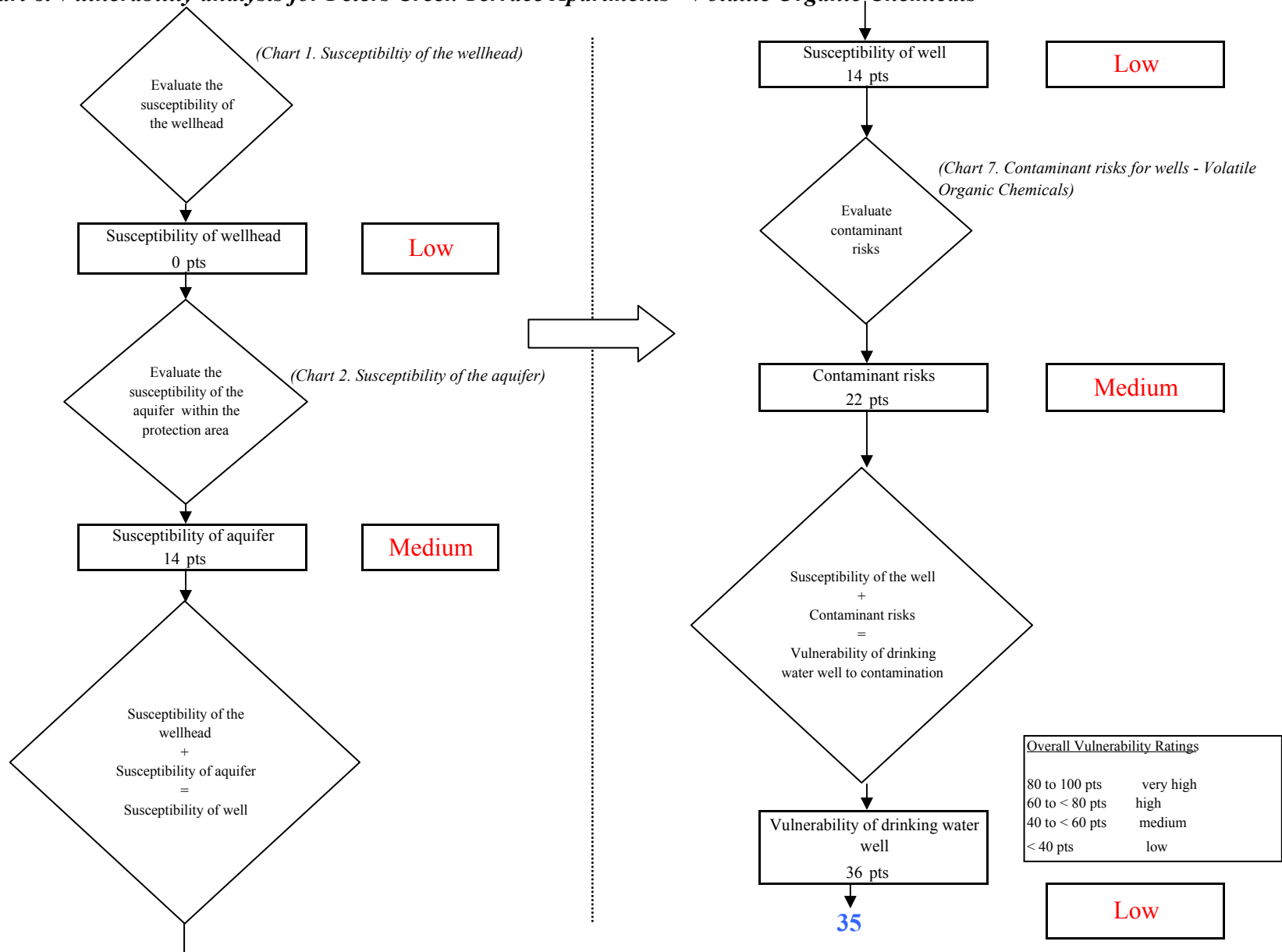


Chart 9. Contaminant risks for Peters Creek Terrace Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

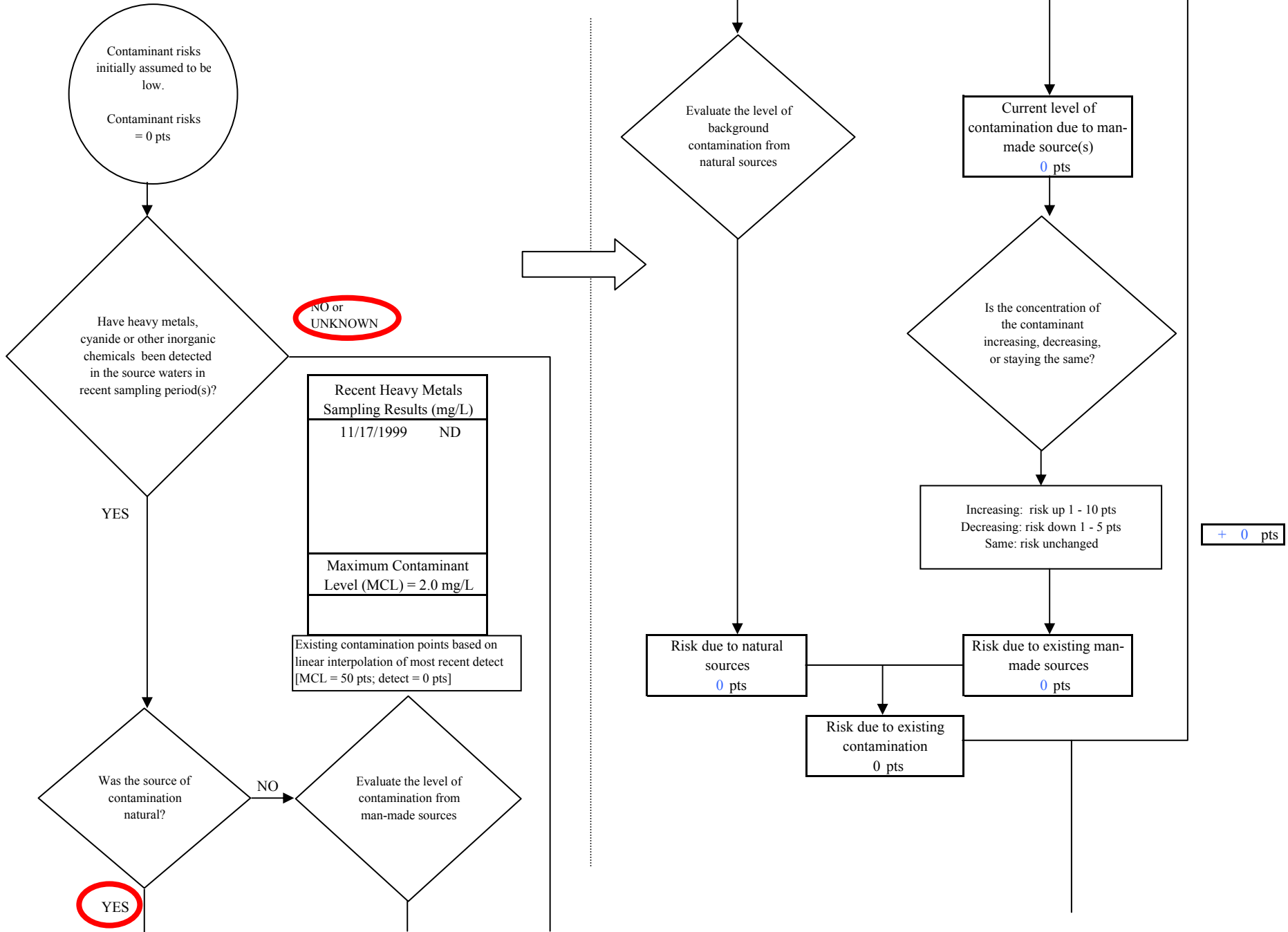
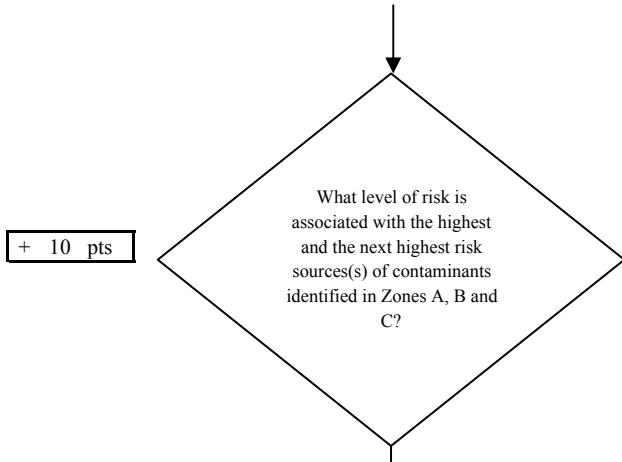


Chart 9. Contaminant risks for Peters Creek Terrace Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals



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	4	8

	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.

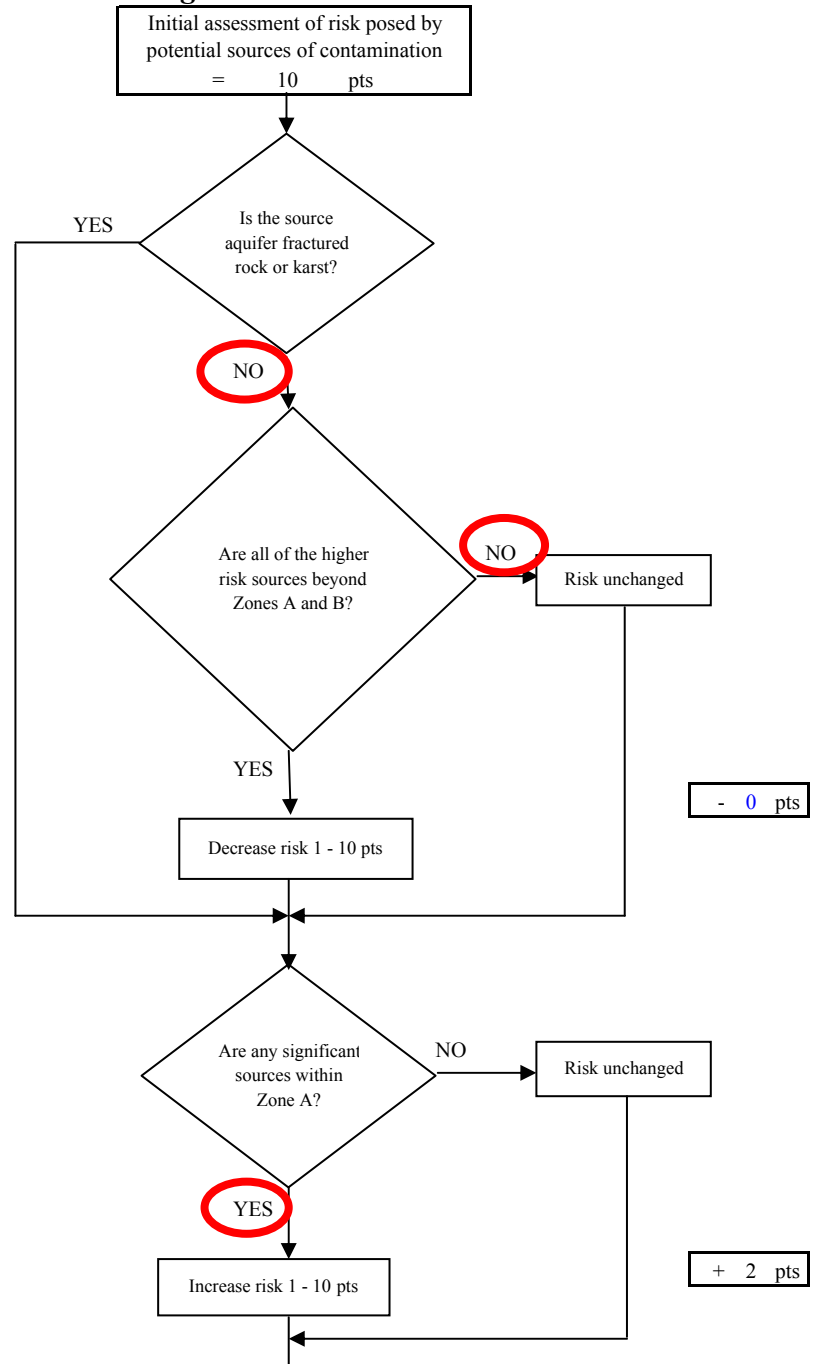
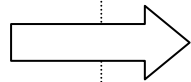


Chart 9. Contaminant risks for Peters Creek Terrace Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

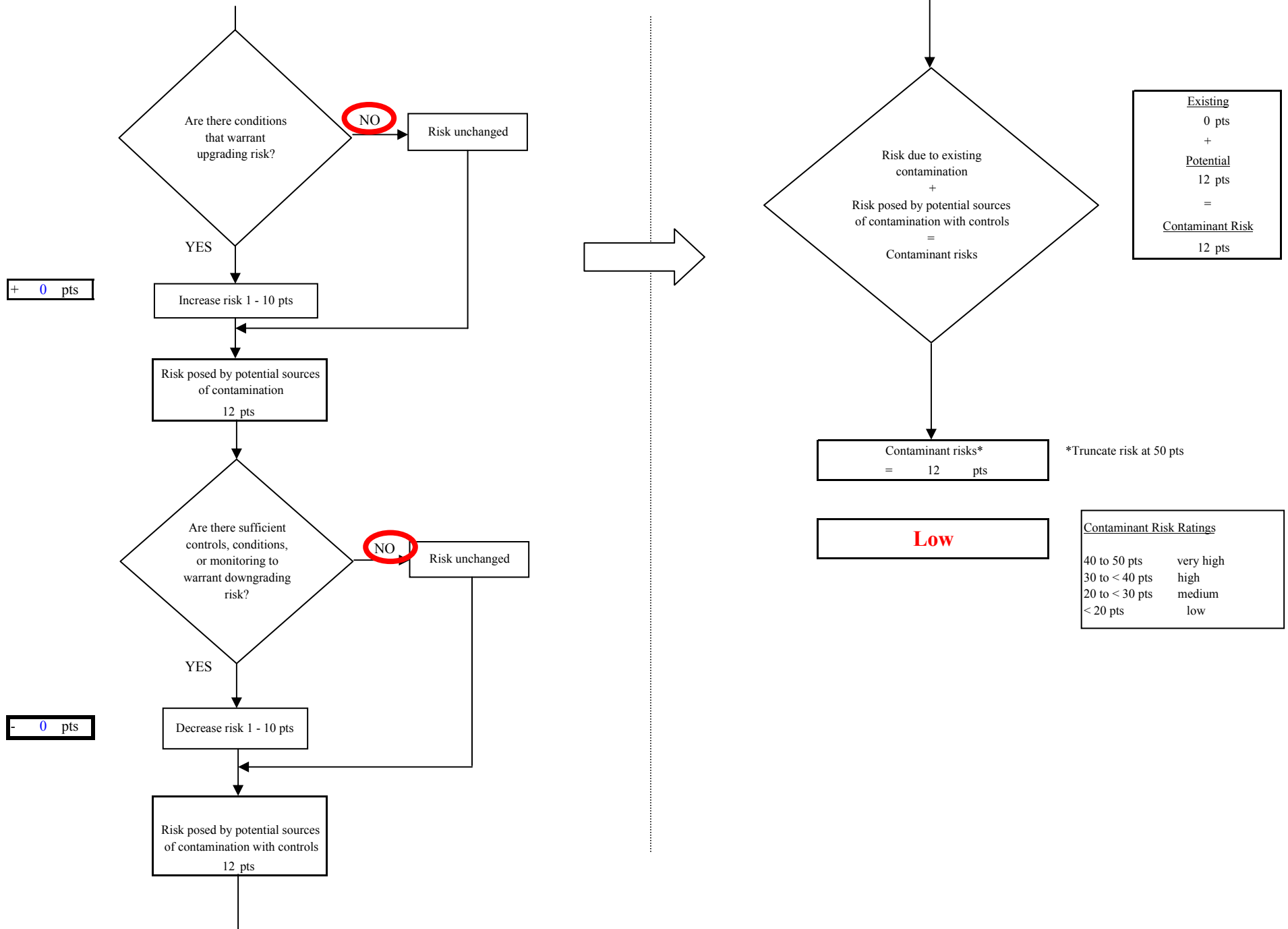


Chart 10. Vulnerability analysis for Peters Creek Terrace Apartments - Heavy Metals, Cyanide and Other Inorganic Chemicals

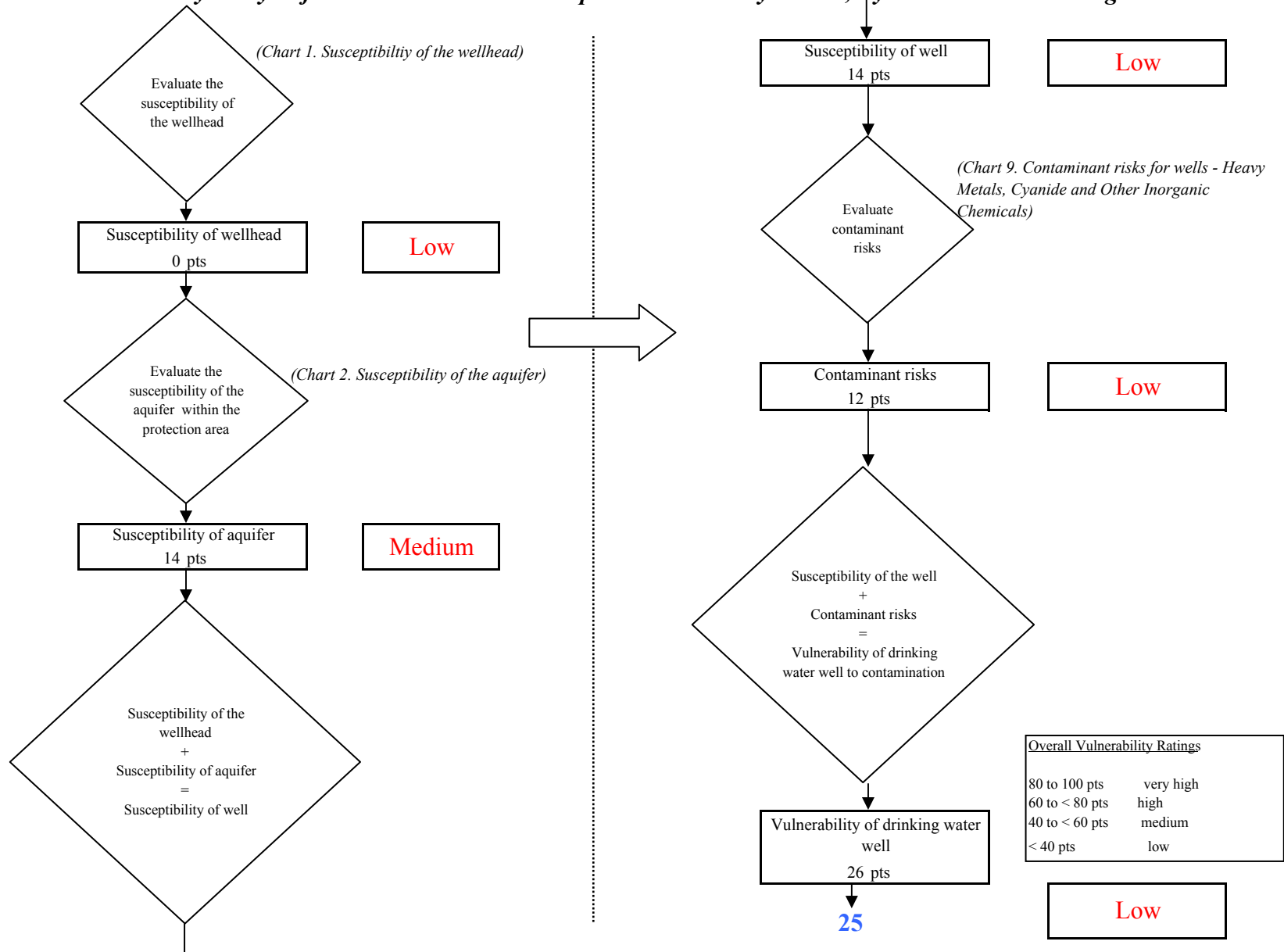


Chart 11. Contaminant risks for Peters Creek Terrace Apartments - Synthetic Organic Chemicals

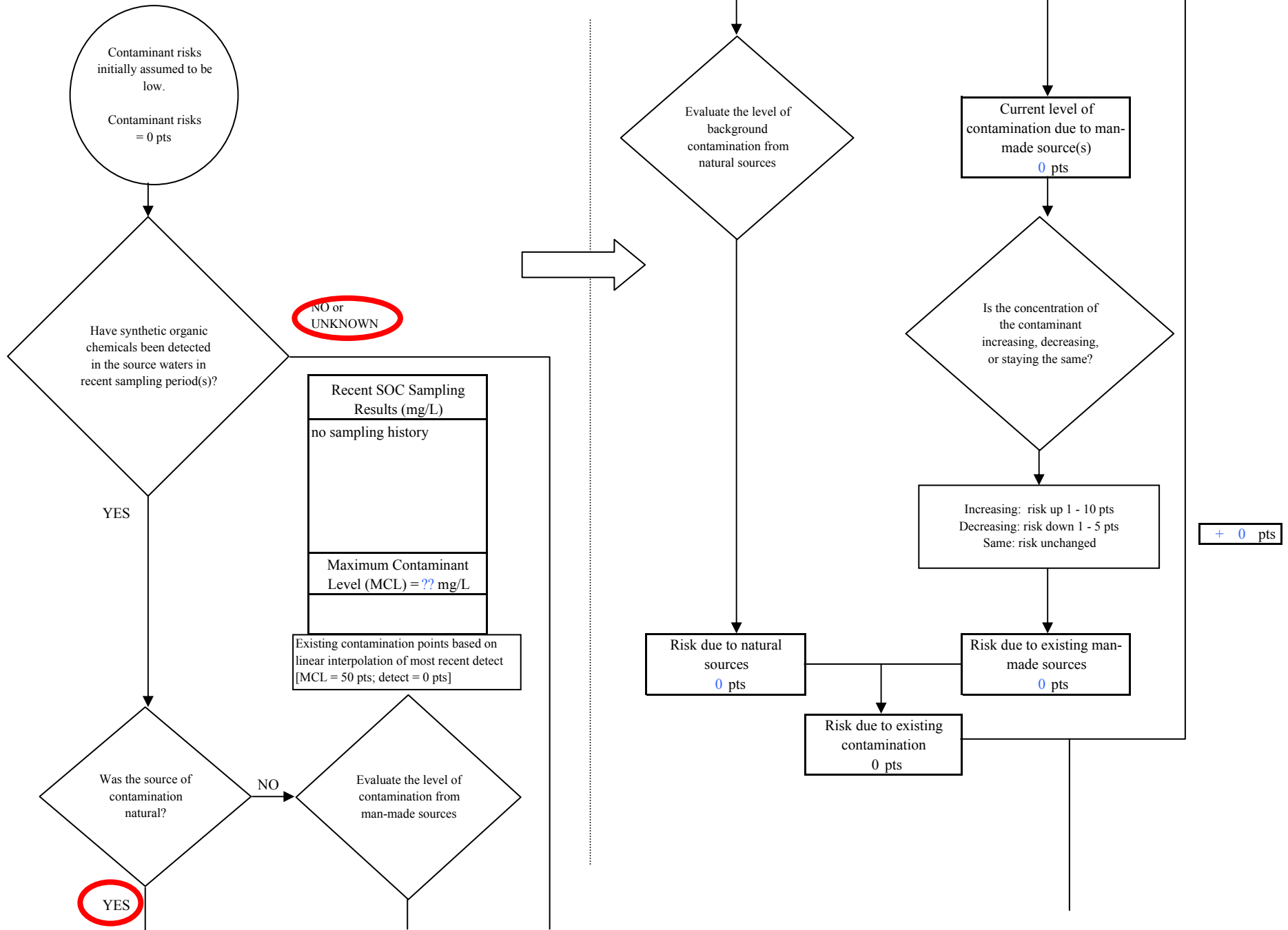
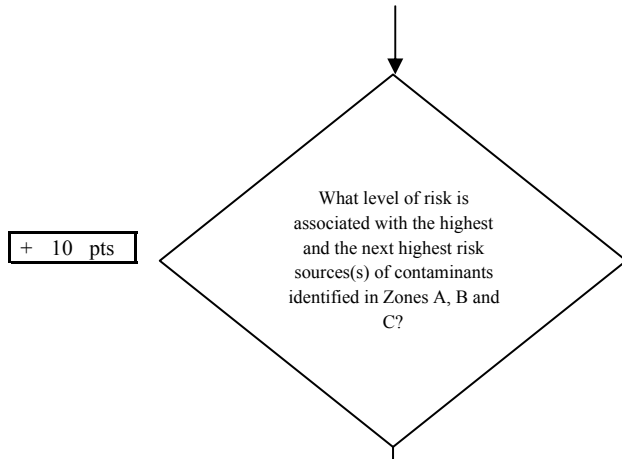


Chart 11. Contaminant risks for Peters Creek Terrace Apartments - Synthetic Organic Chemicals



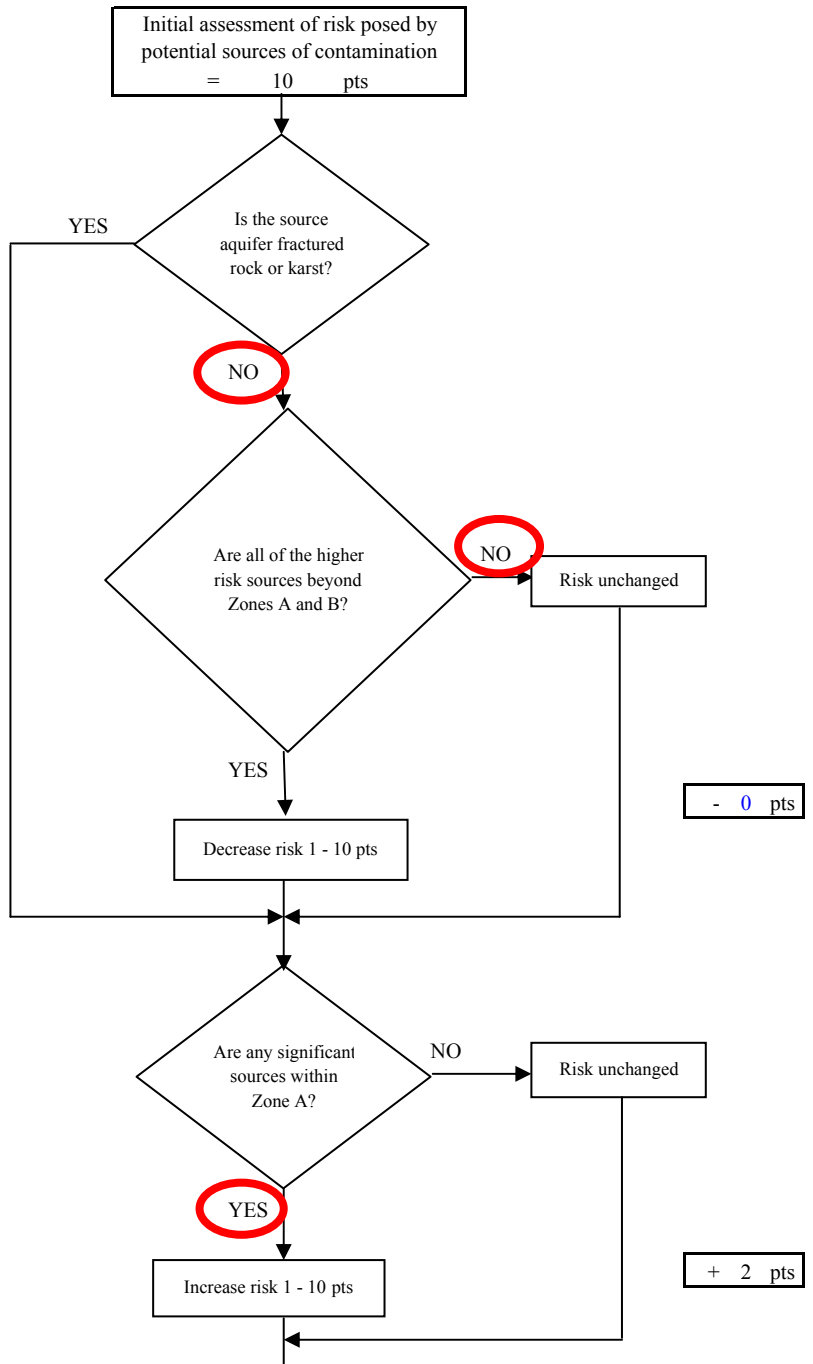
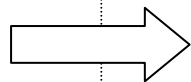
+ 10 pts

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)	3	2	5

	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.



- 0 pts

+ 2 pts

Chart 11. Contaminant risks for Peters Creek Terrace Apartments - Synthetic Organic Chemicals

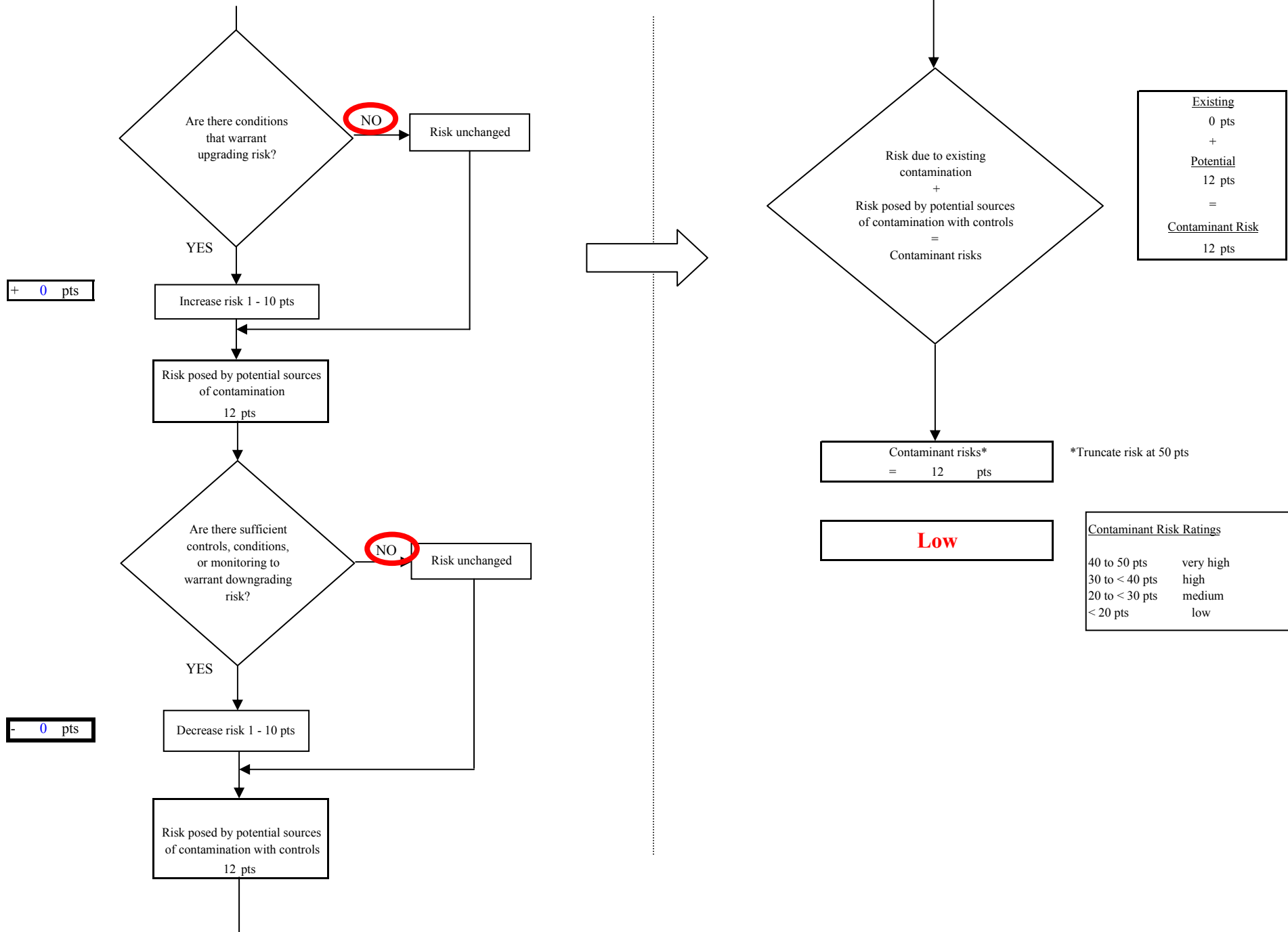


Chart 12. Vulnerability analysis for Peters Creek Terrace Apartments - Synthetic Organic Chemicals

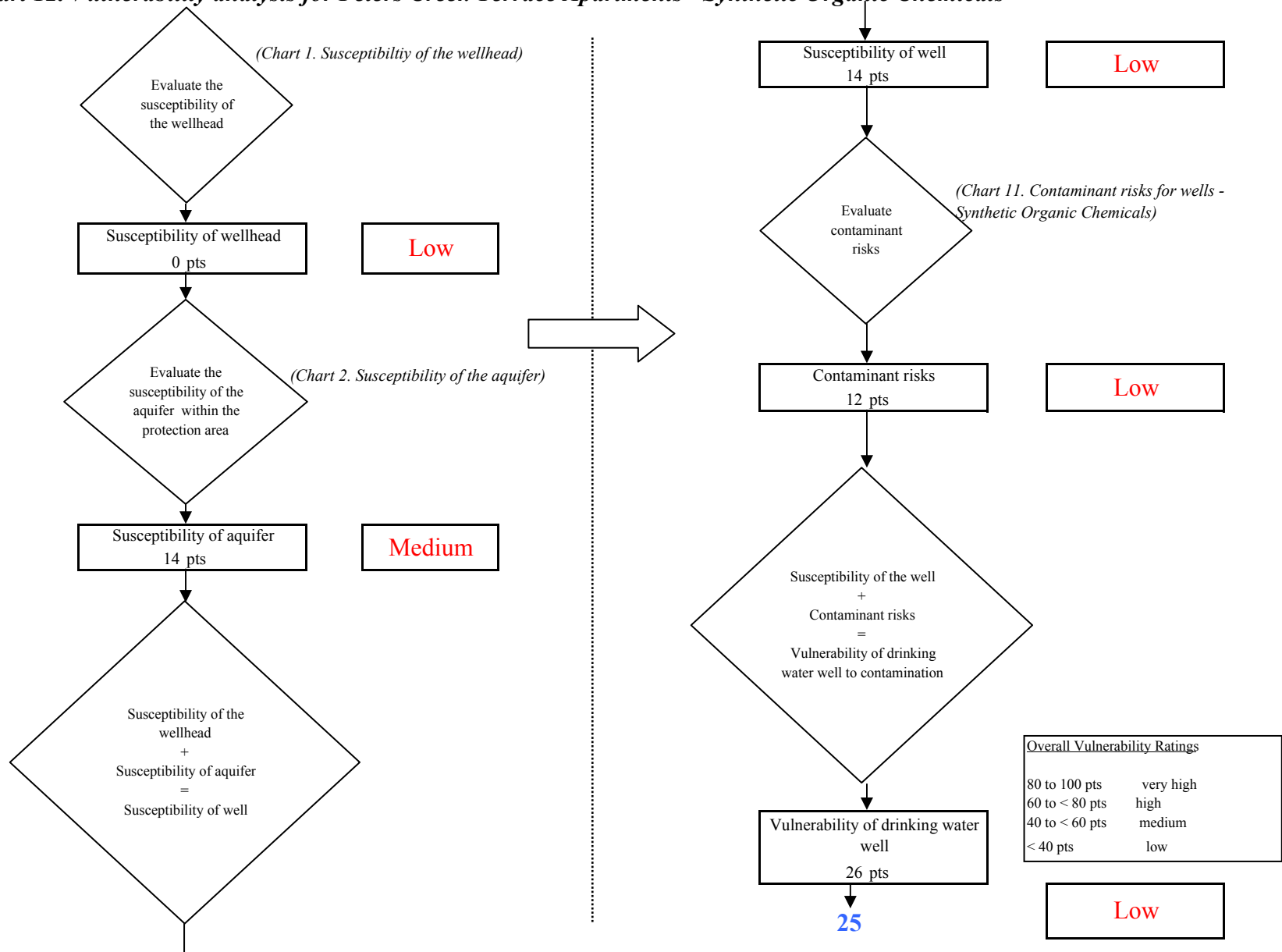


Chart 13. Contaminant risks for Peters Creek Terrace Apartments - Other Organic Chemicals

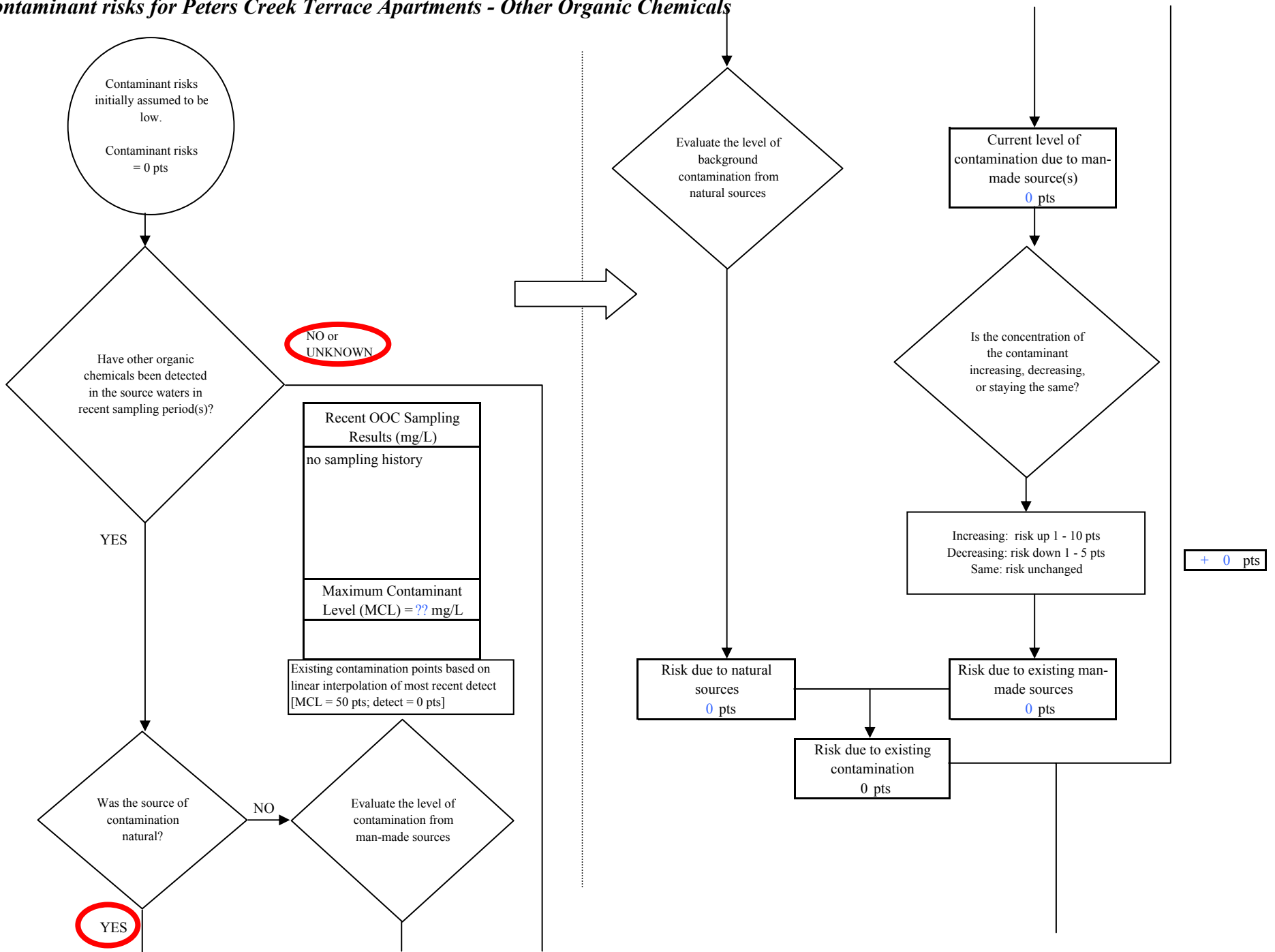
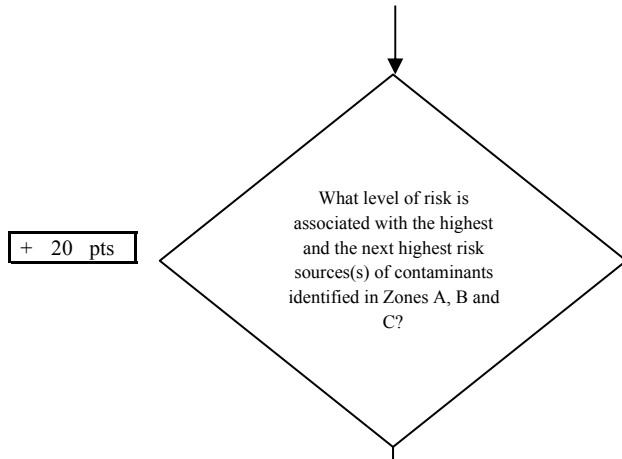


Chart 13. Contaminant risks for Peters Creek Terrace Apartments - Other Organic Chemicals



+ 20 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	1	1
Low(s)	4	3	7

	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 20

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.

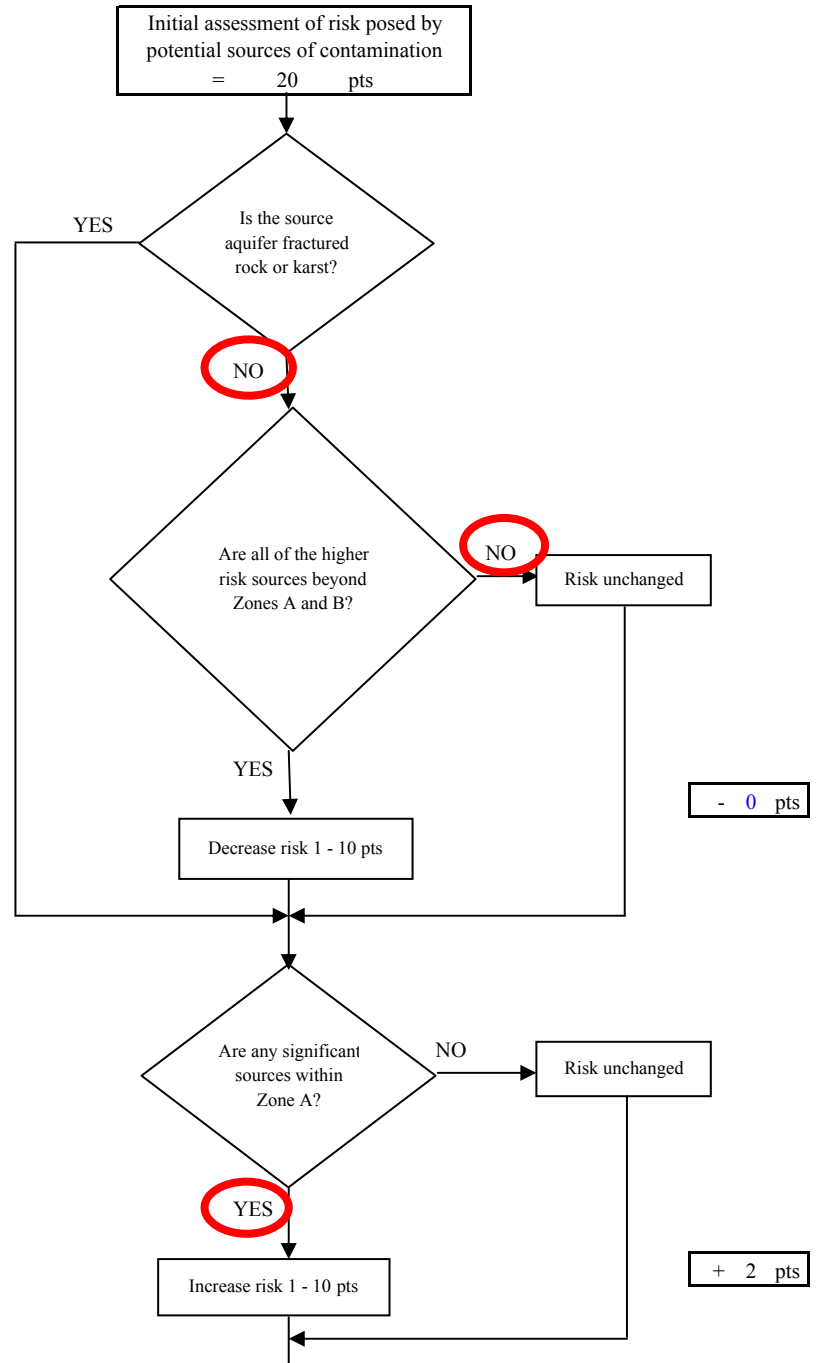
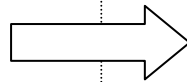


Chart 13. Contaminant risks for Peters Creek Terrace Apartments - Other Organic Chemicals

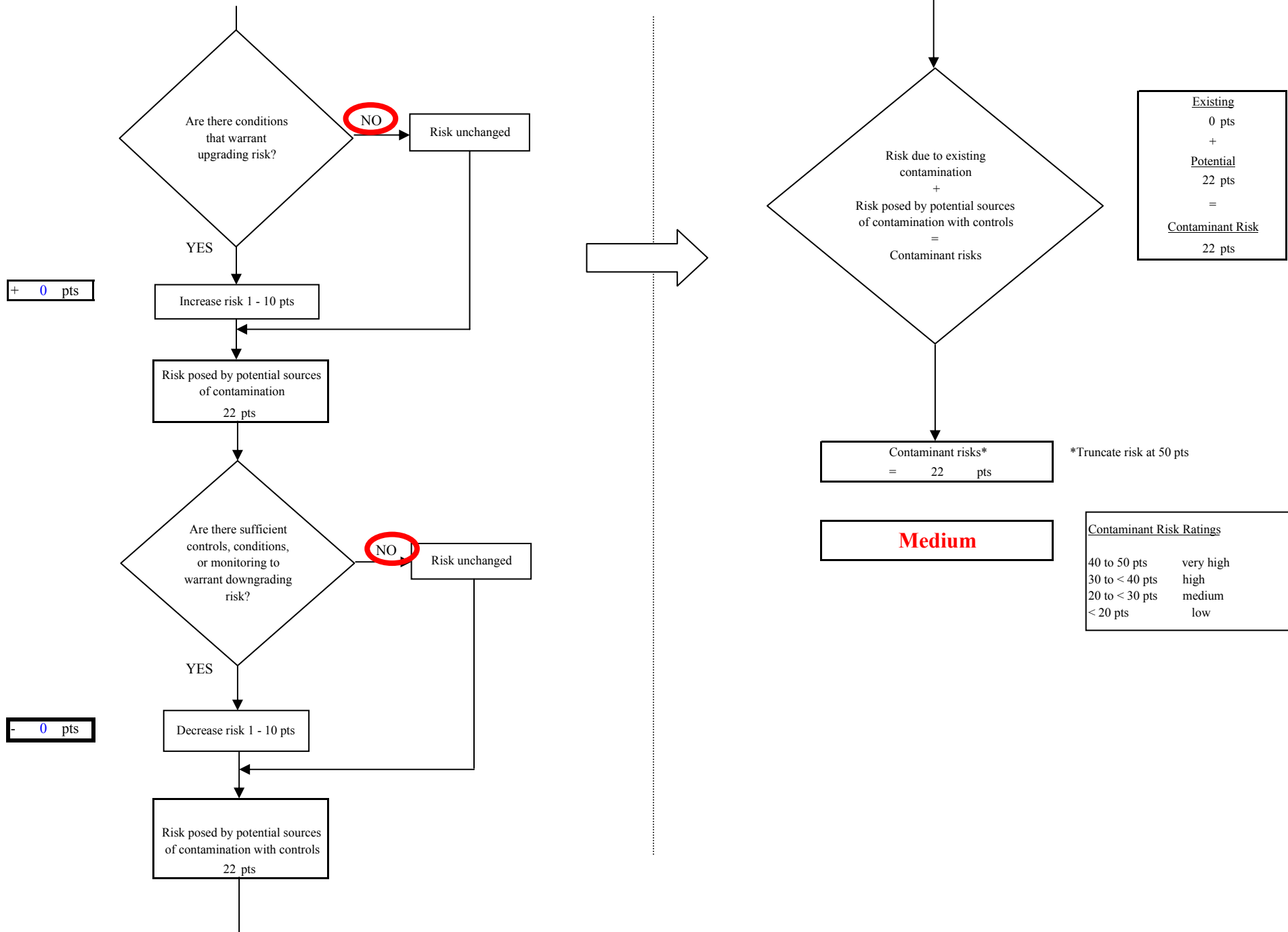


Chart 14. Vulnerability analysis for Peters Creek Terrace Apartments - Other Organic Chemicals

