Source Water Assessment for Sand Lake Services - Well #2 Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 425
PWSID 210485.002

April 2002

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By HEATHER A. HAMMOND

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The Drinking Water Protection Program is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

CONTENTS

TABLES

ILLUSTRATIONS

APPENDICES

Source Water Assessment for Sand Lake Services - Well #2, Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

By Heather A. Hammond

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Sand Lake Services - Well #2 is a Class A (community) water source and is a backup component of the greater Sand Lake Services water system. The Sand Lake Services community water system consists of three wells. Due to the location and position of the drinking water protection areas for each of the wells this Source Water Assessment focuses only on Well #2. Identified potential and current sources of contaminants that present the most significant risk to Well #2 includes approximately 170 acres of residential area, residential septic systems, sewer lines, roads, recreation trails, and a construction trade 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 drinking water source for Sand Lake Services - Well #2 received a vulnerability rating of **medium** for nitrates and/or nitrites and heavy metals; and **low** for bacteria and viruses, volatile organic chemicals, synthetic organic chemicals and other organic chemicals.

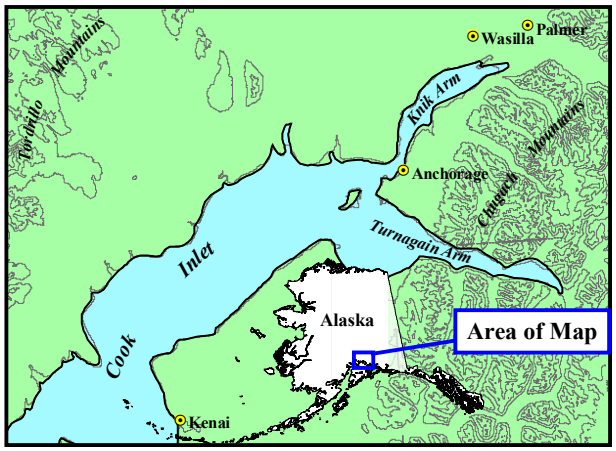

Figure 1. Index map showing the location of Anchorage, Alaska

INTRODUCTION

The purpose of this environmental 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. This assessment was completed for the source of public drinking water serving Sand Lake Services - Well #2. This water system consists of three wells in the Anchorage area (see Figure 1). This assessment, known under the Alaska Drinking Water Protection Program as the *Source Water Assessment*, has combined a review of the natural hydrogeologic sensitivity with potential and existing contaminant risks to arrive at an overall vulnerability of the drinking water source to contamination. This assessment has been completed as a basis for local voluntary protection efforts and to assist agencies in their efforts to reduce risk to this public drinking water supply.

DESCRIPTION OF THE ANCHORAGE AREA, ALASKA

Location

Anchorage, located in southcentral Alaska, encompasses 1,698 square miles of land and 264 square miles of water. The area containing a majority of the urban development, commonly referred to as the Anchorage Bowl, encompasses approximately 180 square miles [*Partick, Brabets, and Glass, 1989*] and envelopes the low lands of the area. This area is bounded on the east by the Chugach Mountains and the north, west, and south by the Knik and Turnagain Arm of Cook Inlet (Figure 1). In recent times, urban development has extended eastward along the flanks of the Chugach Mountains. This area, known locally as the Anchorage Hillside, contains development at elevations exceeding 3,700 feet in elevation above sea level.

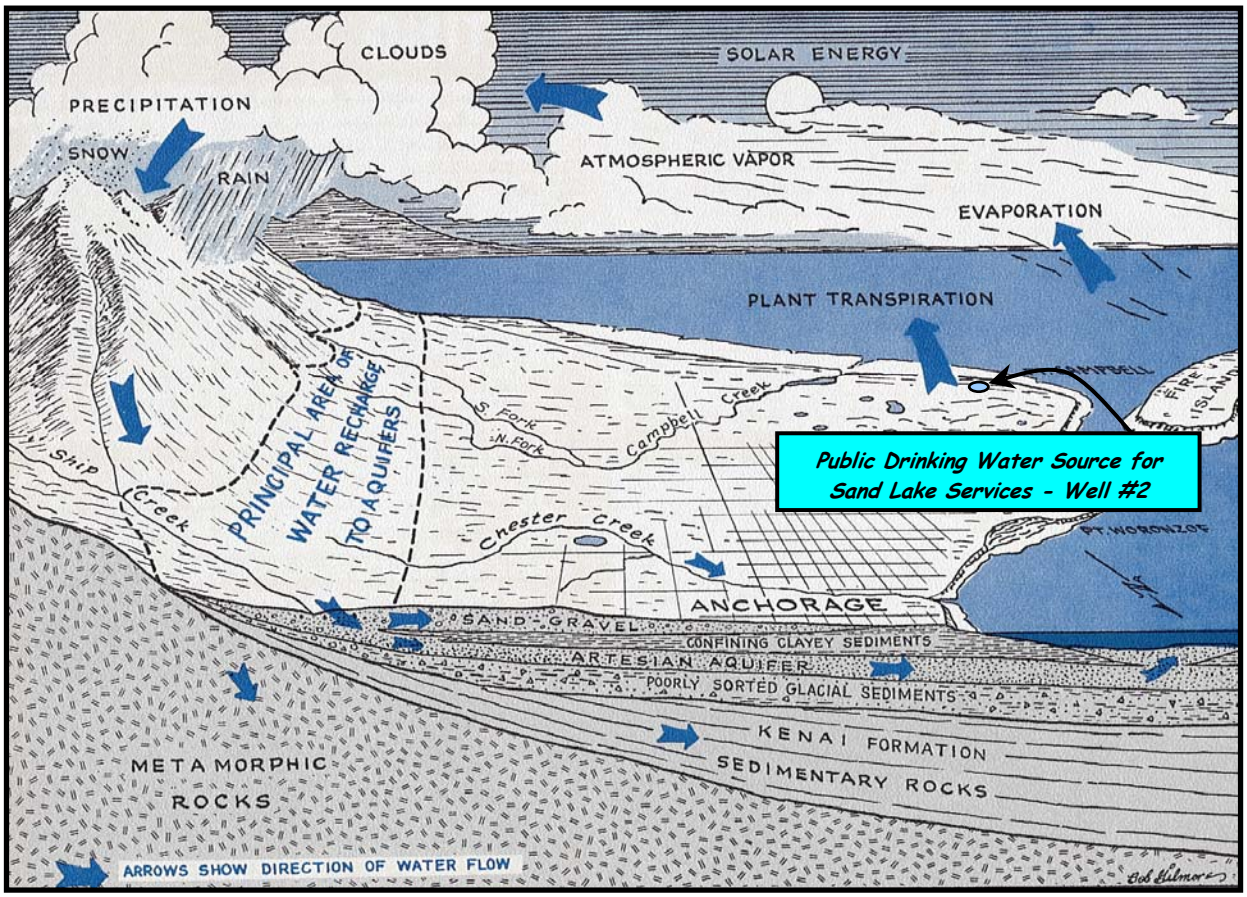

Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

Climate

The Anchorage area climate is somewhat transitional in that it does not experience large daily and annual temperature fluctuations like those experienced in the interior of Alaska nor does it experience high amounts of precipitation typified by gulf coast regions. Mean annual precipitation at the Anchorage International Airport is approximately 16 inches per year. On average, Anchorage receives a total snow accumulation of 69 inches per year. Precipitation generally increases inland toward the Chugach Mountains where annual precipitation may exceed 160 inches per year [*Barnwell, George, Dearborn, Weeks, and Zenone*, 1972]. Mean daily temperature ranges from 65^{o} F during July to 8^{o} F in January [*Western Regional Climate Center*, 2000].

Physiography and Groundwater Conditions

Surface elevations in the Anchorage area range from sea level at Knik and Turnagain Arms to well over 5,000 feet in the peaks that bound the area. Glacial moraine and outwash deposits primarily mantle the surface of the Anchorage Bowl.

The backbone of the Chugach Mountains is composed primarily of metamorphic marine and volcanic rocks (bedrock). These high peaks that bound Anchorage's east side are flanked with colluvium or slope deposits. These slope deposits eventually grade into the glacial and stream deposits at lower elevations in the Anchorage Bowl.

In the Anchorage area, two principal groundwater flow systems or aquifers exist (see Figure 2). The upper unconfined aquifer or water-table aquifer is separated from a lower confined aquifer system by layers of silty, clayey glacially derived sediments (confining layer) [*Ulery and Updike*, 1983]. The lower confined aquifer system consists of a series of hydrologically interconnected layers and lenses of gravel, sand and silt that, collectively, form the confined aquifer. The confining layer ranges from 0 to 270 feet thick throughout the Anchorage area and generally thins with increasing distance from Cook Inlet, thus pinching out at the mountain front [*Patrick, Brabets, and Glass*, 1989].

Water enters or recharges these two aquifer systems in several different ways. Along the front of the Chugach Mountains, groundwater seeps from fractures in bedrock into the sediments. At these higher elevations, rain and snowmelt also enters the sediments. This area along the

mountain front is considered the principal recharge area for wells in the Anchorage area. Precipitation in the low lands may also percolate directly into the ground. Lastly, aquifers may also be recharged by streams where surface water percolates into surrounding permeable sediments (losing reaches of streams). Groundwater flow in the confined aquifer is generally east to west from the mountain front toward Cook Inlet and Turnagain Arm, except in areas where the direction of flow is influenced by large municipal or industrial production wells. The direction of groundwater flow in the upper unconfined aquifer is more variable due to the influence from surfacial topography as well as its close connection with surface water bodies.

SAND LAKE SERVICES - WELL #2

Sand Lake Services Public Drinking Water System is a Class A (community) water system consisting of three wells. This Source Water Assessment focuses on Well #2, a backup source for the water system. Well #2 is located in Tract A of the Seacliff Plaza at an elevation of approximately 50 feet above sea level (see Figure 3). Installation of the well occurred January 27, 1976 to a total depth of 476 feet below ground surface and was completed in a 6-inch well casing. According to the most recent Sanitary Survey (10/26/98) the well is located in a pit that was approved in 1992 by ADEC. The well casing extends over 3 feet above the pit. The concrete floor of the pit seals tightly around the well casing and no major cracks were noted at the time the Sanitary Survey was performed. The well site is properly drained so that foreign matter and surface water are diverted away from the well. There was no mention of grouting in the well log or the Sanitary Survey. Therefore, it is suspected that grouting was not applied at the time of drilling. Proper grouting can provide added protection against contaminants traveling from the ground surface and along the well casing into source waters.

This system operates year round and serves approximately 465 residents through 110 service connections.

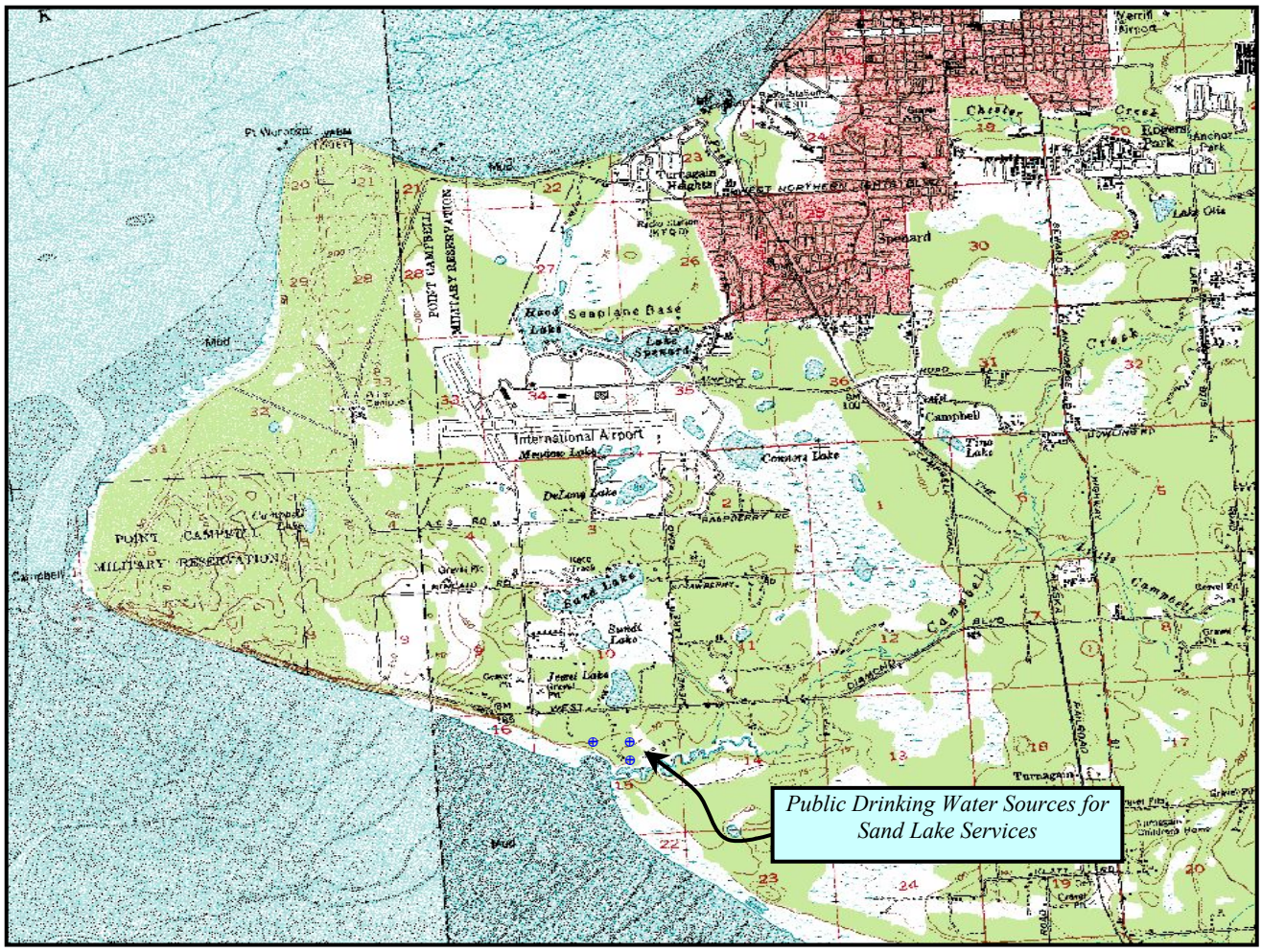

Figure 3. Map showing the location of the drinking water sources for Sand Lake Services - Well #2 [Base: USGS Tyonek A1].

ASSESSMENT AND PROTECTION AREA FOR SAND LAKE SERVICES - WELL #2

The Drinking Water Protection and Assessment Area that has been established for Sand Lake Services - Well #2 is the area that is most sensitive to contamination. This area serves as a basis for assessing the risk of the drinking water source to contamination. The zones around the drinking water source outline the most critical area for the preservation of the quality of the drinking water for this system. For simplicity, this area will be known as your Drinking Water Protection Area and will serve as the focus for voluntary protection efforts.

Conceptually, groundwater enters the aquifer systems along the front range of the Chugach Mountains (Figure 2) and flows toward Cook Inlet. An analytical calculation was used to determine the size and shape of the area that contributes water to the well. 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*]. This analytical calculation was used as a guide as the first step in establishing the protection area for each public drinking water source in Anchorage. Additional methods were further employed to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at meaningful and conservative protection areas with respect to public health (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The Drinking Water Protection Areas established for wells by the Alaska Department of Environmental Conservation are separated into zones. These zones correspond to a time-of-travel. Time-of-travel is the time required for water to move in the saturated zone of the ground from a specific point to the well. The Drinking Water Protection Area for Sand Lake Services - Well #2 contains four zones, Zone A through Zone D (See Map 1 in Appendix A). Zone A corresponds to the area between the wells and the distance equal to ¼ of the distance of the 2-year time-of-travel. Depending on where a contaminant source is located within Zone A, travel time for a contaminant to the wells may be on the order of several days to several hours. Zone A also extends downgradient from the wells to take into account the area of the aquifer that is influenced by pumping of the wells. Zone B corresponds to a time-of-travel of less than two years. Zones C and D correspond to those areas between 5 years and 10 years time-of-travel, respectively.

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 Drinking Water Protection Area for Sand Lake Services - Well #2. This survey was completed through a search of agency records and other publicly available information. Potential sources of contamination to drinking water supplies cover 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 this assessment and 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
- Other organic chemicals

Maps 2 and 3 in Appendix C depict the Contaminant Source Inventory for Sand Lake Services - Well #2. Table 1 in Appendix B lists the inventoried potential sources of contamination within Zones A through D. Below is a summary of the contaminant sources inventoried:

- Approximately 170 acres of residential area;
- residential septic systems;
- sewer lines;
- roads;
- recreation trails;
- a construction trade area;

These potential and existing contaminant sources present the most significant risk for all six categories, respectively.

RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been identified, 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. Contaminant risks are further a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the public drinking water wells.

VULNERABILITY OF SAND LAKE SERVICES - WELL #2

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 have been analyzed and an overall vulnerability score of 0 to 100 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)

According to the well log the well was completed in a confined aquifer to a total depth of 476 feet below ground surface and had a static water level of 73 feet below ground surface at the time of drilling (01/27/76). The depth to the top of the confining layer is approximately 90 feet below ground surface and consists of a layer of blue silty clay and has a thickness of approximately 100 feet. This confining layer may provide a protective barrier against the movement of contaminants in the subsurface. However, near the base of the Chugach Mountains, these clay layers tend to be discontinuous and thin toward the mountains. Therefore, contaminants that enter the subsurface near the base of the mountains may enter the confined aquifer uninhibited by the absence of any protective layer.

Combining the susceptibility of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility of the well to contamination (See Appendix D). Table 1 depicts the overall Susceptibility score and rating for Sand Lake Services - Well #2.

Table 1. Natural Susceptibility - Susceptibility of the Wellhead and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	9	Low
Natural Susceptibility	14	Low

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (See Appendix B - Table 1 – Table 7). This portion of the analysis examines any existing or historical contamination that has been detected at the drinking water source through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the well. Table 2 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 2. Contaminant Risks to Sand Lake Services - Well #2

Contaminant Risks	Score	Rating
Bacteria and Viruses	12	Low
Nitrates and/or Nitrites	31	High
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, And Other Inorganic Chemicals	29	Medium
Synthetic Organic Chemicals	22	Medium
Other Organic Chemicals	12	Low

Appendix D contains fourteen charts, which together form the 'Vulnerability Analysis' for a Class A public drinking water system. 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 Analysis for nitrates and nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

Vulnerability of drinking water sources to contamination is the combination of susceptibility of the aquifer and the well with contaminant risks. Table 3 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants (See Appendix D). Note: scores are rounded off to the nearest five.

Table 3. Overall Vulnerability of Sand Lake Services - Well #2 to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	25	Low
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	25	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	45	Medium
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	25	Low

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, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

The contaminant risk for bacteria and viruses is low with residential areas, sewer lines, and septic systems presenting the most significant risk to the drinking water well. After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamiantion is low from bacteria and viurses.

Review of the historical sampling data indicates that no bacteria and viruses have been detected in Sand Lake Services - Well #2 within the past 5 years (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminanted 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].

Sampling history for Sand Lake Services - Well #2 indicates that low concentrations of nitrates have been detected in source waters (See Chart 5 – Contaminant Risks for Nitrates and/or Nitrites in Appendix D). The most recent nitrate detection occurred August 8, 2002 with a concentration of approximately 8% of the Maximum Contaminant Level or MCL. 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. Though existing nitrate contamination was detected at the site, concentrations remain at very safe levels with respect to human health.

The contaminant risk for nitrates and/or nitrites is high with residential areas, residential septic systems, sewer lines, and parks and recreation trails presenting the most significant risk to the drinking water source. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability of the well to contamination is medium from nitrates and/or nitrates.

The contaminant risk for volatile organic chemicals is low with residential areas, sewer lines, roads, and residential septic systems presenting the most significant risk to the drinking water well. Due to the potential for fuel spills to occur, roads ranked as a low source of contamination to the drinking water source for volatile organic chemicals. Combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamiantion is low from volatile organic chemicals.

Review of the historical sampling data indicates that no volatile organic chemical contamination has been detected in Sand Lake Services - Well #2 (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

The contaminant risk for heavy metals and other organic chemicals is medium with residential areas, roads, sewer lines, residential septic systems, a park, and a construction trade area presenting the most significant risk to the drinking water well.

The presence of existing contamination also contributes to the overall risk for other inorganic chemicals. Recent historical sampling indicates that arsenic was detected at very low levels. Sampling done on 10/01/01 detected arsenic at 0.00145 mg/l or 15% of the MCL of 0.01 mg/l and barium at 0.0418mg/l or <1% MCL (See Chart 9 – Contaminant Risks for Heavy Metals and Other Inorganic Chemicals in Appendix D). Combining the contaminant risk with the natural susceptibility of the well leads to an overall vulnerability to heavy metals and inorganic chemical contamination of medium.

According to the EPA "arsenic occurs naturally in rocks and soil, water, air, and plants and animals. It can be further released into the environment through natural activities such as volcanic action, erosion of rocks, and forest fires, or through human actions. Approximately 90 percent of industrial arsenic in the U.S. is currently used as a wood preservative, but arsenic is also used in paints, dyes, metals, drugs, soaps, and semi-conductors. Agricultural applications, mining, and smelting also contribute to arsenic releases in the environment." (EPA, 2001) Since there are no known sources of arsenic, it is likely that the arsenic detected at Sand Lake Services - Well #2 is naturally occurring.

Studies have linked long-term exposure to arsenic in drinking water to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Non-cancer effects of ingesting arsenic include cardiovascular, pulmonary, immunological, neurological, and endocrine (e.g., diabetes) effects. Short-term exposure to high doses of arsenic can cause other adverse health effects, but such effects are unlikely to occur from U.S. public water supplies that are in compliance with the previous arsenic standard of 0.05 mg/l (EPA, 2001). The levels of arsenic detected at Best View RV and Trailer Park are considered safe for human consumption.

Barium is a lustrous metal, which exists in nature in ores containing mixtures of elements. It is used in making a wide variety of electronic components, in metal alloys, bleaches, dyes, fireworks, ceramics and glass. In particular, it is used in well drilling operations where it is directly released into the ground (USEPA, 2002).
The EPA has found barium to potentially cause gastrointestinal disturbances and muscular weakness at levels above the MCL when exposed for relatively short periods of time. Long term exposure above the MCL has the potential to cause high blood pressure (USEPA, 2002).

Not enough information is exists to determine where the barium originates. However, due to the low levels it is highly likely that it is from natural sources. The levels of barium and chromium are very low and are considered safe for human consumption.

The contaminant risk for synthetic organic chemicals is medium and other organic chemicals is low with residential areas, sewer lines, residential septic systems, a park, and roads presenting the most significant risk to the drinking water well. Combining the contaminant risk for synthetic organic chemicals and other organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamiantion from both contaminant categories is low.

Review of the historical sampling data indicates that no synthetic organic chemicals or other organic chemicals have been detected in Sand Lake Services - Well #2 within the past 5 years (See Charts 11 and 13 – Contaminant Risks for Synthetic Organic Chemicals and Other Organic Chemicals in Appendix D, respectively).

SUMMARY

A *Source Water Assessment* has been completed for Sand Lake Services - Well #2. The overall vulnerability of this water source to contamination is **medium** for nitrates and/or nitrites and heavy metals; and **low** for bacterial and viruses, volatile organic chemicals, synthetic organic chemicals and other organic chemicals. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for continuous efforts on the part of Sand Lake Services 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 Sand Lake Services - Well #2.

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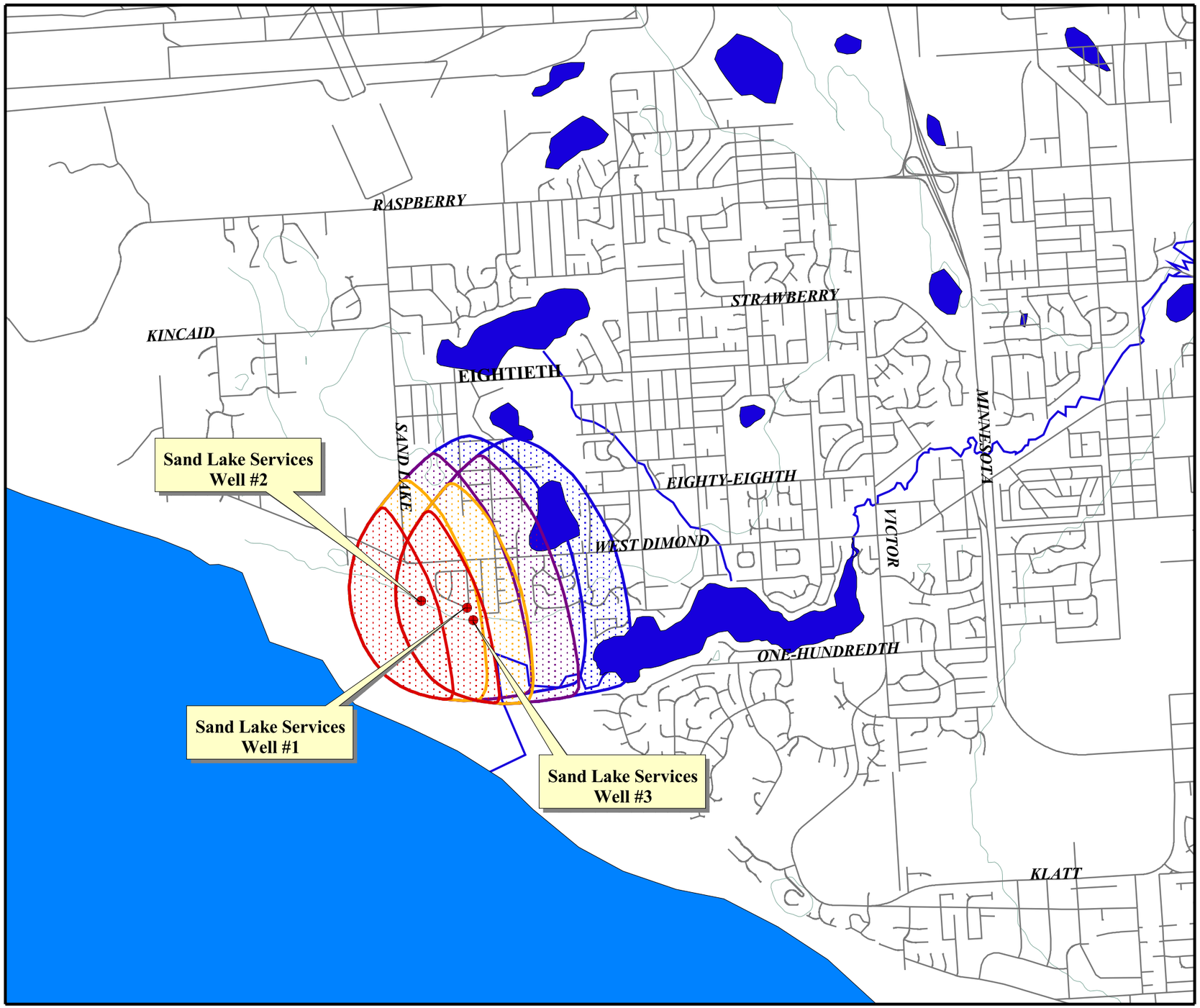
APPENDIX A

Drinking Water Protection Area for Sand Lake Services - Well #2

Drinking Water Protection Area for Sand Lake Services



- Drinking Water Sources for Sand Lake Services

Zone A Protection Area
- Several Months Travel Time

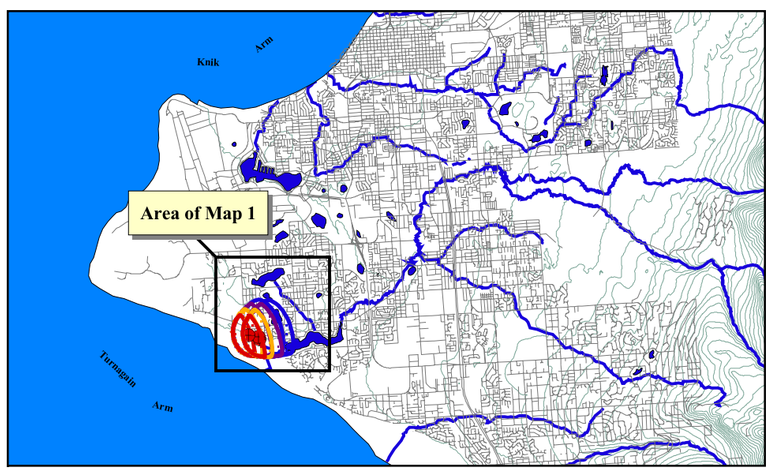
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

- Anchorage Roads
- Anchorage Lakes
- Cook Inlet Water
- Anchorage Streams
- Elevation Contours

N W E S



4000 0 4000 8000 Feet

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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Well #2

Table 1

Contaminant Source Inventory for
Sand Lake Services - Secondary

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	West Dimond Blvd.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Sand Lake Road	2	
Dog walking areas/foot trails	X46	X46-1	A	Trail along the south side of Dimond Blvd.	2	
Dog walking areas/foot trails	X46	X46-2	A	Trail intersecting Zone A through C	2	
Dog walking areas/foot trails	X46	X46-3	A	Trail along the west side of Sand Lake Road	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Near Endicott Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Between Kavik Street and Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Along Emerald Street	3	
Residential Areas	R01	R1-2	B	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1	B	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-3	B	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-4	B	Along Jaclaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Along Jaccaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-7	B	Along Endicott Street	2	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Shorecrest Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Jaclaire Lane	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Ninety-Fourth Court	2	
Construction trade areas and materials	C09	C9-1	C	Off of Emerald Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Along Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Along Catkin Circle	3	
Residential Areas	R01	R1-3	C	Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-7-9	C	Septics located within Zone C	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7-18	C	Roads located within Zone C	2	

Table 2

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Bacteria and Viruses

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1	B	Low	3	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Low	4	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-3	B	Low	5	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-4	B	Low	6	Along Jaclaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Low	7	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Low	8	Along Jaccaire Lane	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Medium	9	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Medium	10	Near Endicott Street	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		West Dimond Blvd.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Sand Lake Road	2	
Dog walking areas/foot trails	X46	X46-1	A	Low		Trail along the south side of Dimond Blvd.	2	
Dog walking areas/foot trails	X46	X46-2	A	Low		Trail intersecting Zone A through C	2	
Dog walking areas/foot trails	X46	X46-3	A	Low		Trail along the west side of Sand Lake Road	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Medium		Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Medium		Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Medium		Between Kavik Street and Jade Street	3	

Table 2 (continued)

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Bacteria and Viruses

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Medium		Along Emerald Street	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Along Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Shorecrest Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Jaclaire Lane	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Ninety-Fourth Court	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Medium		Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Medium		Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Medium		Along Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Medium		Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Medium		Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Medium		Along Catkin Circle	3	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-7-9	C	Low		Septics located within Zone C	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7-18	C	Low		Roads located within Zone C	2	

Table 3

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Nitrates/Nitrites

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1	B	Low	3	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Low	4	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-3	B	Low	5	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-4	B	Low	6	Along Jaclaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Low	7	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Low	8	Along Jaccaire Lane	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Medium	9	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Medium	10	Near Endicott Street	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		West Dimond Blvd.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low		Sand Lake Road	2	
Dog walking areas/foot trails	X46	X46-1	A	Low		Trail along the south side of Dimond Blvd.	2	
Dog walking areas/foot trails	X46	X46-2	A	Low		Trail intersecting Zone A through C	2	
Dog walking areas/foot trails	X46	X46-3	A	Low		Trail along the west side of Sand Lake Road	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Medium		Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Medium		Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Medium		Between Kavik Street and Jade Street	3	

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Nitrates/Nitrites

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Medium		Along Emerald Street	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Along Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Shorecrest Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Jaclaire Lane	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Ninety-Fourth Court	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Medium		Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Medium		Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Medium		Along Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Medium		Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Medium		Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Medium		Along Catkin Circle	3	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-7-9	C	Low		Septics located within Zone C	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7-18	C	Low		Roads located within Zone C	2	

Table 4

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Volatile Organic Chemicals

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Low	3	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low	4	Near Endicott Street	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	5	West Dimond Blvd.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	6	Sand Lake Road	2	
Septic systems (serves one single-family home)	R02	R2-1	B	Low	7	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Low	8	Along Shorecrest Drive	2	
Residential Areas	R01	R1-3	C	Low	9	Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-4	B	Low	10	Along Jaclaire Lane	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low		Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low		Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Between Kavik Street and Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Along Emerald Street	3	
Septic systems (serves one single-family home)	R02	R2-3	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		Along Jaccaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Along Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Shorecrest Drive	2	

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Volatile Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Jaclaire Lane	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Ninety-Fourth Court	2	
Construction trade areas and materials	C09	C9-1	C	Low		Off of Emerald Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Low		Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Low		Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Low		Along Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Low		Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Low		Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Low		Along Catkin Circle	3	
Septic systems (serves one single-family home)	R02	R2-7-9	C	Low		Septics located within Zone C	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7-18	C	Low		Roads located within Zone C	2	

Table 5

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary
Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	2	West Dimond Blvd.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	3	Sand Lake Road	2	
Residential Areas	R01	R1-2	B	Low	4	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Low	5	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low	6	Near Endicott Street	3	
Septic systems (serves one single-family home)	R02	R2-1	B	Low	7	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Low	8	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-3	B	Low	9	Along Shorecrest Drive	2	
Construction trade areas and materials	C09	C9-1	C	Low	10	Off of Emerald Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low		Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low		Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Between Kavik Street and Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Along Emerald Street	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		Along Jaclaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		Along Jaccaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Along Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Shorecrest Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Jaclaire Lane	2	

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low		Ninety-Fourth Court	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Low		Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Low		Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Low		Along Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Low		Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Low		Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Low		Along Catkin Circle	3	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-7-9	C	Low		Septics located within Zone C	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7-18	C	Low		Roads located within Zone C	2	

Table 6

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Synthetic Organic Chemicals

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Low	3	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low	4	Near Endicott Street	3	
Septic systems (serves one single-family home)	R02	R2-1	B	Low	5	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Low	6	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-3	B	Low	7	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-4	B	Low	8	Along Jaclaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Low	9	Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Low	10	Along Jaccaire Lane	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low		Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low		Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Between Kavik Street and Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Along Emerald Street	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Along Endicott Street	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Low		Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Low		Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Low		Along Jade Street	3	

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Synthetic Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Low		Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Low		Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Low		Along Catkin Circle	3	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-7-9	C	Low		Septics located within Zone C	2	

Table 7

Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Other Organic Chemicals

PWSID 210485.002

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	2	Approximately 55 acres of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	2	Approximately 30 acres of residential area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	3	West Dimond Blvd.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	4	Sand Lake Road	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low	5	Shorecrest Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low	6	Jaclaire Lane	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	7	Endicott Street	2	
Highways and roads, paved (cement or asphalt)	X20	X20-6	B	Low	8	Ninety-Fourth Court	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	B	Low	9	Along Dimond Blvd.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	B	Low	10	Near Endicott Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low		Along Ninety-fourth Court	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4	B	Low		Along Kavik Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-5	B	Low		Between Kavik Street and Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-6	B	Low		Along Emerald Street	3	
Septic systems (serves one single-family home)	R02	R2-1	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-2	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-3	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		Along Jaclaire Lane	2	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		Along Shorecrest Drive	2	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		Along Jaccaire Lane	2	

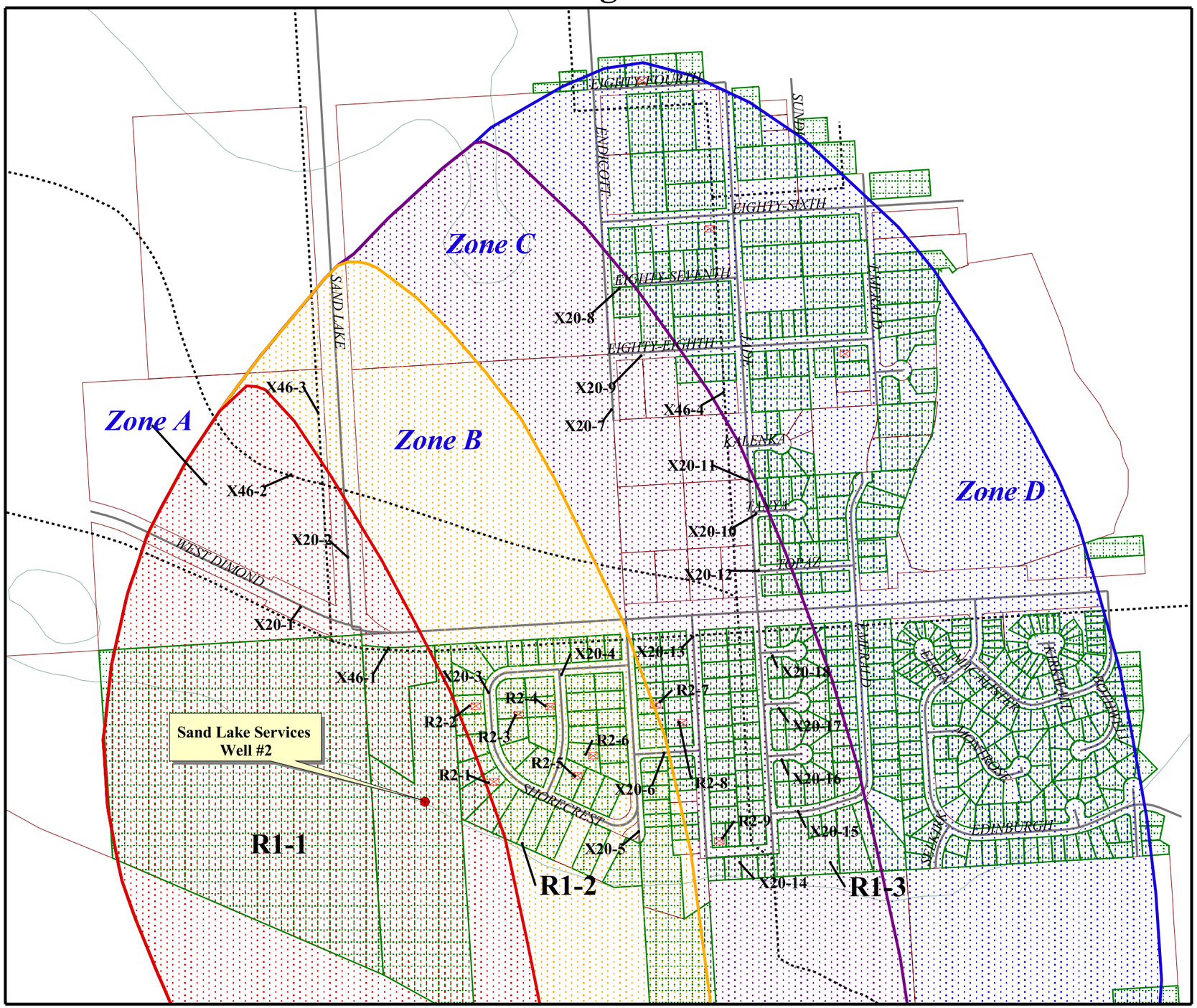
Contaminant Source Inventory and Risk Ranking for Sand Lake Services - Secondary Sources of Other Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Along Endicott Street	2	
Construction trade areas and materials	C09	C9-1	C	Low		Off of Emerald Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-10	C	Low		Along Topaz Ave.	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-11	C	Low		Along Tanya Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-12	C	Low		Along Jade Street	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-7	C	Low		Along Carousel Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-8	C	Low		Along Arnica Circle	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-9	C	Low		Along Catkin Circle	3	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	2	Approximately 30 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-7-9	C	Low		Septics located within Zone C	2	
Highways and roads, paved (cement or asphalt)	X20	X20-7-18	C	Low		Roads located within Zone C	2	

APPENDIX C

Drinking Water Protection Area and Potential & Existing Contaminant Sources for Sand Lake Services - Well #2

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Sand Lake Services - Well #2



- Sand Lake Services Well #2

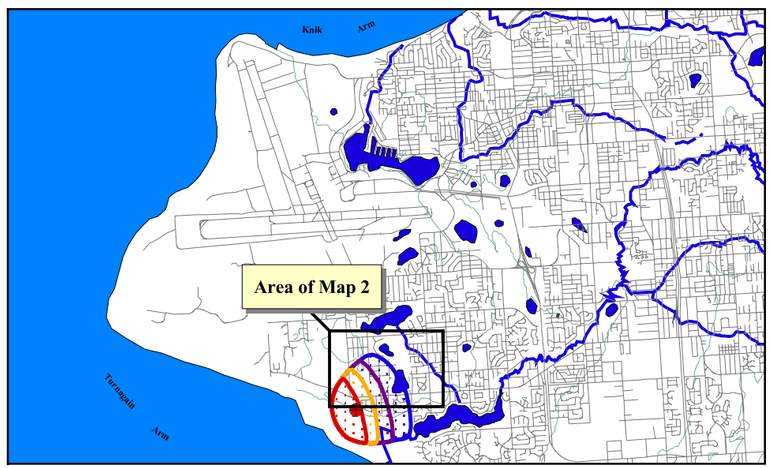
Zone A Protection Area
- Several Months Travel Time

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
- Septic Systems (R2)
- Residential Areas (R1)
- Anchorage Roads (X20)
- Trails (X46)
- Anchorage Land Parcels
- Anchorage Streams
- Elevation Contours

N W E S



900 0 900 1800 Feet

PWSID 210485.002

Map 2

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Sand Lake Services - Well #2

Due to the distant proximity of Zone D to the drinking water well only very high and high potential and existing contaminant sources are accounted for within the protection area. No very high or high potential or existing contaminant sources were identified within Zone D.

Zone A

Zone B

Zone C

Zone D

Sand Lake Services Well #2

EIGHTY-FOURTH

EIGHTY-SIXTH

EIGHTY-SEVENTH

EIGHTY-EIGHTH

KALENKA

CATKIN

ARNICA

CAROUSEL

SHORECREST

BYRD

WEST DIMOND

SAND LAKE

JAC CLAIRE

ENDICOTT

SUNDAY

EMERALD

FERRIN

SELKIRK

X4-1

D1-1

D1-2

D1-3

D1-4

D1-5

D1-6

D1-7

D1-8

D1-9

D1-10

D1-11

D1-12

C9-1

900 0 900 1800 Feet

PWSID 210485.002

- Sand Lake Services - Well #2
- Private and Public Wells

Zone A Protection Area
- Several Months Travel Time

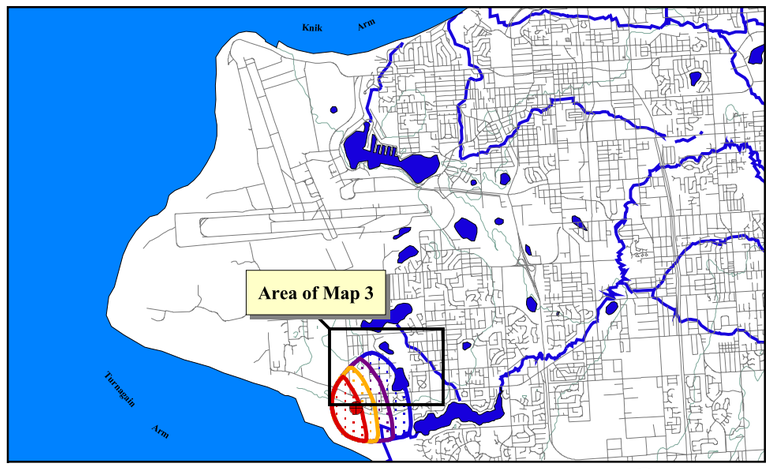
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

Potential Contaminant Sources
- Construction Trade Areas (C9)
- Anchorage Parks (X4)
- Sewer Lines (D1)
- Anchorage Roads (X20)
- Anchorage Land Parcels
- Anchorage Streams
- Elevation Contours

N W E S



Map 3

APPENDIX D

Vulnerability Analysis for
Sand Lake Services - Well #2

Chart 1. Susceptibility of the wellhead - Sand Lake Services - Well #2

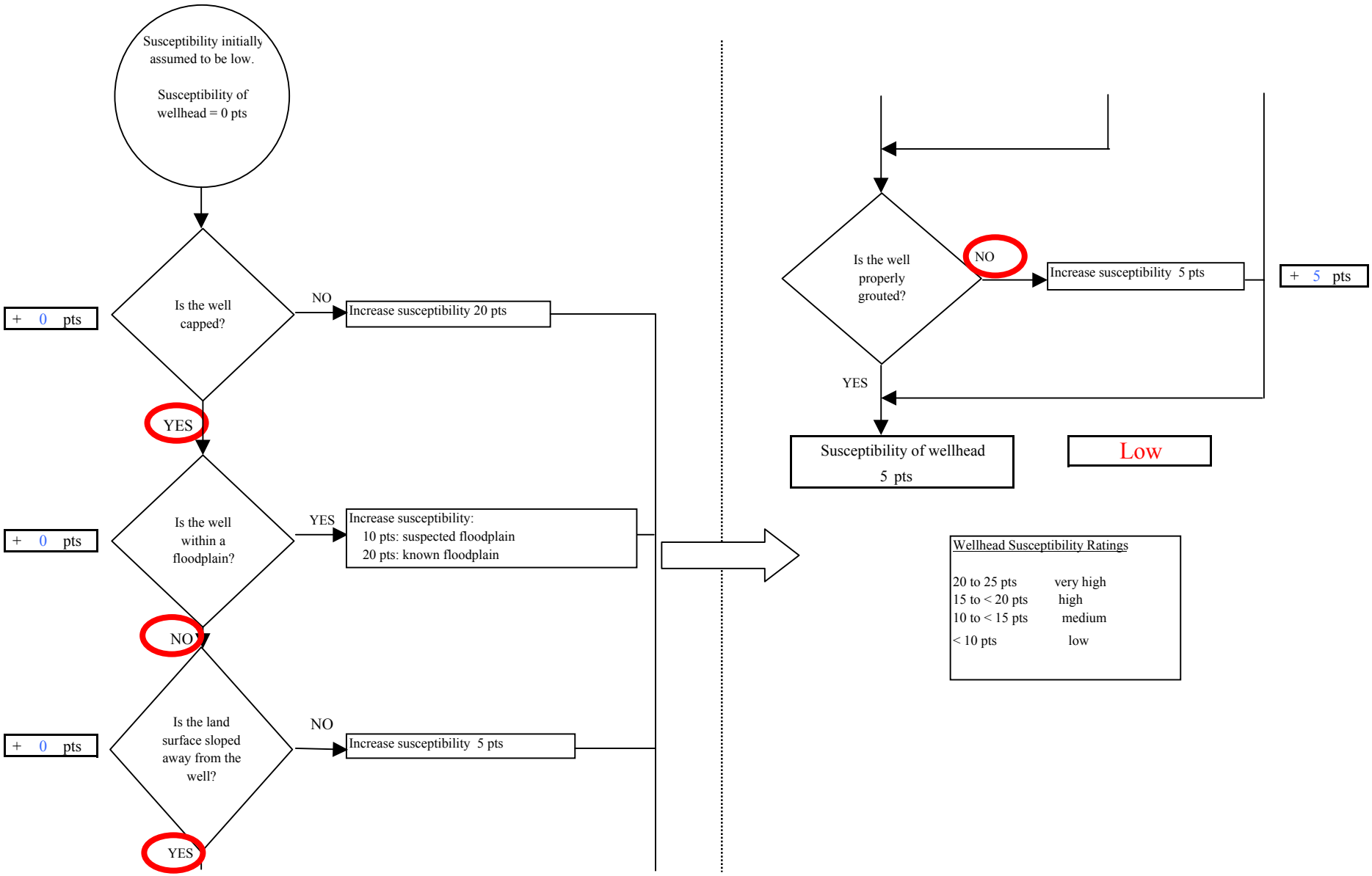


Chart 2. Susceptibility of the aquifer - Sand Lake Services - Well #2

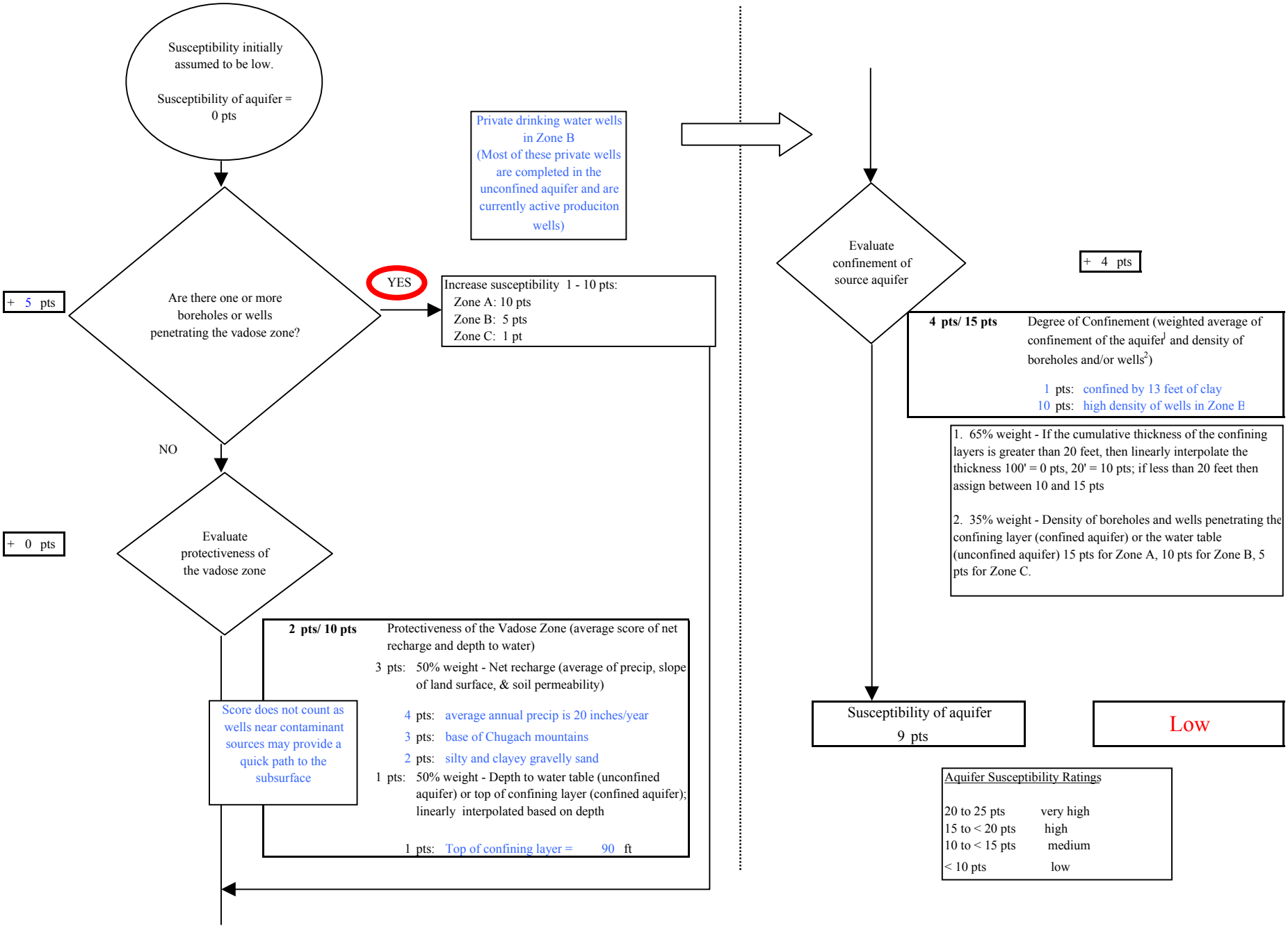
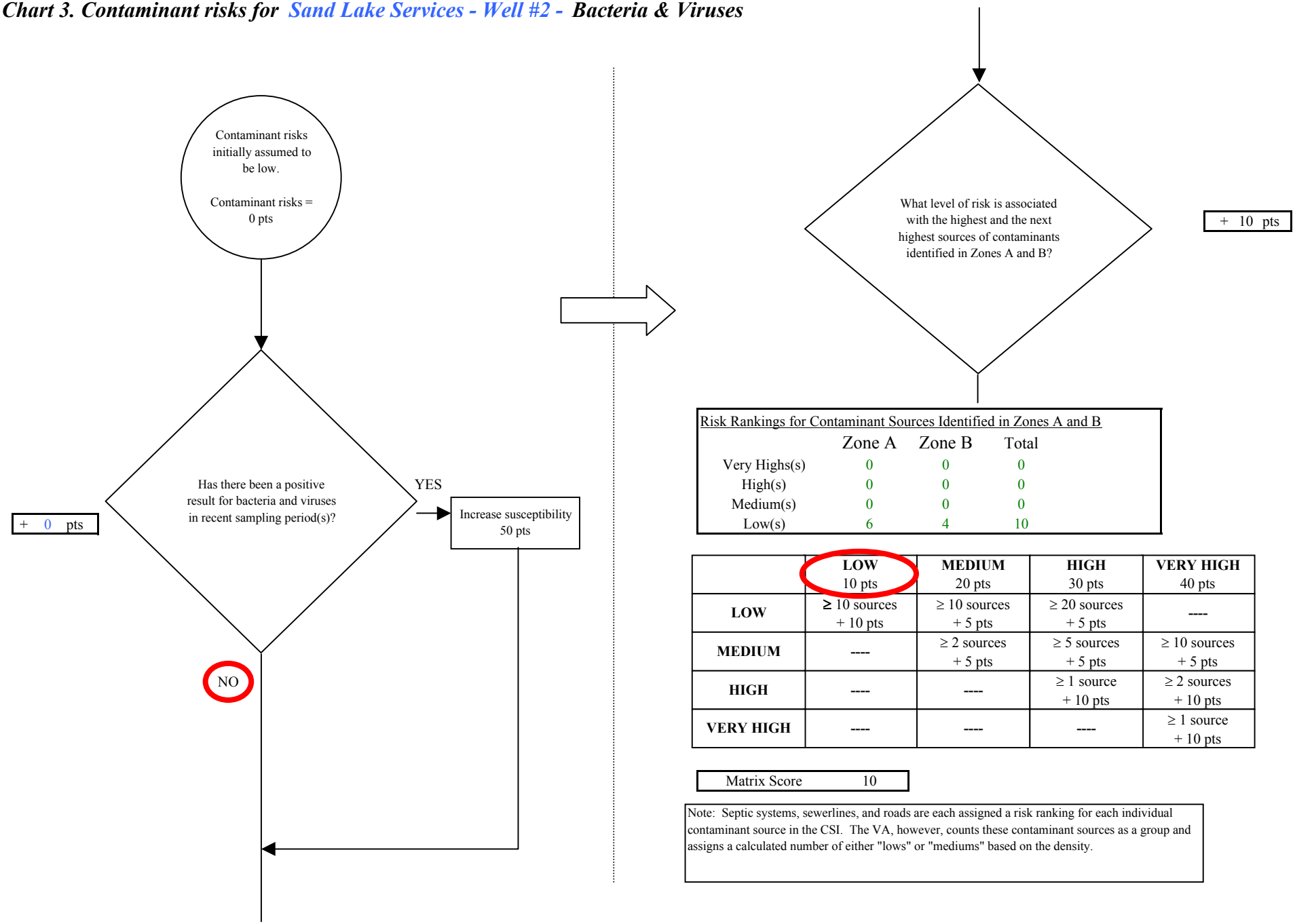


Chart 3. Contaminant risks for Sand Lake Services - Well #2 - Bacteria & Viruses



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)	6	4	10

	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 Sand Lake Services - Well #2 - Bacteria & Viruses

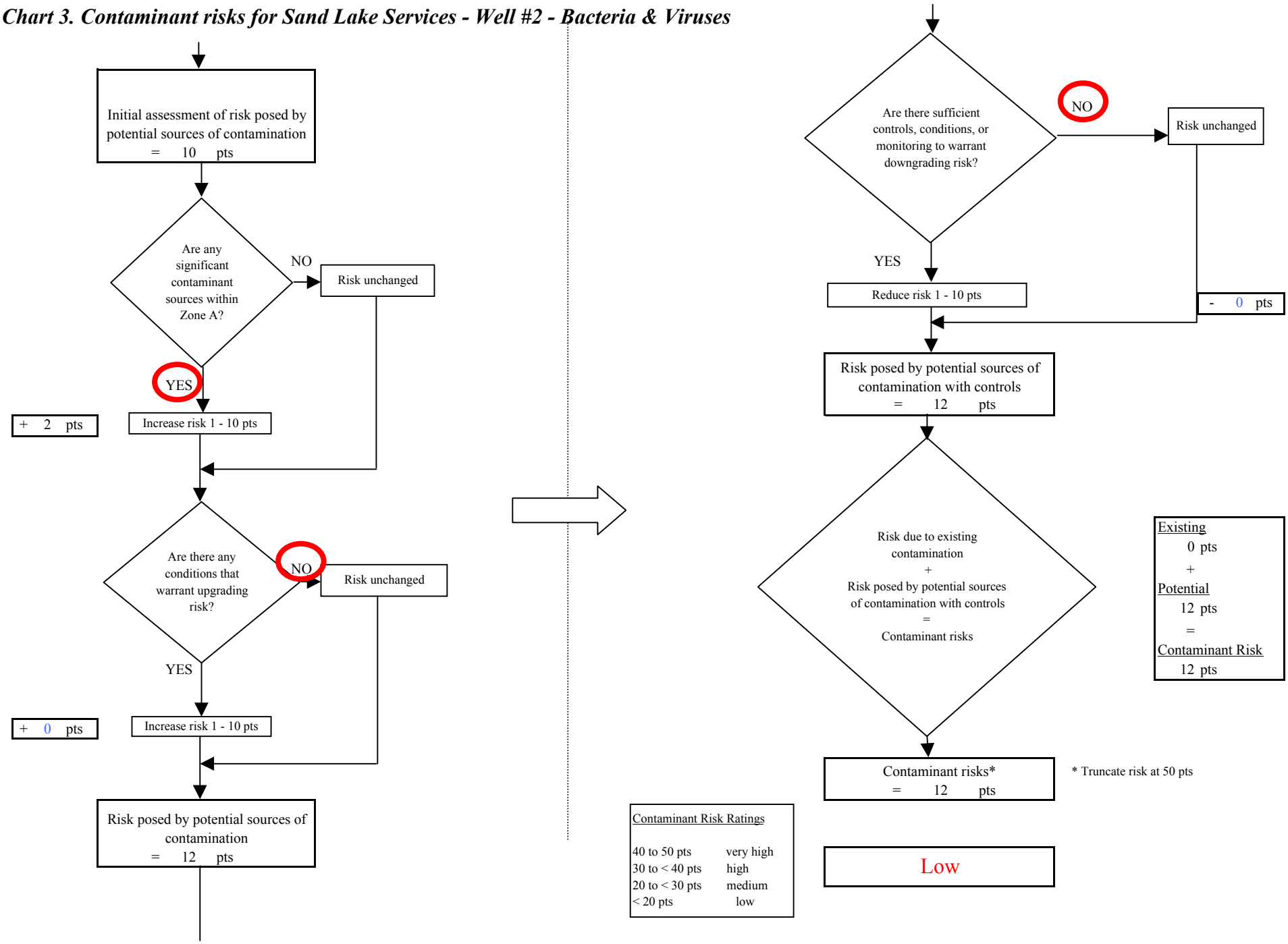


Chart 4. Vulnerability analysis for Sand Lake Services - Well #2 - Bacteria & Viruses

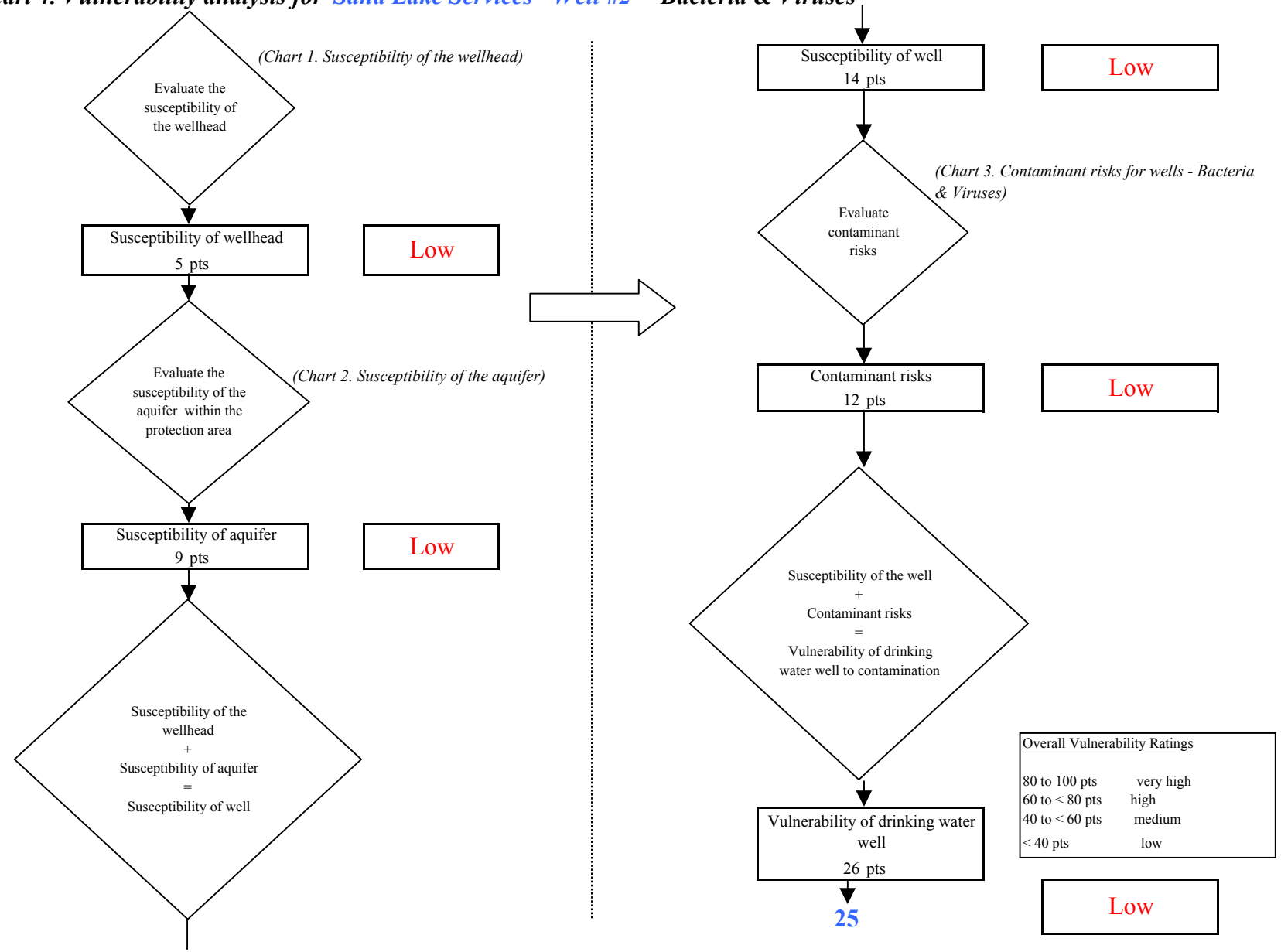


Chart 5. Contaminant risks for Sand Lake Services - Well #2 - Nitrates and Nitrites

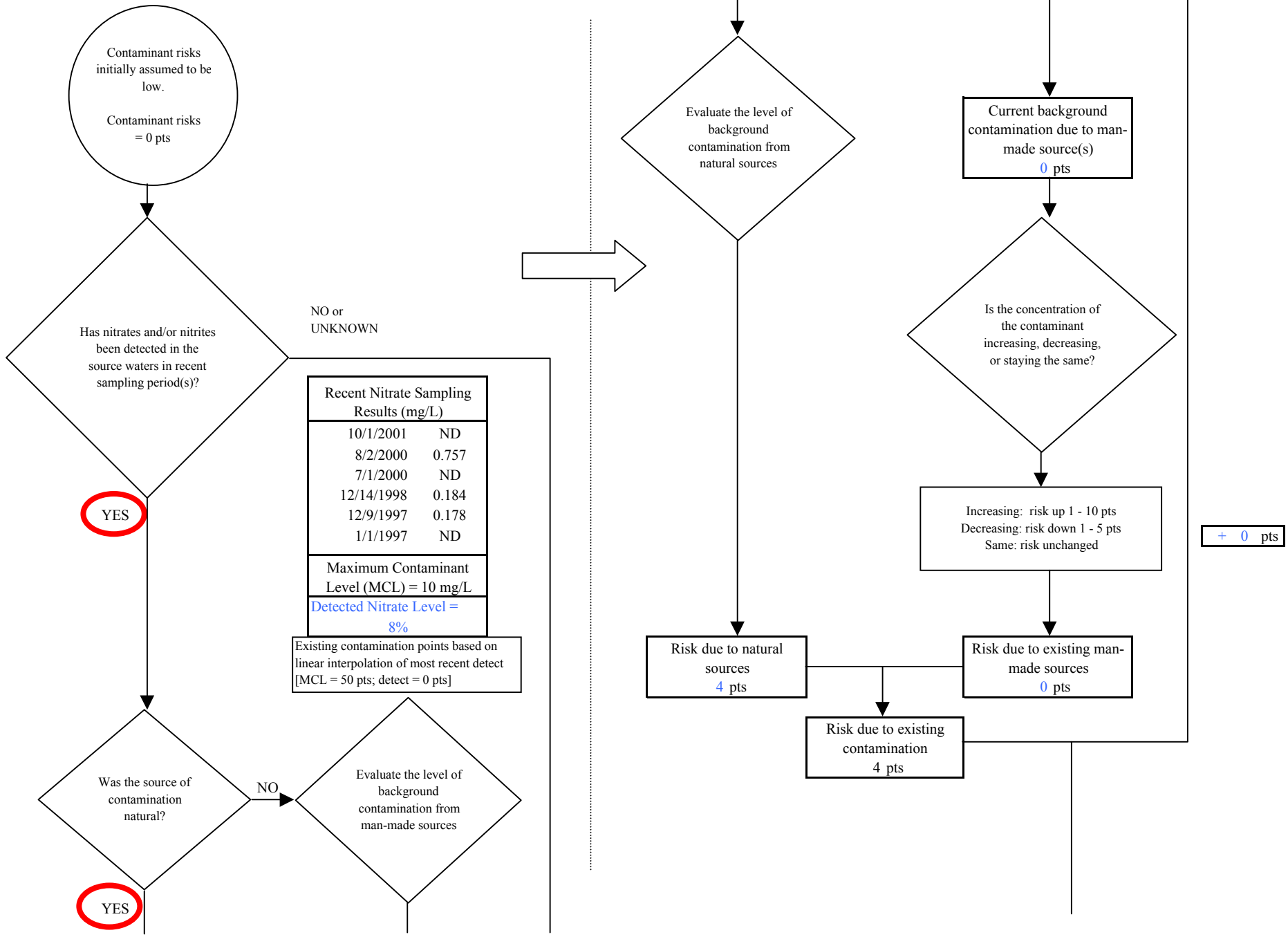


Chart 5. Contaminant risks for Sand Lake Services - Well #2 - Nitrates and Nitrites

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?

+ 25 pts

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	1	1
Low(s)	6	6	12

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

Matrix Score 25

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

Initial assessment of risk posed by potential sources of contamination = 25 pts

Is the source aquifer fractured rock or karst?

YES

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

Chart 5. Contaminant risks for Sand Lake Services - Well #2 - Nitrates and Nitrites

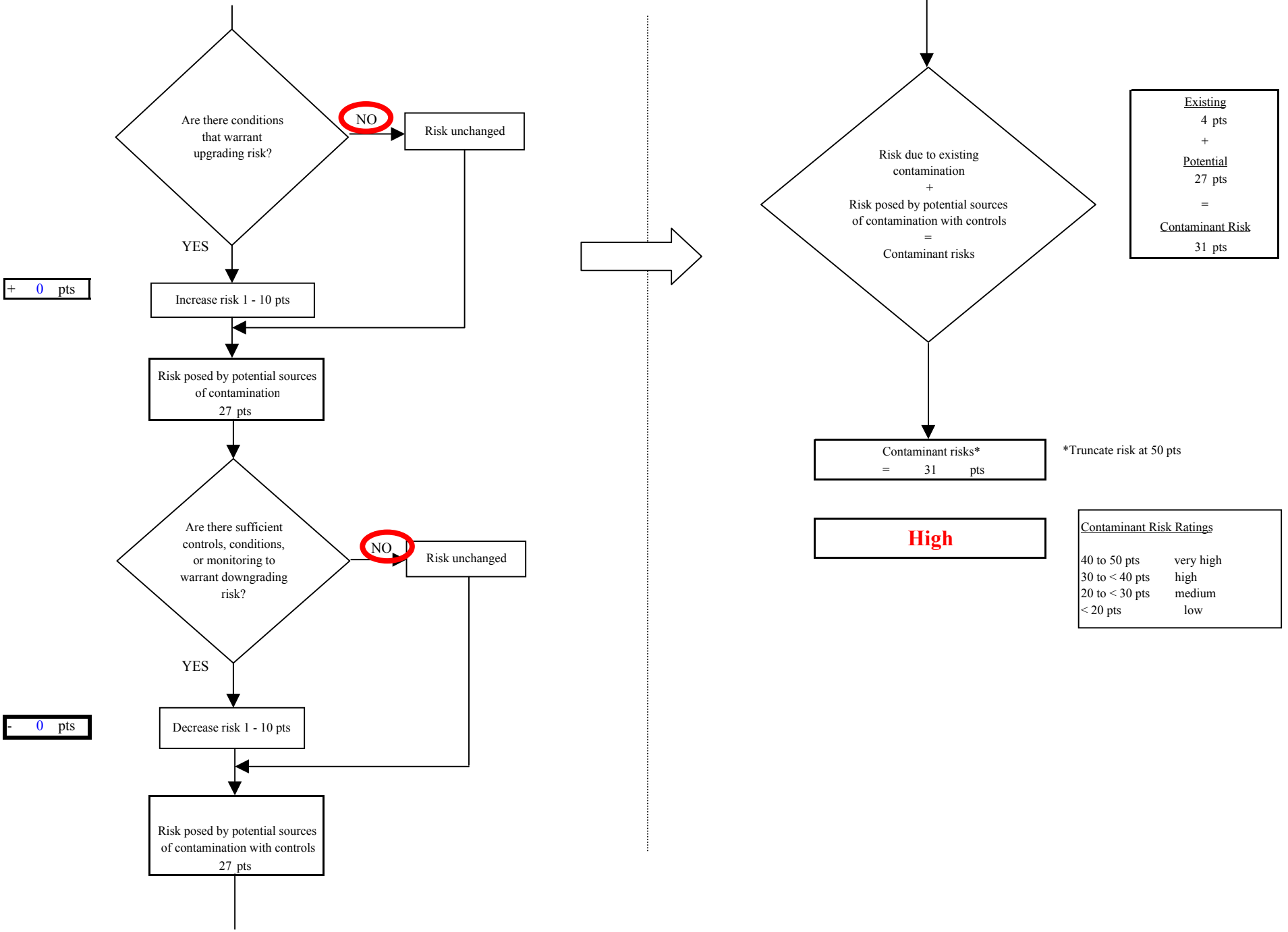


Chart 6. Vulnerability analysis for Sand Lake Services - Well #2 - Nitrates and Nitrites

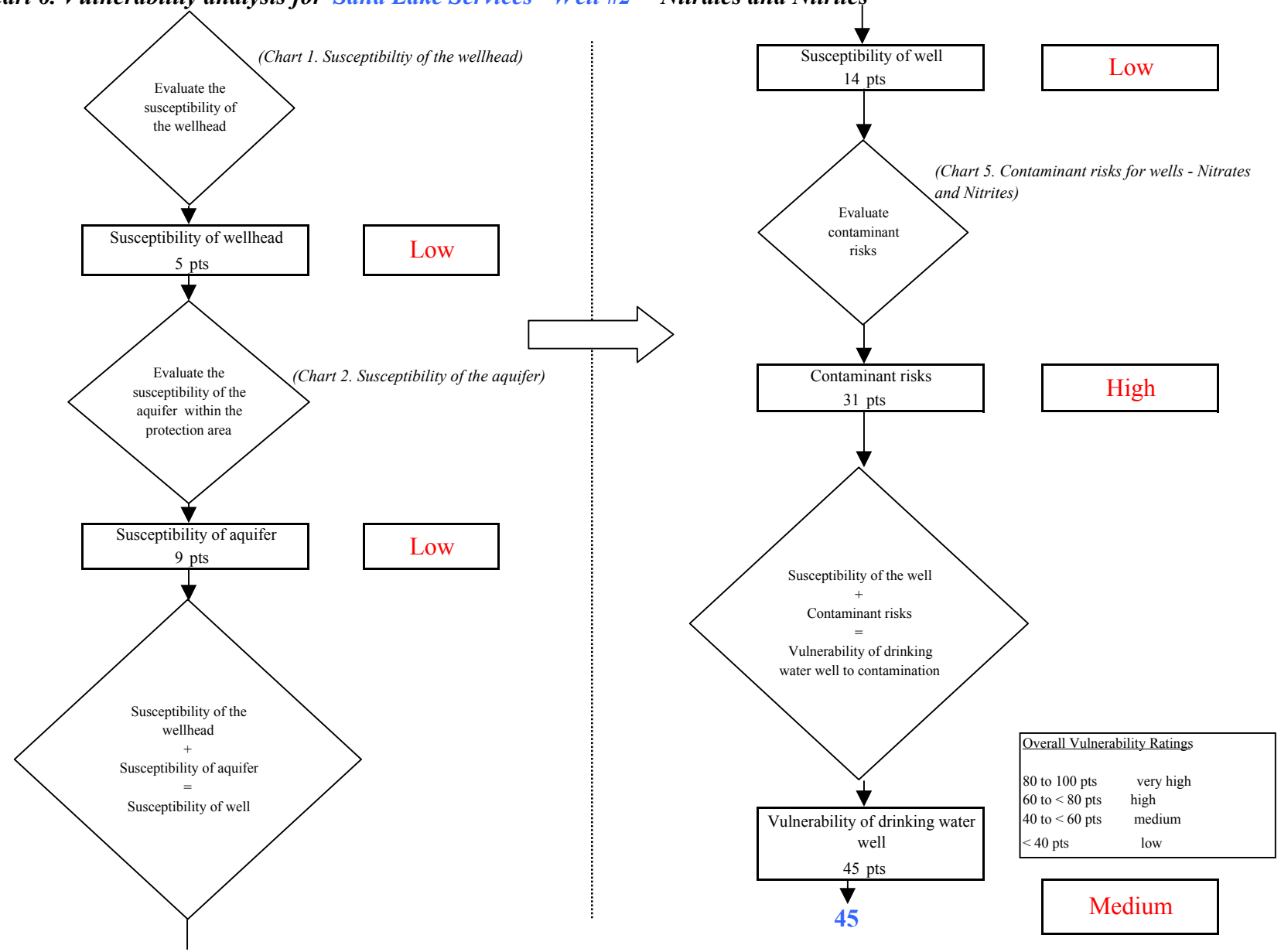


Chart 7. Contaminant risks for Sand Lake Services - Well #2 - Volatile Organic Chemicals

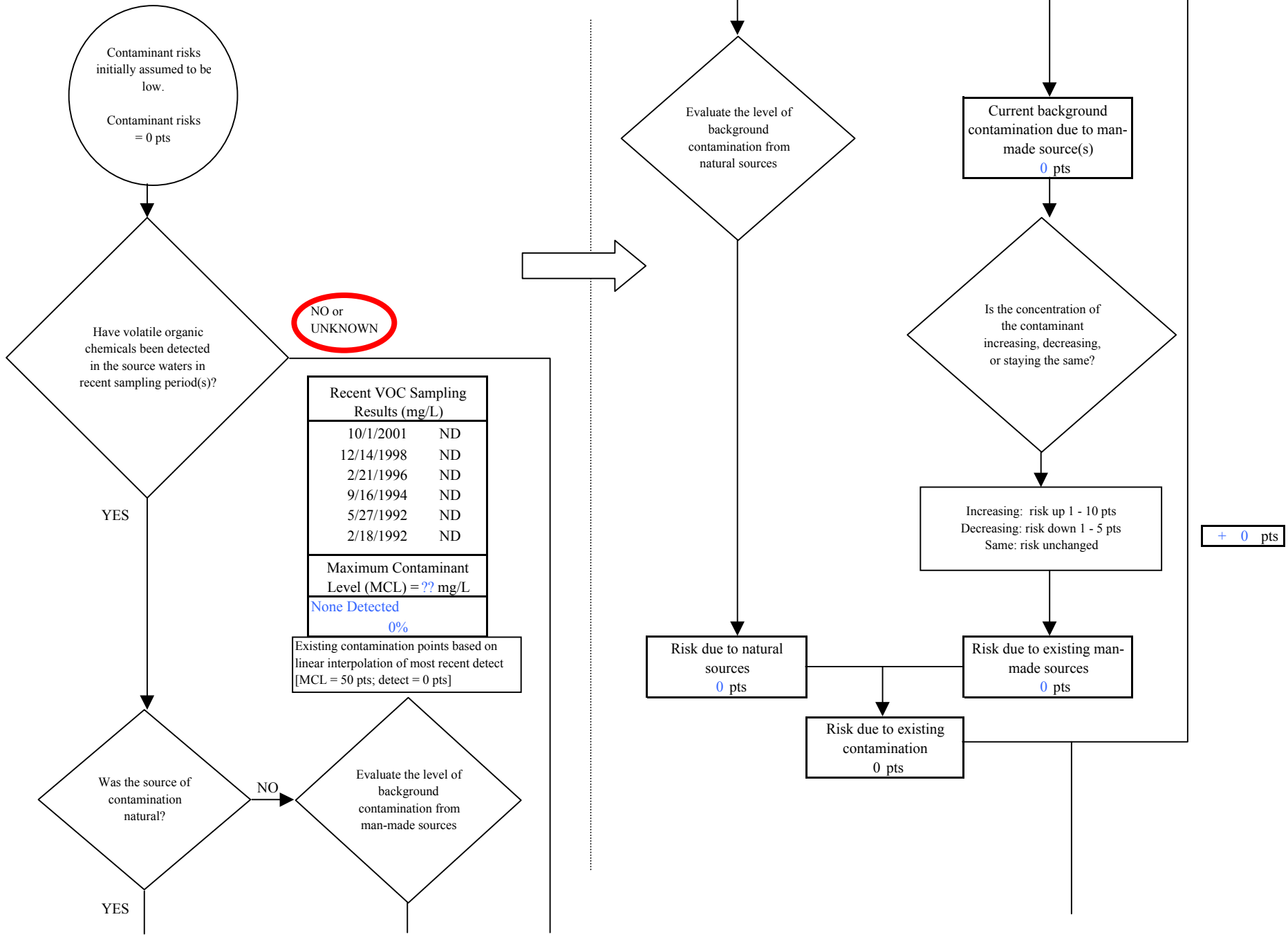


Chart 7. Contaminant risks for Sand Lake Services - Well #2 - Volatile Organic Chemicals

+ 10 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	3	5	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.

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

Is the source aquifer fractured rock or karst?

YES

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

Chart 7. Contaminant risks for Sand Lake Services - Well #2 - Volatile Organic Chemicals

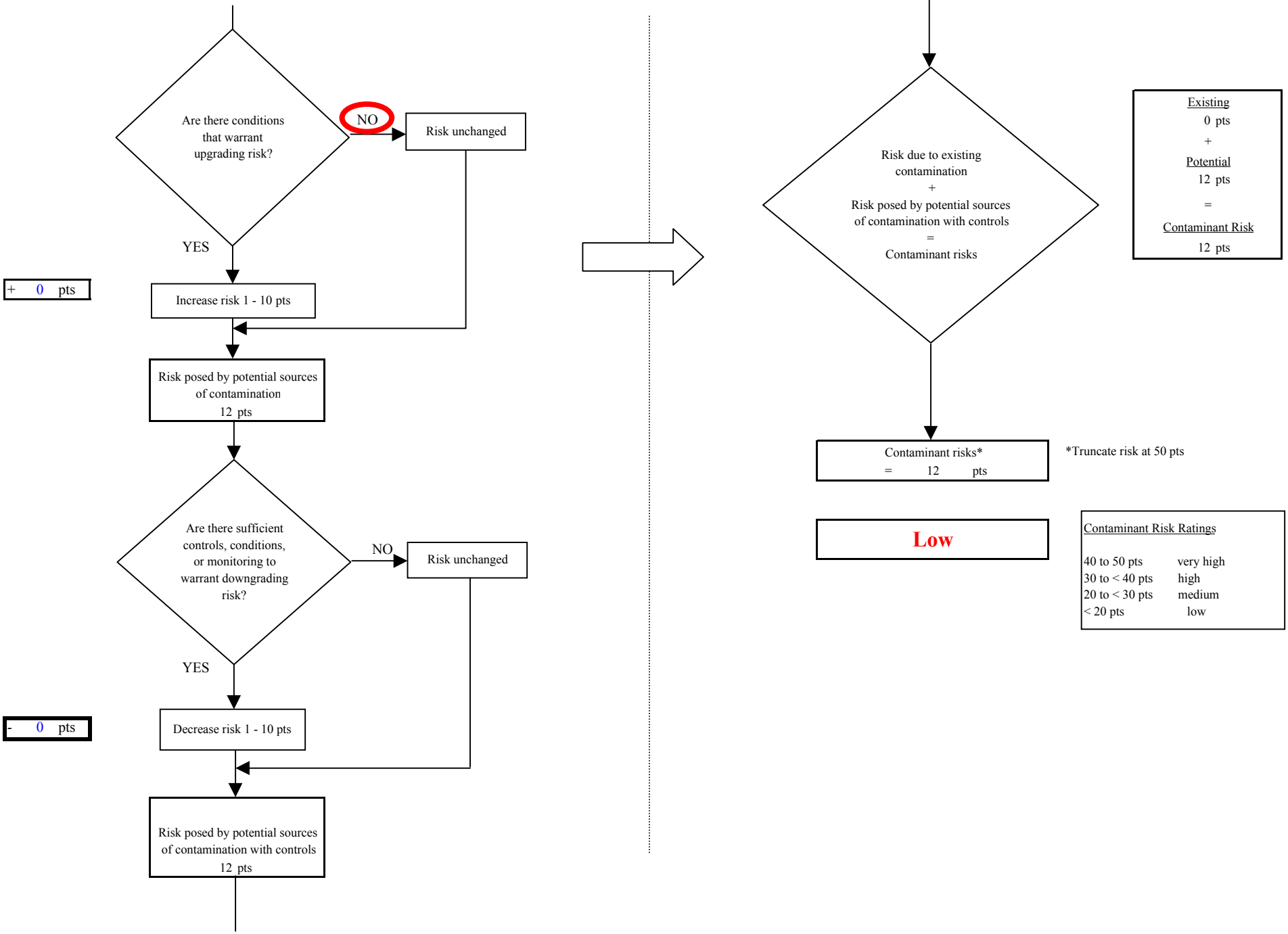


Chart 8. Vulnerability analysis for Sand Lake Services - Well #2 - Volatile Organic Chemicals

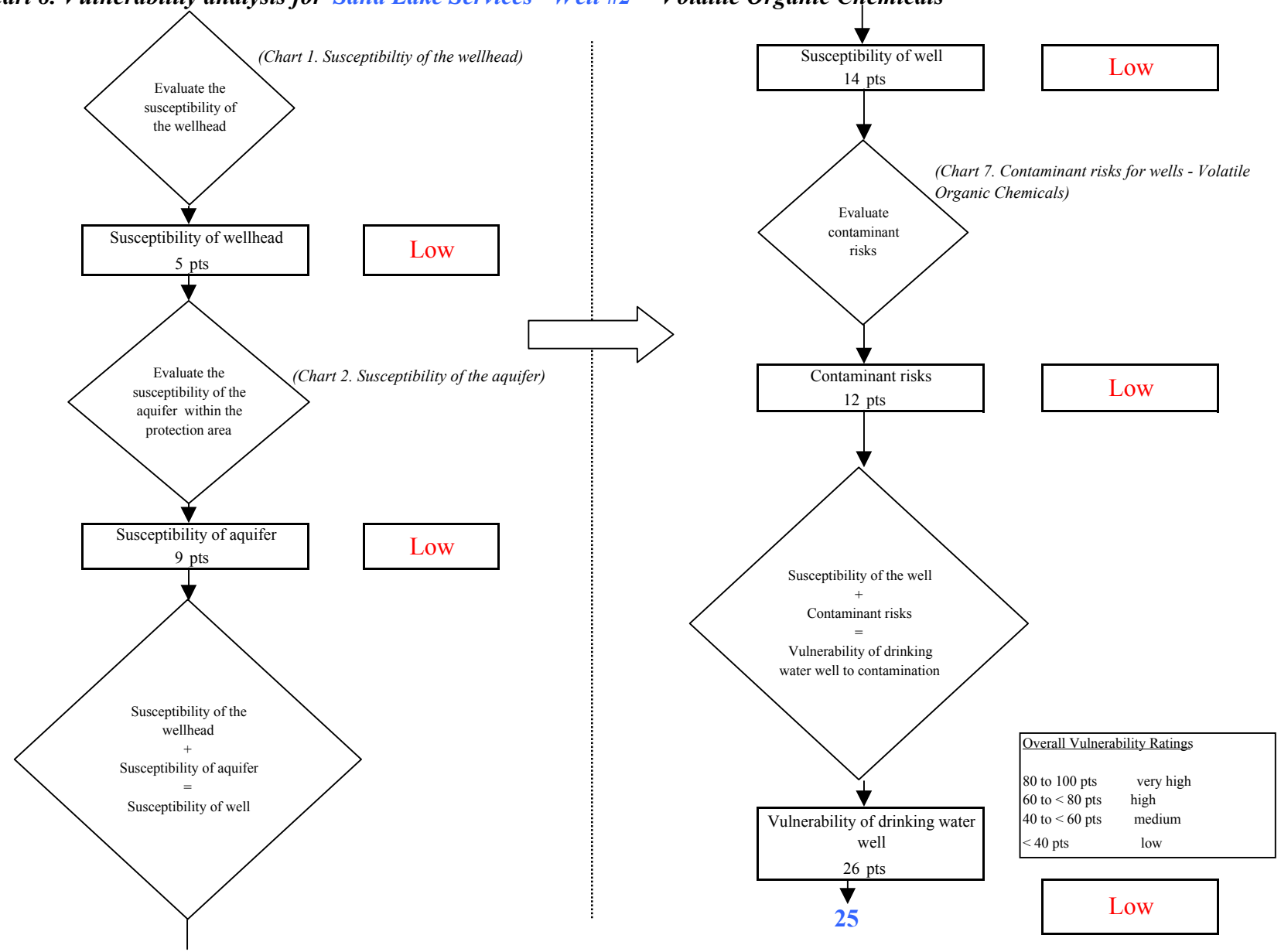


Chart 9. Contaminant risks for Sand Lake Services - Well #2 - Heavy Metals, Cyanide and Other Inorganic Chemicals

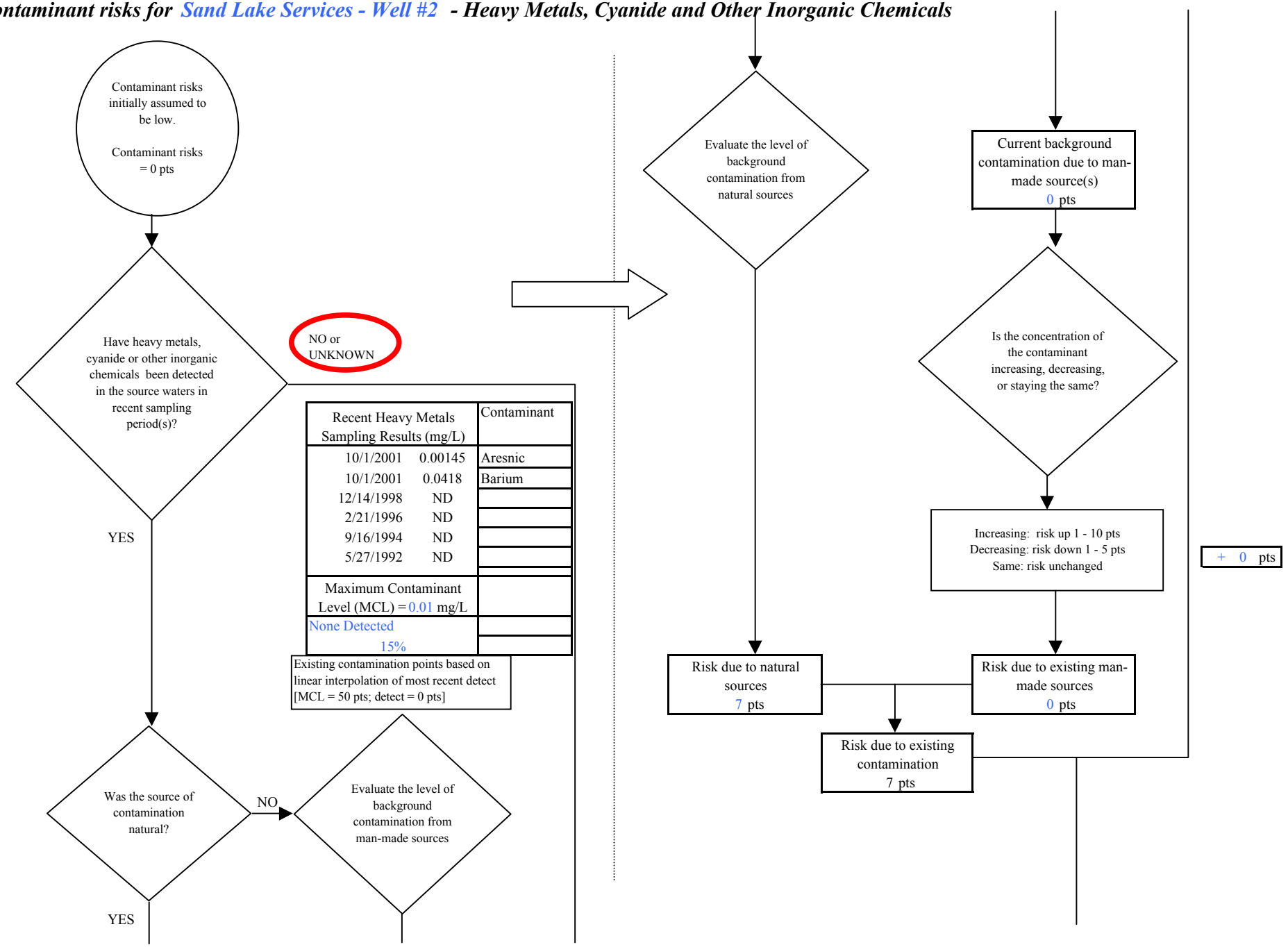


Chart 9. Contaminant risks for Sand Lake Services - Well #2 - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 20 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	1	1
Low(s)	2	5	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.

Initial assessment of risk posed by potential sources of contamination = 20 pts

Is the source aquifer fractured rock or karst?

YES

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

Chart 9. Contaminant risks for Sand Lake Services - Well #2 - Heavy Metals, Cyanide and Other Inorganic Chemicals

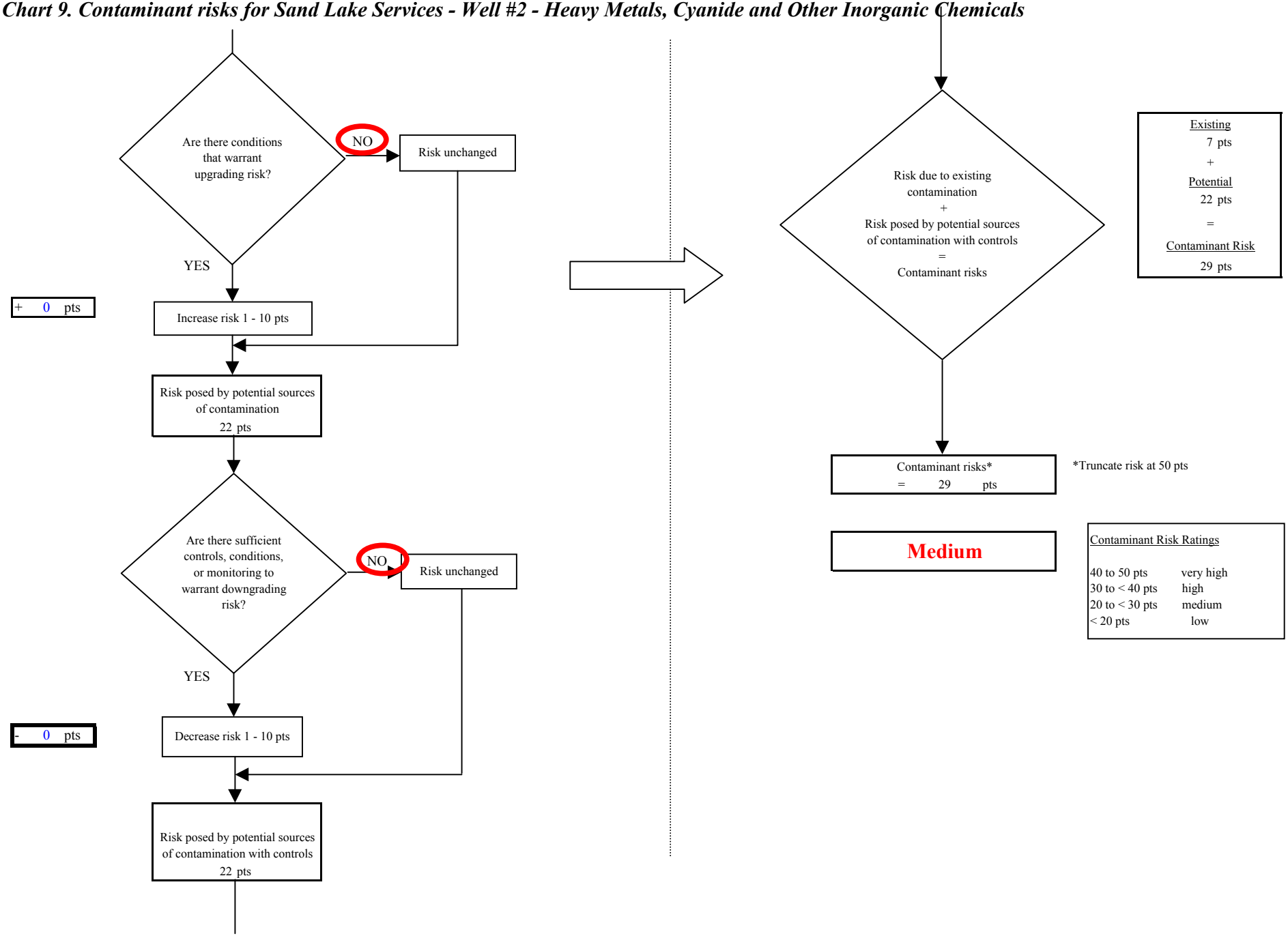


Chart 10. Vulnerability analysis for Sand Lake Services - Well #2 - Heavy Metals, Cyanide and Other Inorganic Chemicals

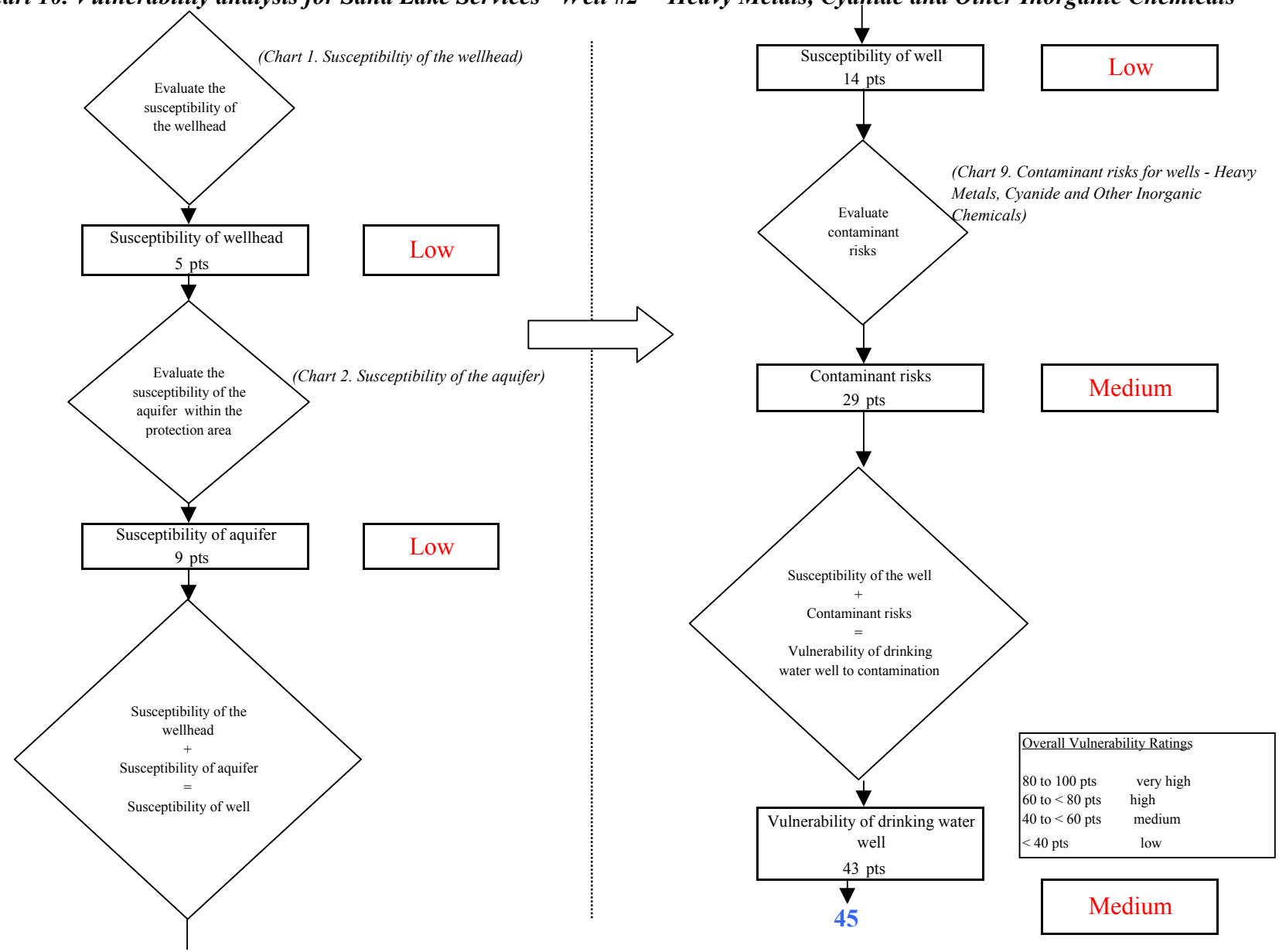


Chart 11. Contaminant risks for Sand Lake Services - Well #2 - Synthetic Organic Chemicals

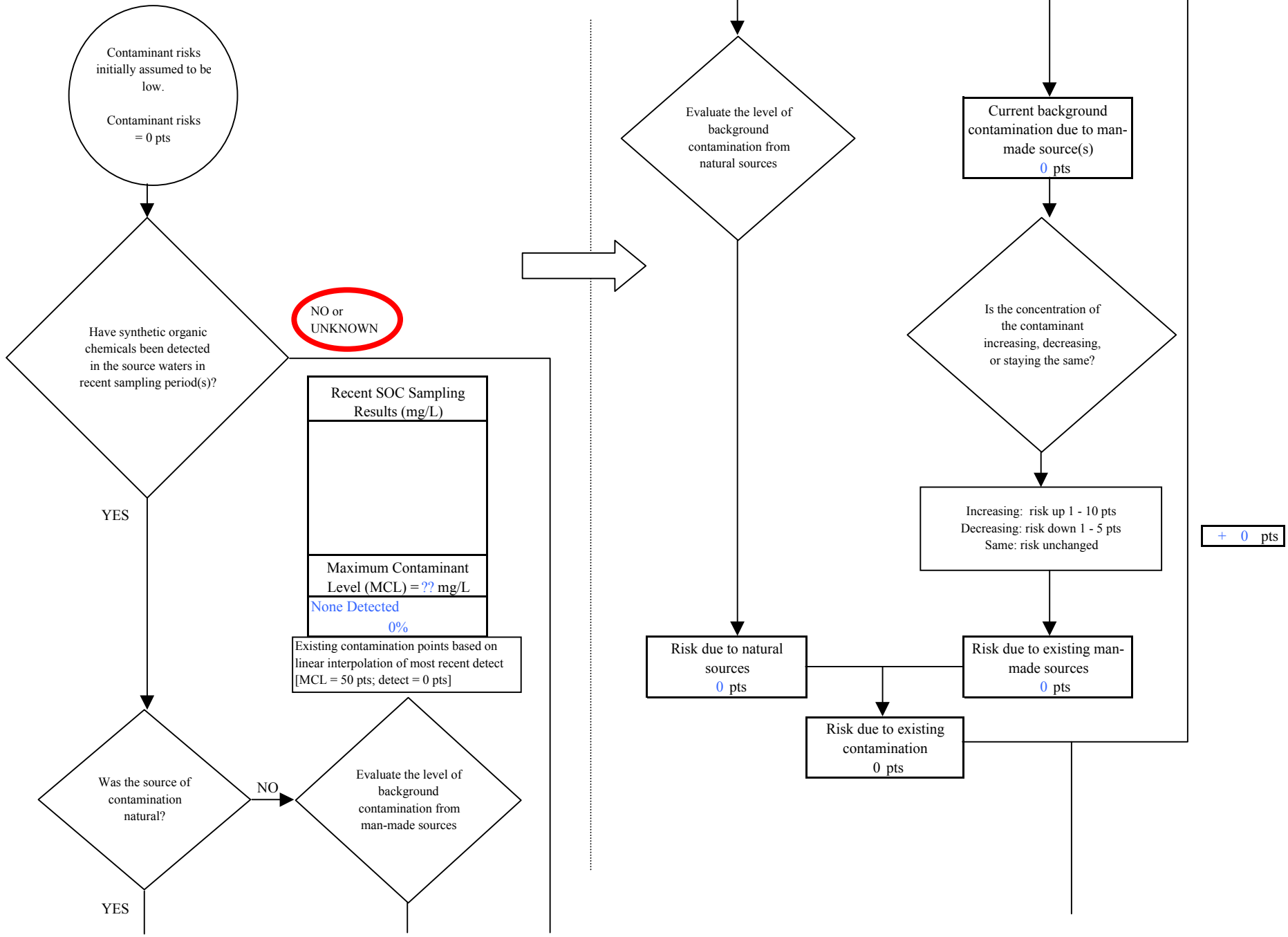


Chart 11. Contaminant risks for Sand Lake Services - Well #2 - Synthetic Organic Chemicals

+ 20 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	1	1
Low(s)	1	3	4

	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.

Initial assessment of risk posed by potential sources of contamination = 20 pts

Is the source aquifer fractured rock or karst?

YES

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

Chart 11. Contaminant risks for Sand Lake Services - Well #2 - Synthetic Organic Chemicals

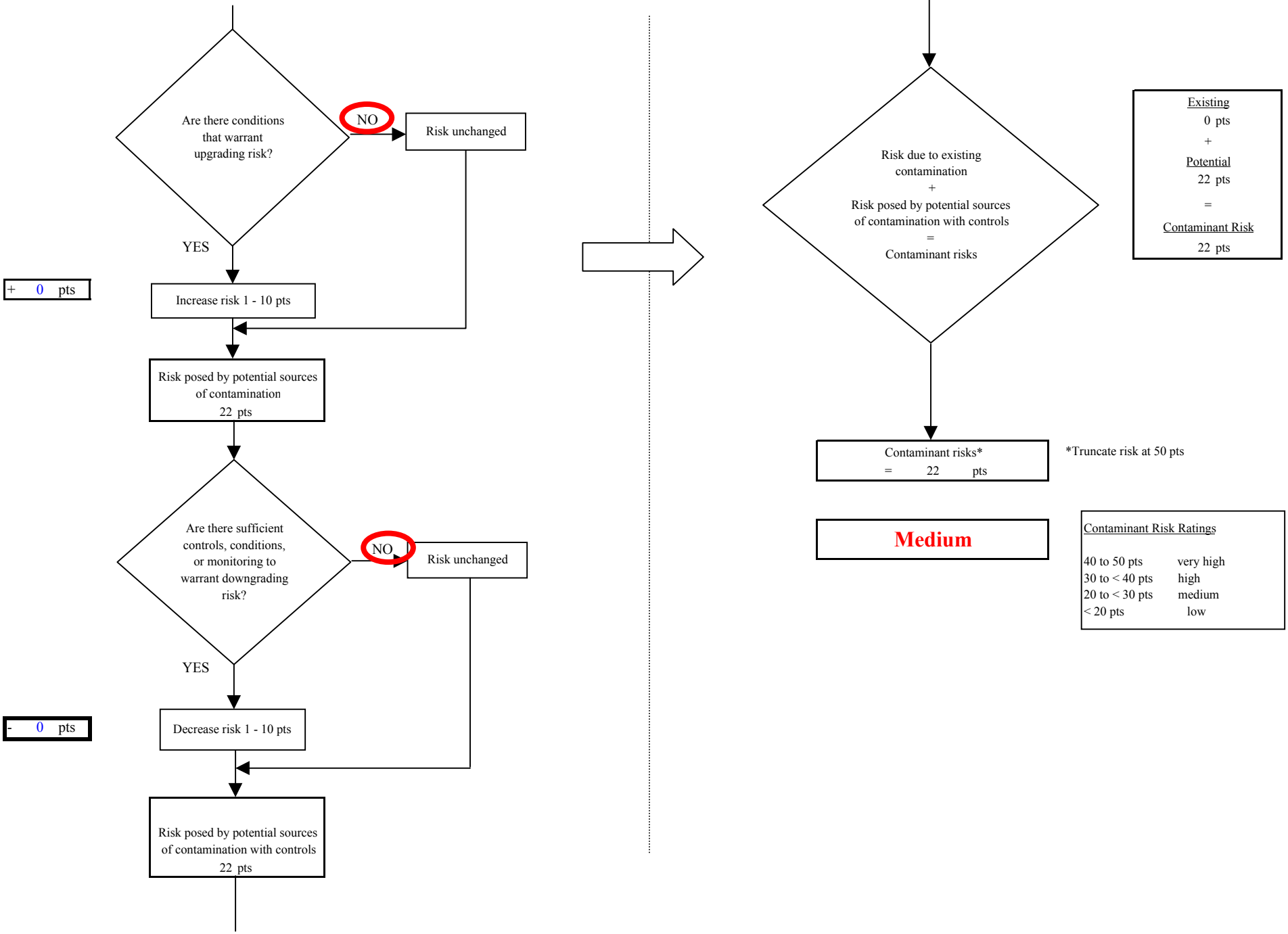


Chart 12. Vulnerability analysis for Sand Lake Services - Well #2 - Synthetic Organic Chemicals

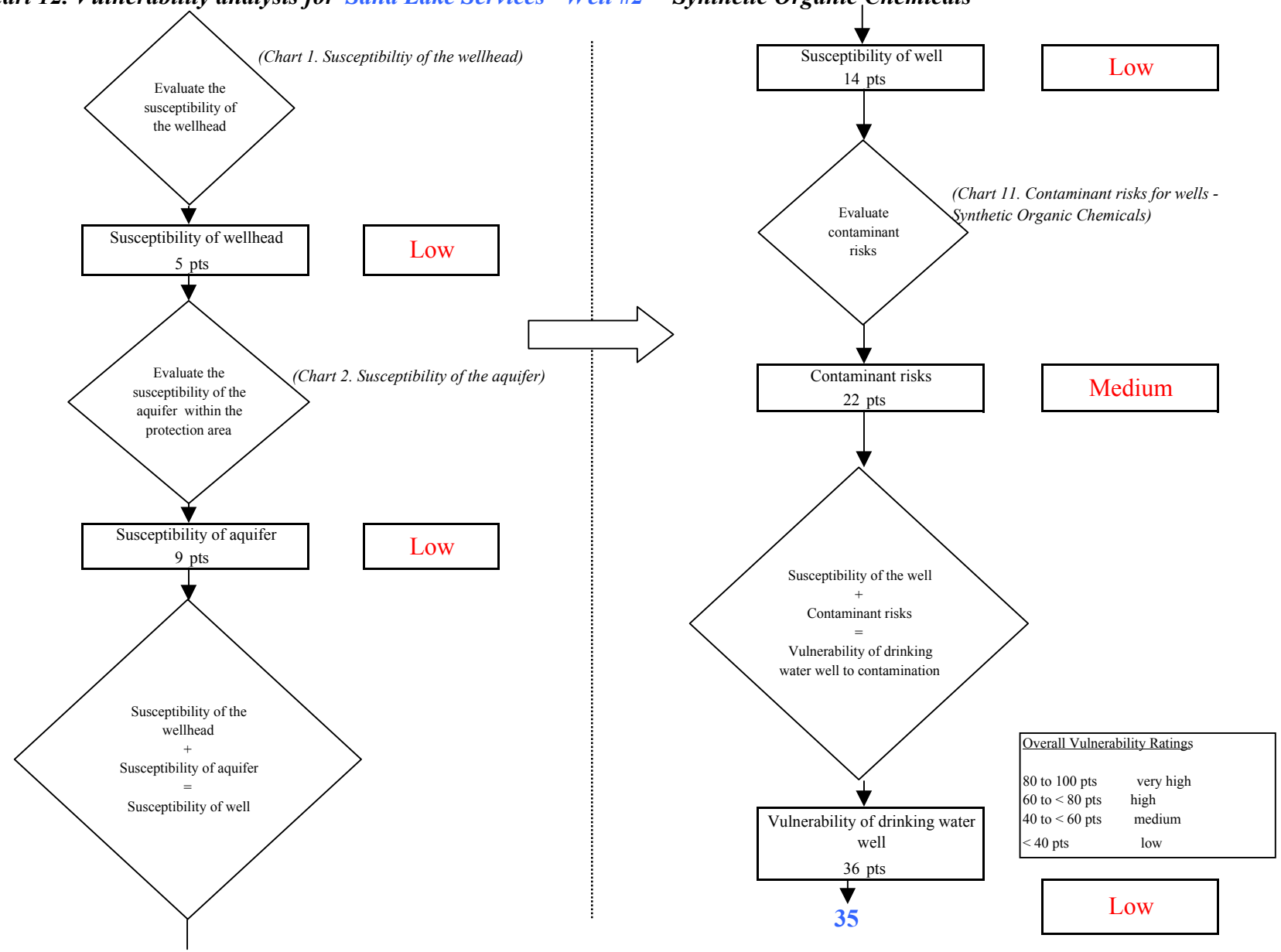


Chart 13. Contaminant risks for Sand Lake Services - Well #2 - Other Organic Chemicals

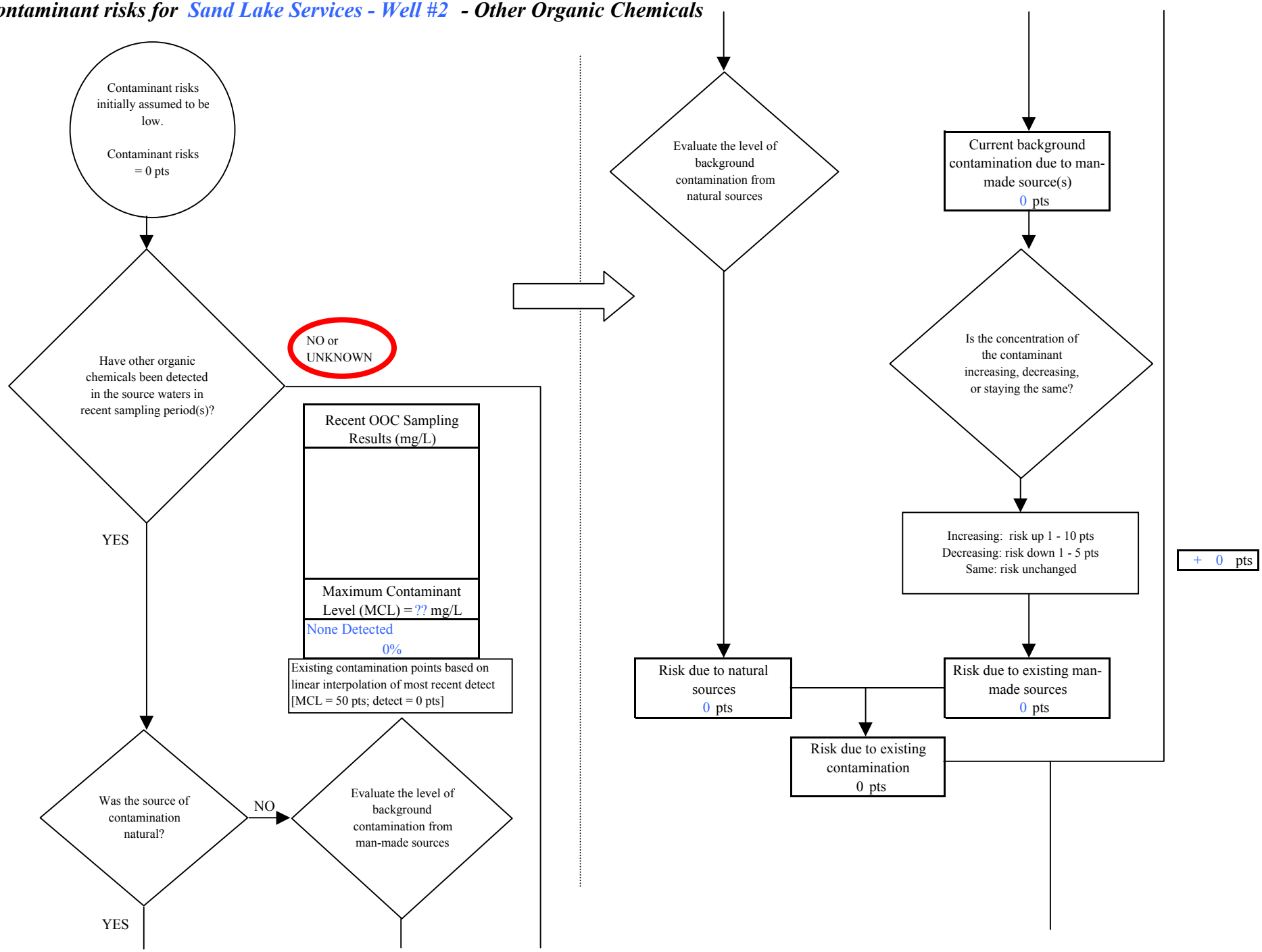


Chart 13. Contaminant risks for Sand Lake Services - Well #2 - Other Organic Chemicals

+ 10 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	2	4	6

	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

Is the source aquifer fractured rock or karst?

YES

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

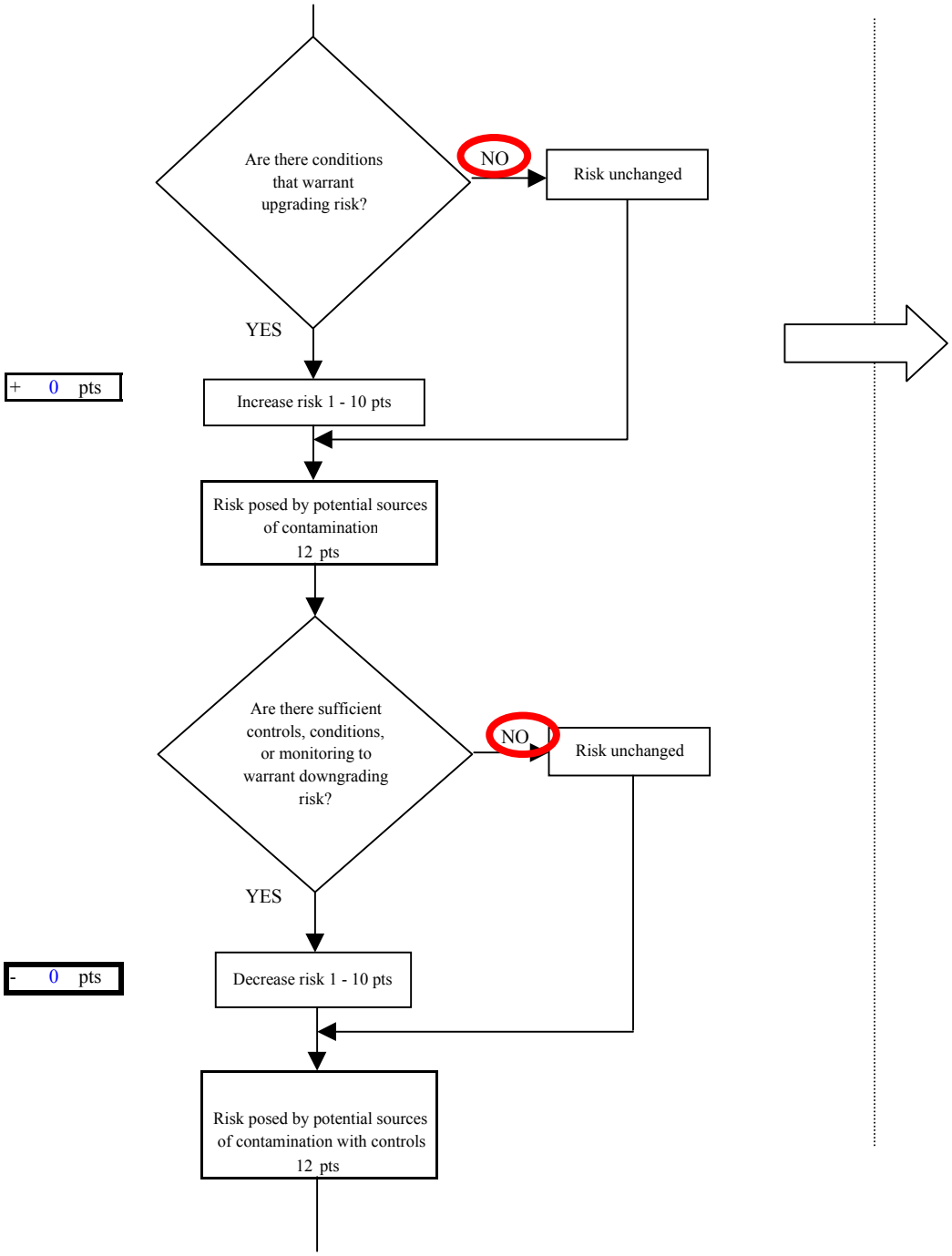
Risk unchanged

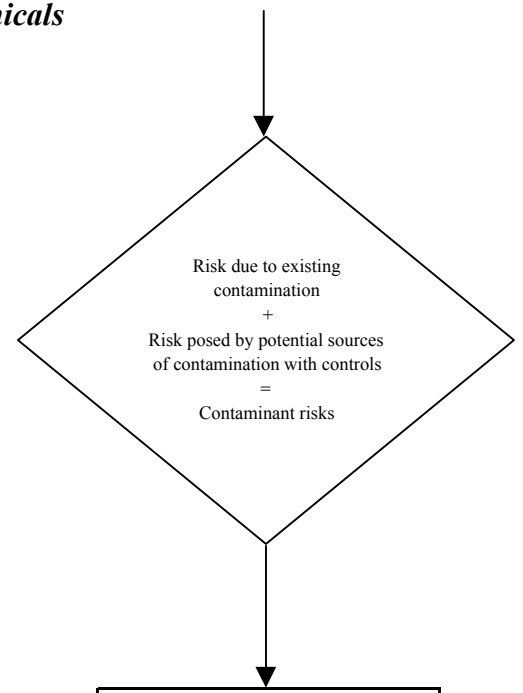
YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 13. Contaminant risks for Sand Lake Services - Well #2 - Other Organic Chemicals





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

Contaminant risks*
= 12 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 14. Vulnerability analysis for Sand Lake Services - Well #2 - Other Organic Chemicals