Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for H&H Lodge Drinking Water System, Willow, Alaska H&H Lodge # 220464

DRINKING WATER PROTECTION PROGRAM REPORT # 224
Alaska Department of Environmental Conservation

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By Shannon & Wilson, Inc.

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Source Water Assessment for H&H Lodge Source of Public Drinking Water, Willow, Alaska

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Drinking Water Protection Program
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EXECUTIVE SUMMARY

The H&H Lodge is a Class B (transient/non-community) water system consisting of one well, south of Talkeetna, Alaska. Identified potential and current sources of contaminants for H&H Lodge public drinking water source include: a contaminated site; aboveground diesel, gasoline, heating oil and aviation fuel; roads; residential areas; single family and large capacity septic systems; and a laundromat. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for H&H Lodge received a vulnerability rating of **Medium** for volatile organic chemicals, **Medium** for bacteria and viruses, and **High** for nitrates and nitrites.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system. Shannon & Wilson has been contracted to perform these assessments under the supervision of ADEC.

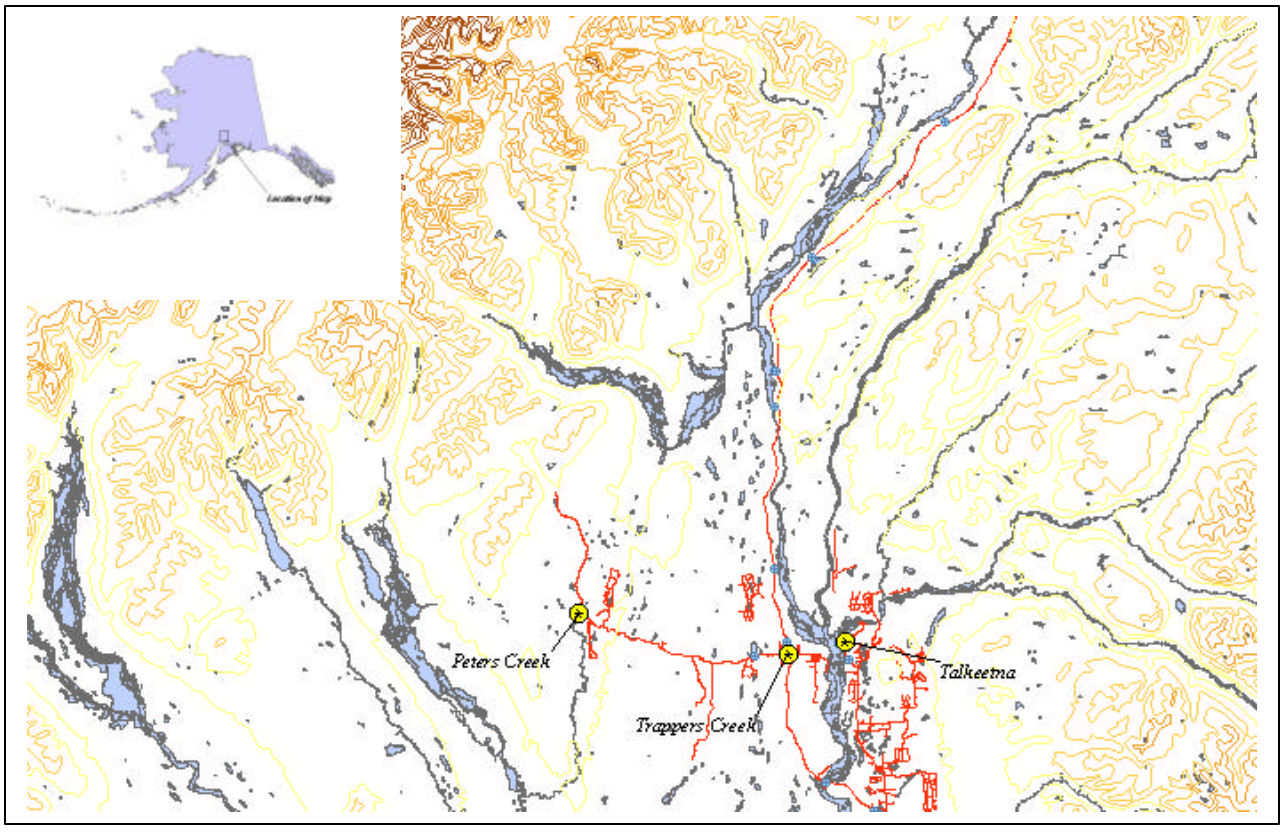


Figure 1. Index map showing the location of the Upper Susitna River Region

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 UPPER SUSITNA RIVER REGION

Location

The Susitna River watershed is the largest watershed in Southcentral Alaska with the community of Talkeetna located at the confluence of the Chulitna, Talkeetna, and Susitna rivers. The area surrounding Talkeetna is shown in Figure 1. Talkeetna is located in the Matanuska-Susitna (Mat-Su) Borough.

Glacial and alluvial forces have shaped the Susitna Region surrounding Talkeetna. These forces have resulted in the broad U-shaped river valleys, lakes, streams and undulating ridges and hills. Landforms in and around the Middle Susitna River Region are typified by the broad river floodplains, low ridges and lowlands.

Precipitation

Talkeetna averages about 30 inches of precipitation per year, including about 107 inches of snowfall.

Topography and Drainage

The area topography varies from about 300 feet to 400 feet within the river floodplains 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. Many homes and businesses in the area rely on individual wells for their water supply. Most of these wells are shallow with depths of less than 100 feet to 200 feet. Static water levels in many of these wells are less than 15 feet below the surface. The coarse, alluvial, sandy gravel in the floodplains of the areas streams and rivers provides a large aquifer even in the winter when infiltration is low.

Geology and Soils

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.

H&H LODGE PUBLIC DRINKING WATER SYSTEM

H&H Lodge is a Class B (transient/non-community) water system. The system consists of one well at Mile 99.5 on the Parks Highway.

According to the well log completed for the water system, installation of the well occurred on May 24, 1978, to a total depth of approximately 70 feet below ground surface and was completed in 6-inch well casing. The most recent Sanitary Survey (6/27/99) indicates the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The land surface is also appropriately sloped away from the well providing adequate surface water drainage. The well was 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 6 residents and more than 300 non-residents through one service connection.

H&H LODGE DRINKING WATER PROTECTION AREA

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

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the Drinking Water Protection Area (DWPA). Because a release of contaminants within the DWPA are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources. Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The DWPAs established for wells by the ADEC are separated into four zones. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four DWPA zones and the calculated TOT for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2 year TOT
B	Less than the 2 year TOT
C	Less Than the 5 year TOT
D	Less than the 10 year TOT

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

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 H&H Lodge DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

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

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

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

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are sorted and ranked according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the well.

VULNERABILITY OF H&H LODGE DRINKING WATER SOURCE

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

- Natural susceptibility; and
- Contaminant risks.

Each of the three categories of drinking water contaminants has been analyzed and an overall vulnerability score of 0 to 100 is ultimately assigned:

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 H&H Lodge is completed in an unconfined aquifer setting. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Overall Susceptibility score and rating for H&H Lodge.

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

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	18	High
Natural Susceptibility	18	Low

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data has been derived from an examination of existing or historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	40	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	35	High

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

Table 4 contains the overall vulnerability scores (0 – 10) and ratings for each of the three categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability of H&H Lodge to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	55	Medium
Nitrates and Nitrites	70	High
Volatile Organic Chemicals	55	Medium

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

The contaminated site, storage tanks, roads, septic systems, residential areas and the Laundromat create a risk increase for bacteria and viruses, nitrates and nitrites, and volatile organic compounds.

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses have not been detected during recent water sampling of the system at H&H Lodge.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils, adopted from the U.S. Geological Survey (Wang, et al., 2000).

Sampling history for H&H Lodge well indicates nitrate samples were not detected during recent sampling events. (see Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing concentrations were not detected during the past 6 sampling events for nitrates. The Maximum Contaminant Level 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.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving H&H Lodge. The overall vulnerability of this source to contamination is **Medium** for volatile organic chemicals, **Medium** for bacteria and viruses, and **High** for nitrates and nitrites. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of H&H Lodge to protect public health. It is anticipated that *Source Water Assessments* will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of H&H Lodge public drinking water source.

REFERENCES CITED

Patrick, L.D., Brabets, T.P., and Glass, R.L., 1989, Simulation of ground-water flow at Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 88-4139, 41p.

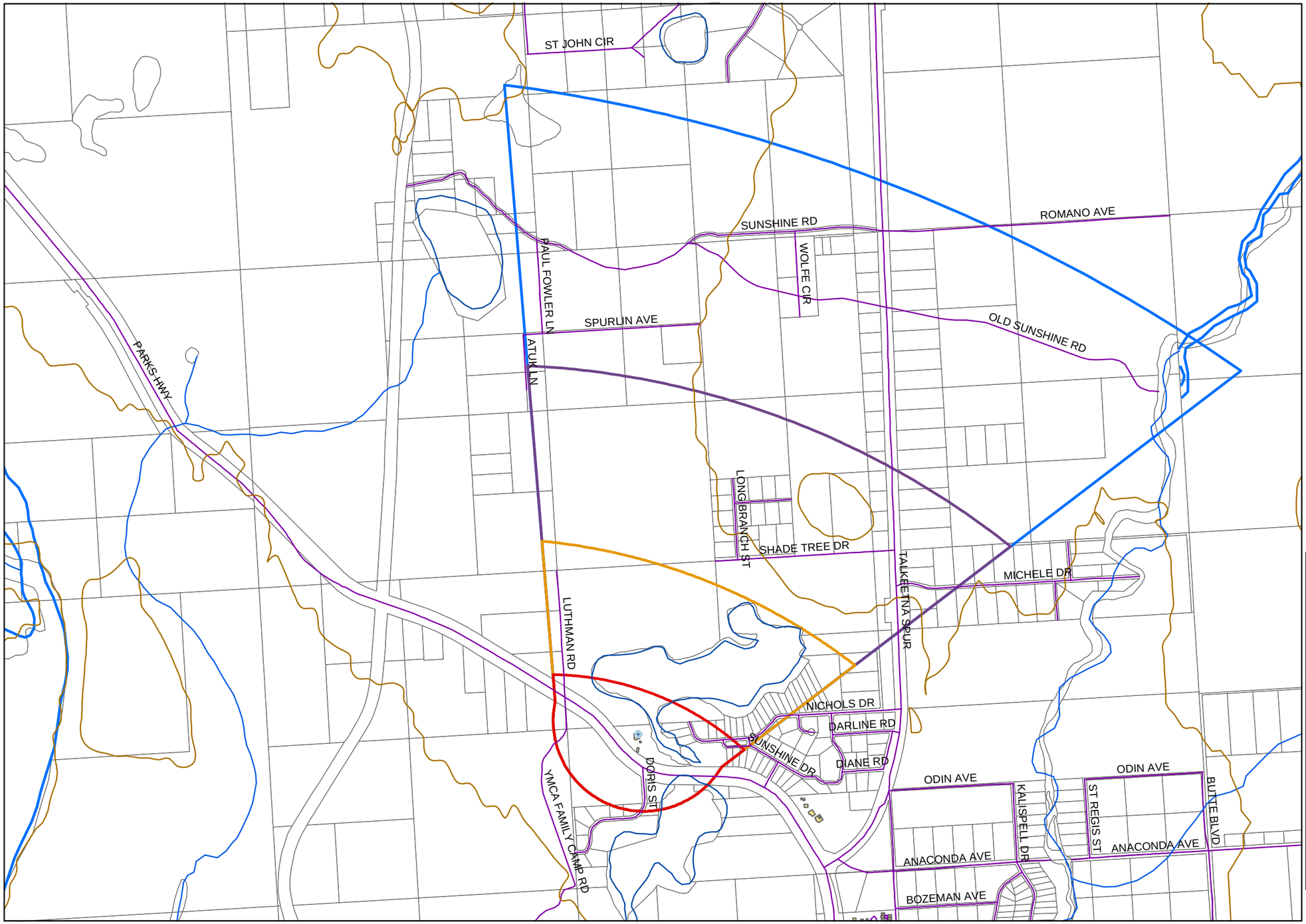
Wang, B., Strelakos, P.M., and Jokela, J.B., 2000, Nitrate source indicators in ground water of the scimitar subdivision, Peters Creek Area, Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 00-4137.

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

APPENDIX A

H&H Lodge
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Areas for H & H Lodge



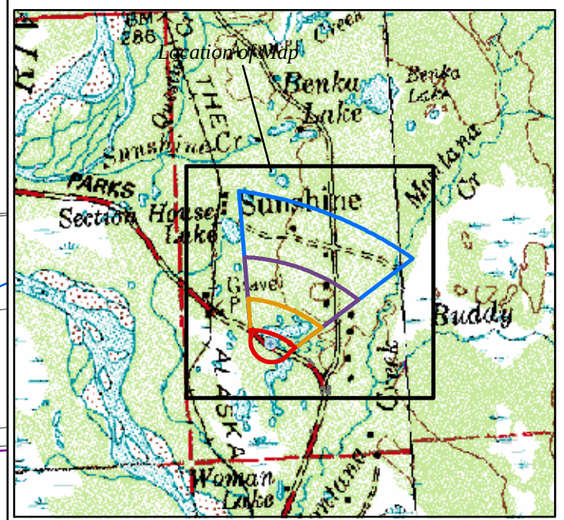
- H & H Lodge Well
- MSB Roads
- Smaller Rivers
- Main Rivers
- Lakes
- 25 Meter Contours
- MSB Land Parcels
- Site Buildings

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



3,200 1,600 0 3,200 Feet

PWSID 220464.001

N W E S

Map 1

APPENDIX B

Contaminant Source Inventory and
Risk Ranking for **H&H Lodge**
(Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 220464.001***

H & H Lodge

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Laundromats without dry cleaning	C22	C22-1	A	NW of H & H Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	South of H&H Lodge Well	3	
Residential Areas	R01	R1-1	A	West of Nichols Drive, north of Parks Highway	2	9 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	West off Doris Street	3	
Septic systems (serves one single-family home)	R02	R2-2	A	East of H&H Lodge Well	3	
Closed tanks, gasoline (above ground)	T11	T11-1	A	West of H & H Lodge Well	3	
Closed tanks, gasoline (above ground)	T11	T11-2	A	West of H & H Lodge Well	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	North side of site building	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	North of site building	3	
Tanks, aviation fuel (above ground)	T02	T2-1	A	North of H & H Lodge Well	3	
Tanks, aviation fuel (above ground)	T02	T2-2	A	North of H & H Lodge Well	3	
Closed tanks, diesel (above ground)	T07	T7-1	A	West of H & H Lodge Well	3	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-1	A	South of H & H Lodge Well	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Doris Street	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Luthman Road	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Nichols Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Sunshine Drive	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	North of Nichols Drive	3	
Residential Areas	R01	R1-2	B	Subdivision north of Nichols drive	2	24 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02	R2-3	B	North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	NW of Nichols Drive	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-7	B	NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-8	B	North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	East of Luthman Road, north of H&H Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	South of Shade Tree Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	SE corner of Frontage Road and Michele Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	C	NE corner of Frontage Road and Michele Drive	3	
Residential Areas	R01	R1-3	C	Residences north and south of Michele Drive; and around Setting Sun	2	102 acreas of residential area in Zone C
Septic systems (serves one single-family home)	R02	R2-10-20	C	10 septics in Zone C	3	
Highways and roads, dirt/gravel	X24	X24-5	C	Talkeetna Spur	2	
Highways and roads, dirt/gravel	X24	X24-6	C	Michele Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	C	Longbranch Street	2	
Highways and roads, dirt/gravel	X24	X24-8	C	Setting Sun Drive	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	D	West of Talkeetna Spur, south of Old Sunshine Road	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-7	D	NE corner of Talkeetna Spur and Old Sunshine Road	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-8	D	West of Talkeetna Spur and north of Old Sunshine Road	3	

Contaminant Source Inventory and Risk Ranking for

Table 2 ***PWSID 220464.001***

H & H Lodge

Sources of Bacteria and Viruses

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	South of H&H Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	High	2	North of Nichols Drive	3	
Laundromats without dry cleaning	C22	C22-1	A	Low	3	NW of H & H Lodge Well	3	
Residential Areas	R01	R1-1	A	Low	4	West of Nichols Drive, north of Parks Highway	2	9 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	Low	5	West off Doris Street	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	6	East of H&H Lodge Well	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	7	Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	8	Doris Street	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	9	Luthman Road	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	10	Nichols Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low		Sunshine Drive	2	
Residential Areas	R01	R1-2	B	Low		Subdivision north of Nichols drive	2	24 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02	R2-3	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		East of Luthman Road, north of H&H Lodge	3	

Contaminant Source Inventory and Risk Ranking for

Table 3 ***PWSID 220464.001***

H & H Lodge

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*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	1	South of H&H Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	High	2	North of Nichols Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	High	3	South of Shade Tree Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	High	4	SE corner of Frontage Road and Michele Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	C	High	5	NE corner of Frontage Road and Michele Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	D	High	6	West of Talkeetna Spur, south of Old Sunshine	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-7	D	High	7	NE corner of Talkeetna Spur and Old Sunshine	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-8	D	High	8	West of Talkeetna Spur and north of Old	3	
Laundromats without dry cleaning	C22	C22-1	A	Low	9	NW of H & H Lodge Well	3	
Residential Areas	R01	R1-1	A	Low	10	West of Nichols Drive, north of Parks Highway	2	9 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	Low		West off Doris Street	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low		East of H&H Lodge Well	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low		Doris Street	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low		Luthman Road	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low		Nichols Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low		Sunshine Drive	2	
Residential Areas	R01	R1-2	B	Low		Subdivision north of Nichols drive	2	24 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02	R2-3	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		NW of Nichols Drive	3	

Contaminant Source Inventory and Risk Ranking for

Table 3 (continued) ***PWSID 220464.001***

H & H Lodge

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*
Septic systems (serves one single-family home)	R02	R2-7	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		East of Luthman Road, north of H&H Lodge	3	
Residential Areas	R01	R1-3	C	Low		Residences north and south of Michele Drive; and around Setting Sun Drive and Long Branch	2	102 acreas of residential area in Zone C
Septic systems (serves one single-family home)	R02	R2-10-20	C	Low		10 septics in Zone C	3	
Highways and roads, dirt/gravel	X24	X24-5	C	Low		Talkeetna Spur	2	
Highways and roads, dirt/gravel	X24	X24-6	C	Low		Michele Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	C	Low		Longbranch Street	2	
Highways and roads, dirt/gravel	X24	X24-8	C	Low		Setting Sun Drive	2	

Contaminant Source Inventory and Risk Ranking for

Table 4 ***PWSID 220464.001***

H & H Lodge

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*
Closed tanks, gasoline (above ground)	T11	T11-1	A	Medium	1	West of H & H Lodge Well	3	
Closed tanks, gasoline (above ground)	T11	T11-2	A	Medium	2	West of H & H Lodge Well	3	
Tanks, aviation fuel (above ground)	T02	T2-1	A	Medium	3	North of H & H Lodge Well	3	
Tanks, aviation fuel (above ground)	T02	T2-2	A	Medium	4	North of H & H Lodge Well	3	
Closed tanks, diesel (above ground)	T07	T7-1	A	Medium	5	West of H & H Lodge Well	3	
Laundromats without dry cleaning	C22	C22-1	A	Low	6	NW of H & H Lodge Well	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	7	South of H&H Lodge Well	3	
Residential Areas	R01	R1-1	A	Low	8	West of Nichols Drive, north of Parks Highway	2	9 acres of residential area in Zone A
Septic systems (serves one single-family home)	R02	R2-1	A	Low	9	West off Doris Street	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	10	East of H&H Lodge Well	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low		North side of site building	3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	Low		North of site building	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-1	A	Low		Doris Street	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low		Luthman Road	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low		Nichols Drive	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low		Sunshine Drive	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	Low		North of Nichols Drive	3	
Residential Areas	R01	R1-2	B	Low		Subdivision north of Nichols drive	2	24 acres of residential area in Zone B
Septic systems (serves one single-family home)	R02	R2-3	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		NW of Nichols Drive	3	

Contaminant Source Inventory and Risk Ranking for

Table 4 (continued) ***PWSID 220464.001***

H & H Lodge

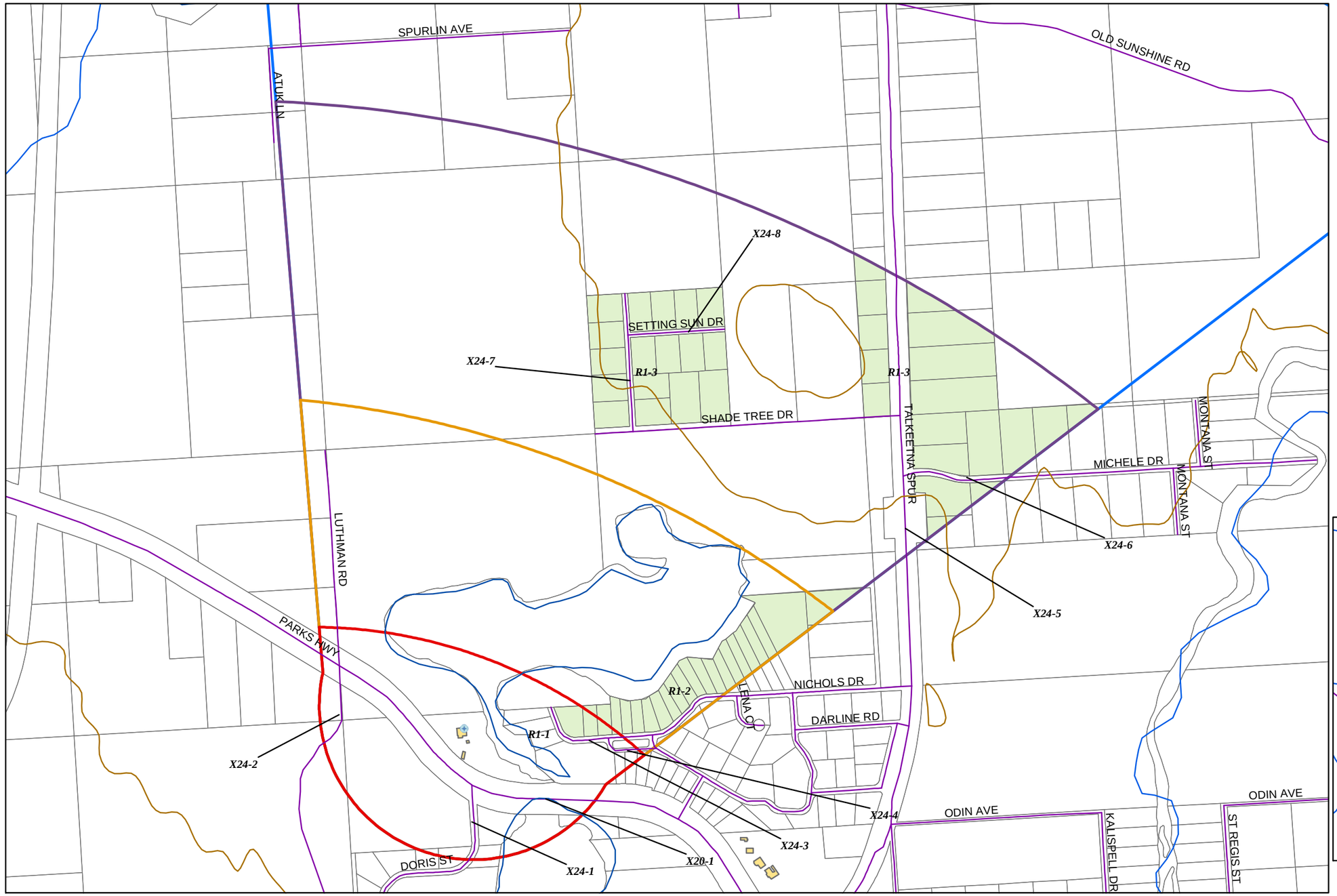
Sources of Volatile Organic Chemicals

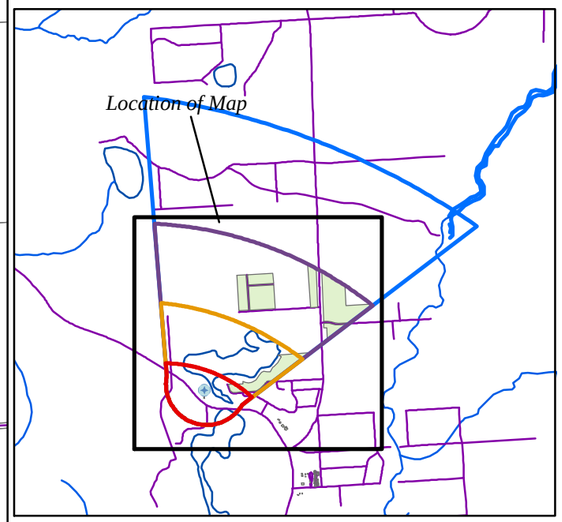
Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-7	B	Low		NW of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		North of Nichols Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		East of Luthman Road, north of H&H Lodge	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	Low		South of Shade Tree Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	Low		SE corner of Frontage Road and Michele Drive	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	C	Low		NE corner of Frontage Road and Michele Drive	3	
Residential Areas	R01	R1-3	C	Low		Residences north and south of Michele Drive; and around Setting Sun Drive and Long Branch	2	102 acreas of residential area in Zone C
Septic systems (serves one single-family home)	R02	R2-10-20	C	Low		10 septics in Zone C	3	
Highways and roads, dirt/gravel	X24	X24-5	C	Low		Talkeetna Spur	2	
Highways and roads, dirt/gravel	X24	X24-6	C	Low		Michele Drive	2	
Highways and roads, dirt/gravel	X24	X24-7	C	Low		Longbranch Street	2	
Highways and roads, dirt/gravel	X24	X24-8	C	Low		Setting Sun Drive	2	

APPENDIX C

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

Drinking Water Protection Areas for H & H Lodge and Potential and Existing Sources of Contamination





- H & H Lodge Well
- MSB Roads
- Smaller Rivers
- Main Rivers
- Lakes
- 25 Meter Contours
- MSB Land Parcels
- Site Buildings
- Residential Areas (R1)

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

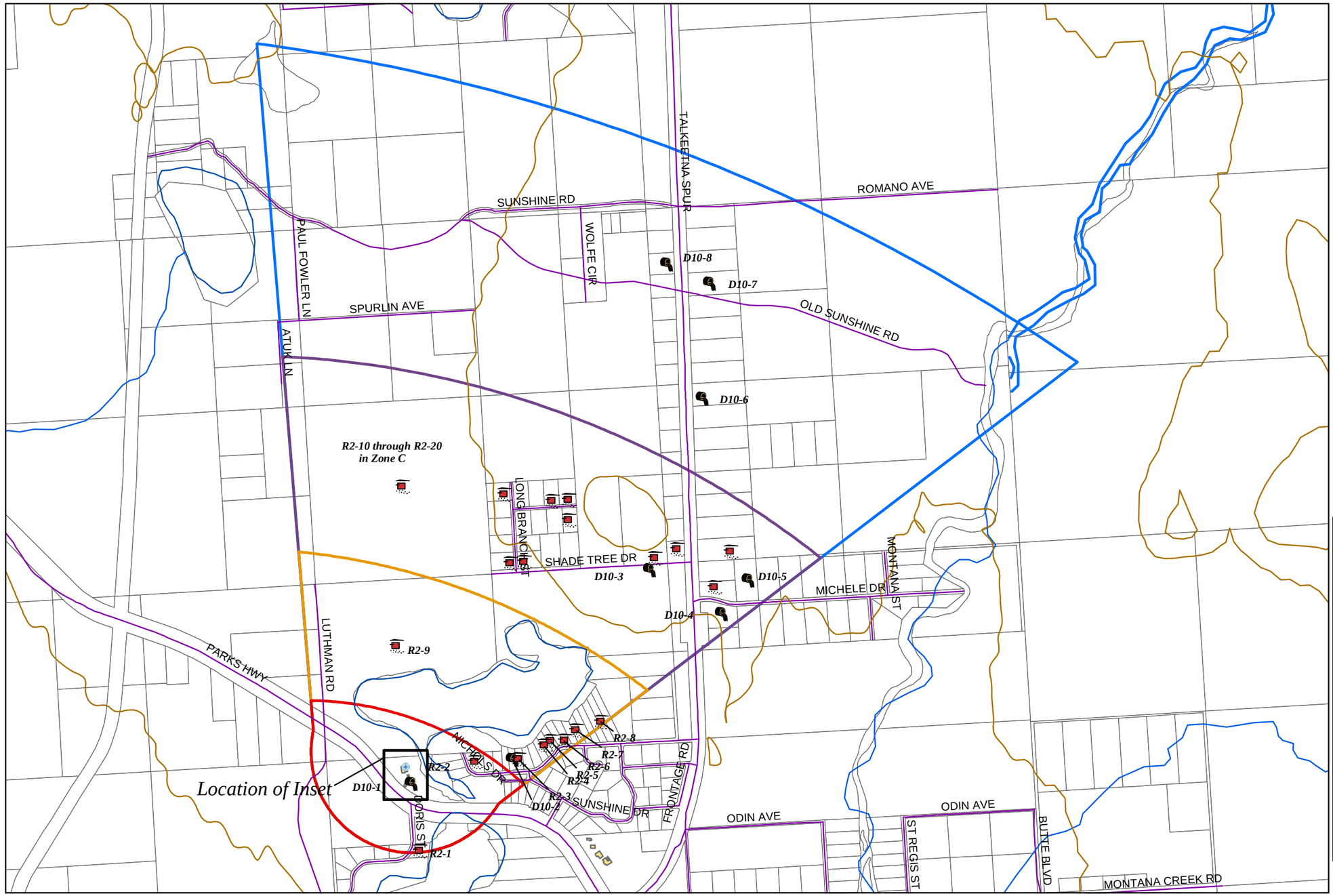
1,900 950 0 1,900 Feet

PWSID 220464.001

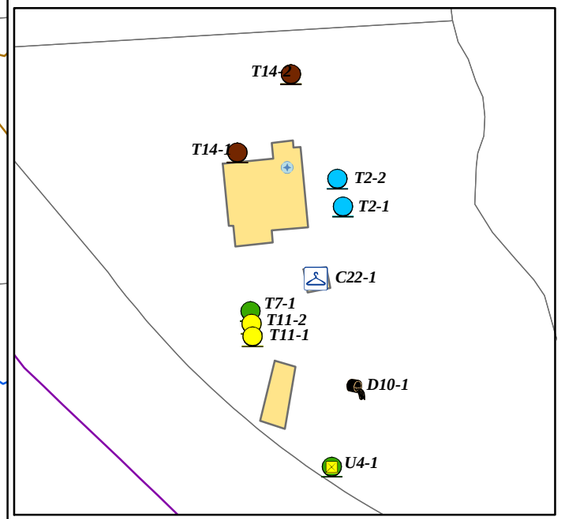
N W E S

Map 2

Drinking Water Protection Areas for H & H Lodge and Potential and Existing Sources of Contamination



- H & H Lodge Well
- Contaminated sites, DEC recognized, non-Superfund, non-RCRA (U4)
- Laundromat (C22)
- Tanks, aviation fuel, aboveground (T2)
- Tanks, diesel, aboveground, closed (T7)
- Tanks, gasoline, aboveground, closed (T11)
- Tanks, heating oil, nonresidential aboveground (T14)
- Large Capacity Septic Systems (D10)
- Single Family Septic Systems (R2)
- MSB Roads
- Site Buildings
- MSB Land Parcels
- **Zone A Protection Area**
  - Several Months Travel Time
- **Zone B Protection Area**
  - Less than 2-Years Travel Time
- **Zone C Protection Area**
  - Less than 5-Years Travel Time
- **Zone D Protection Area**
  - Less than 10-Years Travel Time



2,900 1,450 0 2,900 Feet

PWSID 220464.001

N W E S

Map 3

APPENDIX D

Vulnerability Analysis for H&H Lodge Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the Wellhead - H & H Lodge

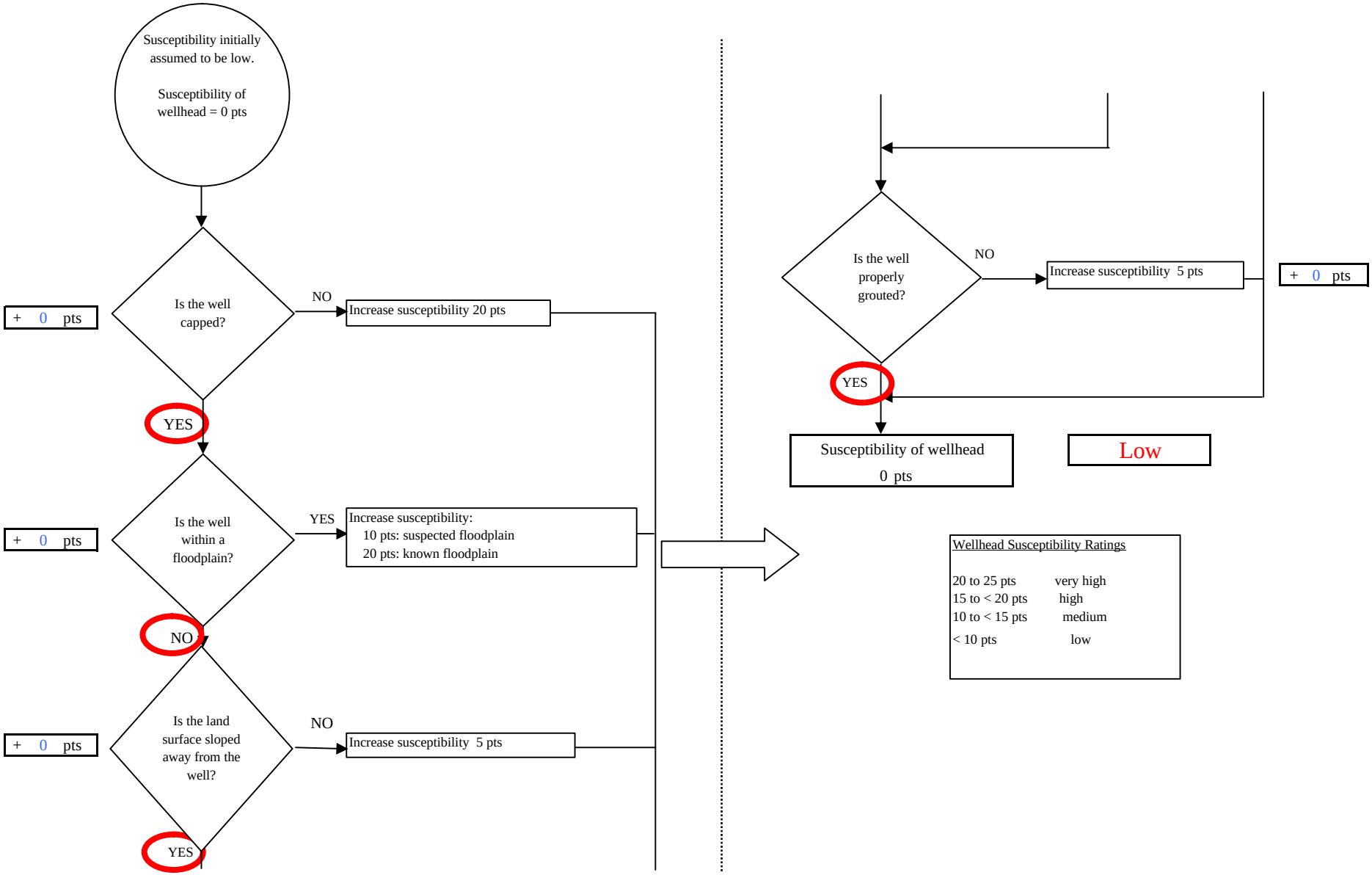


Chart 2. Susceptibility of the Aquifer - H & H Lodge

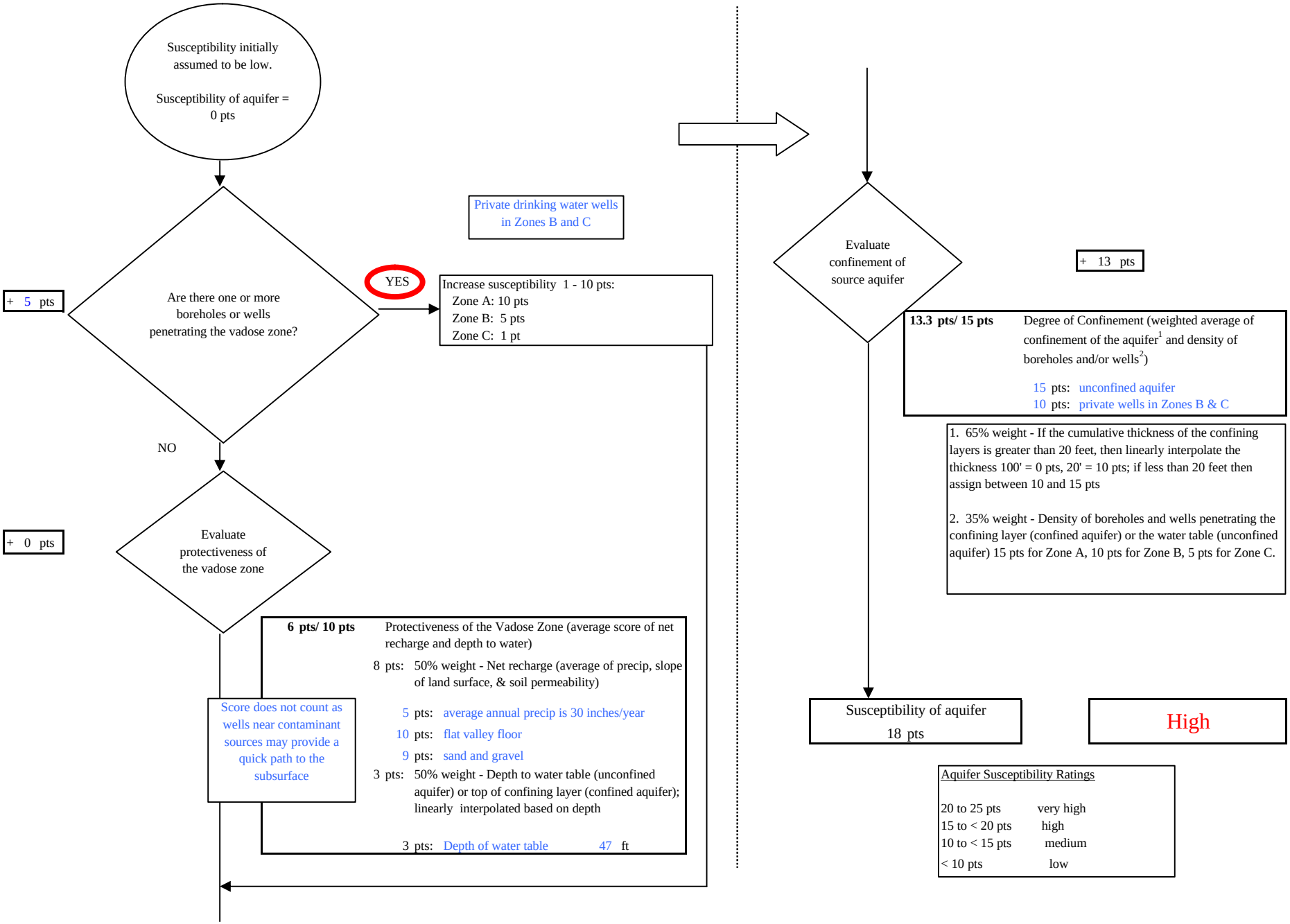
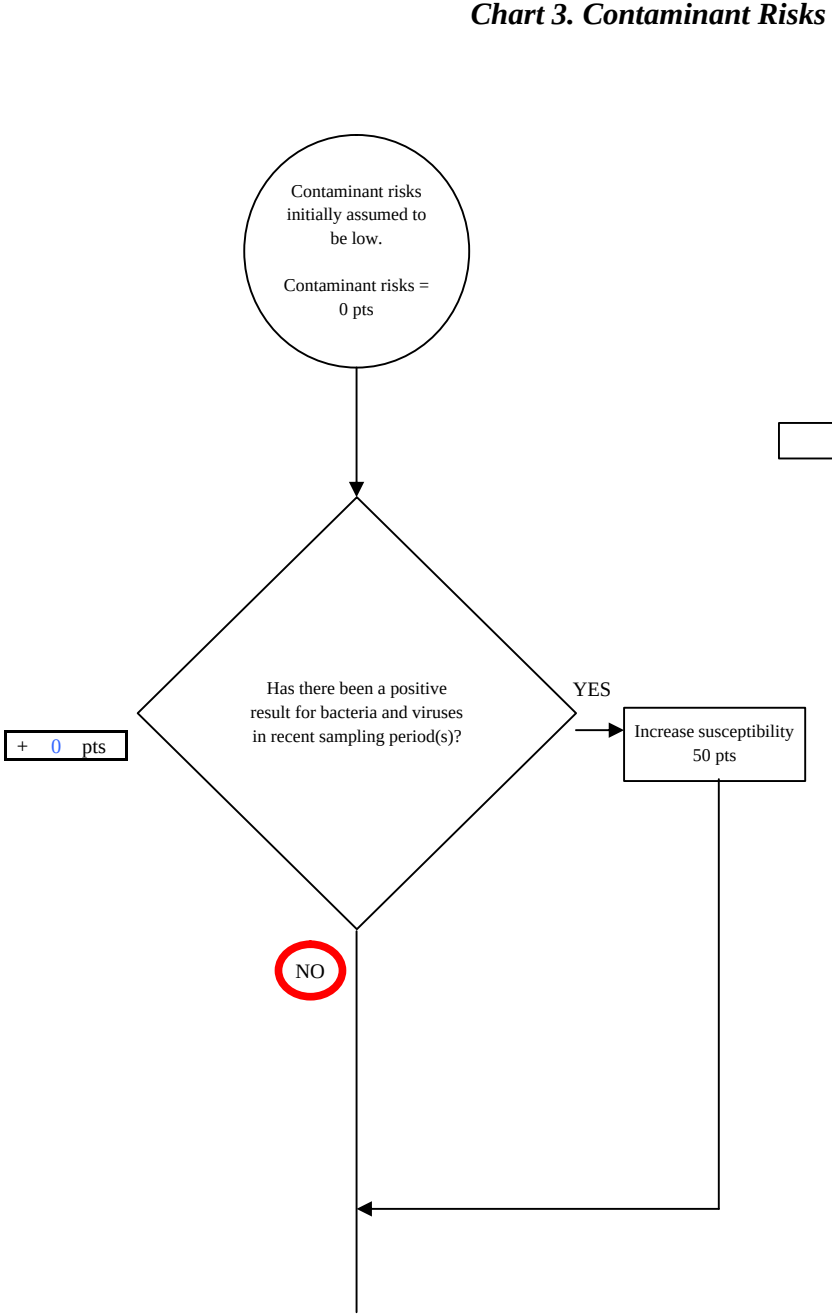
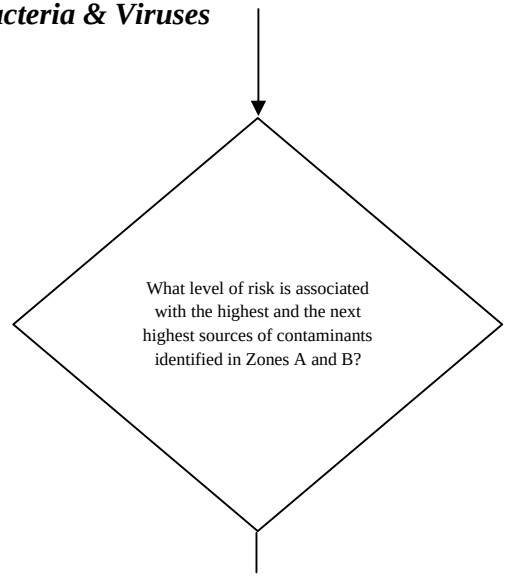


Chart 3. Contaminant Risks for H & H Lodge - Bacteria & Viruses





+ 40 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	1	1	2
Medium(s)	0	0	0
Low(s)	5	2	7

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

Matrix Score 40

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 H & H Lodge - Bacteria & Viruses

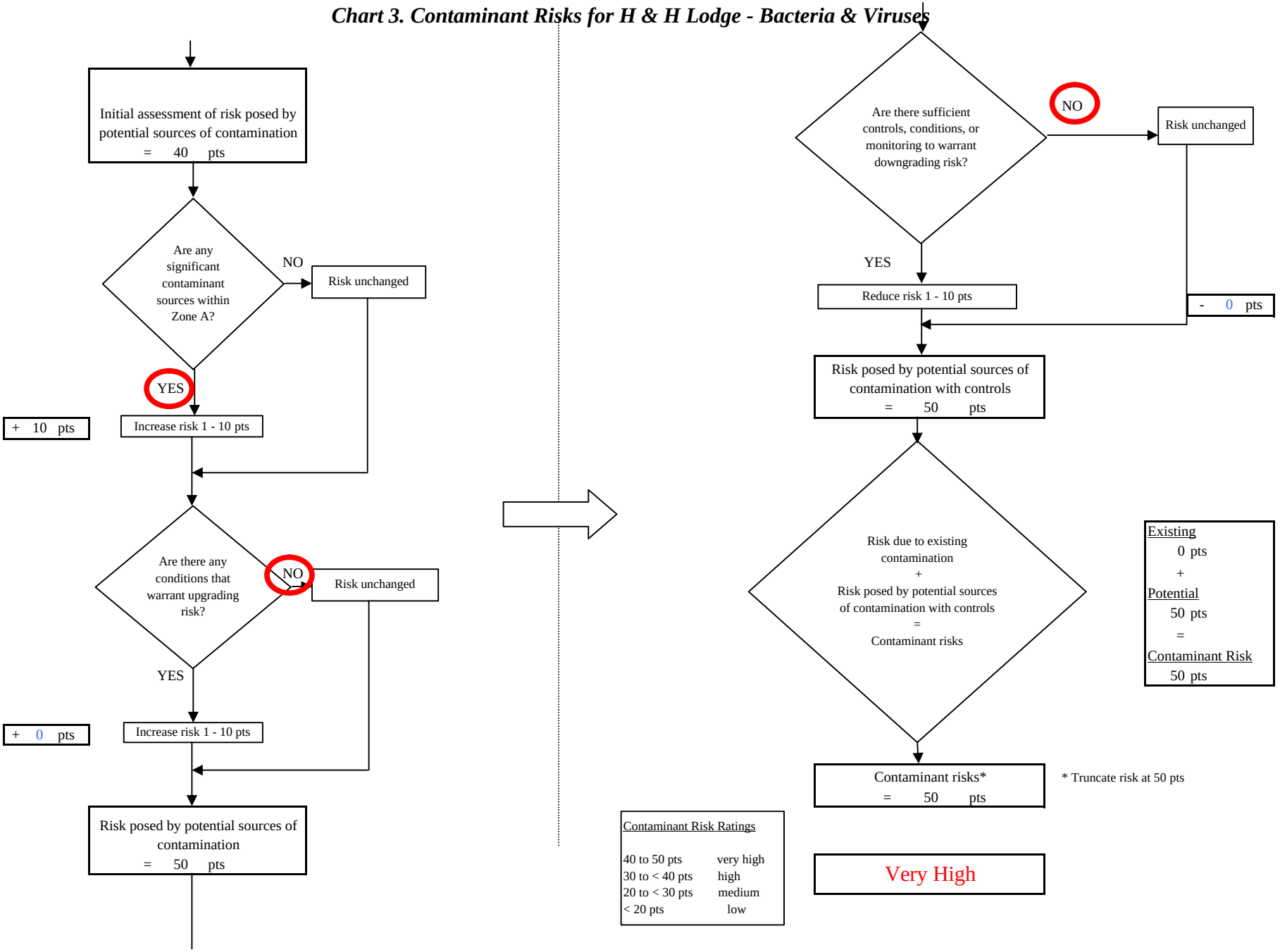


Chart 4. Vulnerability Analysis for H & H Lodge - Bacteria & Viruses

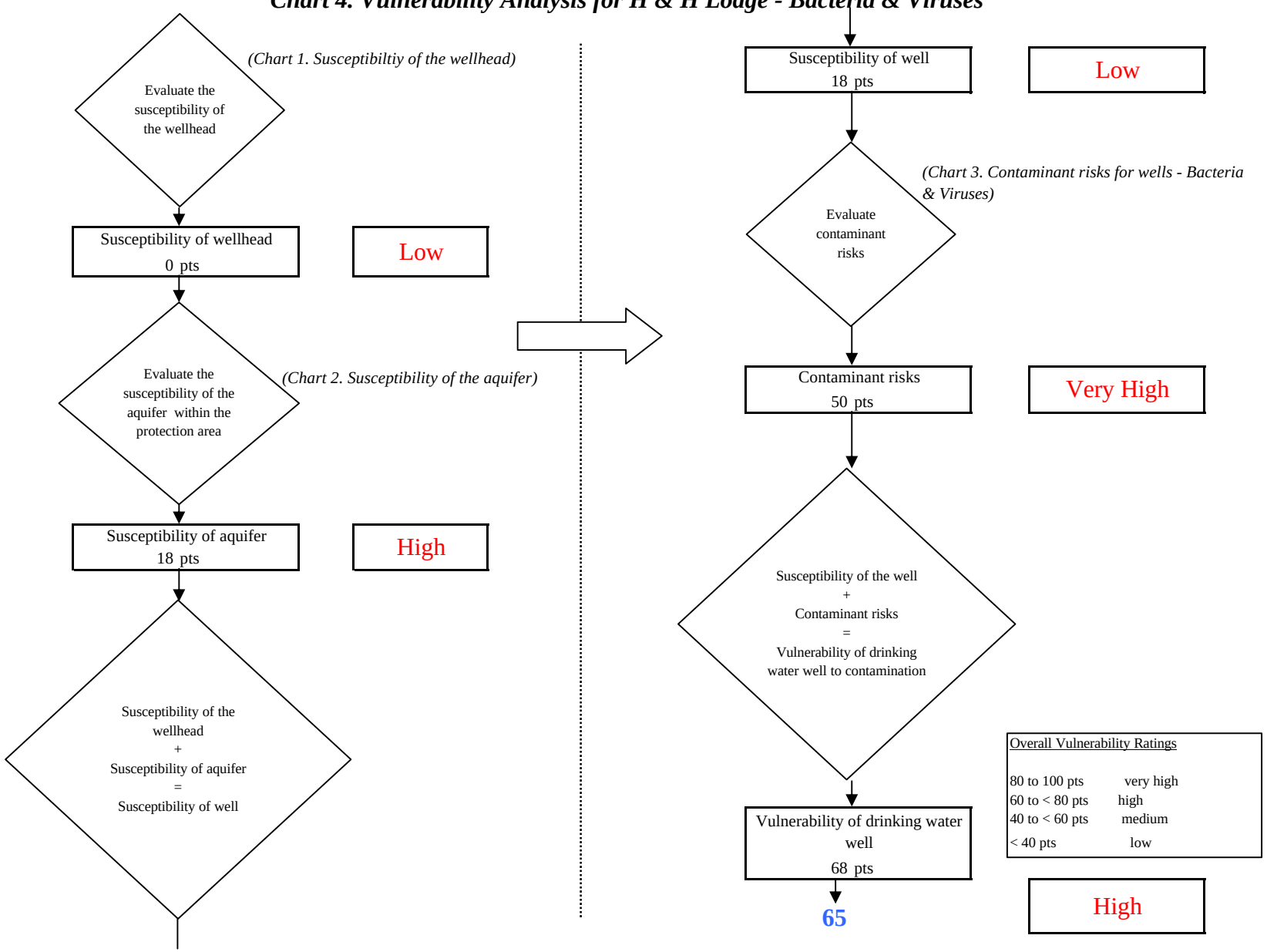


Chart 5. Contaminant Risks for H & H Lodge - Nitrates and Nitrites

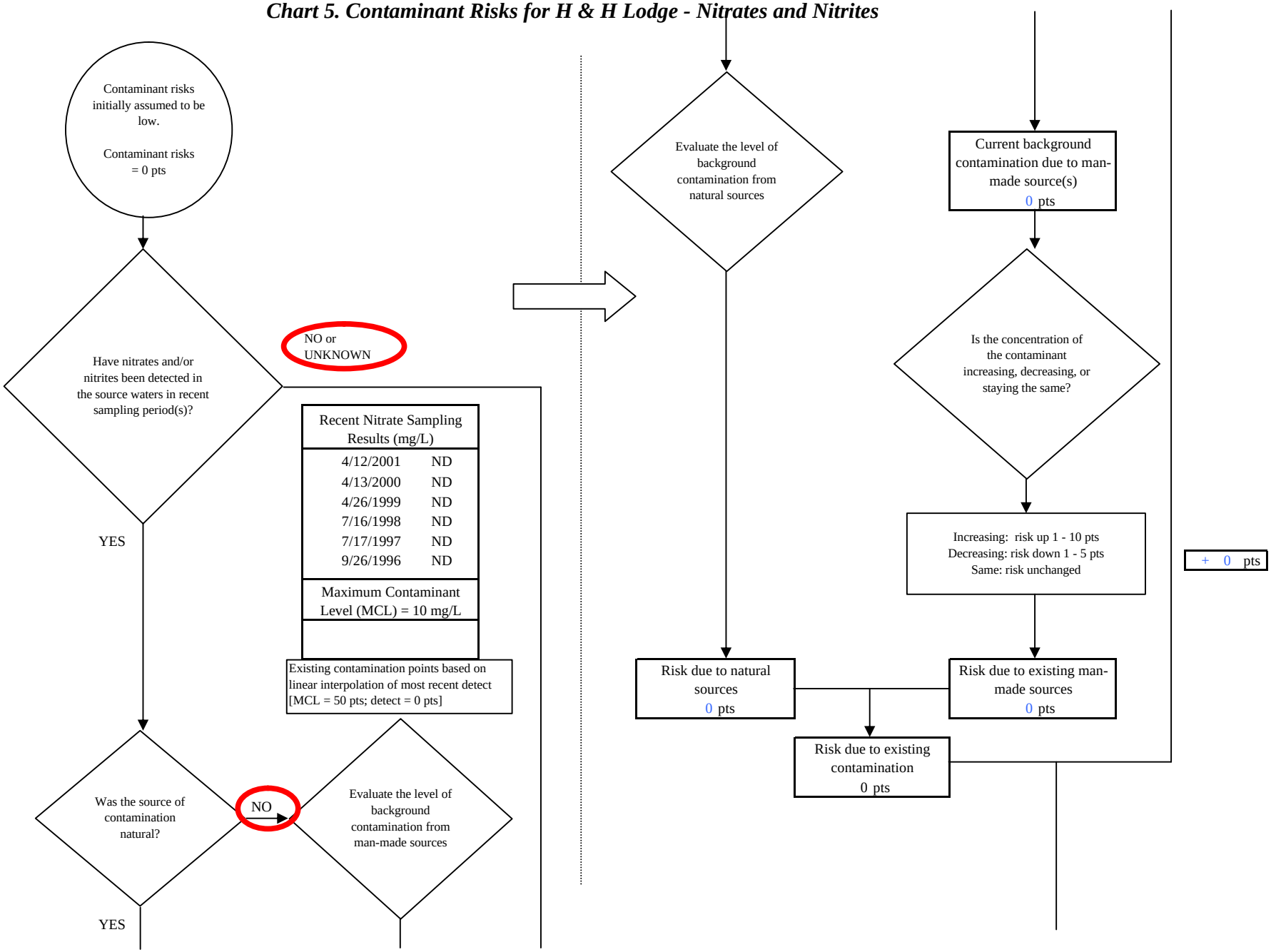


Chart 5. Contaminant Risks for H & H Lodge - Nitrates and Nitrites

+ 40 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)	1	4	5
Medium(s)	0	0	0
Low(s)	3	4	7

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

Matrix Score	40

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 = 40 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

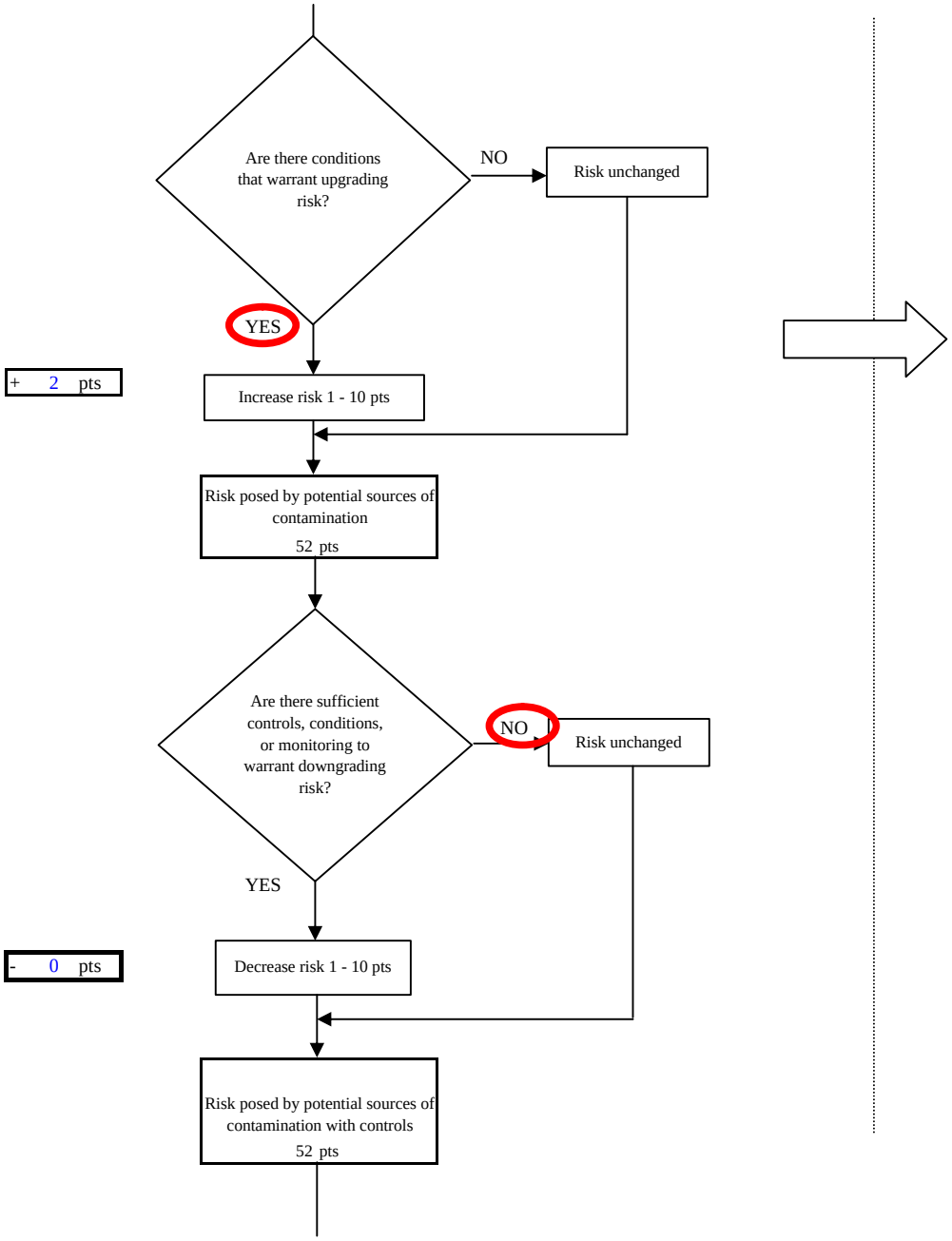
Are any significant sources within Zone A?

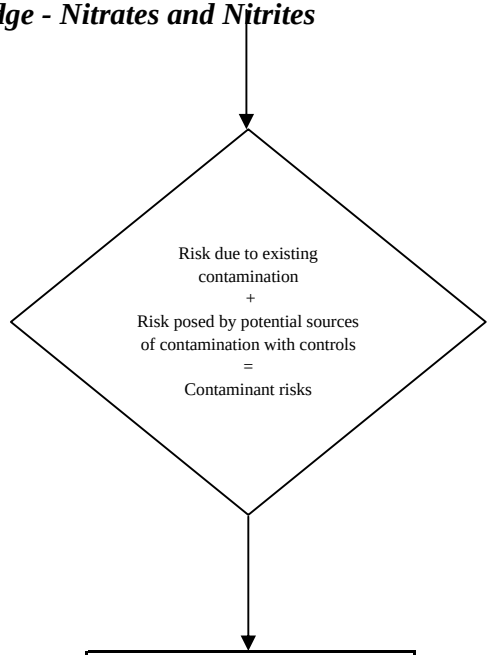
NO → Risk unchanged

YES → Increase risk 1 - 10 pts

+ 10 pts

Chart 5. Contaminant Risks for H & H Lodge - Nitrates and Nitrites





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

Contaminant risks*
= 50 pts

*Truncate risk at 50 pts

Very High

Contaminant Risk Ratings

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

Chart 6. Vulnerability Analysis for H & H Lodge - Nitrates and Nitrites

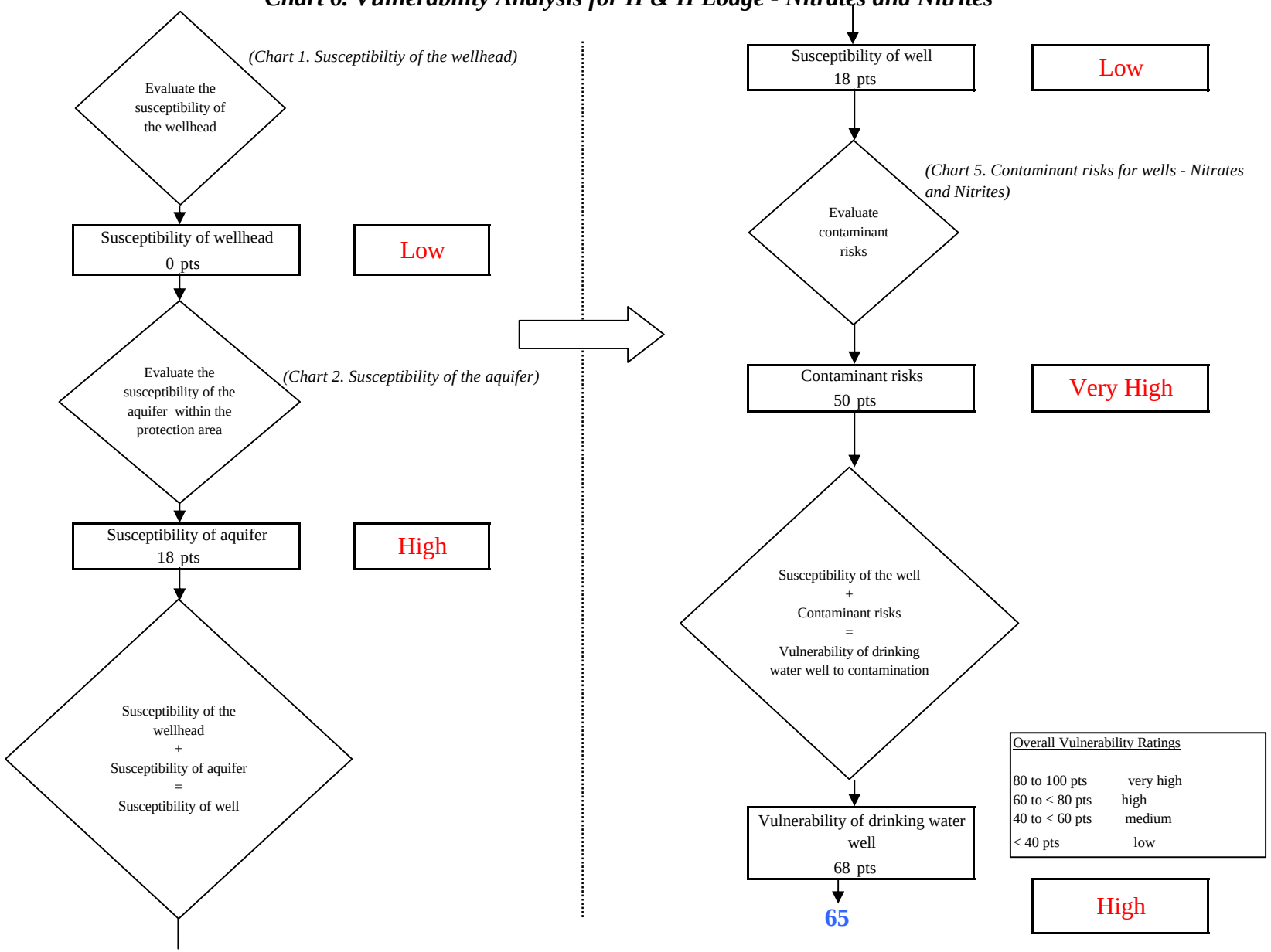


Chart 7. Contaminant Risks for H & H Lodge - Volatile Organic Chemicals

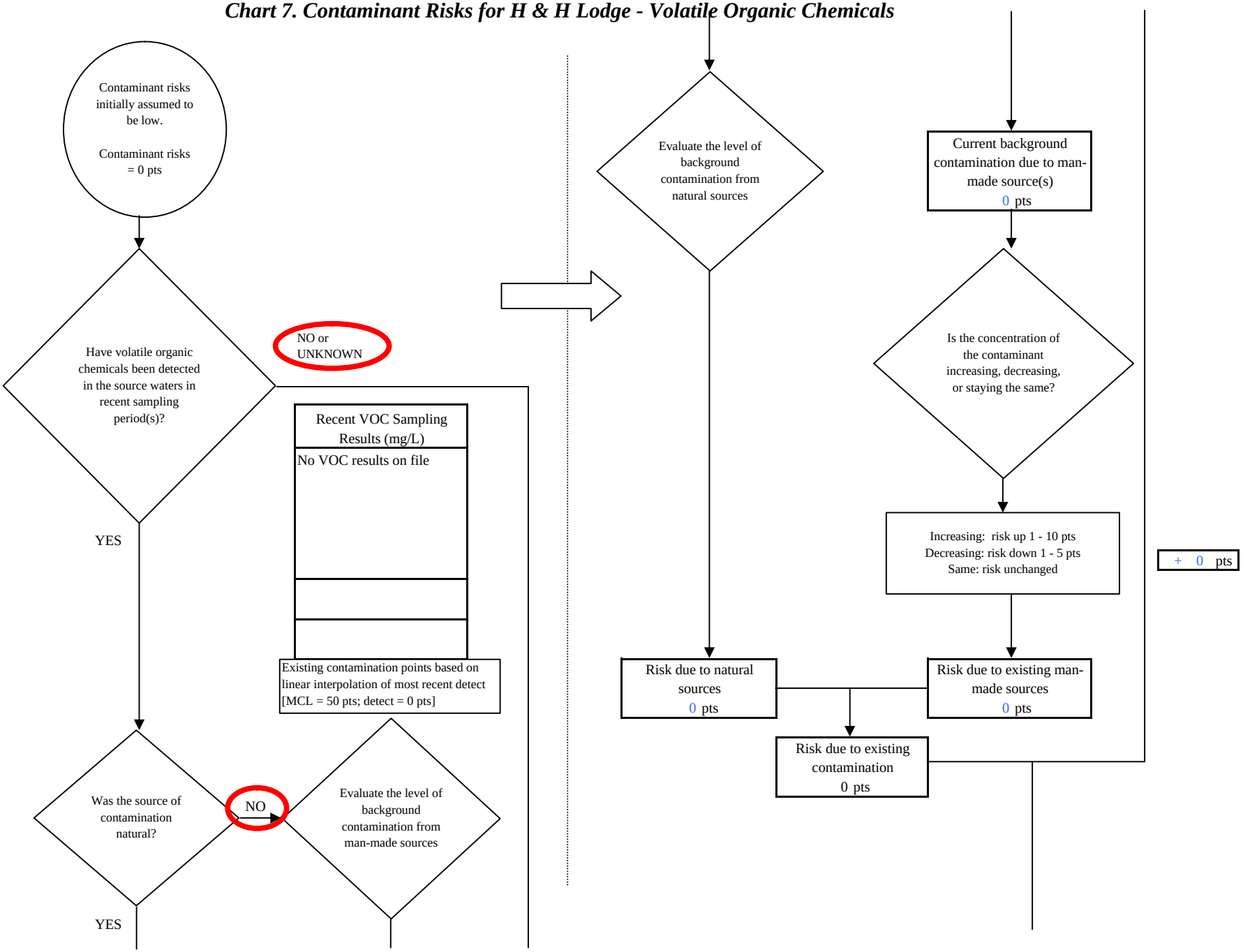


Chart 7. Contaminant Risks for H & H Lodge - Volatile Organic Chemicals

+ 25 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)	5	0	5
Low(s)	7	8	15

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

Matrix Score 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

- 0 pts

Decrease risk 1 - 10 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

+ 10 pts

Increase risk 1 - 10 pts

Chart 7. Contaminant Risks for H & H Lodge - Volatile Organic Chemicals

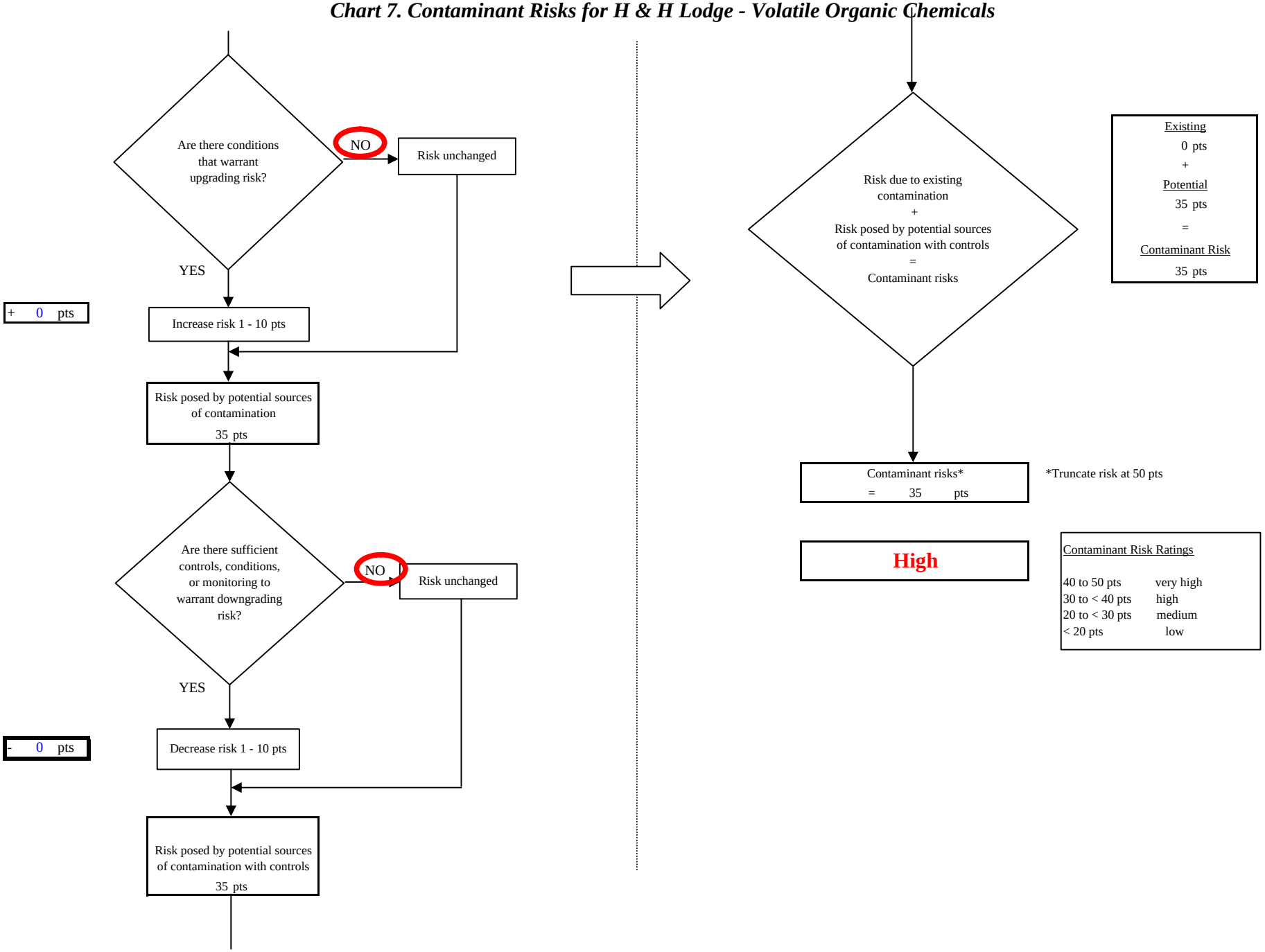


Chart 8. Vulnerability Analysis for H & H Lodge - Volatile Organic Chemicals