Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Montana Creek Drinking Water System, Talkeetna, Alaska Montana Creek # 224450

DRINKING WATER PROTECTION PROGRAM REPORT *236*
Alaska Department of Environmental Conservation

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By Shannon & Wilson, Inc.

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Source Water Assessment for Montana Creek Source of Public Drinking Water, Talkeetna, Alaska

By Shannon & Wilson, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Montana Creek 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 Montana Creek public drinking water source include: water supply wells; roads; large-capacity and single-family septic systems; and residential areas. 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 Montana Creek received a vulnerability rating of **Low** for volatile organic chemicals, **High** 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.

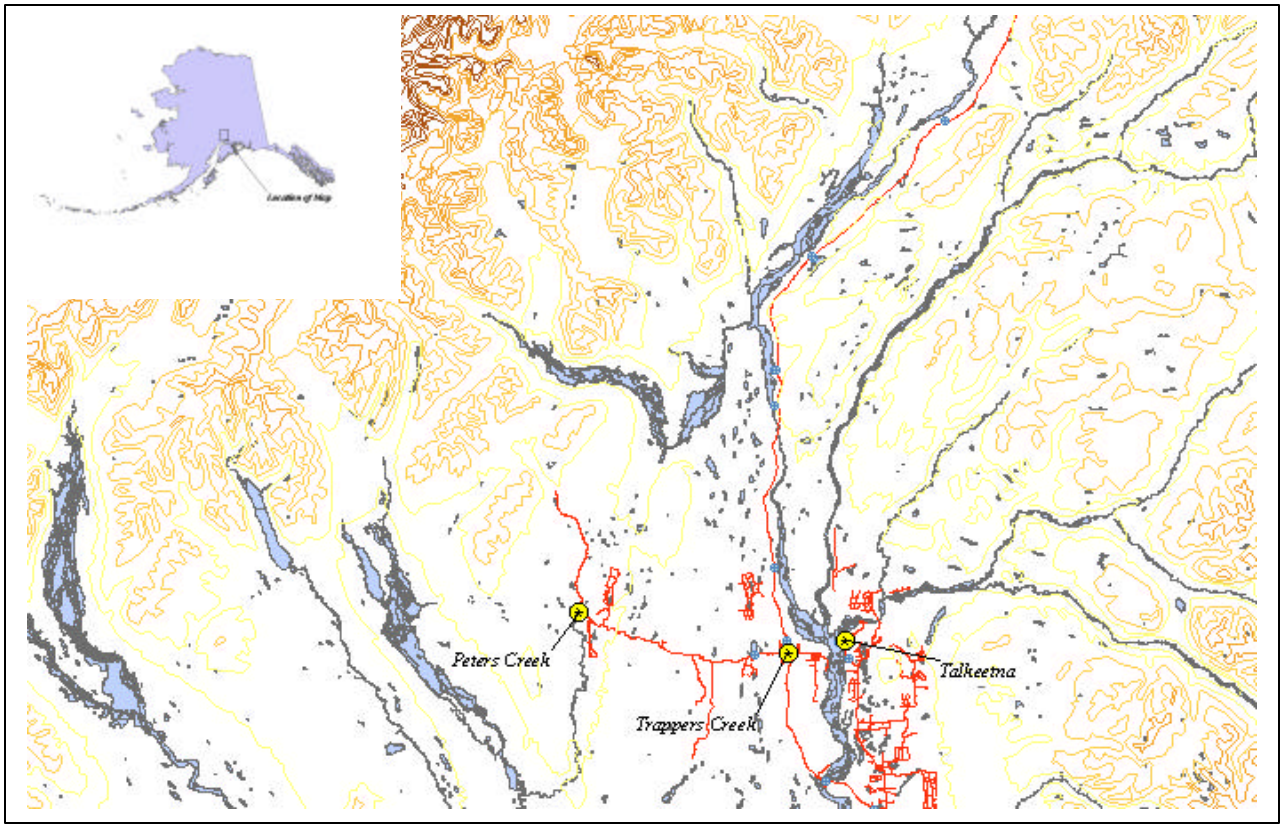


Figure 1. Index map showing the location of the Upper Susitna River Region.

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.

MONTANA CREEK PUBLIC DRINKING WATER SYSTEM

Montana Creek is a Class B (transient/non-community) water system. The system consists of one well at Mile 96.6 of the Parks Highway.

According to the well log completed for the water system, installation of the well occurred on July 10, 1984, to a total depth of approximately 43 feet below ground surface and was completed in 6-inch well casing. The most recent Sanitary Survey (7/5/99) 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 no residents and more than 75 non-residents through one service connection.

MONTANA CREEK 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 Montana Creek 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 MONTANA CREEK 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 Montana Creek 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 Montana Creek.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	22	Very High
Natural Susceptibility	27	Medium

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	50	Very High
Nitrates and/or Nitrites	44	Very High
Volatile Organic Chemicals	7	Low

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

Table 4 contains the overall vulnerability scores (0 – 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 Montana Creek to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	75	High
Nitrates and Nitrites	70	High
Volatile Organic Chemicals	35	Low

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

The water supply wells, roads; large-capacity and single-family septic systems, and residential areas create a risk increase for the bacteria and viruses, nitrates and nitrites, and volatile organic compounds.

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

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).

The ampling history for Montana Creek well indicates that nitrate are not on file (see Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). The Maximum Contaminant Level (MCL) for Nitrates is 10 mg/L. The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water.

The water supply wells; roads; large-capacity and single-family septic systems; and residential areas located in Zones A, B, C and D form the greatest risk for volatile organic chemicals.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Montana Creek. The overall vulnerability of this source to contamination is **Low** for volatile organic chemicals, **High** 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 Montana Creek 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 Montana Creek 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.

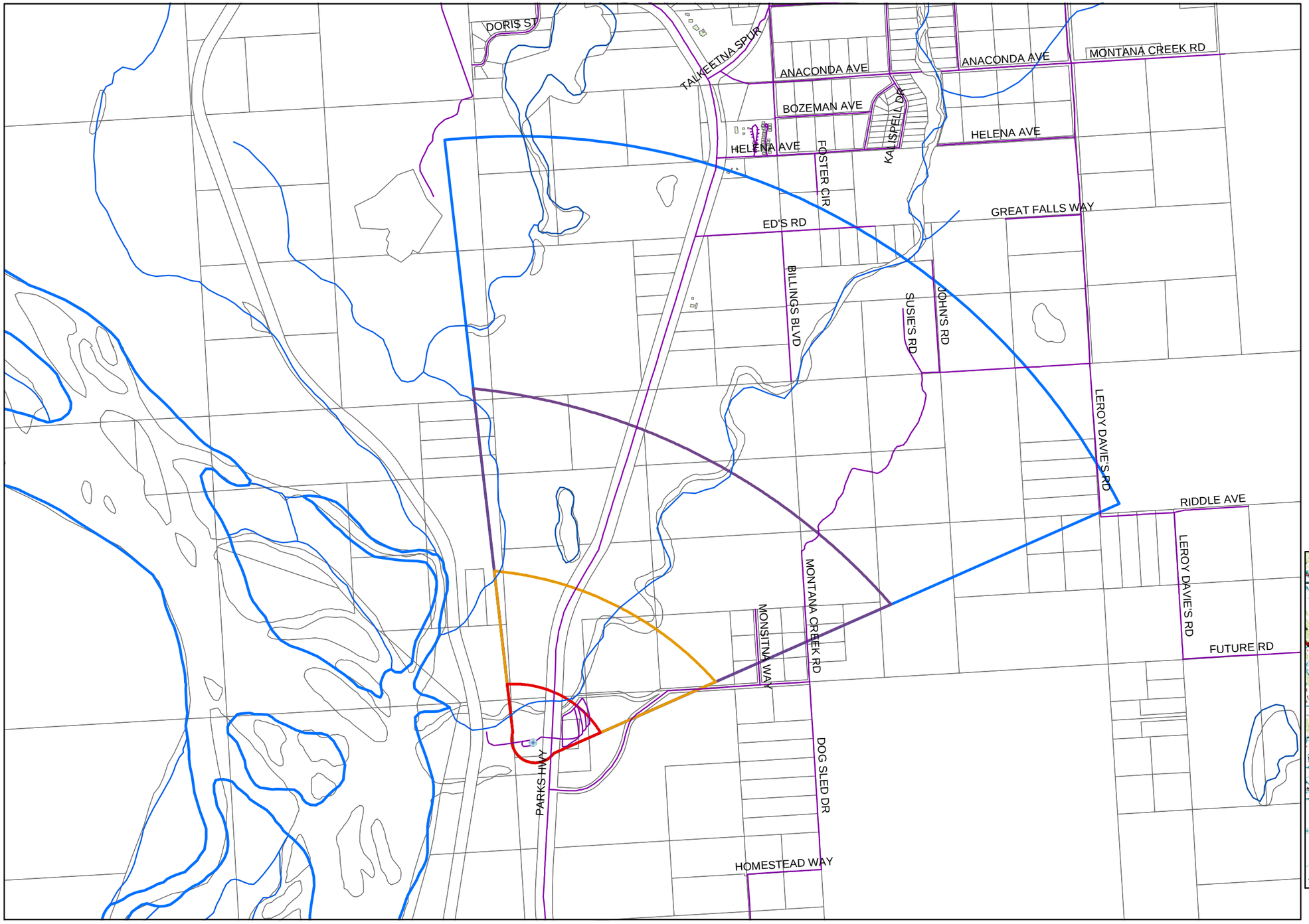
Wang, B., Strelakos, P.M., and Jokela, J.B., 2000, Nitrate source indicators in ground water of the scimitar subdivision, Peters Creek Area, Anchorage, Alaska: US Geological Survey Water-Resources Investigations Report 00-4137.

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

APPENDIX A

Montana Creek
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Areas for Montana Creek



Montana Creek Well

MSB Roads

Smaller Rivers

Main Rivers

Lakes

MSB Land Parcels

Zone A Protection Area

Several Months Travel Time

Zone B Protection Area

Less than 2-Years Travel Time

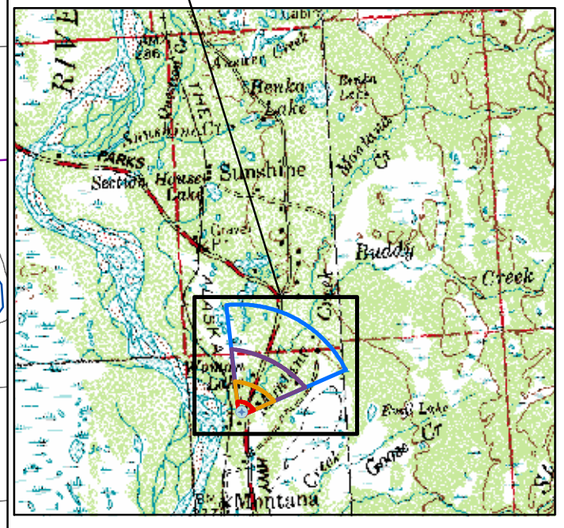
Zone C Protection Area

Less than 5-Years Travel Time

Zone D Protection Area

Less than 10-Years Travel Time

Location of Map



3,400 1,700 0 3,400 Feet

PWSID 22450.001

N W E S

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Montana Creek (Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 224450.001***

Montana Creek

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Water supply wells	W09	W9-1	A	Montana Creek Campground 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	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Access Road 4	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Access Road 5	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Access Road 6	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Access Road 7	2	
Highways and roads, dirt/gravel	X24	X24-8	B	Montana Creek Road	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	C	West of Parks Highway, north of site	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	C	East of Montana Creek Road	3	
Residential Areas	R01	R1-1	C	Residential area near Monsitna Way	2	34 acres of Residential Area
Septic systems (serves one single-family home)	R02	R2-1	C	Residence along Monsitna Way	3	
Septic systems (serves one single-family home)	R02	R2-2	C	Residence along Montana Creek Road	3	
Highways and roads, dirt/gravel	X24	X24-9	C	Monsitna Way	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	D	East of Parks Highway, west of Billings Blvd.	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	D	West off Butte Blvd.	3	

Contaminant Source Inventory and Risk Ranking for

Table 2 ***PWSID 224450.001***

Montana Creek

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*
Highways and roads, dirt/gravel	X24	X24-1	A	Low	1	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	3	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low	4	Access Road 4	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Low	5	Access Road 5	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Low	6	Access Road 6	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Low	7	Access Road 7	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	8	Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-8	B	Low	9	Montana Creek Road	2	

Contaminant Source Inventory and Risk Ranking for

Table 3 ***PWSID 224450.001***

Montana Creek

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	C	High	1	West of Parks Highway, north of site	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	C	High	2	East of Montana Creek Road	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	D	High	3	East of Parks Highway, west of Billings Blvd.	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	D	High	4	West off Butte Blvd.	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	5	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	6	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	7	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low	8	Access Road 4	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Low	9	Access Road 5	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Low	10	Access Road 6	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low		Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Low		Access Road 7	2	
Highways and roads, dirt/gravel	X24	X24-8	B	Low		Montana Creek Road	2	
Residential Areas	R01	R1-1	C	Low		Residential area near Monsitna Way	2	34 acres of Residential Area
Septic systems (serves one single-family home)	R02	R2-1	C	Low		Residence along Monsitna Way	3	
Septic systems (serves one single-family home)	R02	R2-2	C	Low		Residence along Montana Creek Road	3	
Highways and roads, dirt/gravel	X24	X24-9	C	Low		Monsitna Way	2	

Contaminant Source Inventory and Risk Ranking for

Table 4 ***PWSID 224450.001***

Montana Creek

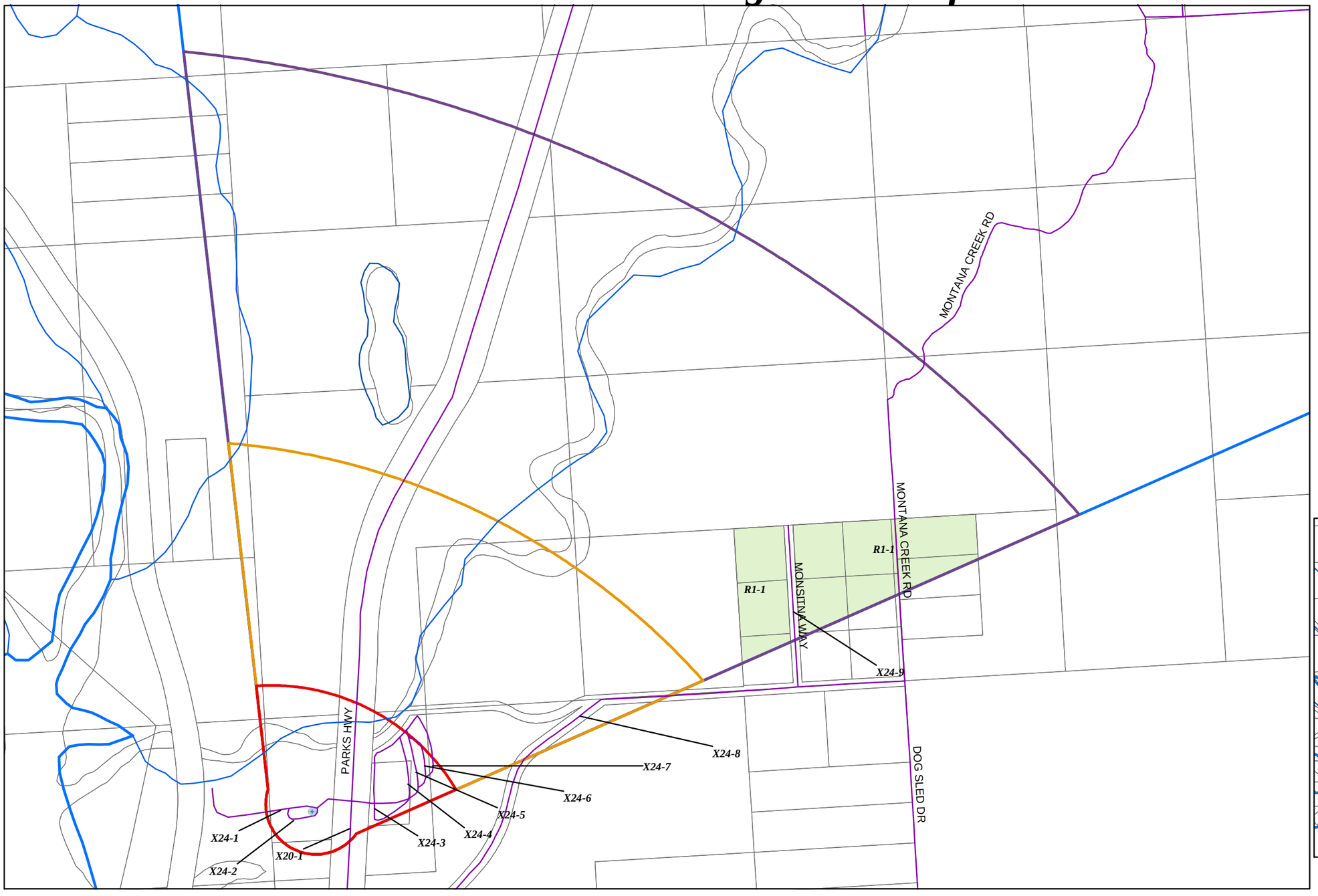
Sources of Volatile Organic Chemicals

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, dirt/gravel	X24	X24-1	A	Low	1	Access Road 1	2	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	2	Access Road 2	2	
Highways and roads, dirt/gravel	X24	X24-3	A	Low	3	Access Road 3	2	
Highways and roads, dirt/gravel	X24	X24-4	A	Low	4	Access Road 4	2	
Highways and roads, dirt/gravel	X24	X24-5	A	Low	5	Access Road 5	2	
Highways and roads, dirt/gravel	X24	X24-6	A	Low	6	Access Road 6	2	
Highways and roads, dirt/gravel	X24	X24-7	A	Low	7	Access Road 7	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	8	Parks Highway	2	
Highways and roads, dirt/gravel	X24	X24-8	B	Low	9	Montana Creek Road	2	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	C	Low	10	West of Parks Highway, north of site	3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	C	Low		East of Montana Creek Road	3	
Residential Areas	R01	R1-1	C	Low		Residential area near Monsitna Way	2	34 acres of Residential Area
Septic systems (serves one single-family home)	R02	R2-1	C	Low		Residence along Monsitna Way	3	
Septic systems (serves one single-family home)	R02	R2-2	C	Low		Residence along Montana Creek Road	3	
Highways and roads, dirt/gravel	X24	X24-9	C	Low		Monsitna Way	2	

APPENDIX C

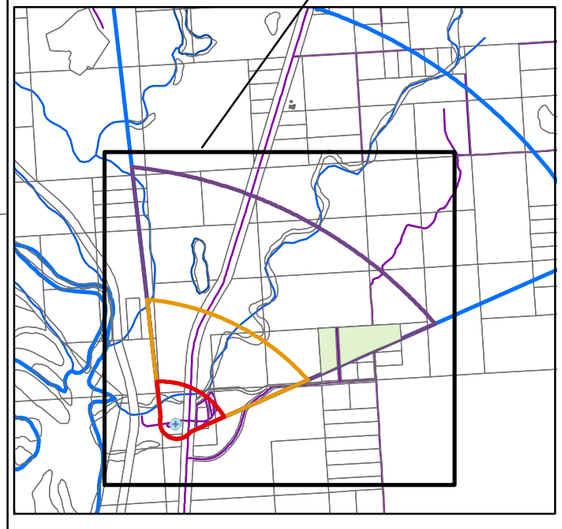
Montana Creek
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps 2-3)

Drinking Water Protection Areas for Montana Creek and Potential and Existing Sources of Contamination



Montana Creek Well
MSB Roads
Smaller Rivers
Main Rivers
Lakes
MSB Land Parcels
Residential Areas
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

Location of Map



1,600 800 0 1,600 Feet

PWSID 22450.001

N
W E
S

Map 2

Drinking Water Protection Areas for Montana Creek and Potential and Existing Sources of Contamination

HELENA AVE
HELENA AVE
FOSTER CIR
GREAT FALLS WAY
ED'S RD
PARKS HWY
BILLINGS BLVD
SUSIE'S RD
JOHN'S RD
D10-3
D10-4
MONTANA CREEK RD
RIDDLE AVE
LEROY DAVIE'S RD
D10-1
Location of Map
R2-2
MONTANA CREEK RD
MONSTRNAWAY
D10-2
R2-1
FUTURE RD
DOG SLED DR
W9-1

Montana Creek Well
Water Supply Wells (W9)
Large Capacity Septic Systems (D10)
Single Family Septic Systems (R2)
MSB Roads
Smaller Rivers
Main Rivers
Lakes
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

2,700 1,350 0 2,700 Feet

N
W E
S

Map 3

APPENDIX D

Vulnerability Analysis for Montana Creek Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Montana Creek

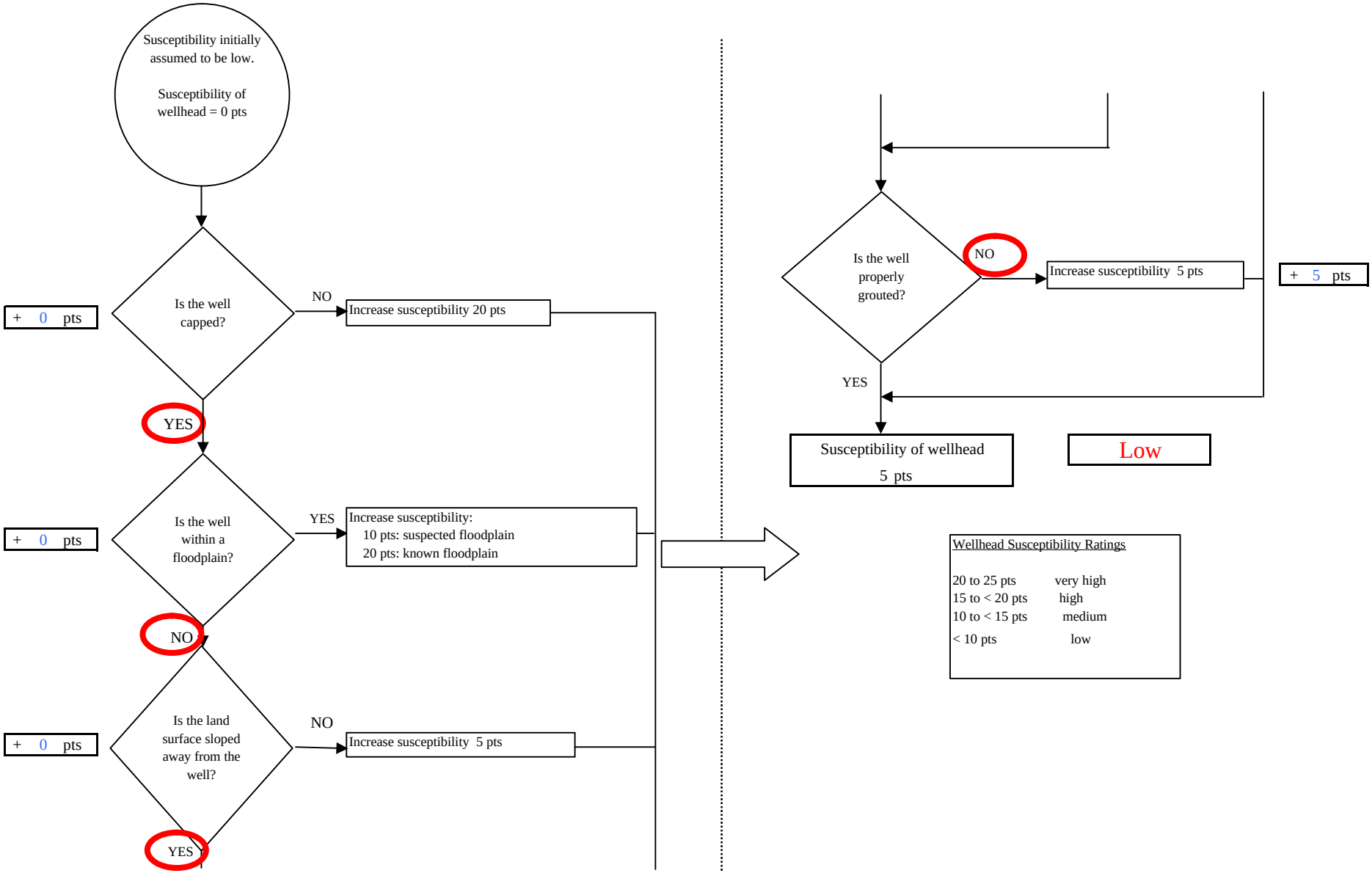


Chart 2. Susceptibility of the aquifer - Montana Creek

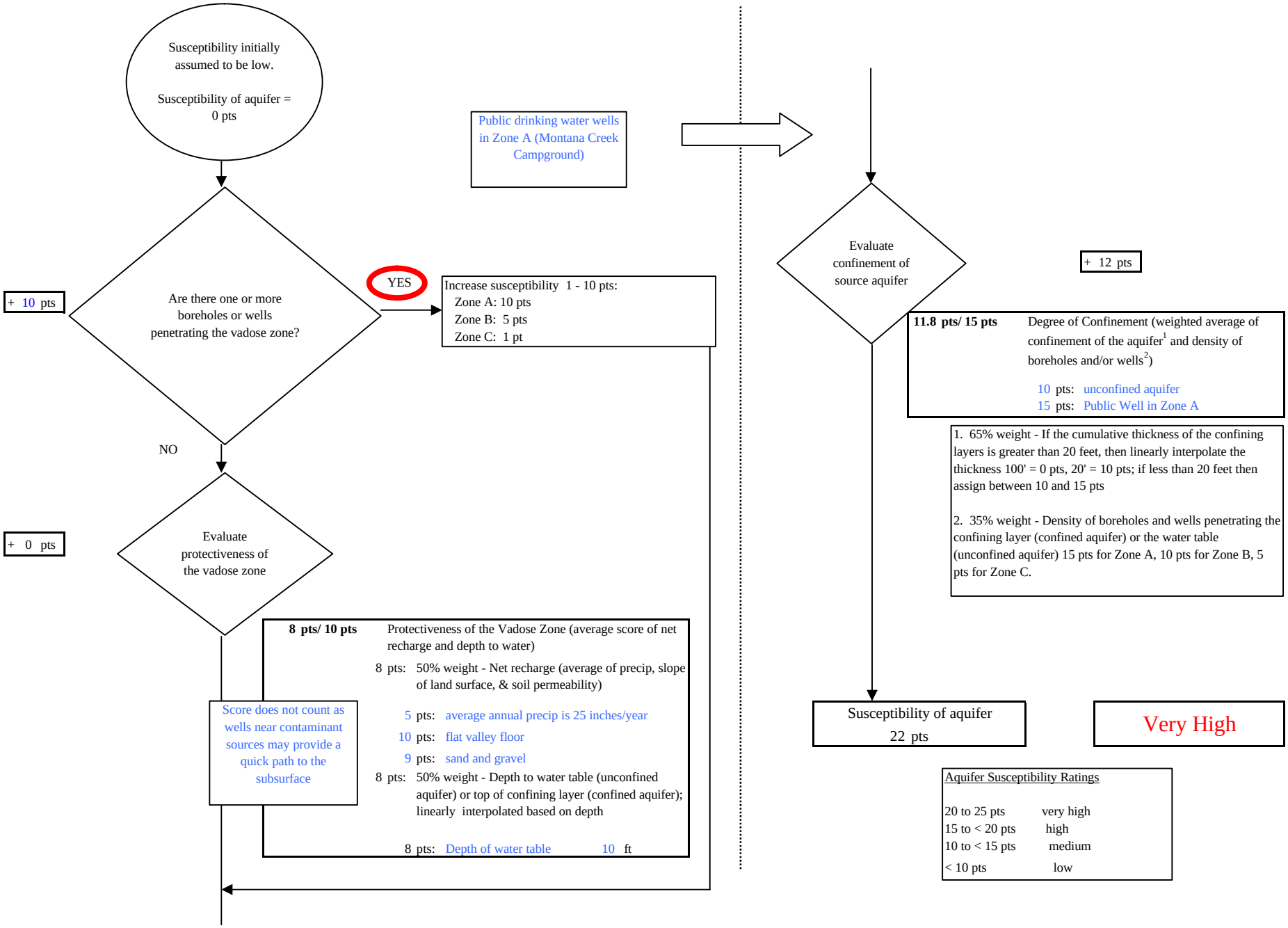
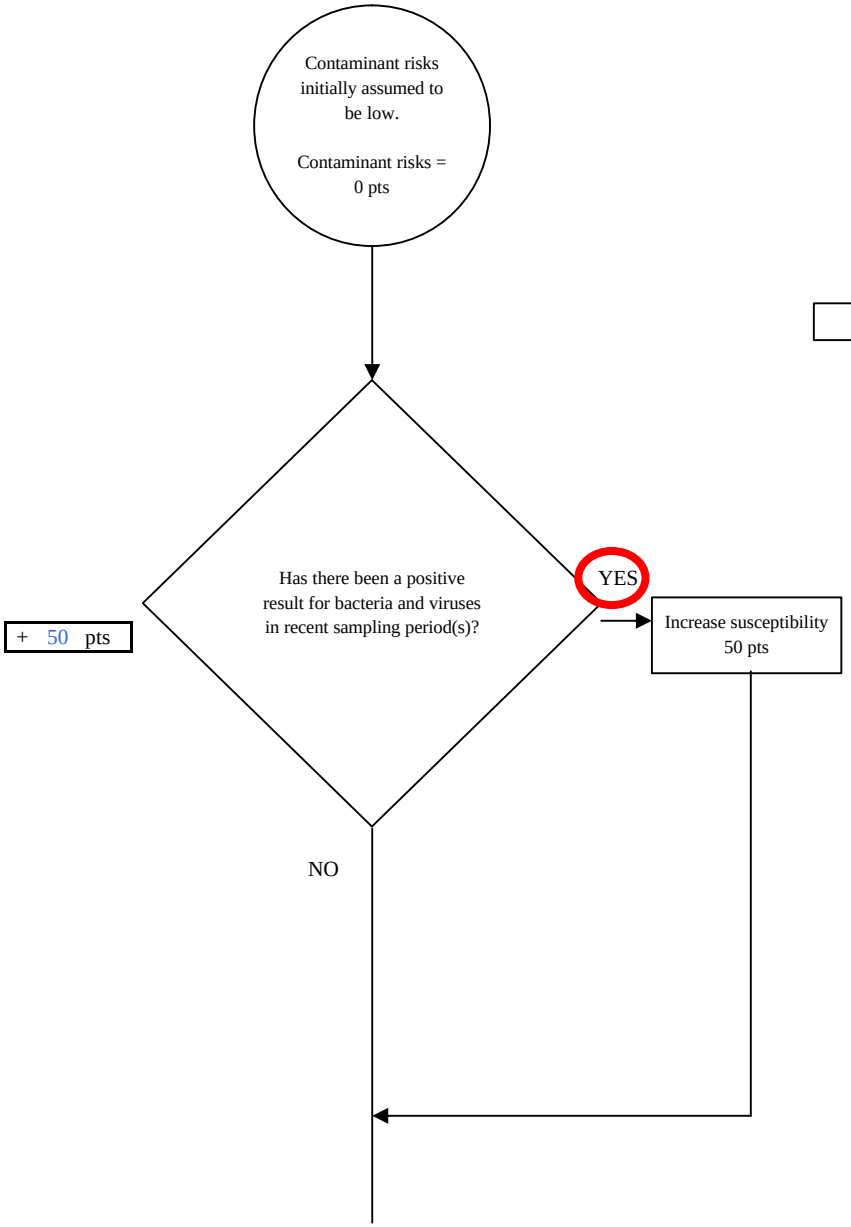
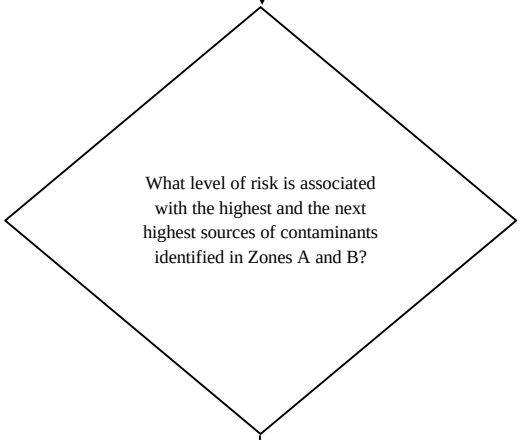


Chart 3. Contaminant risks for Montana Creek - Bacteria & Viruses





+ 10 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

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

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

Matrix Score 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 Montana Creek - Bacteria & Viruses

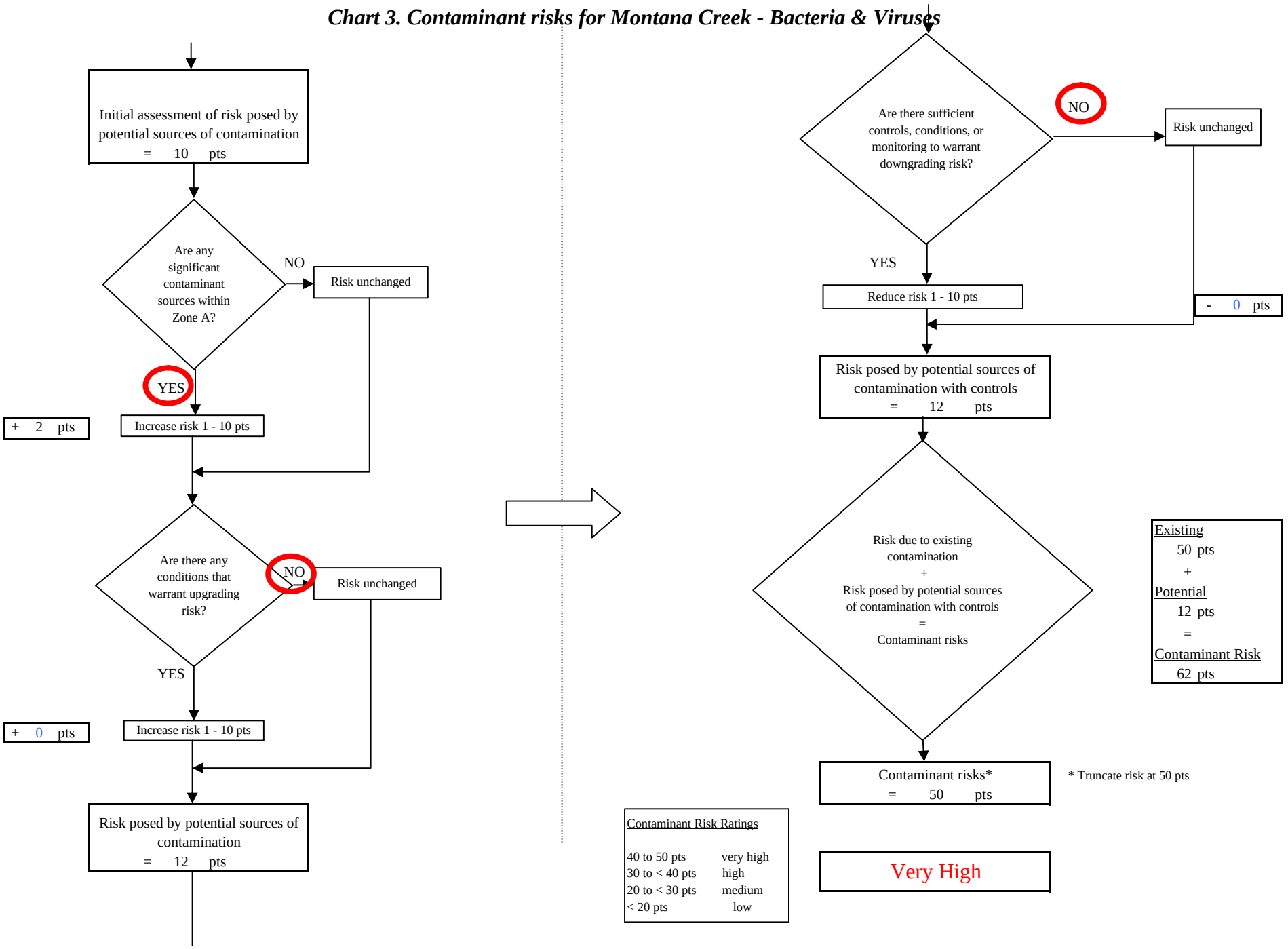


Chart 4. Vulnerability analysis for Montana Creek - Bacteria & Viruses

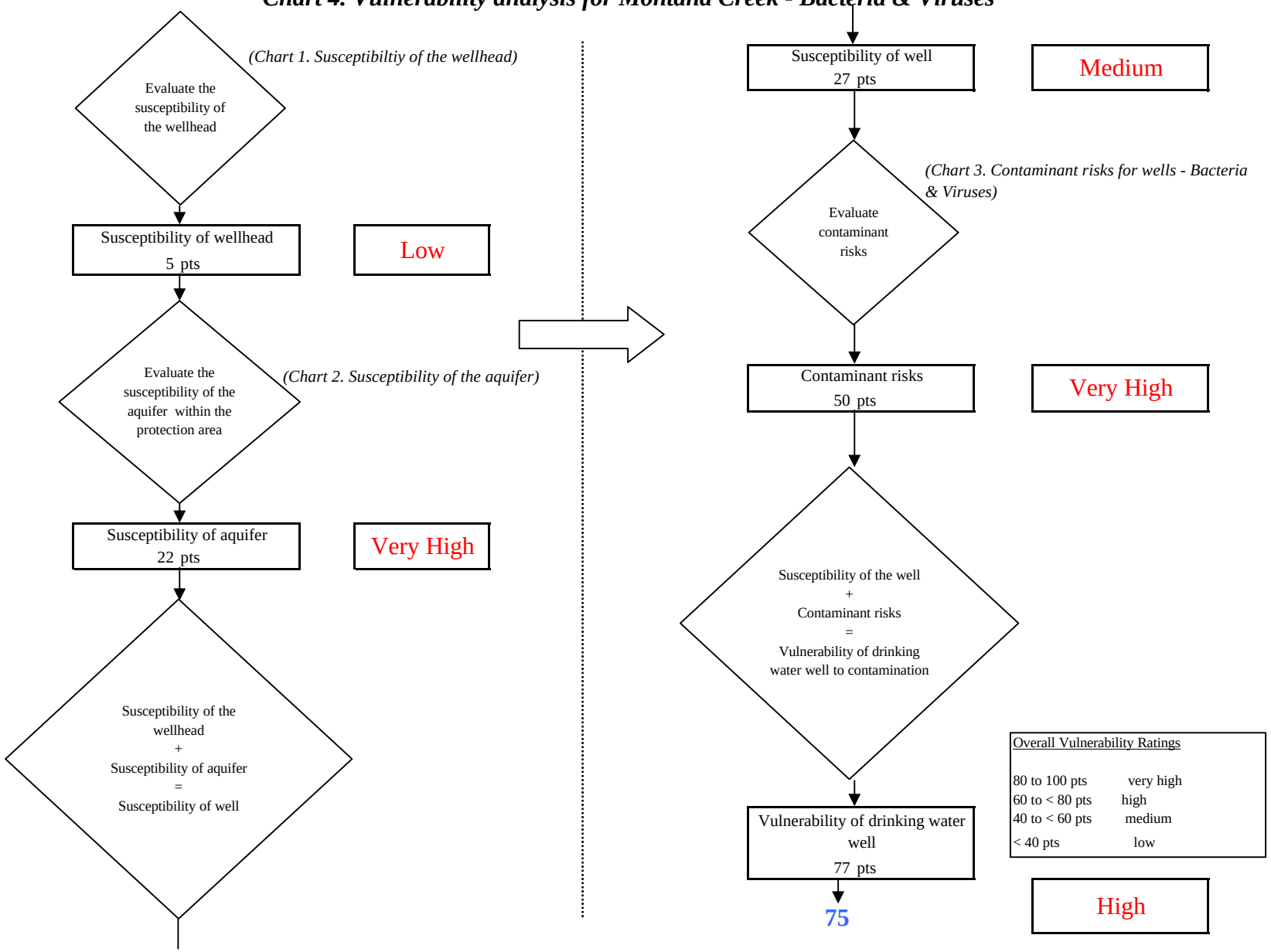


Chart 5. Contaminant risks for Montana Creek - Nitrates and Nitrites

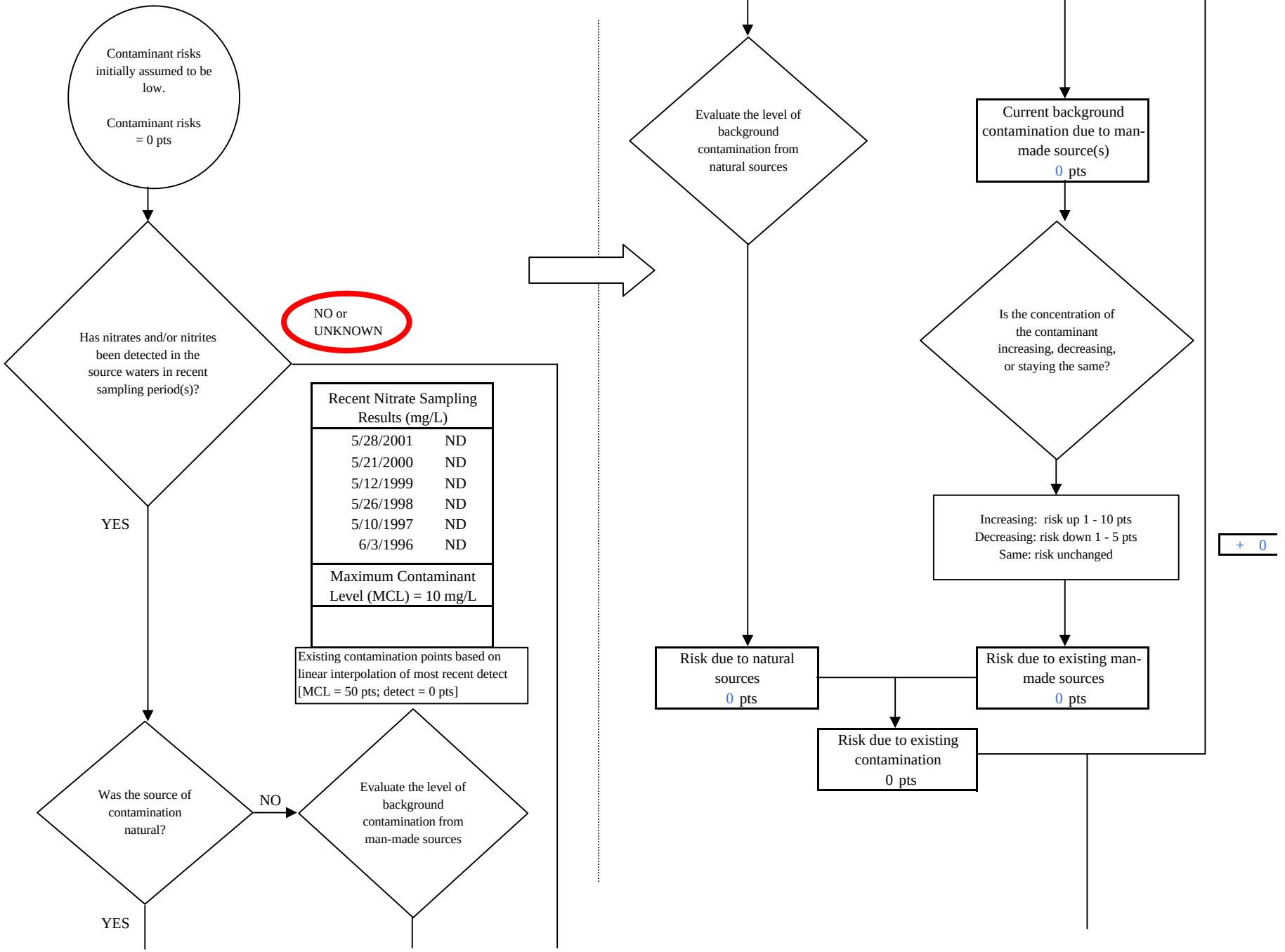
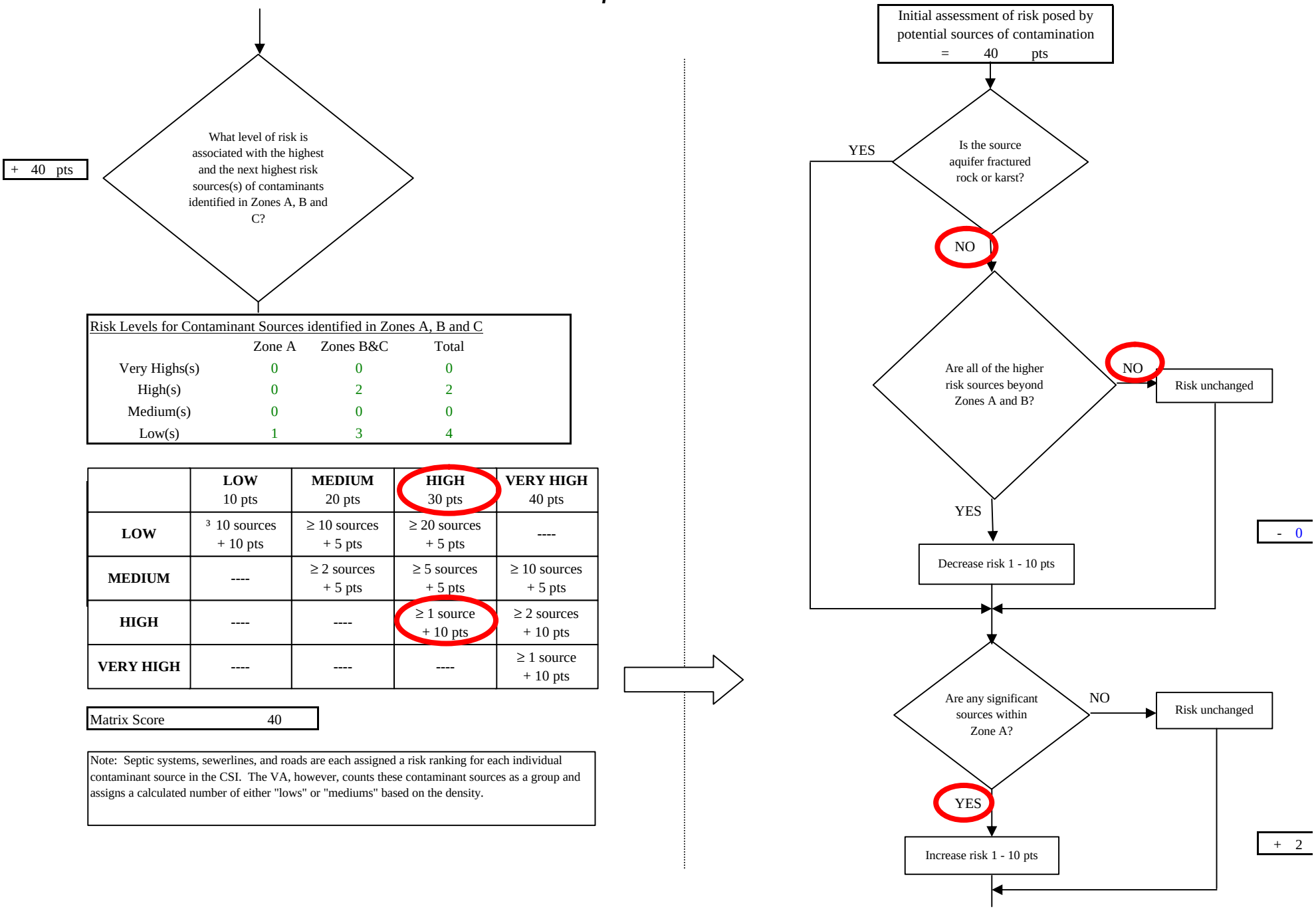


Chart 5. Contaminant risks for Montana Creek - Nitrates and Nitrites



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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	2	2
Medium(s)	0	0	0
Low(s)	1	3	4

	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 5. Contaminant risks for Montana Creek - Nitrates and Nitrites

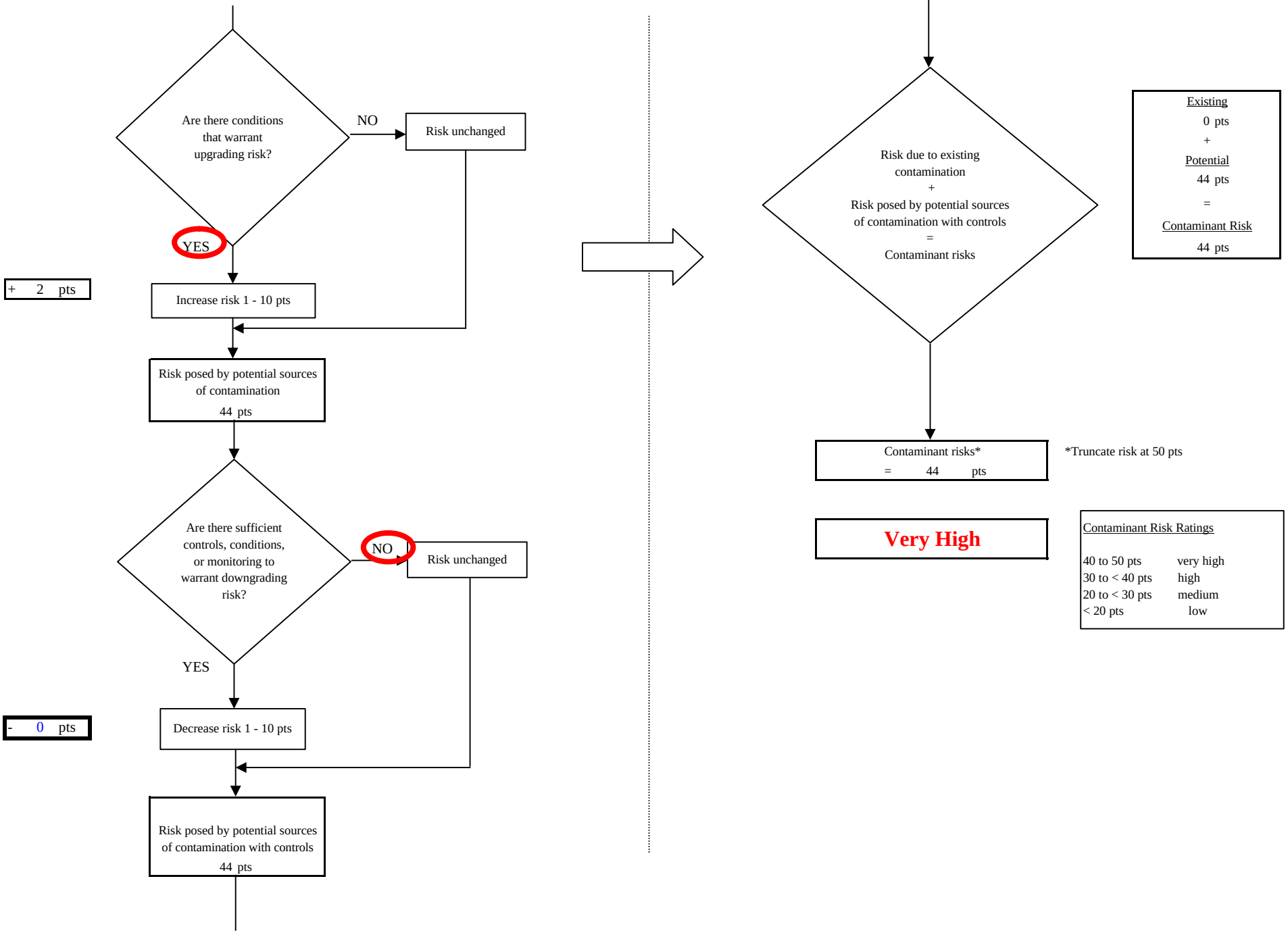


Chart 6. Vulnerability analysis for Montana Creek - Nitrates and Nitrites

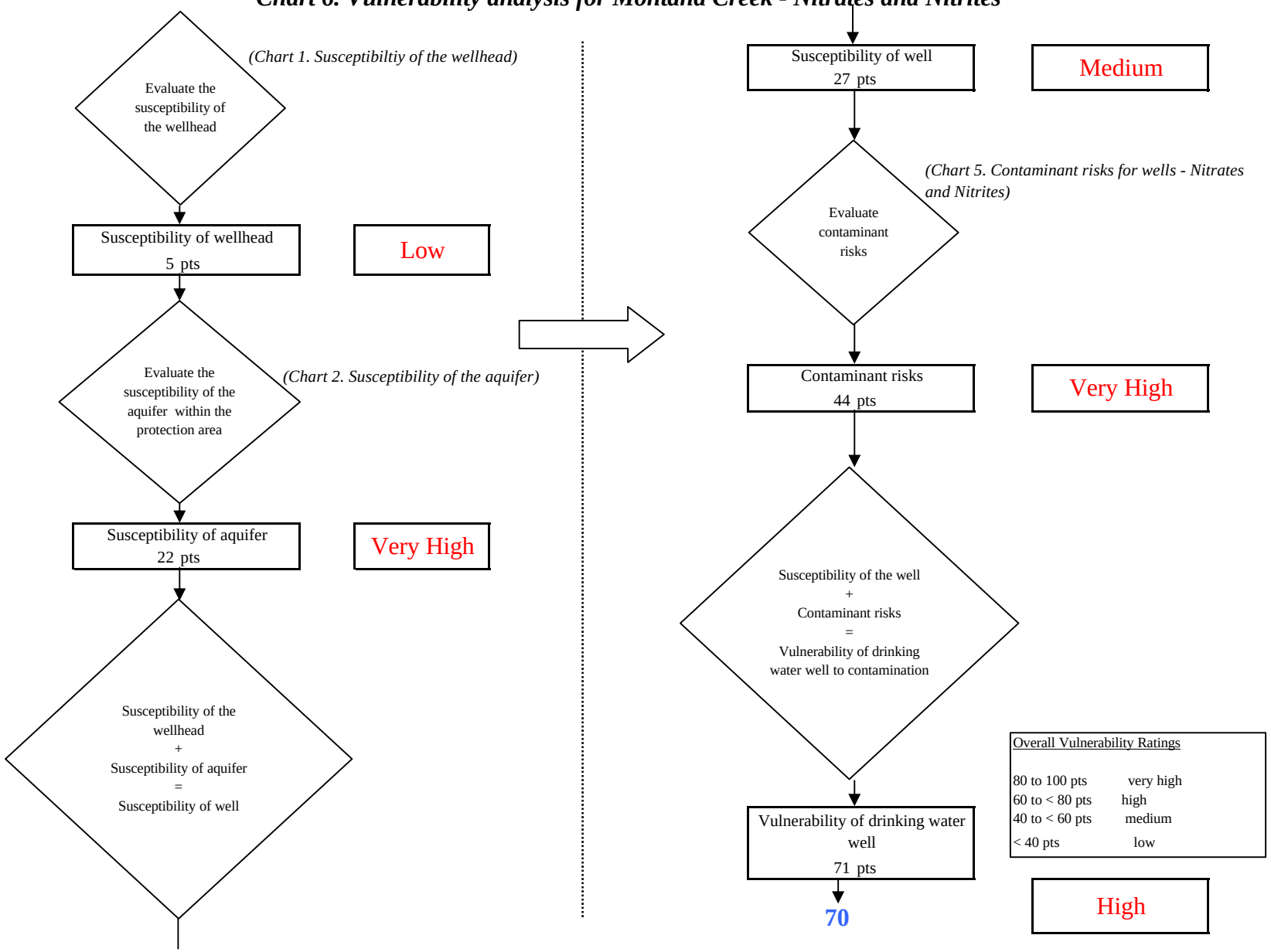


Chart 7. Contaminant risks for Montana Creek - Volatile Organic Chemicals

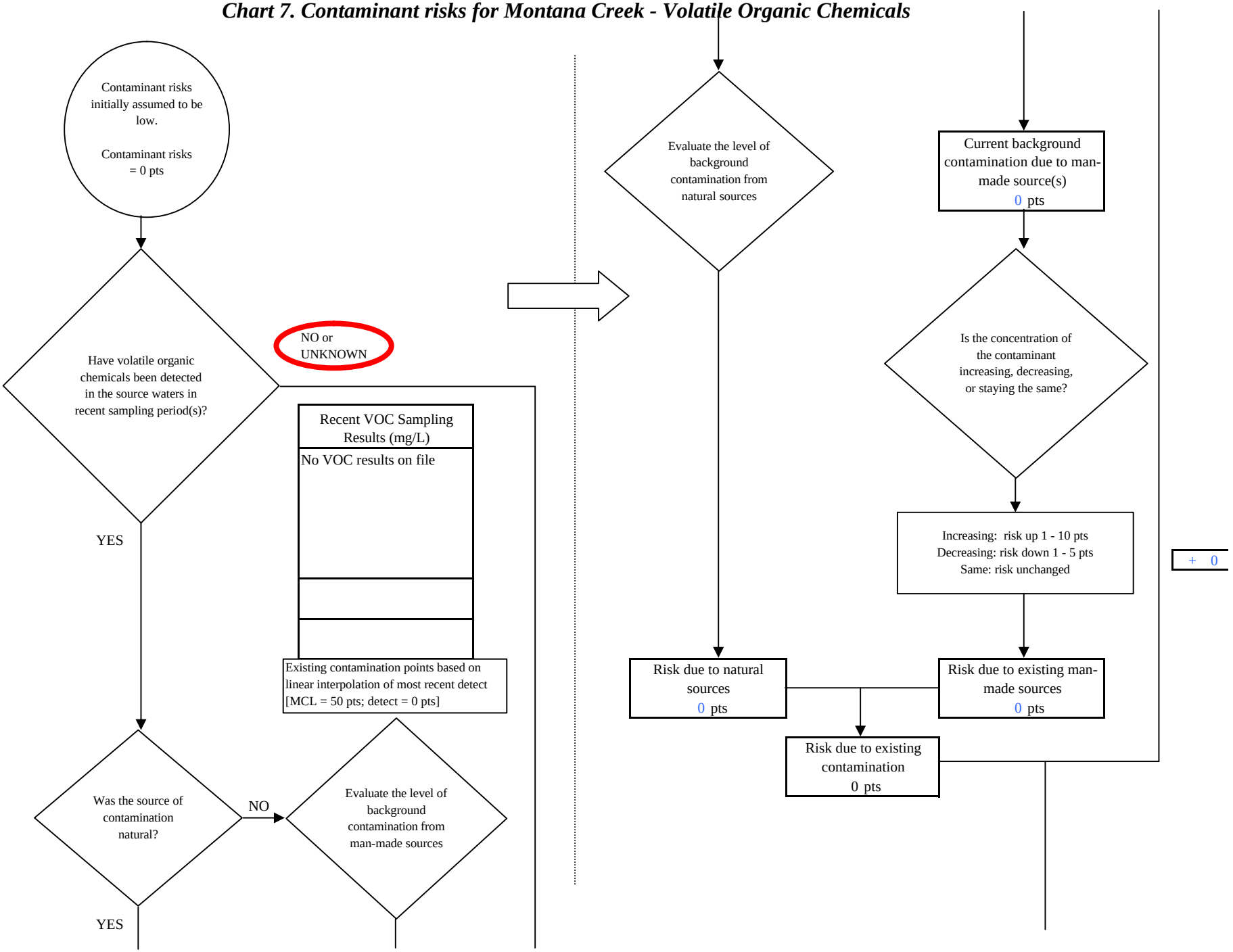


Chart 7. Contaminant risks for Montana Creek - Volatile Organic Chemicals

+ 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)	1	5	6

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

Matrix Score 10

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

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

- 5

Are any significant sources within Zone A?

NO → Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2

Chart 7. Contaminant risks for Montana Creek - Volatile Organic Chemicals

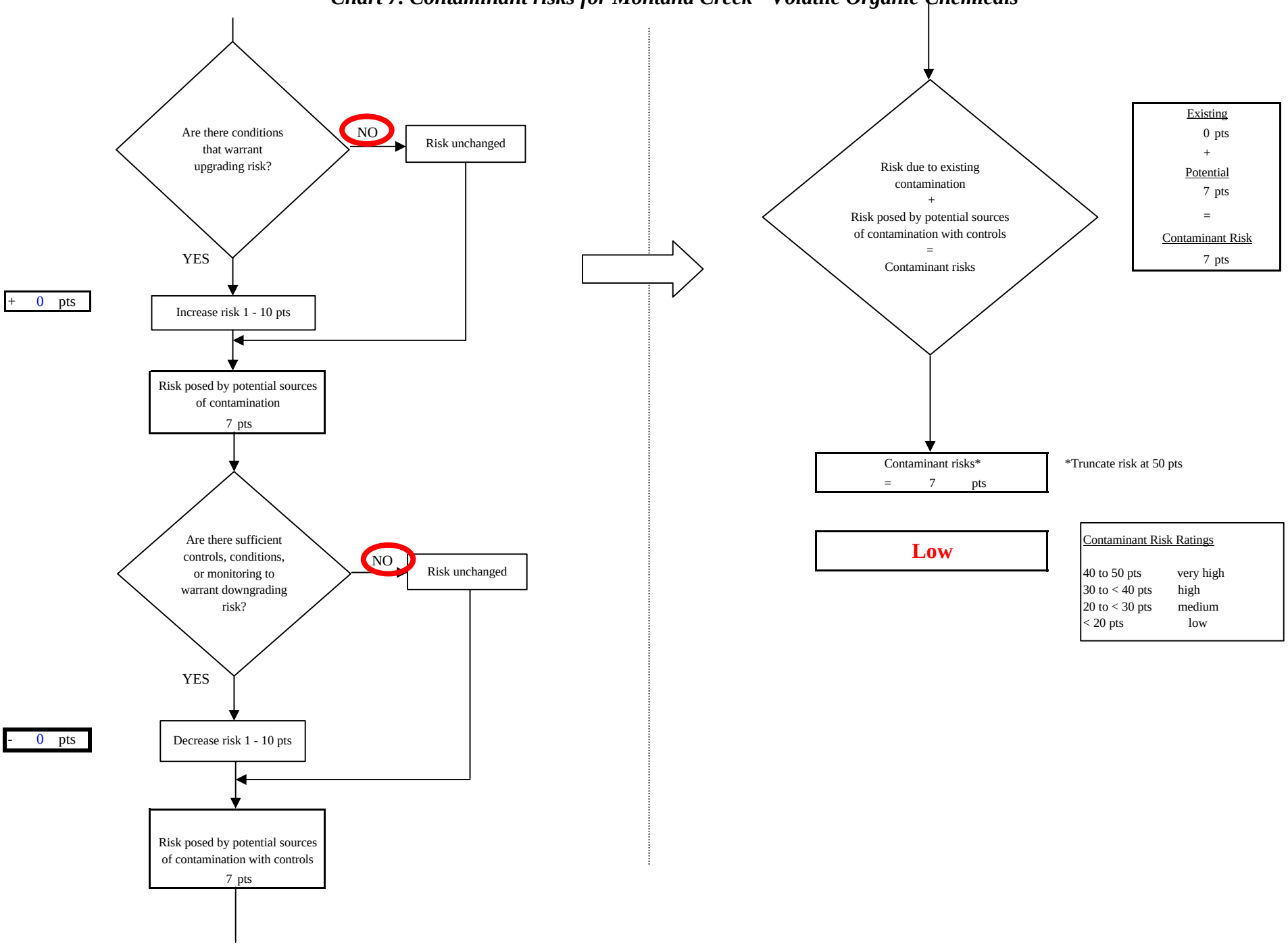


Chart 8. Vulnerability analysis for Montana Creek - Volatile Organic Chemicals