



Source Water Assessment

A Hydrogeologic Susceptibility and
Vulnerability Assessment for
Young's Cafe,
Tok, Alaska
PWSID #380133

DRINKING WATER PROTECTION PROGRAM REPORT NO. 893

Alaska Department of Environmental Conservation

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The Drinking Water Protection Program (DWPP) 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. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

CONTENTS

SECTION	Page
Executive Summary	1
Young's Cafe Public Drinking Water System	1
Young's Cafe Drinking Water Protection Area	1
Inventory of Potential and Existing Contaminant Sources	2
Ranking of Contaminant Risks	2
Vulnerability of Young's Cafe Drinking Water System	2
References	5

TABLES

TABLE		
1.	Definition of Zones	2
2.	Susceptibility	3
3.	Contaminant Risks	3
4.	Overall Vulnerability	3

APPENDICES

APPENDIX	
A.	Young's Cafe Drinking Water Protection Area (Map 1)
B.	Contaminant Source Inventory for Young's Cafe (Table 1)
	Contaminant Source Inventory and Risk Ranking for Young's Cafe - Bacteria and Viruses (Table 2)
	Contaminant Source Inventory and Risk Ranking for Young's Cafe - Nitrates/Nitrites (Table 3)
	Contaminant Source Inventory and Risk Ranking for Young's Cafe - Volatile Organic Chemicals (Table 4)
C.	Young's Cafe Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)
D.	Vulnerability Analysis for Contaminant Source Inventory and Risk Ranking for Young's Cafe Public Drinking Water Source (Charts 1 – 8)

Source Water Assessment for Young's Cafe, Tok, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Young's Cafe is a Class B (transient/non-community) water system consisting of two wells. Well #2 is used only for emergencies and the power to this pump has been turned off. Young's Cafe is located in Tok, Alaska. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produces a **Medium** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Young's Cafe public drinking water source include large-capacity septic systems; aboveground heating oil tanks; closed leaking underground fuel storage tanks; paved highways and roads; single-family septic systems; and a DEC-recognized contaminated site. 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 Young's Cafe received a vulnerability rating of **High** for bacteria and viruses, and nitrates and nitrites; and **Medium** for volatile organic chemicals.

YOUNG'S CAFE PUBLIC DRINKING WATER SYSTEM

Young's Cafe public water system is a Class B (transient/non-community) water system. The system consists of one well at Mile 124.5 of the Tok Cutoff in Tok, Alaska (See Map 1 of Appendix A). Tok is located at the junction of the Alaska Highway and the Tok cutoff to the Glenn Highway, 200 miles southeast of Fairbanks. Tok is called the "Gateway to Alaska" as it is the first major community upon entering Alaska, 93 miles from the Canadian border. The population of Tok is approximately 1,400.

Tok averages about 15 inches of precipitation per year, including 33 inches of snow. Although the quality of the groundwater can vary significantly in a short distance, groundwater supplies are generally abundant in the area. Static water levels in these wells are generally 50 to 80 feet below the surface. The coarse, alluvial, sandy gravel aquifer generally provides sufficient water, even in the winter when infiltration is low.

The Tok area topography varies from about 1,275 feet along the Tanana River to over 5,000 feet in the Alaska Range. Drainages along the Alaska Highway in this area generally flow northwest.

According to a Sanitary Survey dated June 8, 2000, there are two existing wells. Well #1 was installed in 1995 with 6-inch diameter casing to a depth of 85 feet below the ground surface. It is assumed that the length of the well screen for Well #1 is 10 feet. Well #2 is a 4-inch diameter well used only for emergencies and the power to this pump has been turned off.

The Survey does not indicate that the land surface is sloped away from the well, providing adequate surface water drainage. Because the well in use was installed after 1992 we are assuming it is grouted according to ADEC standards. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year round and serves approximately 50 non-residents through one service connection.

YOUNG'S CAFE 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. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

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

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 estimated from information contained in the well logs and/or the Sanitary Survey. Additional methods were also used to take into account any

uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

The DWPA's established for wells by the ADEC are usually 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 TOT 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 protection area zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. time-of-travel
B	Less than the 2 year time-of-travel
C	Less Than the 5 year time-of-travel
D	Less than the 10 year time-of-travel

The DWPA for Young's Cafe extends approximately 3,500 feet to the south of the well. Development in the vicinity of the well extends throughout Zone D (See Map 1 of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Young's Cafe 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;
- Volatile organic chemicals

The sources are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low;
- Medium;
- High; and
- Very High.

The TOT for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

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.

VULNERABILITY OF YOUNG'S CAFE DRINKING WATER SYSTEM

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

- Natural susceptibility; and
- Contaminant risks.

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.

A score for the Natural Susceptibility is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings

40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

We assume the well for the Young's Cafe is completed in an unconfined aquifer. Because unconfined aquifers are 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 Susceptibility scores and ratings for the Young's Cafe.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	23	Very High
Natural Susceptibility	28	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings

40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

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	50	Very High
Volatile Organic Chemicals	12	Low

Finally, an overall vulnerability score is assigned for each water system by combining each of the contaminant risk scores with the natural susceptibility score:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings

80 to 100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

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

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	75	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	40	Medium

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High** with large-capacity septic systems and paved highways and roads representing the risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Only a small amount of bacteria and viruses are required to endanger public health. Recent sampling events indicated no consecutive positive results were detected for bacteria and viruses. However, after combining the contaminant risks with the overall natural susceptibility of the well, the vulnerability of the well to contamination by bacteria and viruses is **High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High** with large-capacity septic systems and paved highways and roads representing the risk to this source of public drinking water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Sampling history for The Young's Cafe indicates that nitrates have been detected in the water, but only in very low concentrations (at 0.890 mg/L on 5/5/03) or 9% of the Maximum Contaminant Level (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.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination by nitrates and nitrites is **High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Low** with large-capacity septic system, an aboveground heating oil tank, and paved highways and roads creating the only known risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

There are no recent sample data available for the drinking water at Young's Cafe for volatile organic chemicals. However, after combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination by volatile organic chemicals is **Medium**.

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- Alaska Department of Natural Resources, Well Log Tracking System (2002). <<http://info.dec.state.ak.us/welts/Default.asp>> (2003, September 1)
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- United States Environmental Protection Agency (2002). <<http://www.epa.gov/safewater/mcl.html#mcls>> (2003, September 1)

APPENDIX A

Young's Cafe Drinking Water Protection Area Location Map (Map 1)

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Young's Cafe (Tables 1-4)

Table 1

Contaminant Source Inventory for
Young's Café

PWSID 380133.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Septic system for Young's Café
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	2	Heating oil tank for Young's Cafe
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U08-1	A	2	AT&T Alascom Tok Terminal Station
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	2	Large capacity system for Alaska Gateway - Tok Schools
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	2	Glenn Highway
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	2	Large capacity system for Tok Liquor & Mini Mart
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	2	Large capacity system for Tok Lodge
Septic systems (serves one single-family home)	R02	R02-1	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-10	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-11	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-12	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-13	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-14	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-2	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-3	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-4	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-5	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-6	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-7	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-8	C	2	Residence
Septic systems (serves one single-family home)	R02	R02-9	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-1	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-10	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-11	C	2	Residence

Table 1 (continued)

**Contaminant Source Inventory for
Young's Café**

PWSID 380133.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Tanks, heating oil, residential (above ground)	R08	R08-12	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-13	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-14	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-2	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-3	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-4	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-5	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-6	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-7	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-8	C	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-9	C	2	Residence
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	C	2	Nonresidential heating oil system for Tok Liquor & Mini Mart
Tanks, heating oil, nonresidential (aboveground)	T14	T14-3	C	2	Nonresidential heating oil system for Tok Lodge
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	D	2	Large capacity septic system for DOT & PF Tok Combined Facility
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	D	2	Large capacity septic system for Mae's Hamburger Joint
Septic systems (serves one single-family home)	R02	R02-15	D	2	Residence
Tanks, heating oil, residential (above ground)	R08	R08-15	D	2	Residence
Tanks, heating oil, nonresidential (aboveground)	T14	T14-4	D	2	Nonresidential heating oil tank for DOT & PF Tok Combined Facility
Tanks, heating oil, nonresidential (aboveground)	T14	T14-5	D	2	Nonresidential heating oil tank for Mae's Hamburger Joint
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-1	D	2	DEC Recognized Benzene Contaminated

Table 2

**Contaminant Source Inventory and Risk Ranking for
Young's Café
Sources of Bacteria and Viruses**

PWSID 380133.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic system for Young's Café
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	High	2	Large capacity system for Alaska Gateway - Tok Schools
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Glenn Highway

Table 3

**Contaminant Source Inventory and Risk Ranking for
Young's Café
Sources of Nitrates/Nitrites**

PWSID 380133.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic system for Young's Café
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	High	2	Large capacity system for Alaska Gateway - Tok Schools
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Glenn Highway
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	C	High	2	Large capacity system for Tok Liquor & Mini Mart
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	C	High	2	Large capacity system for Tok Lodge
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	D	High	2	Large capacity septic system for DOT & PF Tok Combined Facility
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	D	High	2	Large capacity septic system for Mae's Hamburger Joint

Table 4

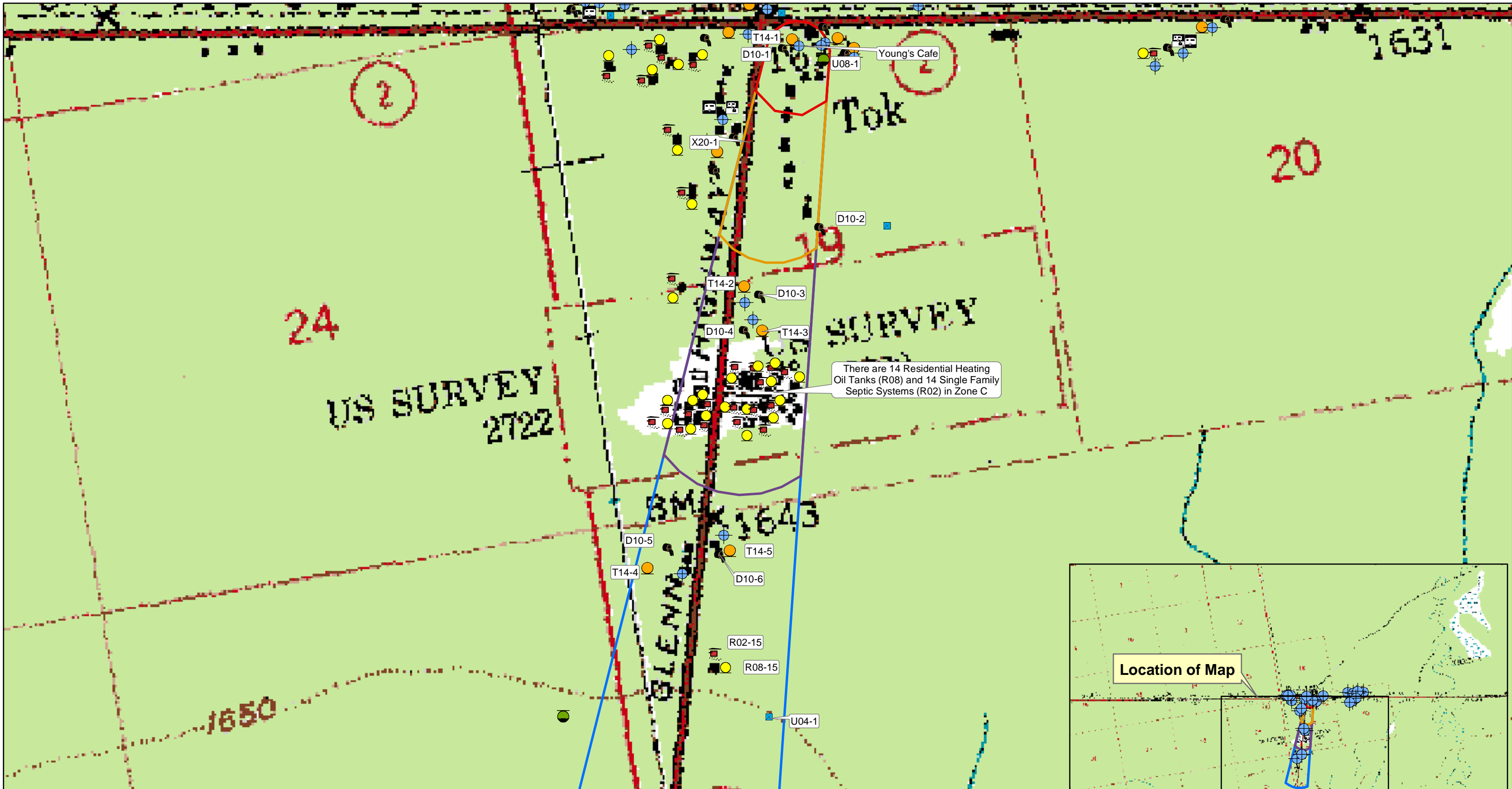
**Contaminant Source Inventory and Risk Ranking for
Young's Café
Sources of Volatile Organic Chemicals**

PWSID 380133.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic system for Young's Café
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Heating oil tank for Young's Cafe
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	B	Low	2	Large capacity system for Alaska Gateway - Tok Schools
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Glenn Highway



APPENDIX C

Young's Cafe Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)



Map 2: Drinking Water Protection Areas for Young's Cafe and Potential and Existing Sources of Contamination

PWSID: 380133.001

















0 225 450 900 1,350 1,800 Feet

1:11,420

Data Sources:

Background image - USGS 1:63,000 mapping

Legend

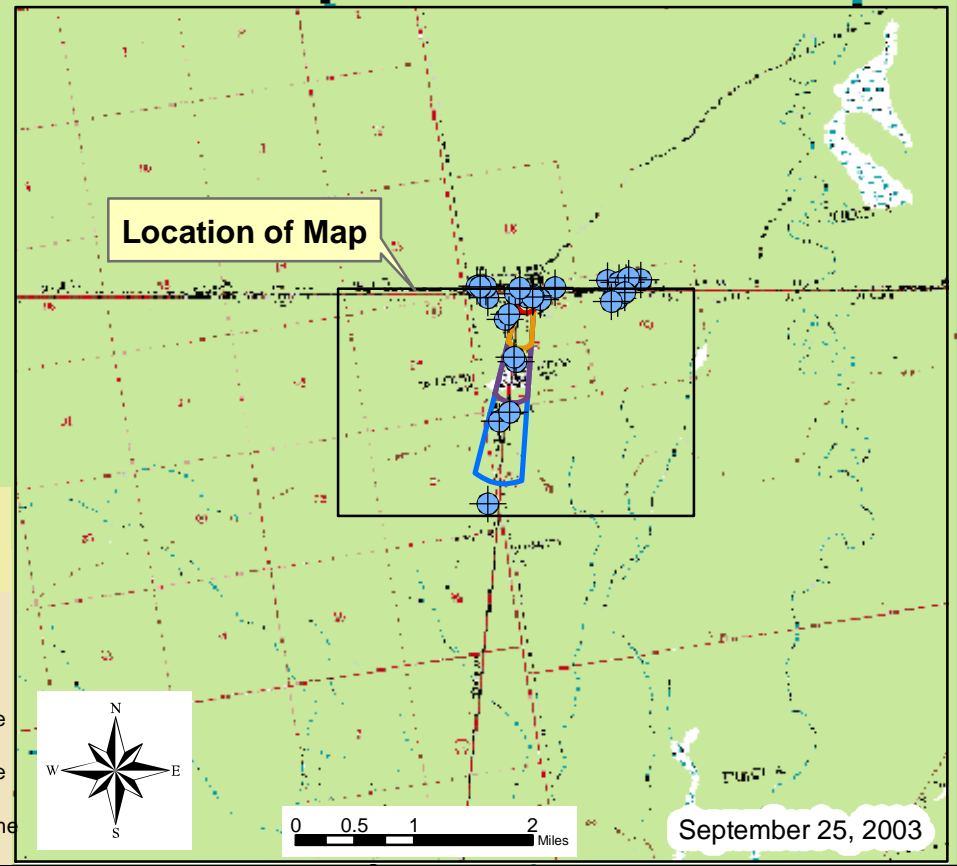
	Public Drinking Water Systems		Residential Heating Oil Tank (R08)		DWPA Zone A
	Closed Leaking UST (U08)		RV Park (X35)		DWPA Zone B
	Single Family Septic System (R02)		Nonresidential Heating Oil Tank (T14)		DWPA Zone C
	RV Dump Station (D18)		DEC Recognized Contaminated Site (U04)		DWPA Zone D
			Gas Station (C15)		
			Large Capacity Septic System (D10)		

DWPA Zone A
Several Months Travel Time

DWPA Zone B
Less than 2 Years Travel Time

DWPA Zone C
Less than 5 Years Travel Time

DWPA Zone D
Less than 10 Years Travel Time



APPENDIX D

Vulnerability Analysis for Young's Cafe Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - Young's Cafe

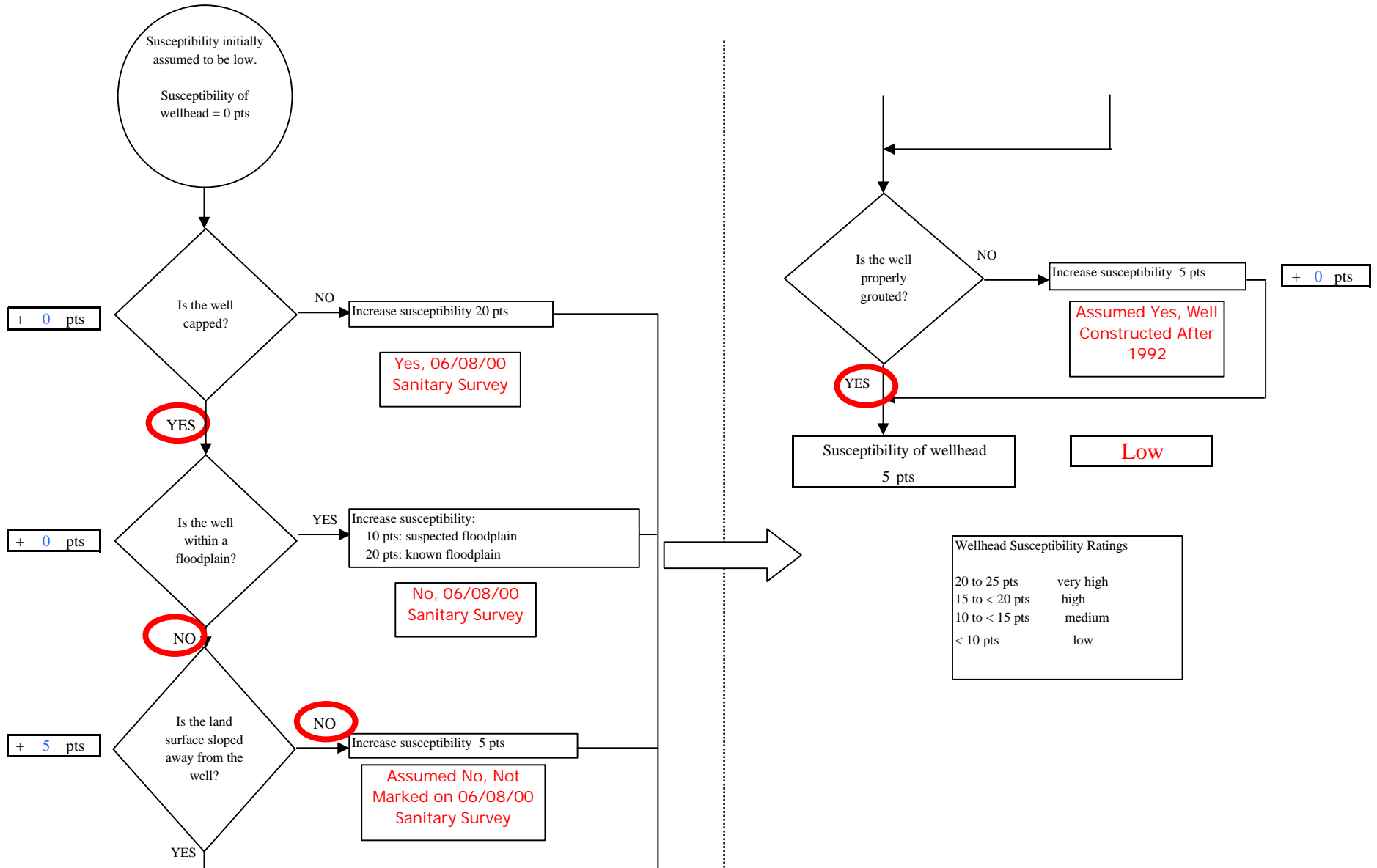


Chart 2. Susceptibility of the aquifer - Young's Cafe

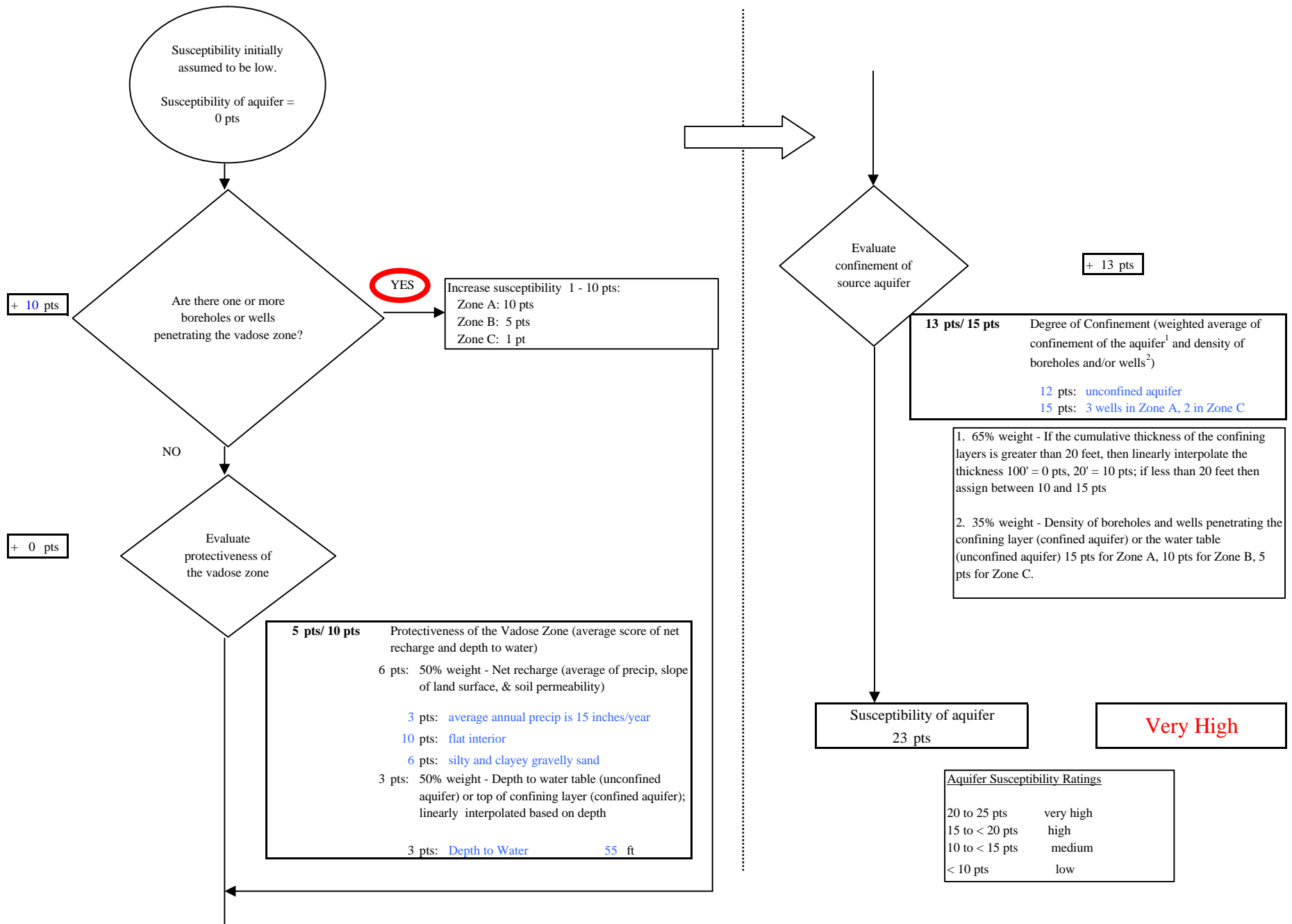


Chart 3. Contaminant risks for Young's Cafe- Bacteria & Viruses

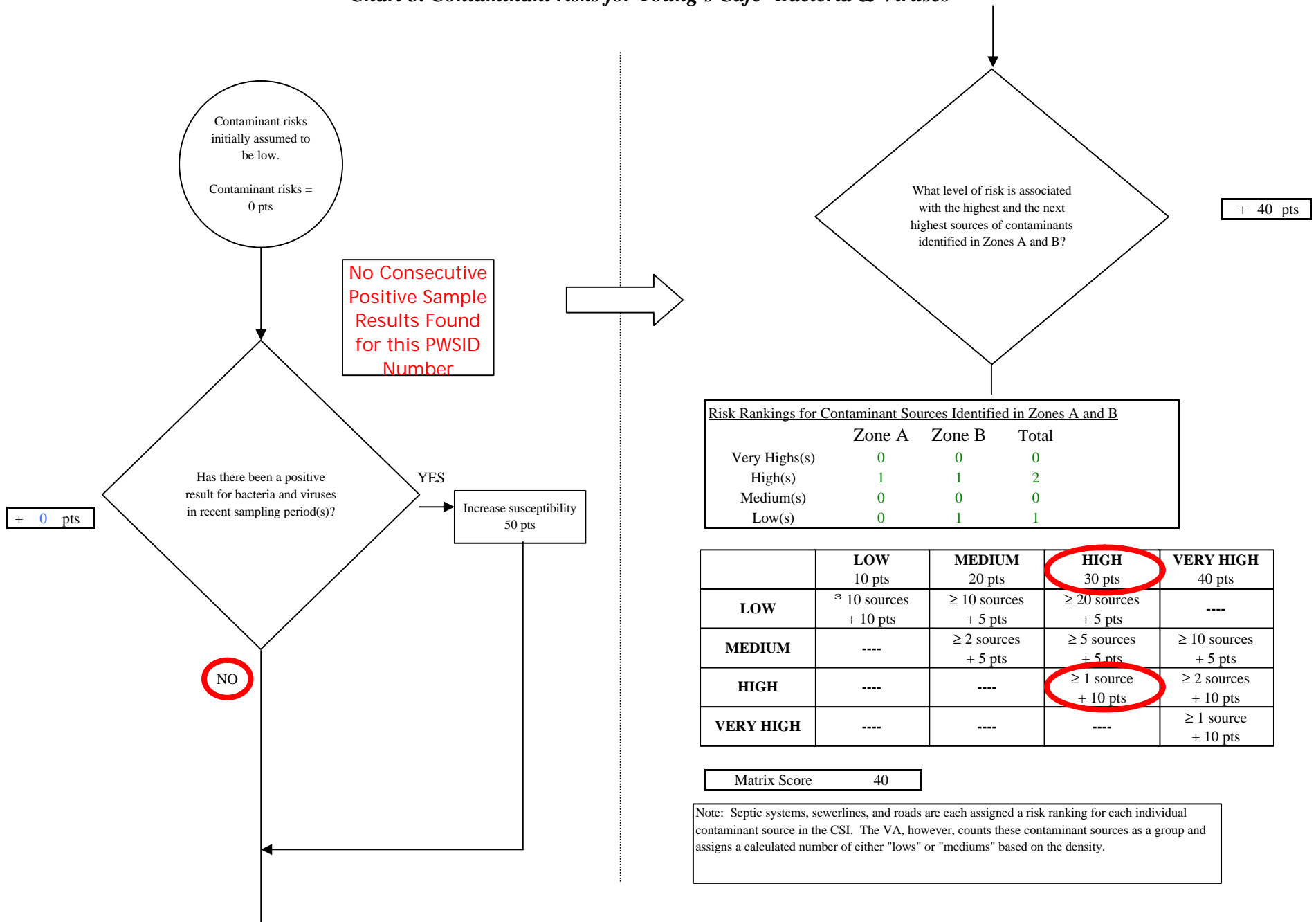
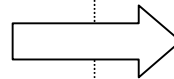
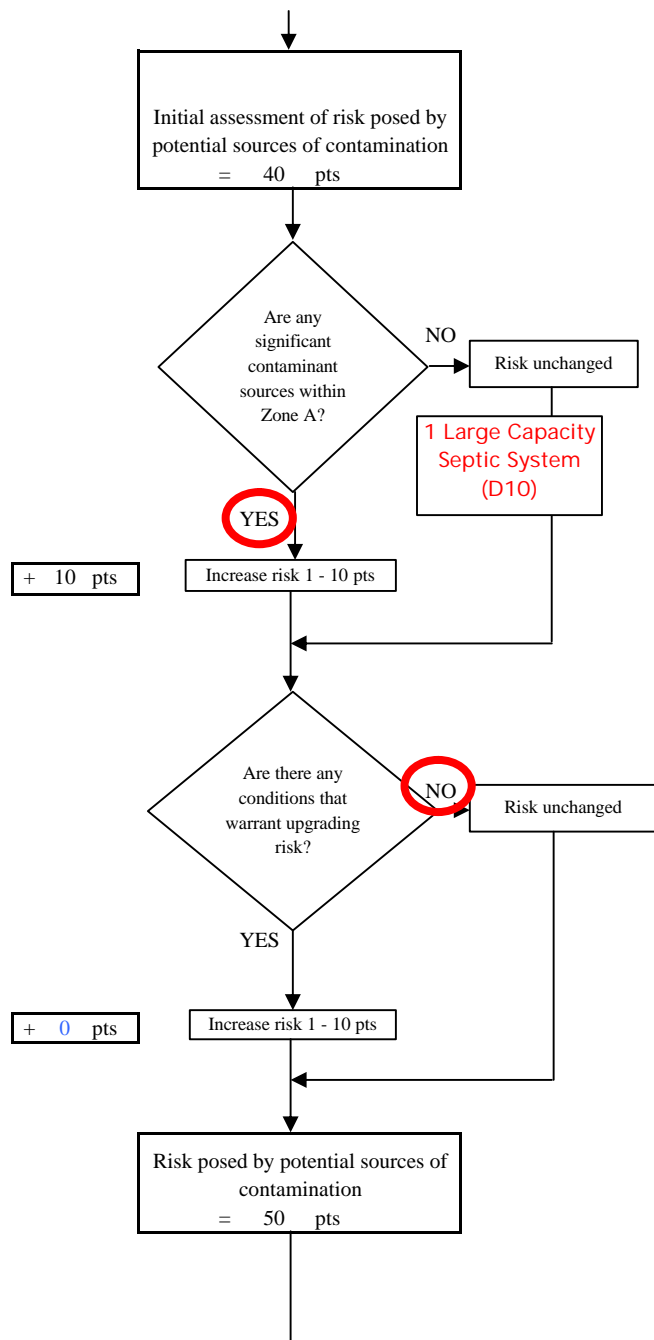


Chart 3. Contaminant risks for Young's Cafe- Bacteria & Viruses



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

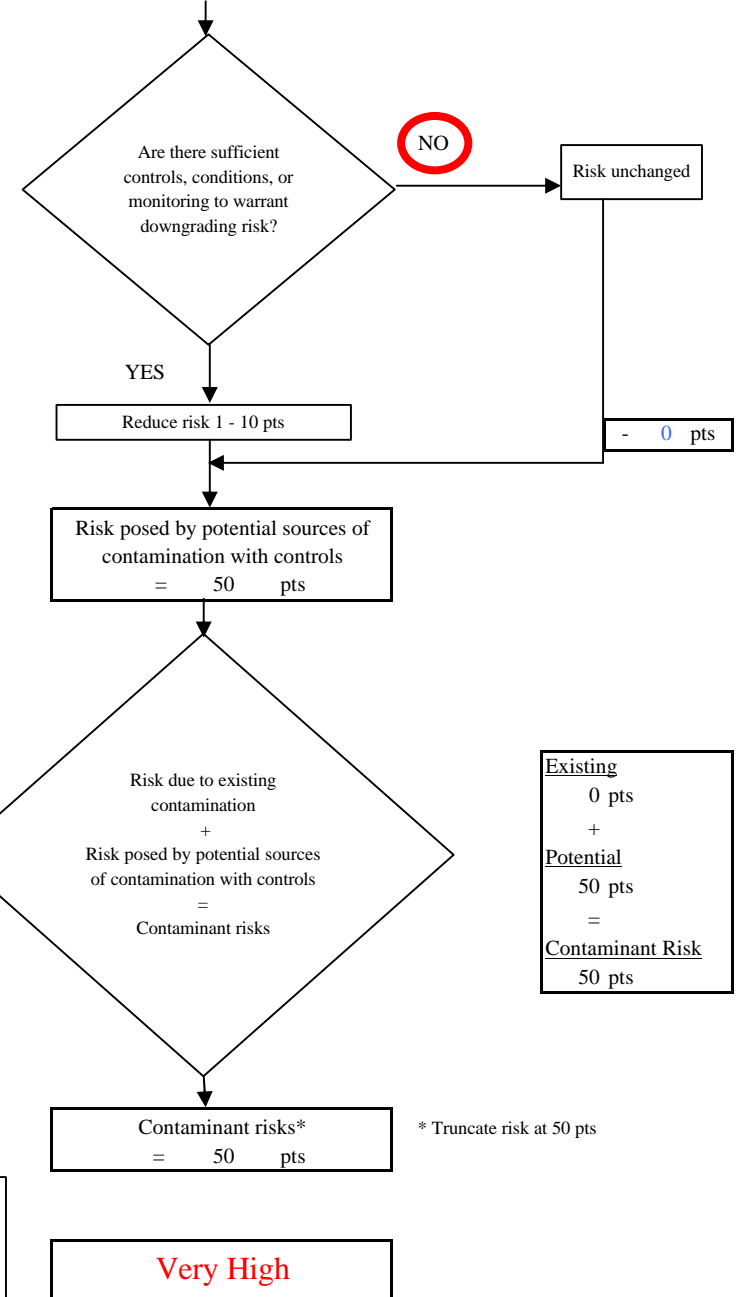


Chart 4. Vulnerability analysis for Young's Cafe - Bacteria & Viruses

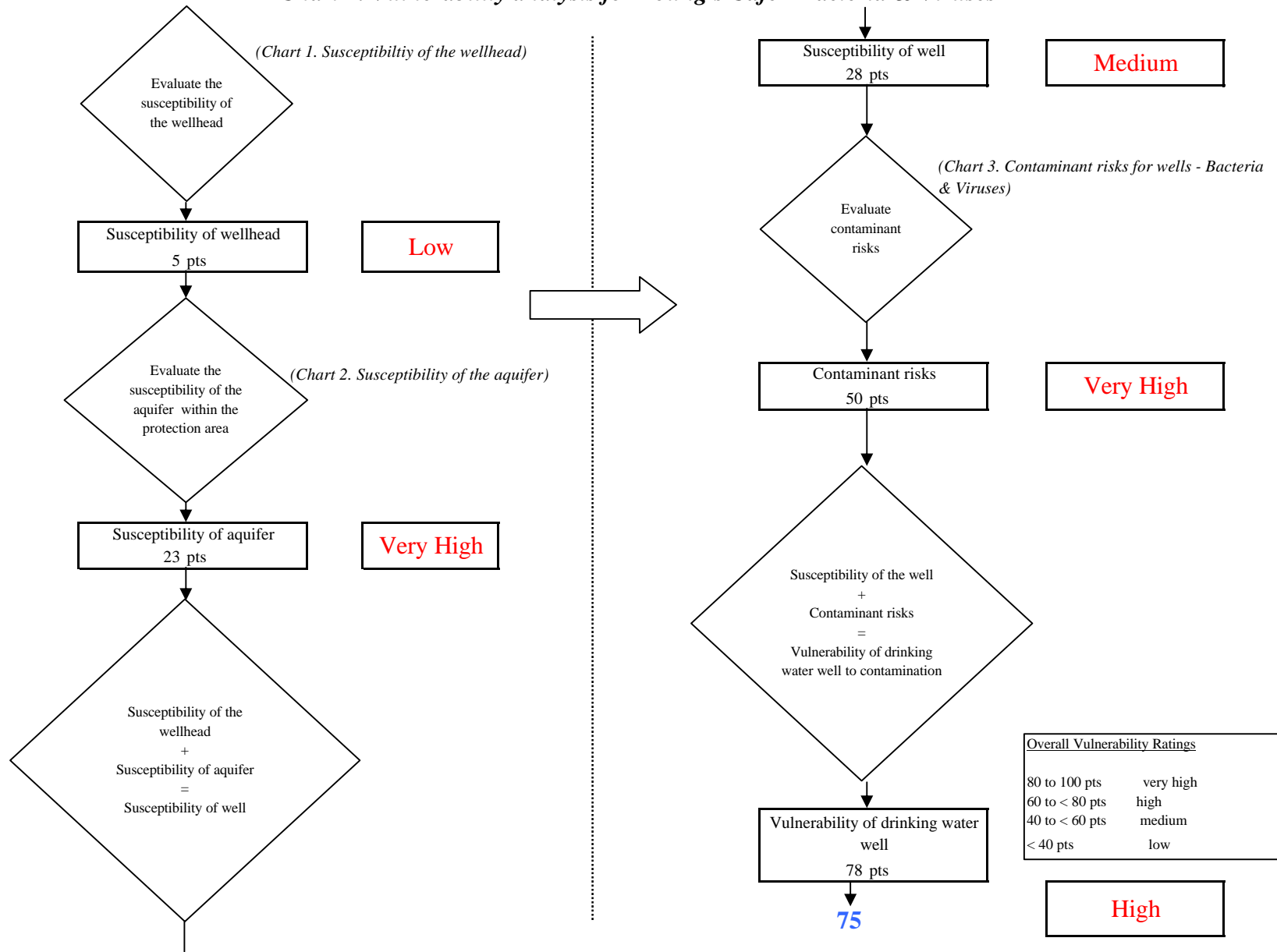


Chart 5. Contaminant risks for Young's Cafe - Nitrates and Nitrites

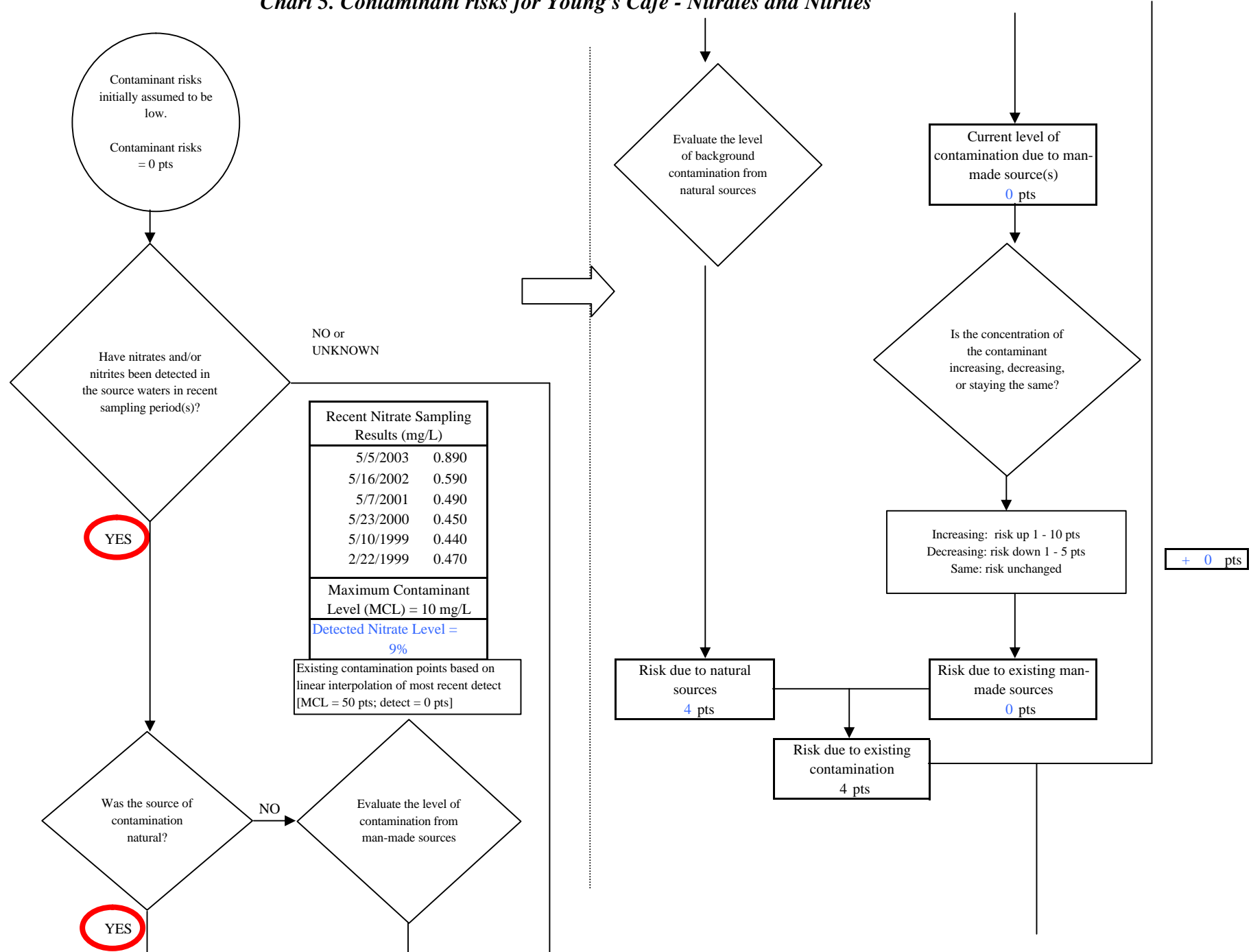


Chart 5. Contaminant risks for Young's Cafe - Nitrates and Nitrites

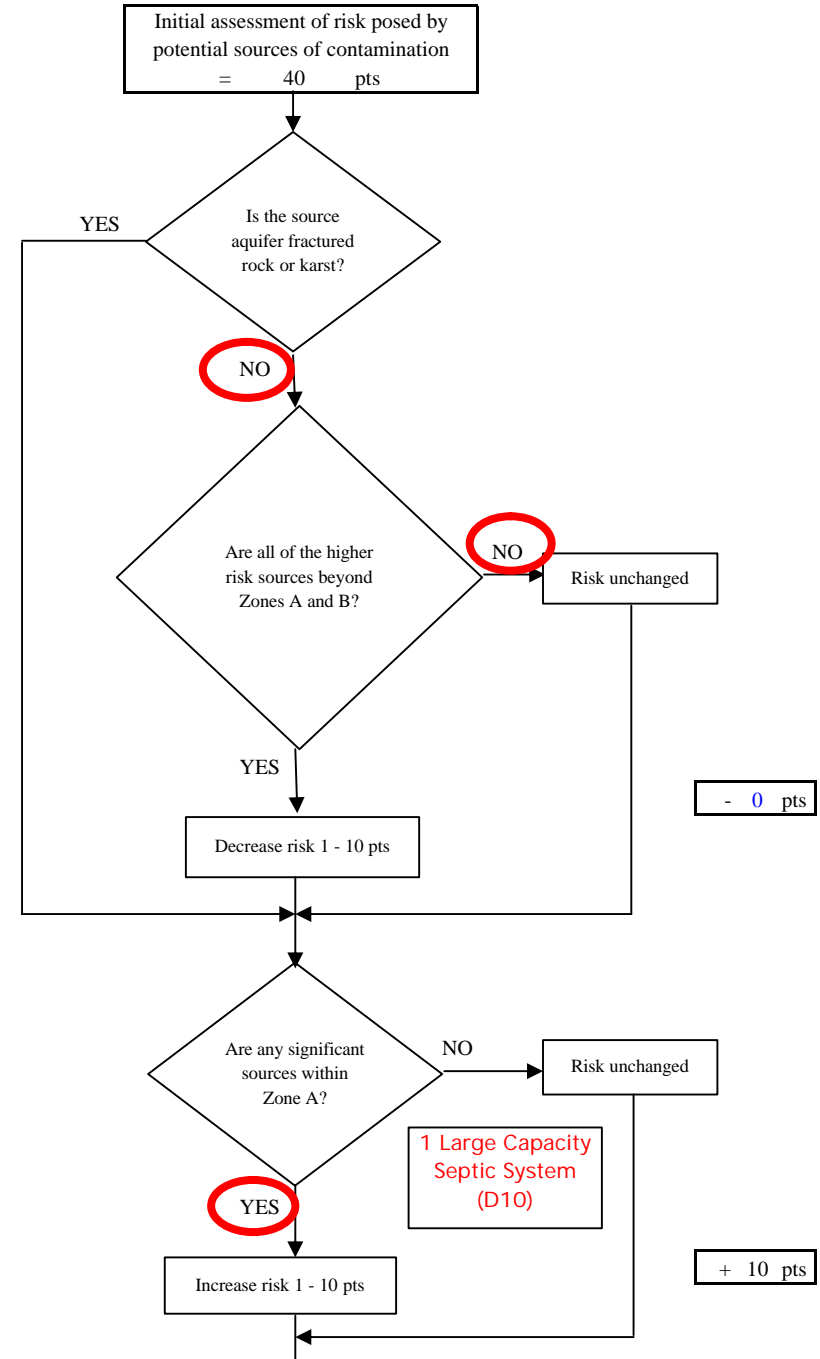
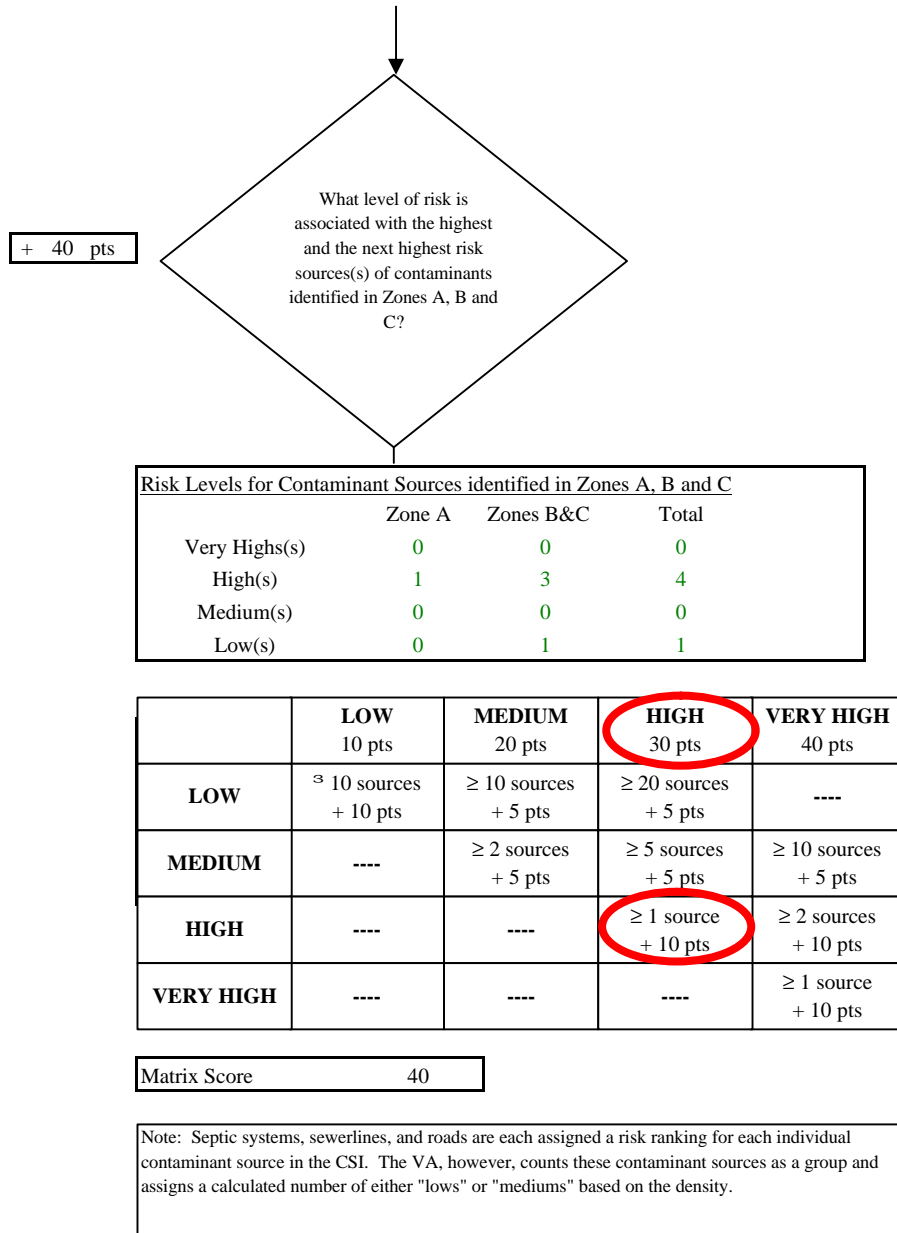


Chart 5. Contaminant risks for Young's Cafe - Nitrates and Nitrites

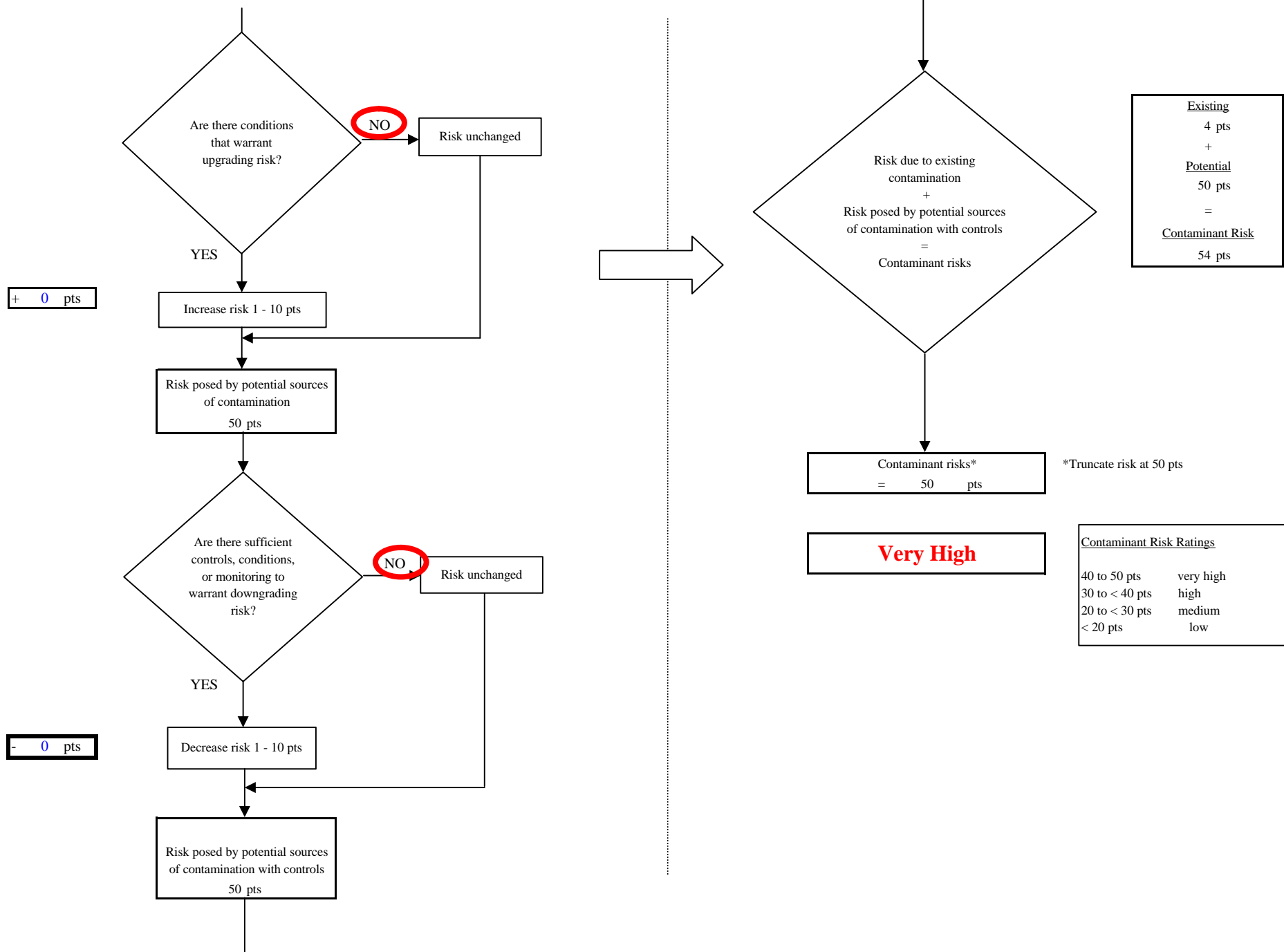


Chart 6. Vulnerability analysis for Young's Cafe - Nitrates and Nitrites

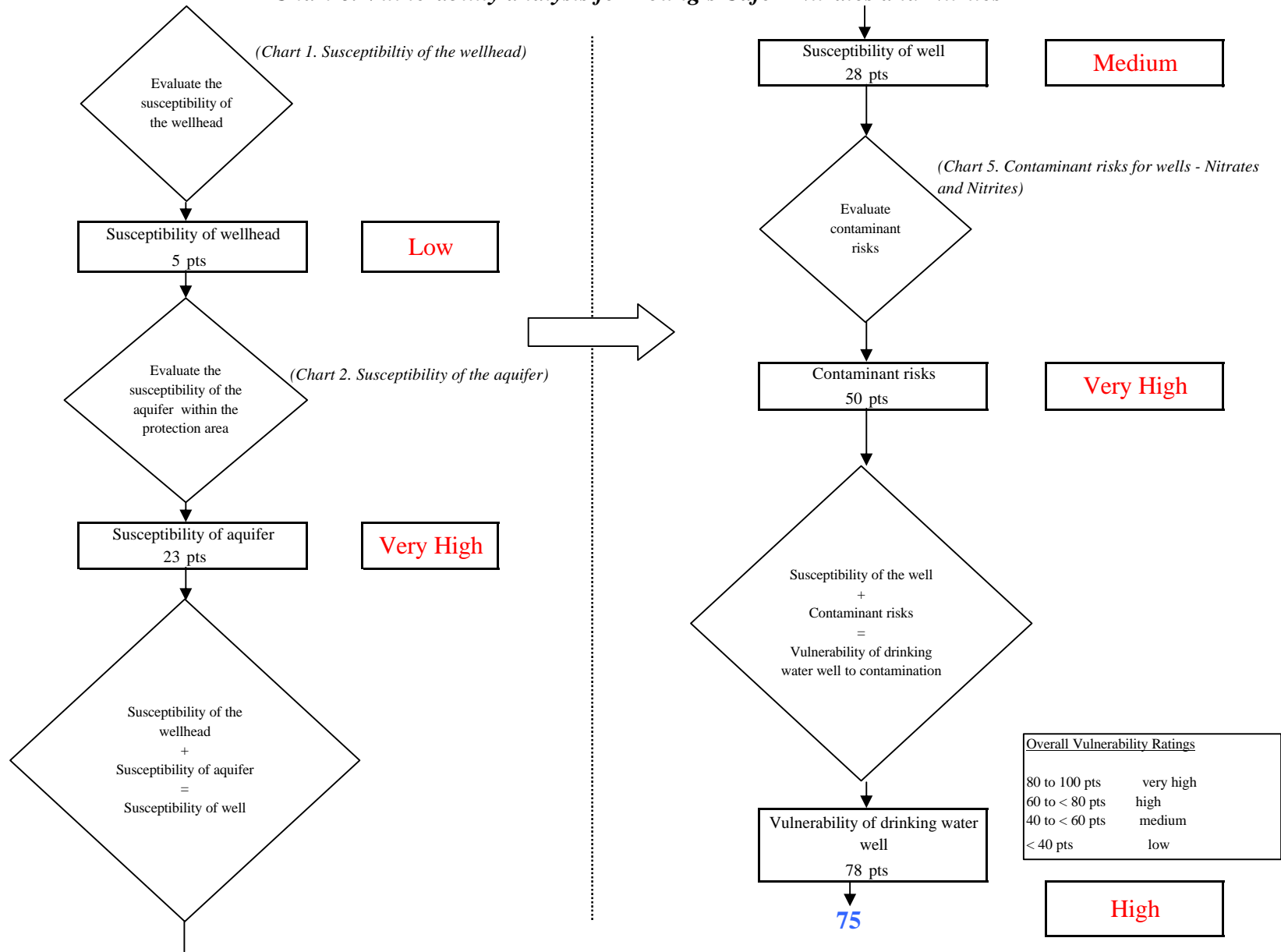


Chart 7. Contaminant risks for Young's Cafe - Volatile Organic Chemicals

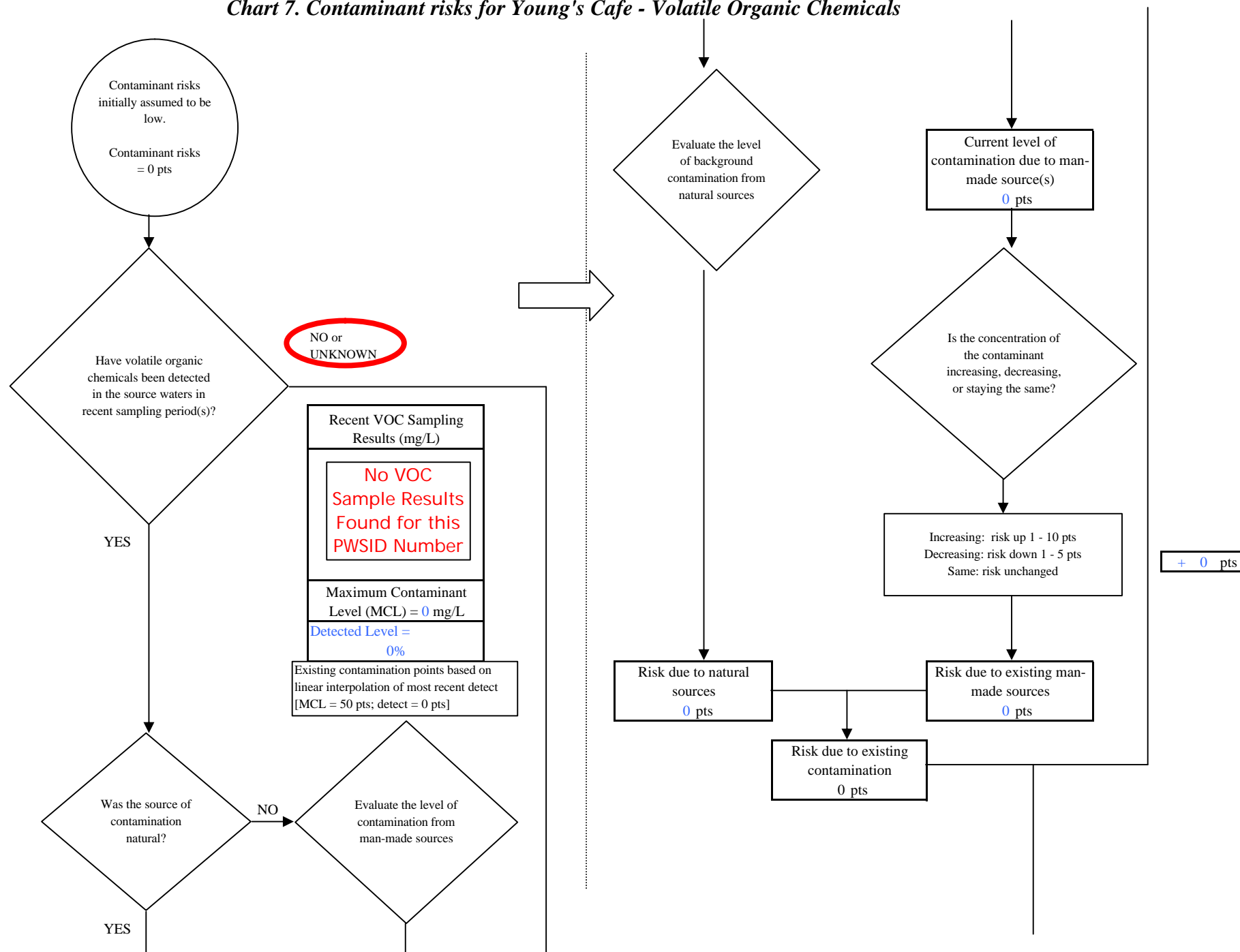


Chart 7. Contaminant risks for Young's Cafe - Volatile Organic Chemicals

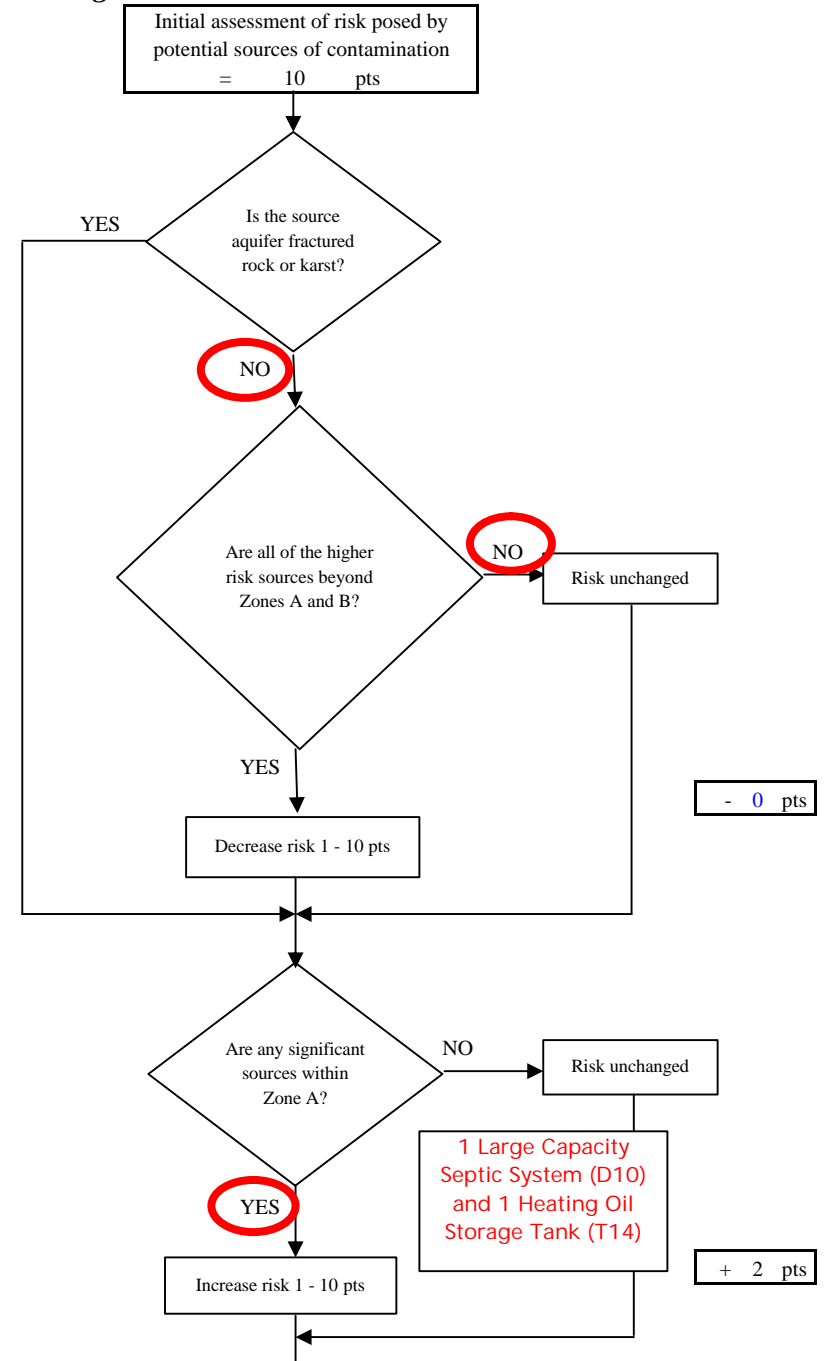
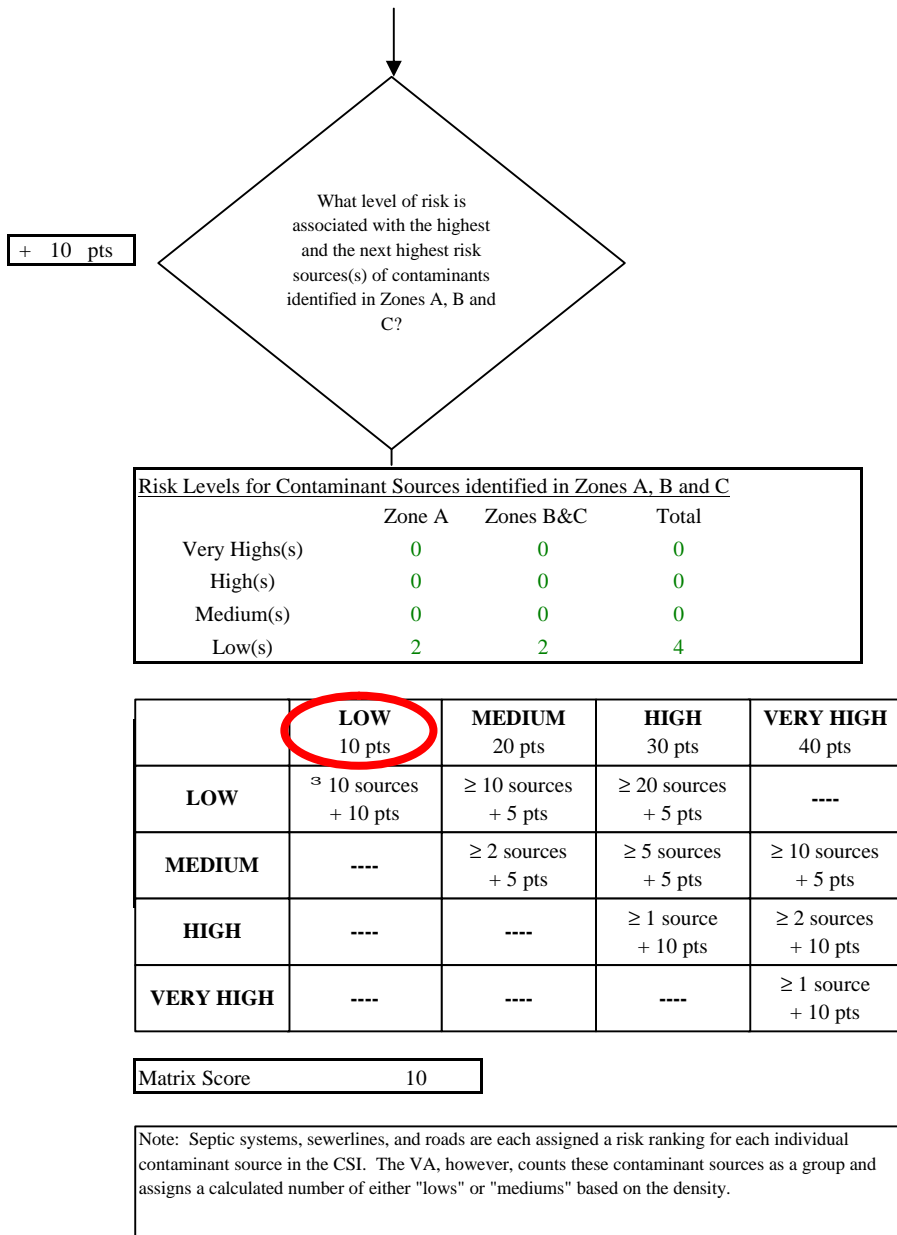


Chart 7. Contaminant risks for Young's Cafe - Volatile Organic Chemicals

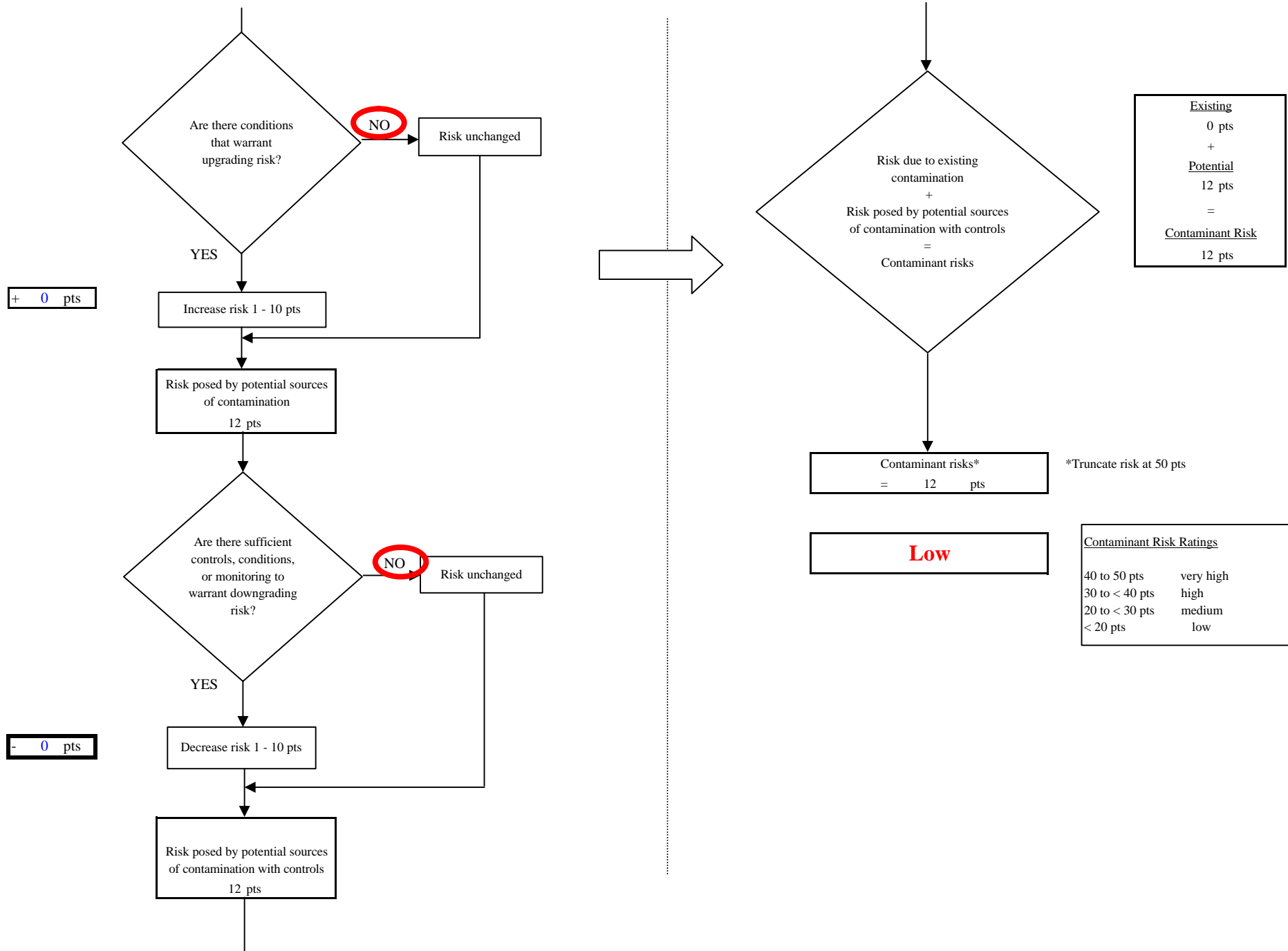


Chart 8. Vulnerability analysis for Young's Cafe - Volatile Organic Chemicals

