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# Source Water Assessment

A Hydrogeologic Susceptibility and  
Vulnerability Assessment for  
Mae's Hamburger Joint,  
Tok, Alaska  
PWSID #381749

DRINKING WATER PROTECTION PROGRAM REPORT NO. 931

Alaska Department of Environmental Conservation

# Source Water Assessment for Mae's Hamburger Joint, Tok, Alaska PWSID #381749

DRINKING WATER PROTECTION PROGRAM REPORT NO. 931

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.

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# Source Water Assessment for Mae's Hamburger Joint, Tok, Alaska

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## Drinking Water Protection Program Alaska Department of Environmental Conservation

### EXECUTIVE SUMMARY

The public water system for Mae's Hamburger Joint is a Class B (transient/non-community) water system consisting of one well. The Mae's Hamburger Joint is located at Mile 124 of the Tok Cutoff, in Tok, Alaska. The wellhead received a susceptibility rating of **Medium** and the aquifer received a susceptibility rating of **Medium**. Combining these two ratings produces a **Medium** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for Mae's Hamburger Joint public drinking water source include large-capacity septic systems; aboveground heating oil tanks; paved highways and roads; and single-family septic systems. 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 Mae's Hamburger Joint received a vulnerability rating of **High** for bacteria and viruses and nitrates and nitrites; and **Low** for volatile organic chemicals.

### MAE'S HAMBURGER JOINT PUBLIC DRINKING WATER SYSTEM

Mae's Hamburger Joint public water system is a Class B (transient/non-community) water system. The system consists of one well at Mile 124 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. Many homes and businesses in the area rely on individual wells for the water supply. Most of these wells are shallow with depths of less than 50 to 125 feet. 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 Inventory Information provided by the Alaska Department of Environmental Conservation, dated April 15, 1999, the existing well was installed in 1999. It is unknown to what depth this well was installed. It is assumed that the length of the well screen is 10 feet.

It is unknown if the land surface is sloped away from the well, providing adequate surface water drainage. It is assumed that the well is not 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 25 non-residents through one service connection.

### MAE'S HAMBURGER JOINT 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**

<b>Zone</b>	<b>Definition</b>
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 Mae's Hamburger Joint extends almost one mile to the southwest of the well. Development in the vicinity of the well extends throughout Zone C (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 Mae's Hamburger Joint 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 MAE'S HAMBURGER JOINT 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.

$$\begin{array}{r}
 \text{Susceptibility of the Wellhead (0 – 25 Points)} \\
 \text{(Chart 1 of Appendix D)} \\
 + \\
 \text{Susceptibility of the Aquifer (0 – 25 Points)} \\
 \text{Chart 2 of Appendix D)} \\
 = \\
 \text{Natural Susceptibility (Susceptibility of the Well)} \\
 \text{(0 – 50 Points)}
 \end{array}$$

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 Mae’s Hamburger Joint 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 Mae’s Hamburger Joint.

**Table 2. Susceptibility**

	Score	Rating
Susceptibility of the Wellhead	10	Medium
Susceptibility of the Aquifer	12	Medium
Natural Susceptibility	22	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	40	Very High
Nitrates and/or Nitrites	42	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:

$$\begin{array}{r}
 \text{Natural Susceptibility (0 – 50 points)} \\
 + \\
 \text{Contaminant Risks (0 – 50 points)} \\
 = \\
 \text{Vulnerability of the} \\
 \text{Drinking Water Source to Contamination (0 – 100).}
 \end{array}$$

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	60	High
Nitrates and Nitrites	65	High
Volatile Organic Chemicals	35	Low

### **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 Mae's Hamburger Joint indicates that nitrates have been detected in the water, but only in very low concentrations (at 0.33 mg/L on 7/31/02) or 3% 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 systems; aboveground heating oil tanks; and paved highways and roads 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 Mae's Hamburger Joint 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 **Low**.

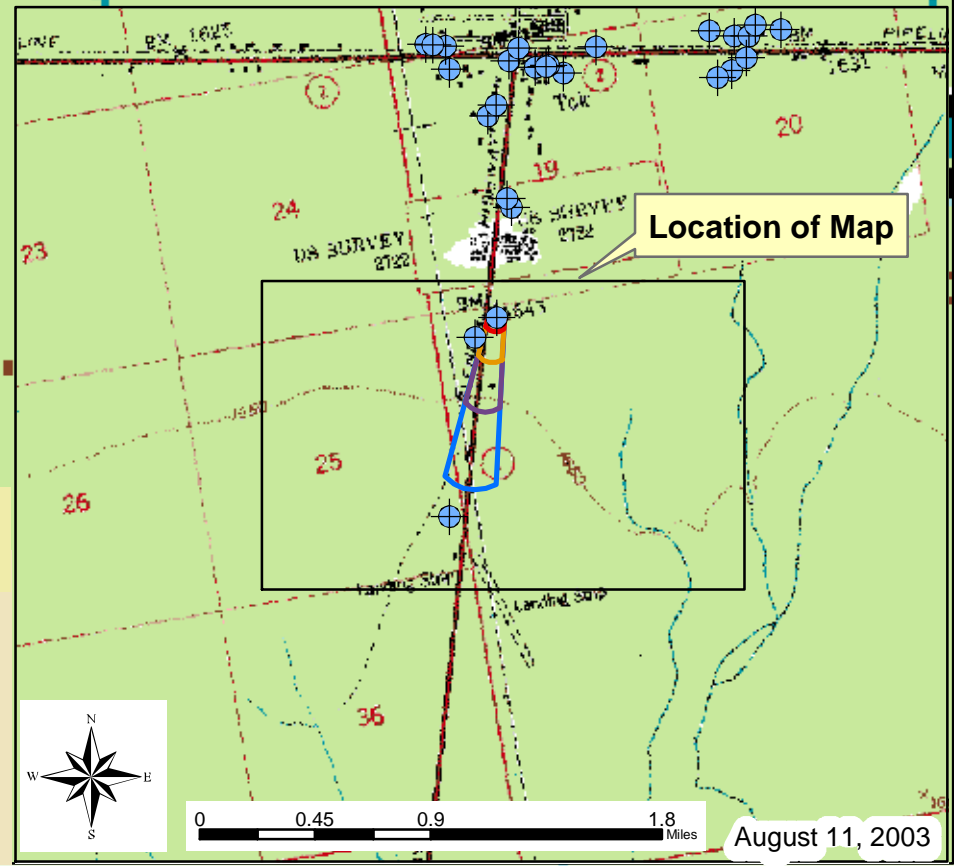
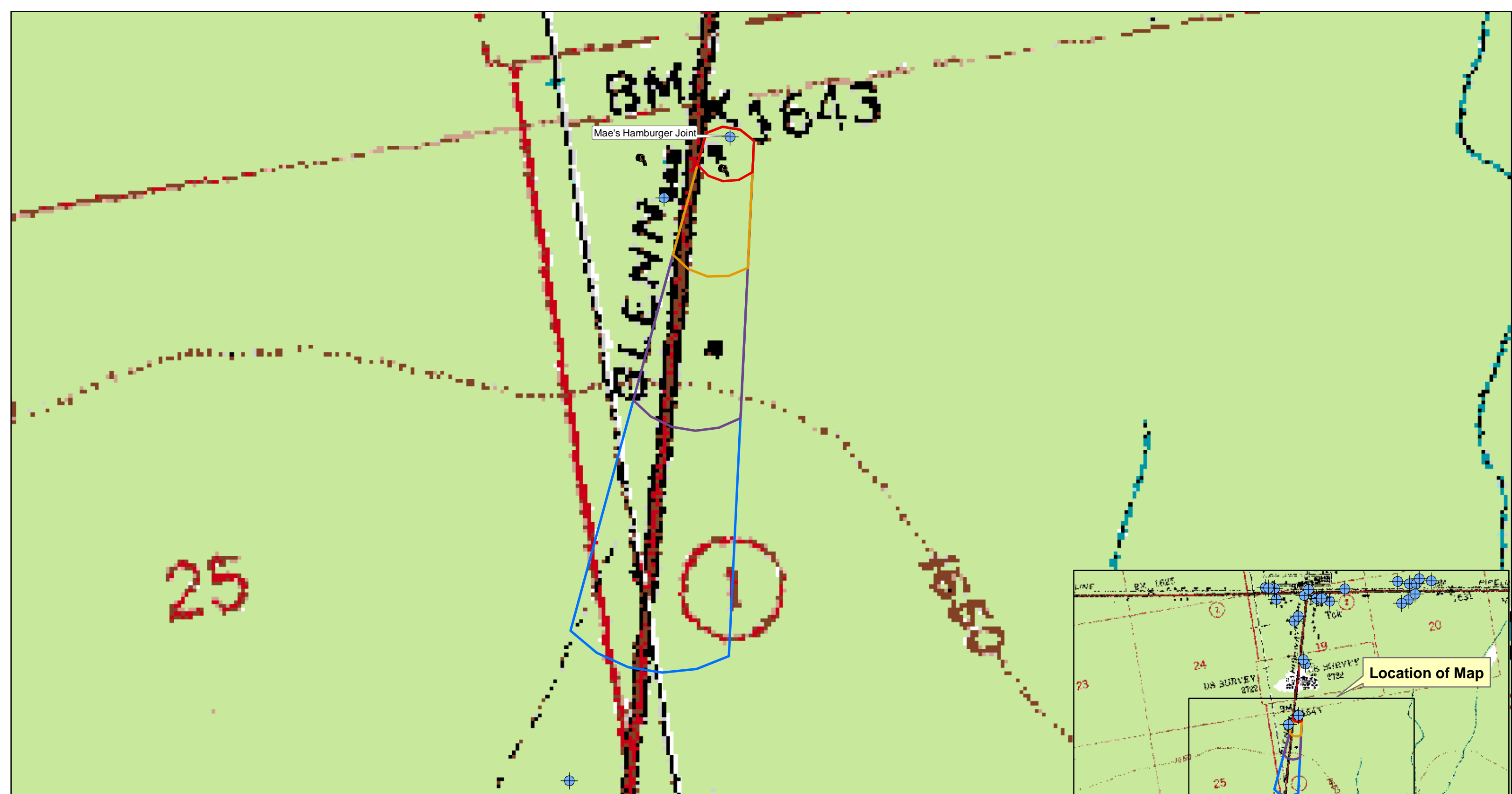
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- King, P.B., compiler, 1969, Tectonic map of North America: US Geological Survey Map (Scale 1:5,000,000) 2 sheets.
- United States Environmental Protection Agency (2002). <<http://www.epa.gov/safewater/mcl.html#mcls>> (2003, September 1)



## **APPENDIX A**

### **Mae's Hamburger Joint Drinking Water Protection Area Location Map (Map 1)**



Map 1: Mae's Hamburger Joint Drinking Water Protection Areas

PWSID: 381749.001



Data Sources:  
Background image - USGS 1:63,000 mapping

- Legend**
- Public Drinking Water Systems
  - 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

August 11, 2003

## **APPENDIX B**

### **Contaminant Source Inventory and Risk Ranking for Mae's Hamburger Joint (Tables 1-4)**

**Table 1****Contaminant Source Inventory for  
Mae's Hamburger Joint****PWSID 381749.001**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Map Number</b>	<b>Comments</b>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Septic System for Mae's Hamburger Joint
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	2	Heating Oil Tank for Mae's Hamburger Joint
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	2	Glenn Highway
Septic systems (serves one single-family home)	R02	R02-1	C	2	Residence South of Mae's Hamburger Joint
Tanks, heating oil, residential (above ground)	R08	R08-1	C	2	Residence South of Mae's Hamburger Joint

**Contaminant Source Inventory and Risk Ranking for  
Mae's Hamburger Joint  
Sources of Bacteria and Viruses**

**PWSID 381749.001**

**Table 2**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Risk Ranking for Analysis</b>	<b>Map Number</b>	<b>Comments</b>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic System for Mae's Hamburger Joint
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Glenn Highway

**Contaminant Source Inventory and Risk Ranking for  
Mae's Hamburger Joint  
Sources of Nitrates/Nitrites**

**PWSID 381749.001**

**Table 3**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Risk Ranking for Analysis</b>	<b>Map Number</b>	<b>Comments</b>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic System for Mae's Hamburger Joint
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Glenn Highway

**Contaminant Source Inventory and Risk Ranking for  
Mae's Hamburger Joint  
Sources of Volatile Organic Chemicals**

**PWSID 381749.001**

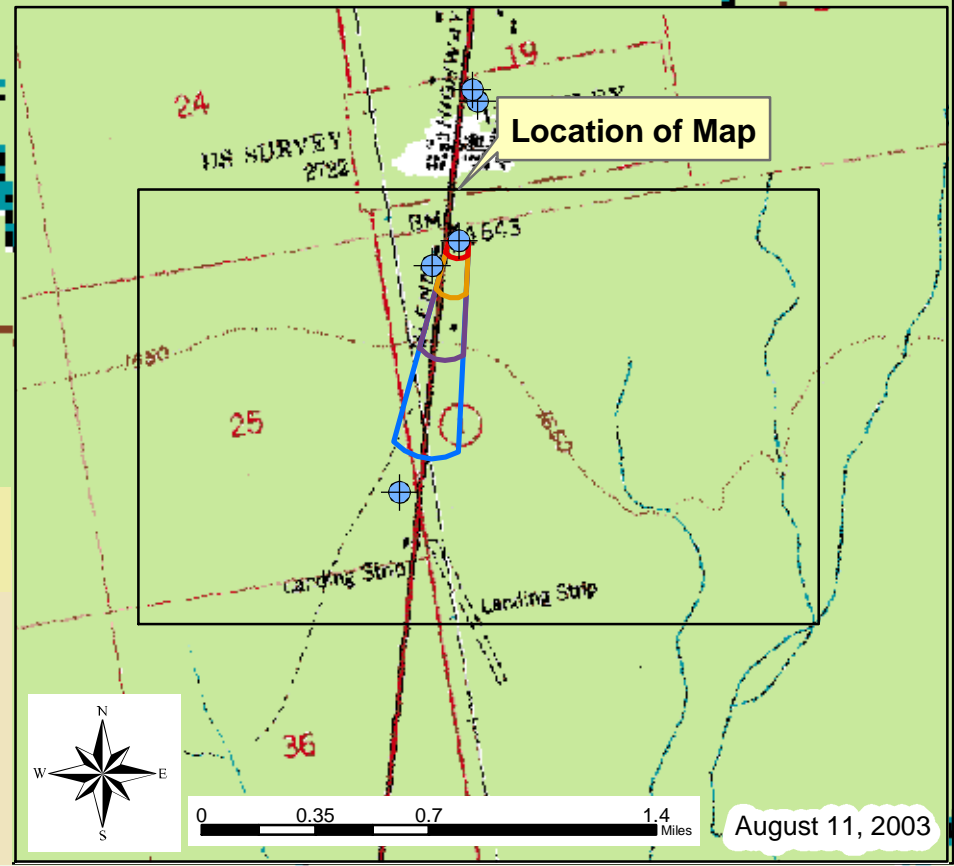
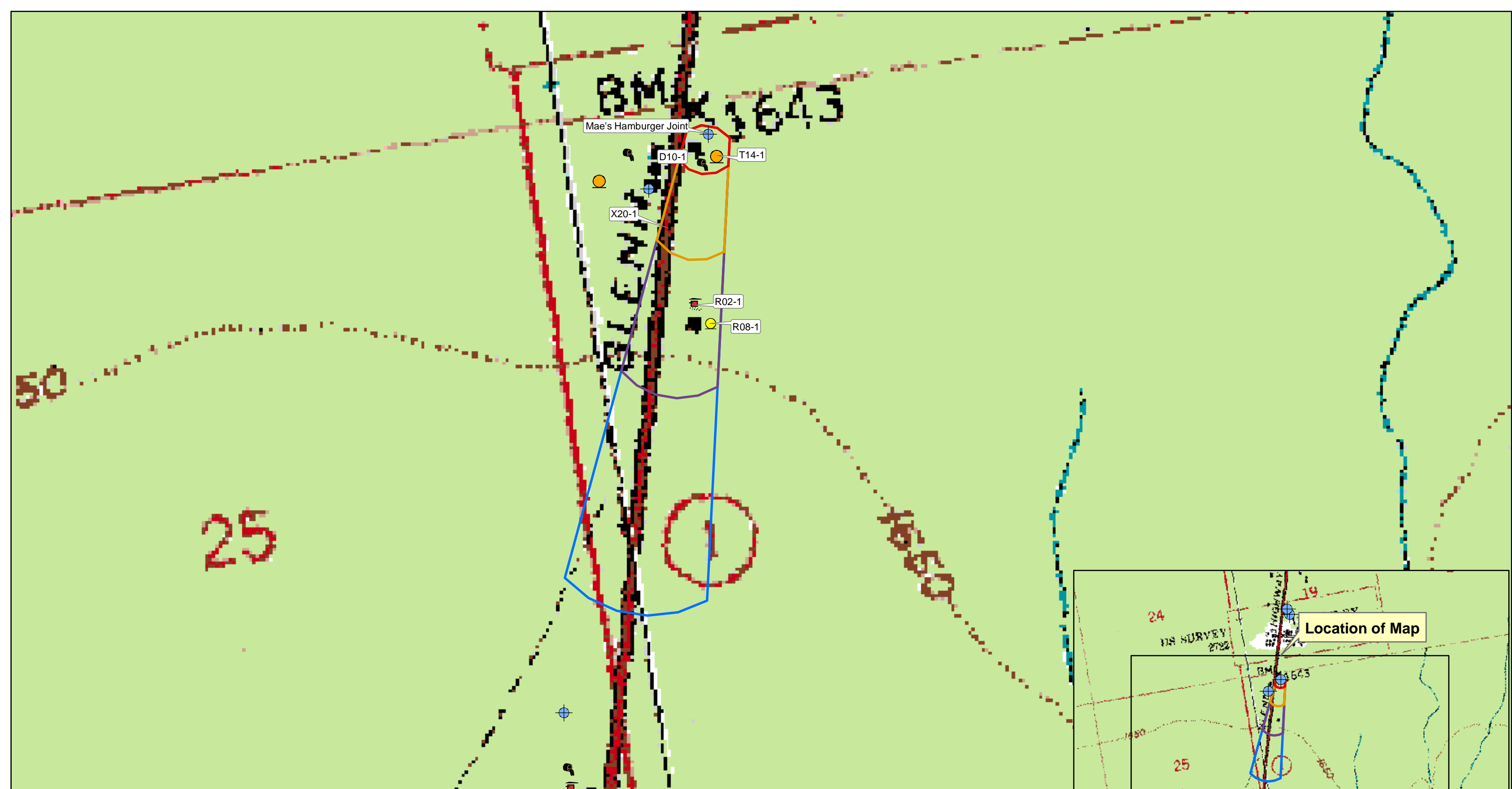
**Table 4**

<b>Contaminant Source Type</b>	<b>Contaminant Source ID</b>	<b>CS ID tag</b>	<b>Zone</b>	<b>Risk Ranking for Analysis</b>	<b>Map Number</b>	<b>Comments</b>
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic System for Mae's Hamburger Joint
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Heating Oil Tank for Mae's Hamburger Joint
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Glenn Highway

## **APPENDIX C**

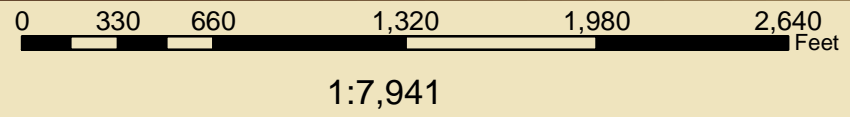
### **Mae's Hamburger Joint Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)**





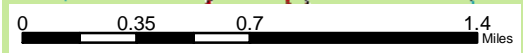
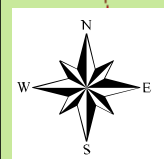
**Map 2: Drinking Water Protection Areas for Mae's Hamburger Joint and Potential and Existing Sources of Contamination**

PWSID: 381749.001



Data Sources:  
Background image - USGS 1:63,000 mapping

- Legend**
- Public Drinking Water Systems
  - Single Family Septic System (R02)
  - Residential Heating Oil Tank (R08)
  - Nonresidential Heating Oil Tank (T14)
  - 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

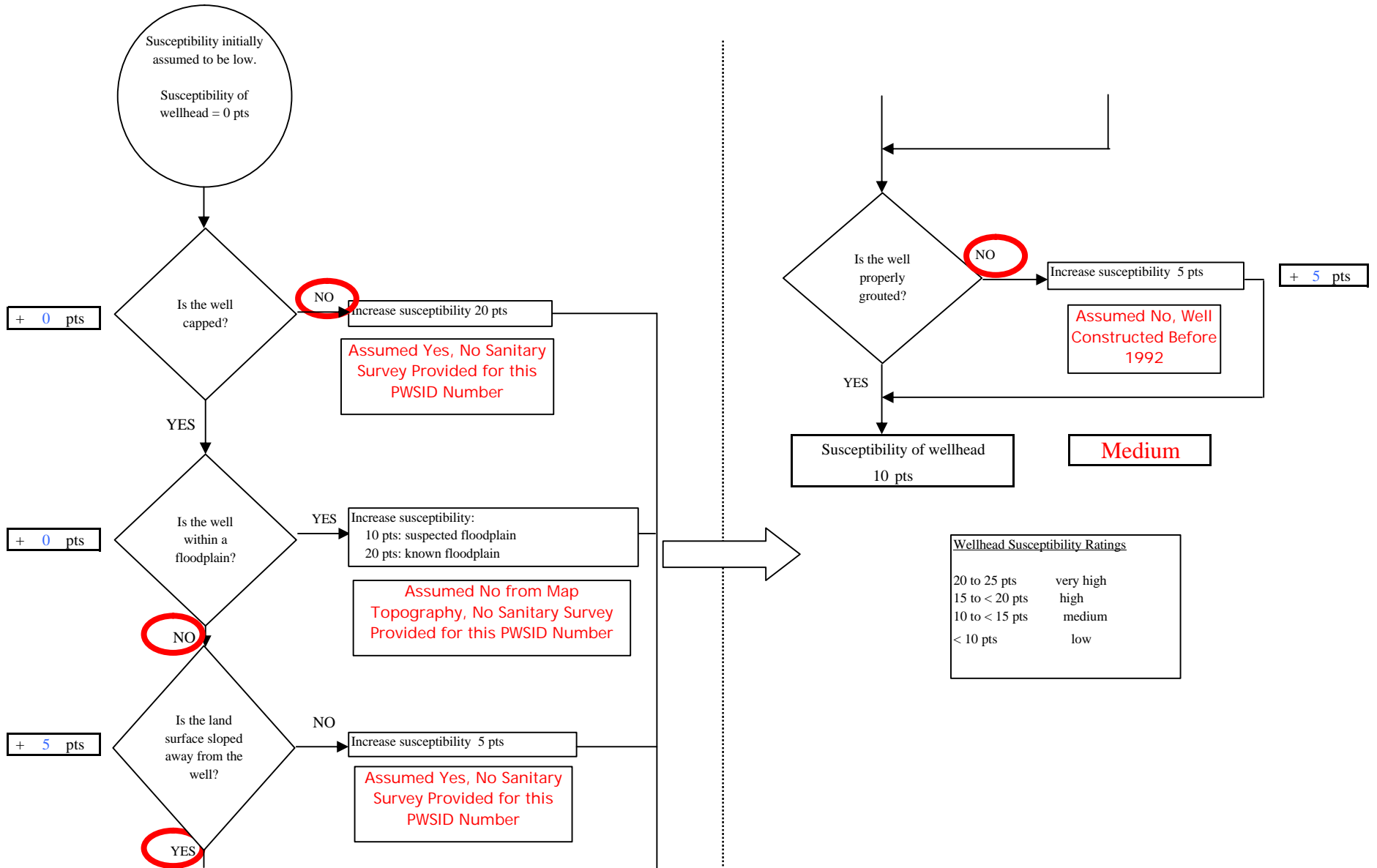


August 11, 2003

## **APPENDIX D**

### **Vulnerability Analysis for Mae's Hamburger Joint Public Drinking Water Source (Charts 1-8)**

**Chart 1. Susceptibility of the wellhead - Mae's Hamburger Joint**



**Chart 2. Susceptibility of the aquifer - Mae's Hamburger Joint**

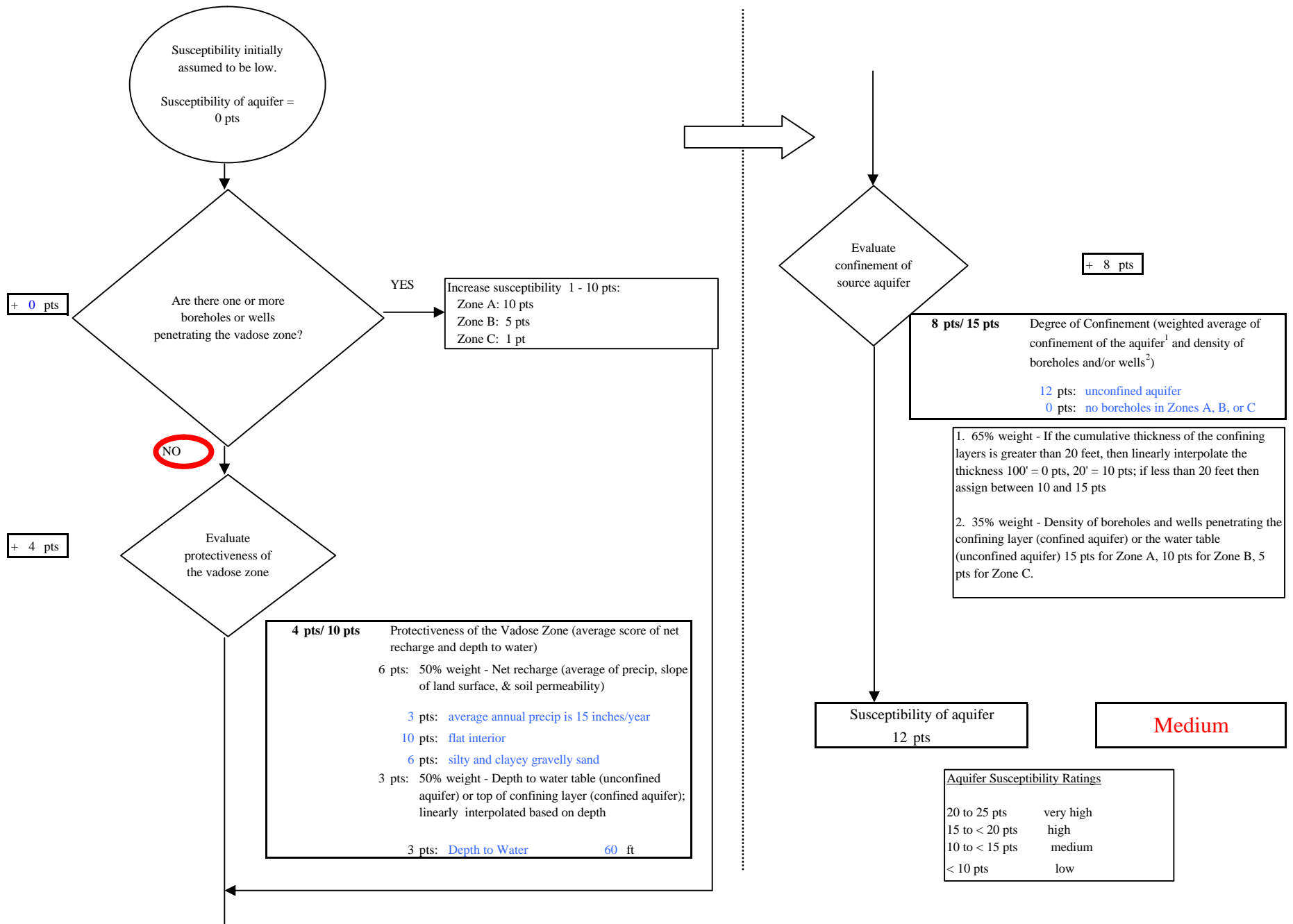
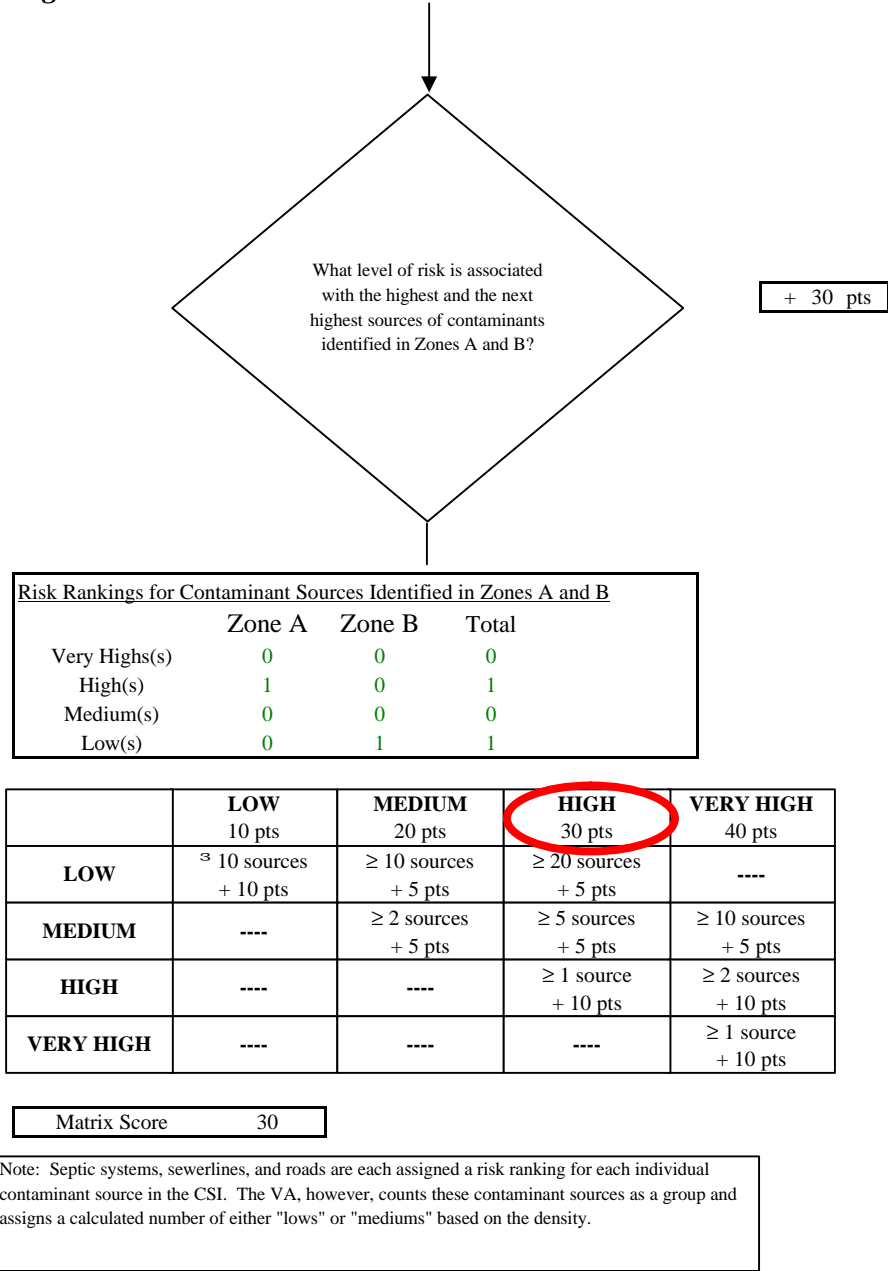
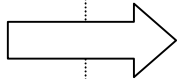
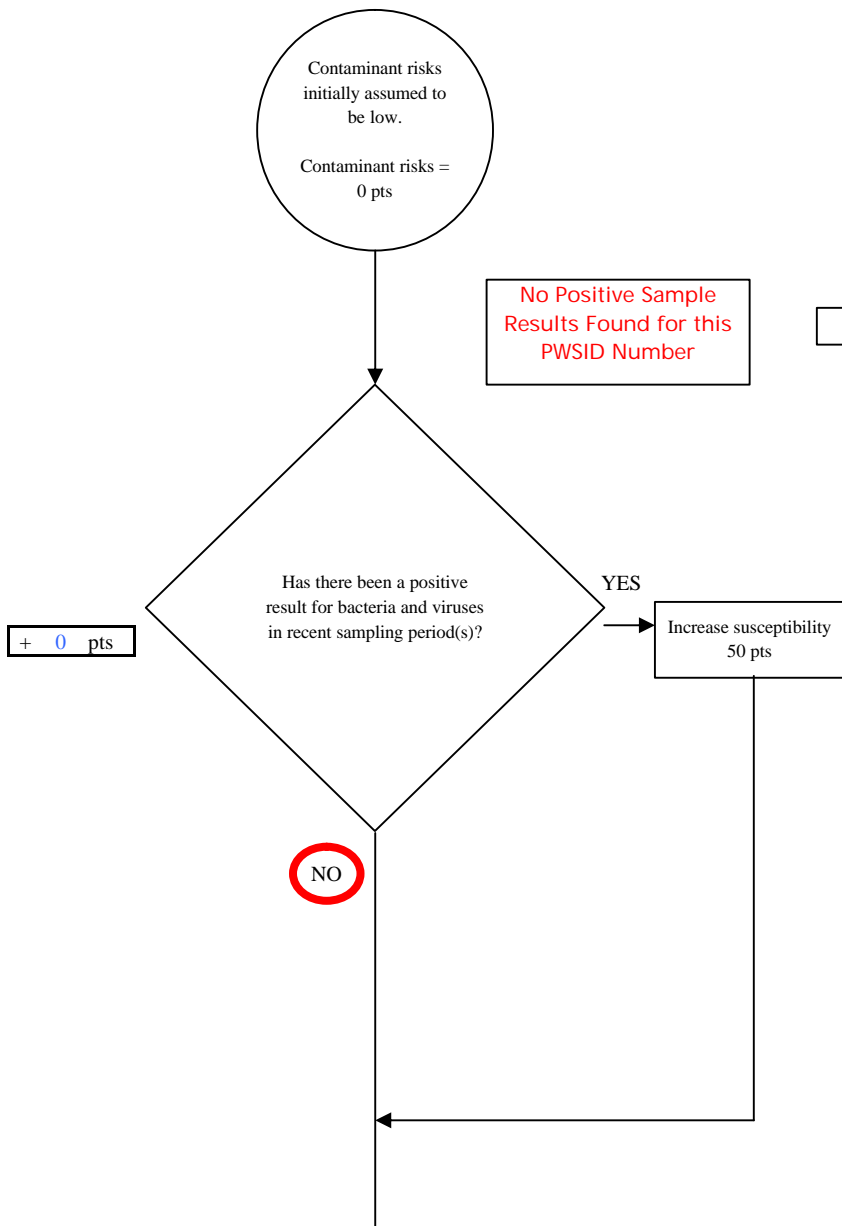
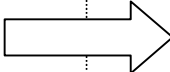
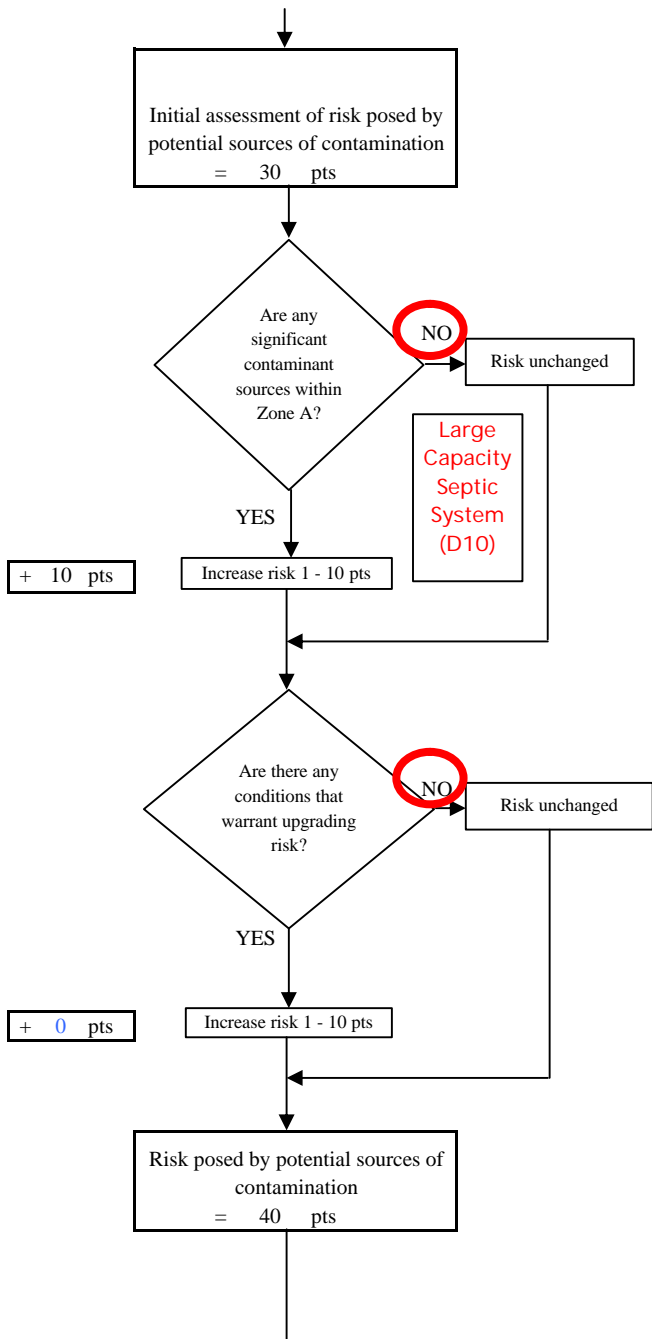


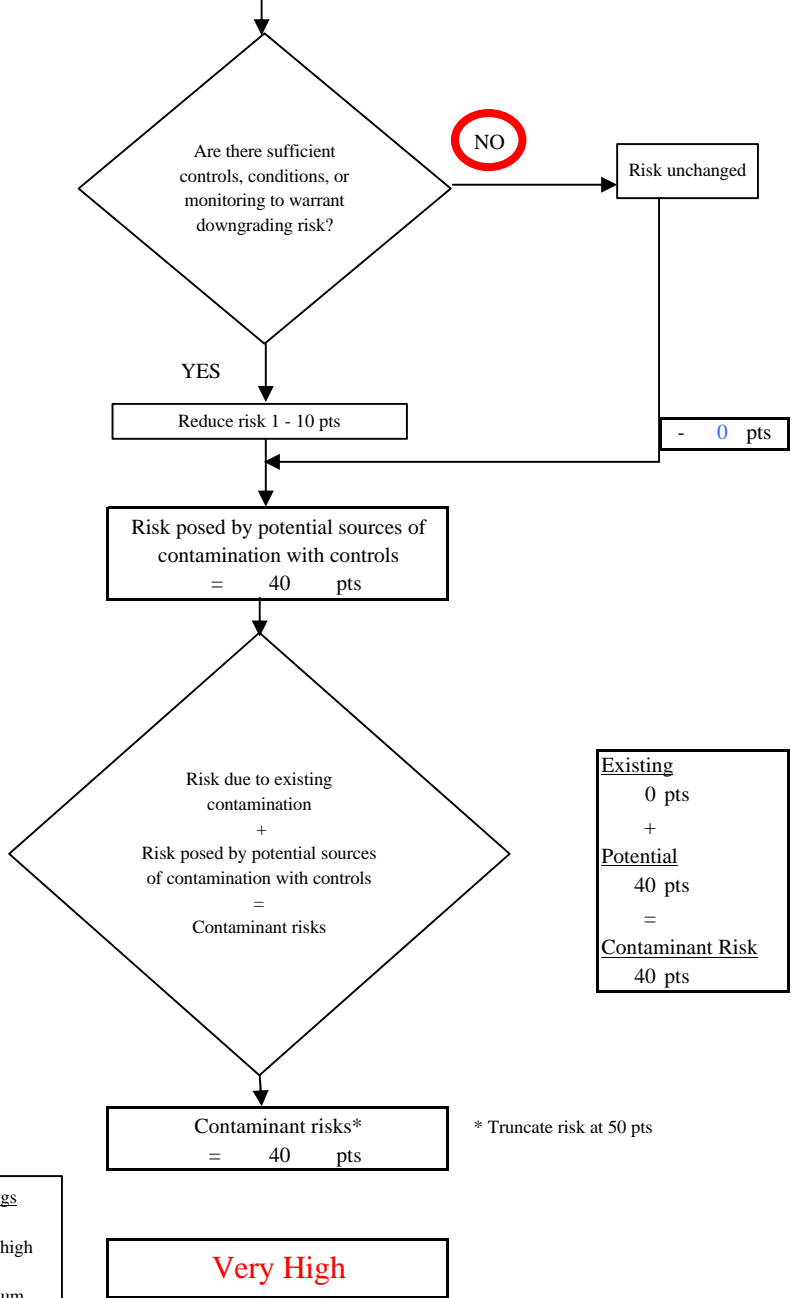
Chart 3. Contaminant risks for Mae's Hamburger Joint - Bacteria & Viruses



**Chart 3. Contaminant risks for Mae's Hamburger Joint - Bacteria & Viruses**



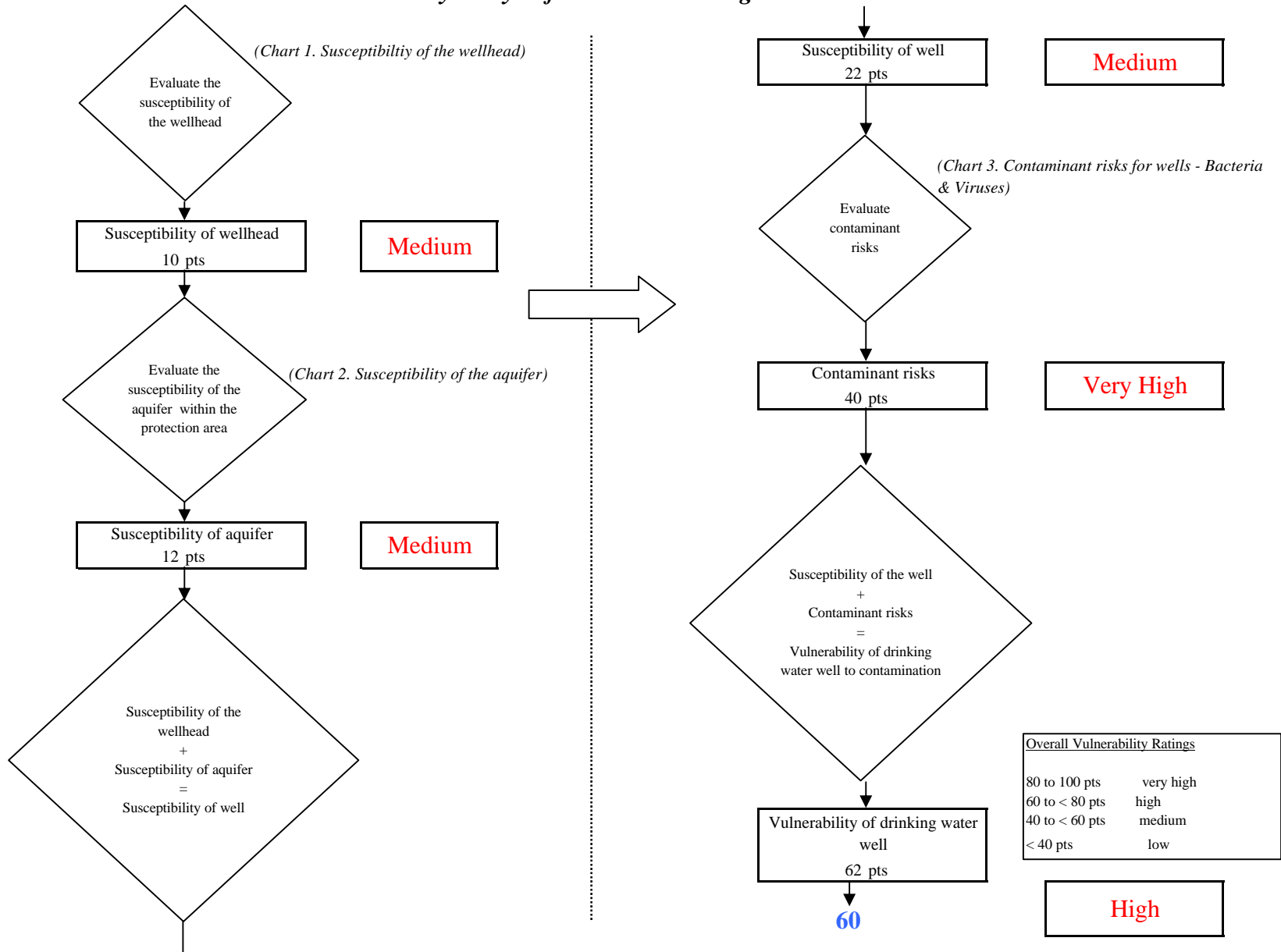
Contaminant Risk Ratings	
40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low



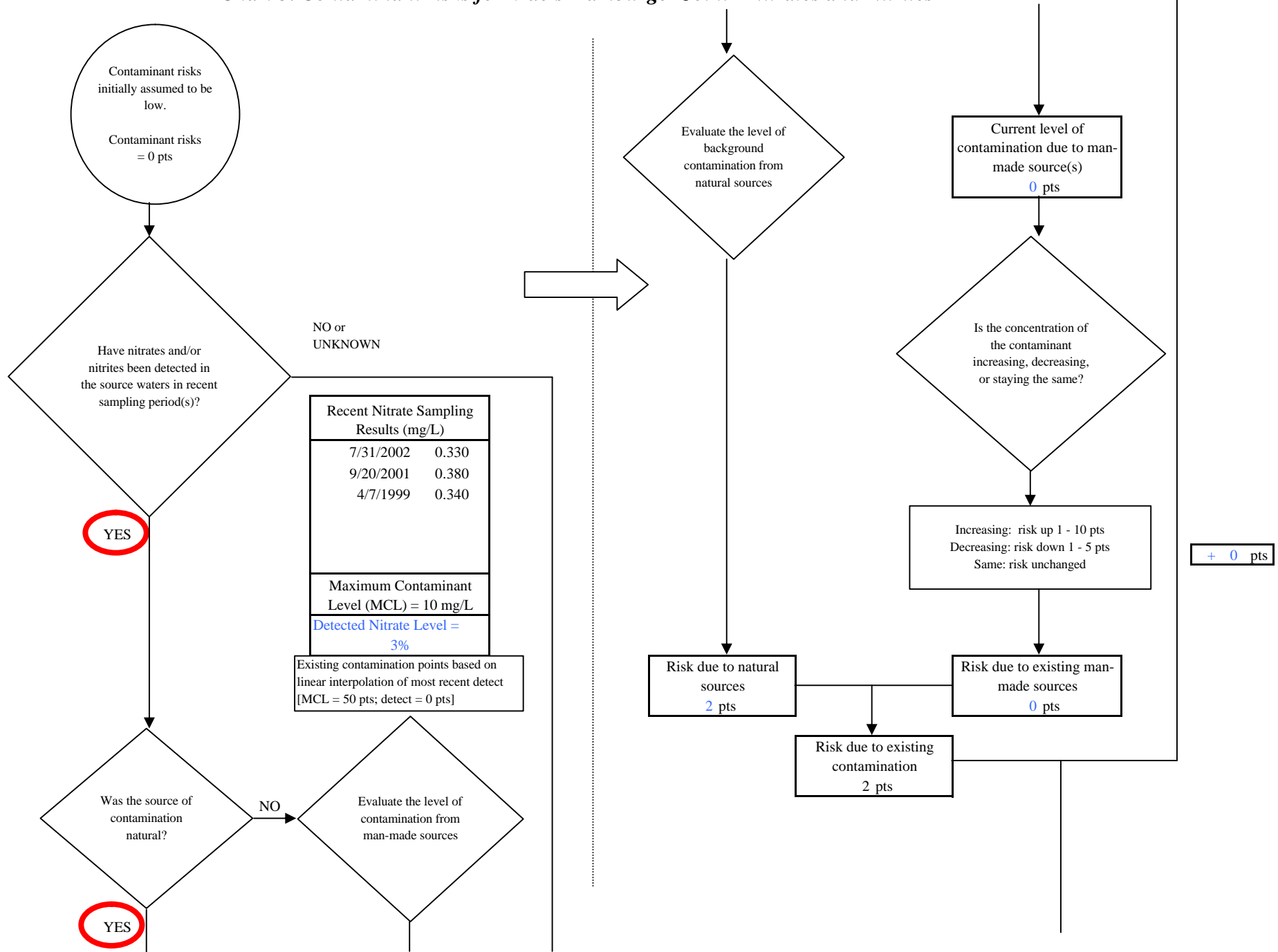
Existing	0 pts
+	
Potential	40 pts
=	
Contaminant Risk	40 pts

\* Truncate risk at 50 pts

**Chart 4. Vulnerability analysis for Mae's Hamburger Joint - Bacteria & Viruses**



**Chart 5. Contaminant risks for Mae's Hamburger Joint - Nitrates and Nitrites**





**Chart 5. Contaminant risks for Mae's Hamburger Joint - Nitrates and Nitrites**

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

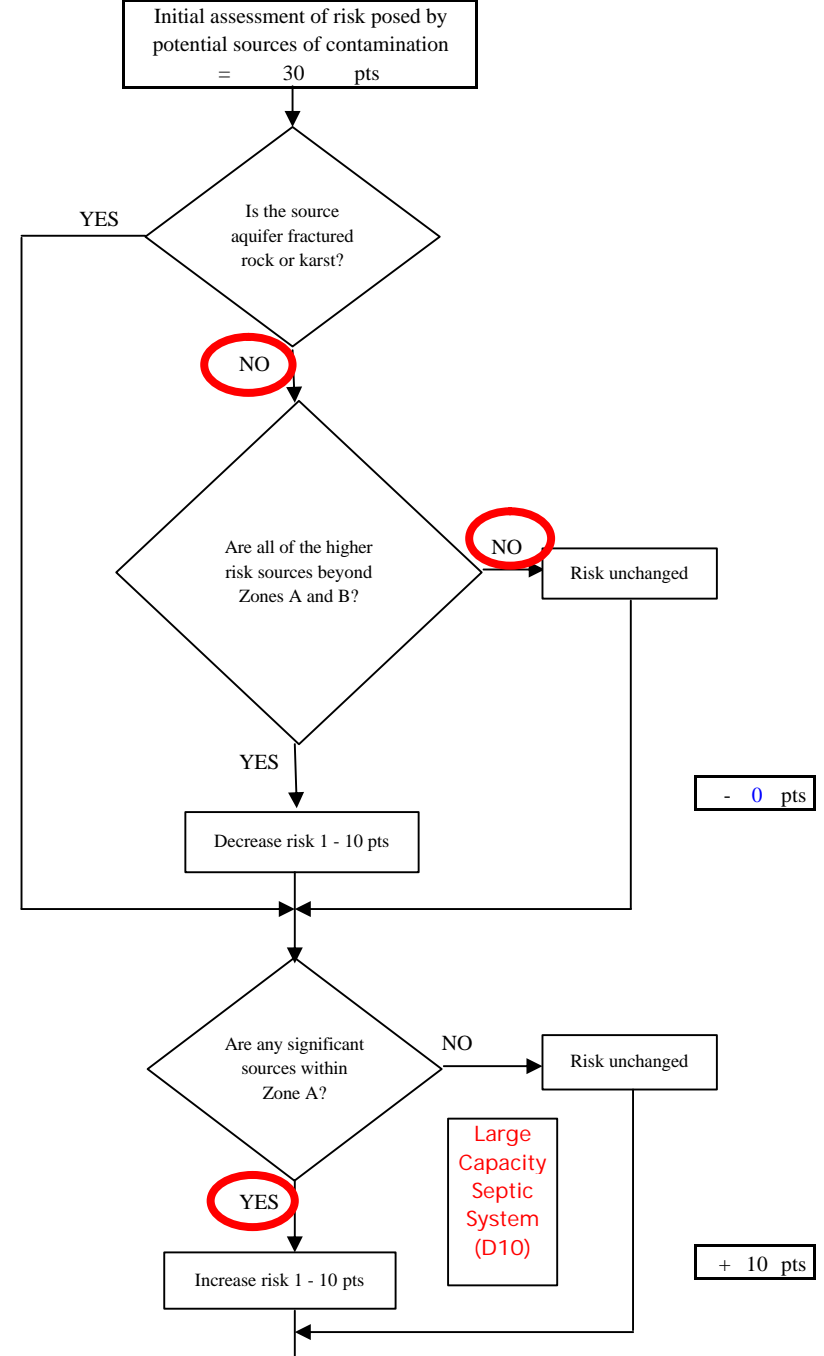
+ 30 pts

Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	0	1	1

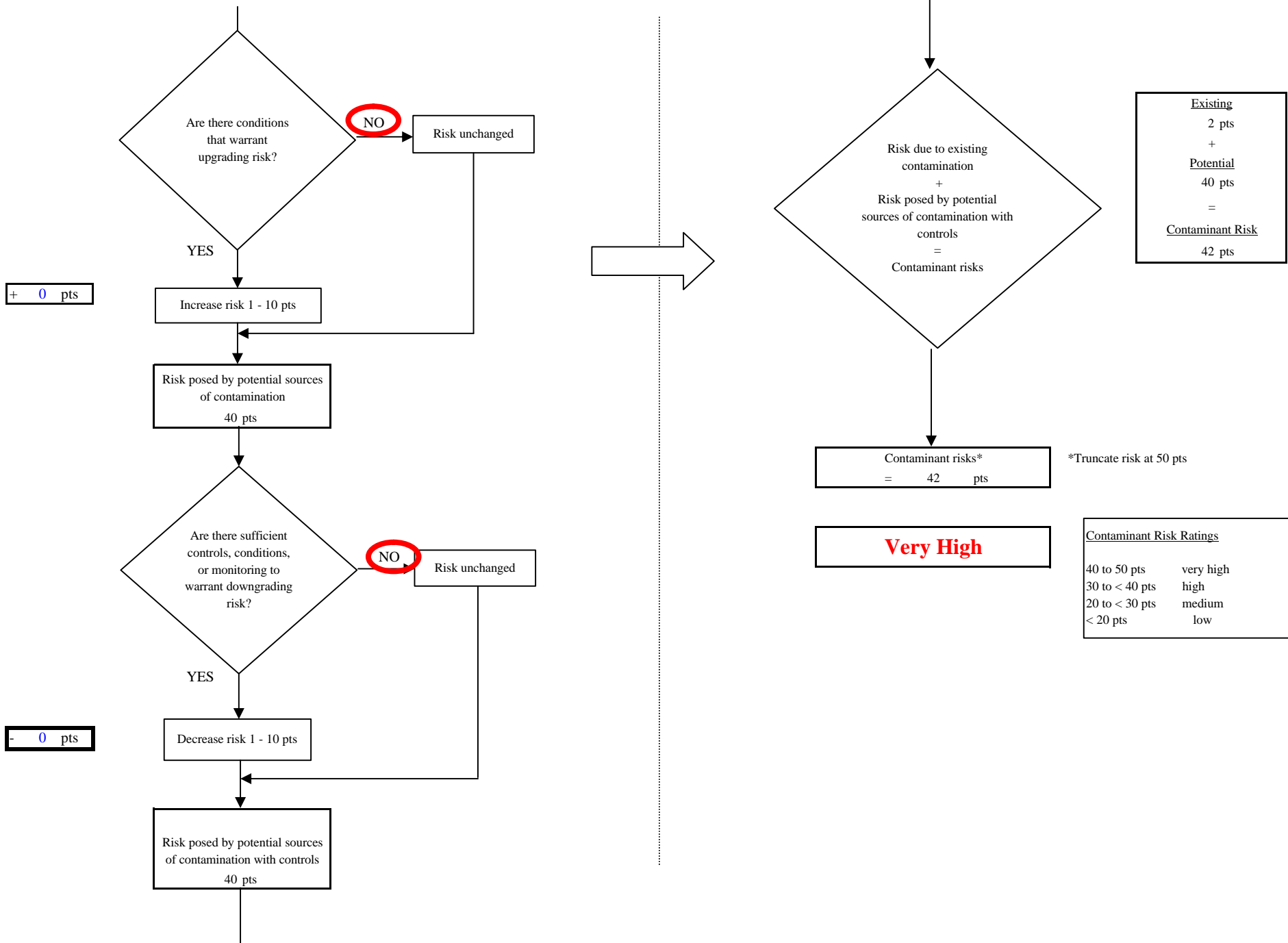
	LOW 10 pts	MEDIUM 20 pts	<b>HIGH 30 pts</b>	VERY HIGH 40 pts
<b>LOW</b>	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
<b>MEDIUM</b>	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
<b>HIGH</b>	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
<b>VERY HIGH</b>	----	----	----	≥ 1 source + 10 pts

Matrix Score      30

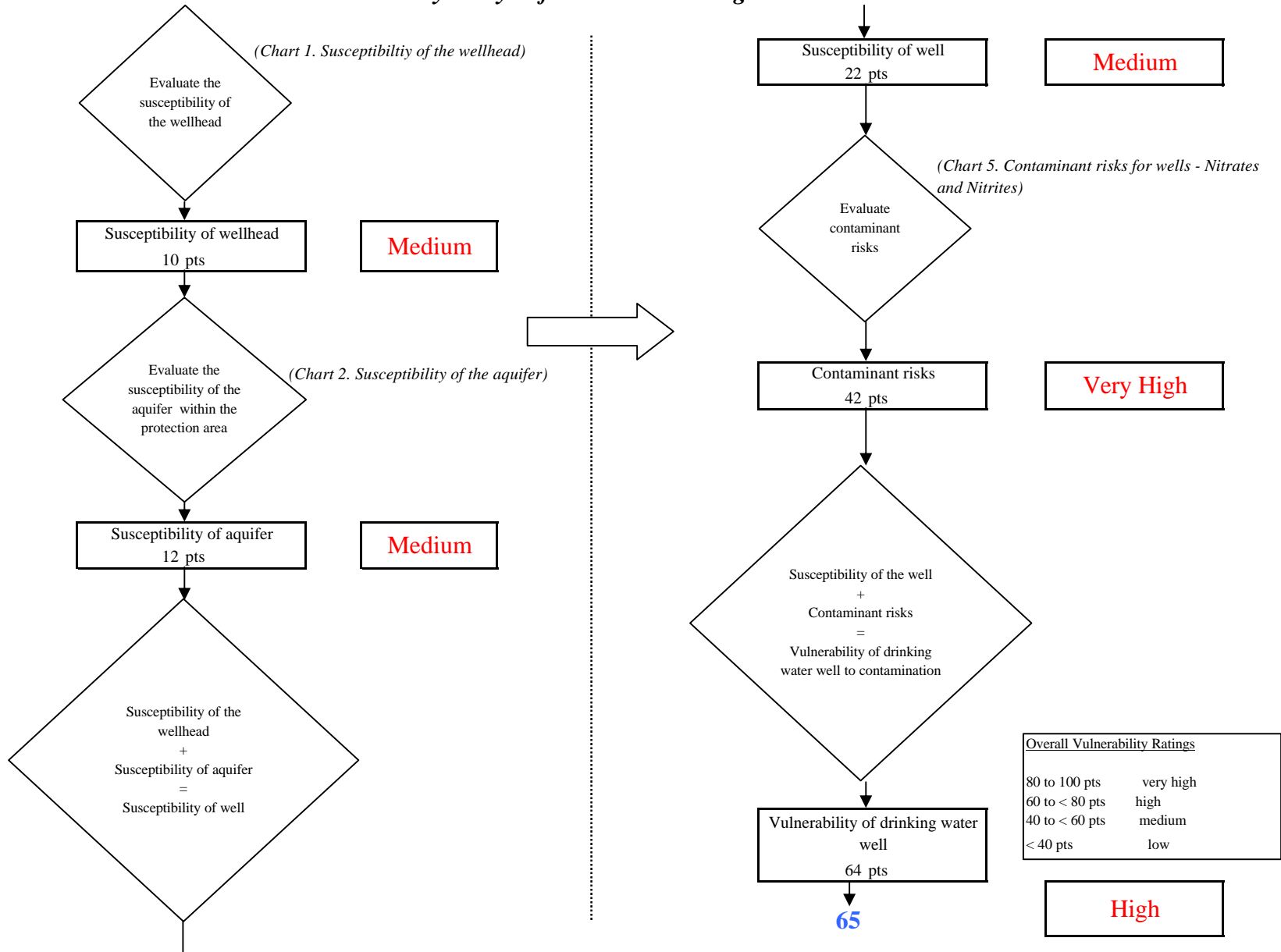
Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



**Chart 5. Contaminant risks for Mae's Hamburger Joint - Nitrates and Nitrites**



**Chart 6. Vulnerability analysis for Mae's Hamburger Joint - Nitrates and Nitrites**



**Chart 7. Contaminant risks for Mae's Hamburger Joint - Volatile Organic Chemicals**

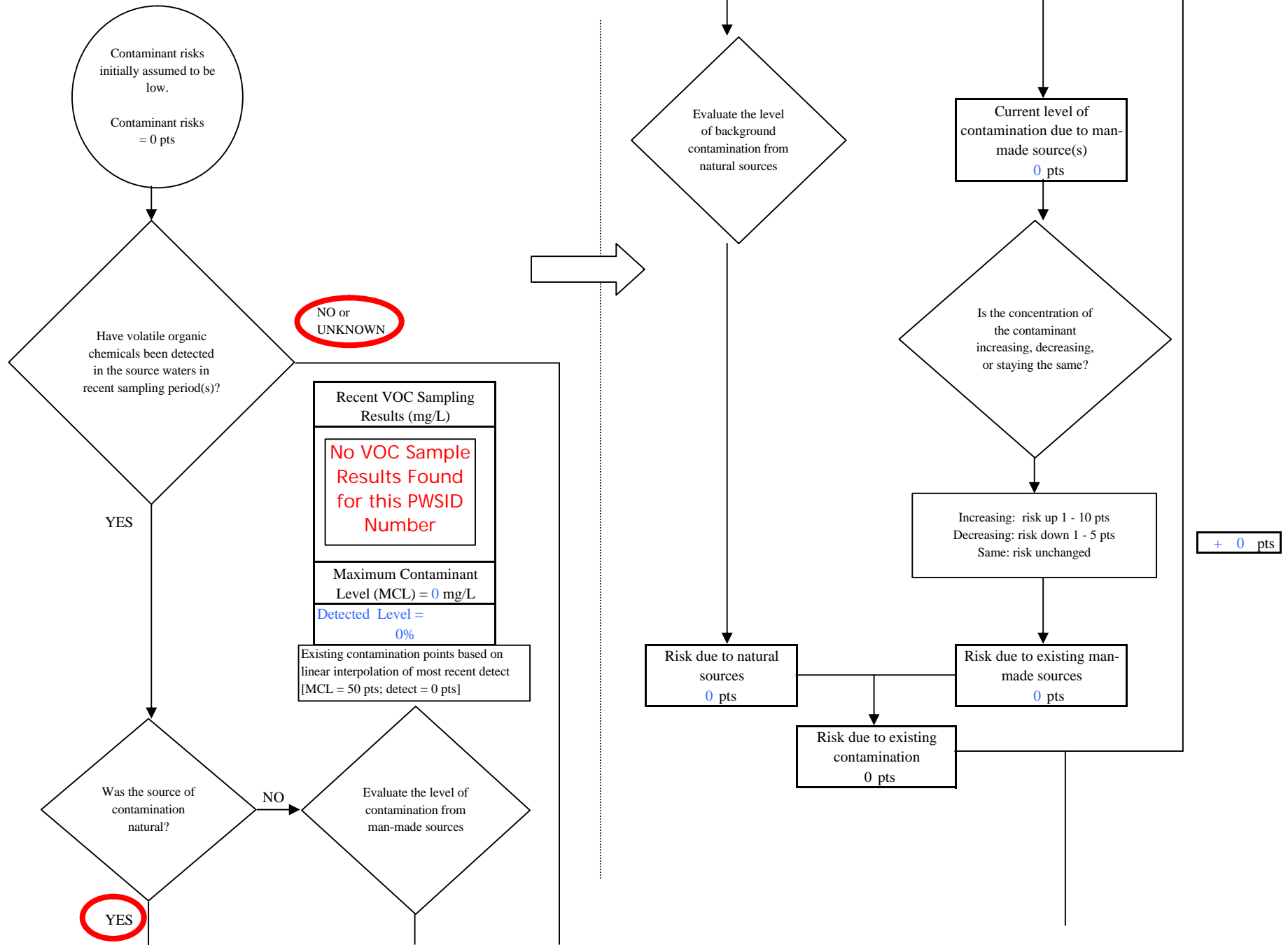
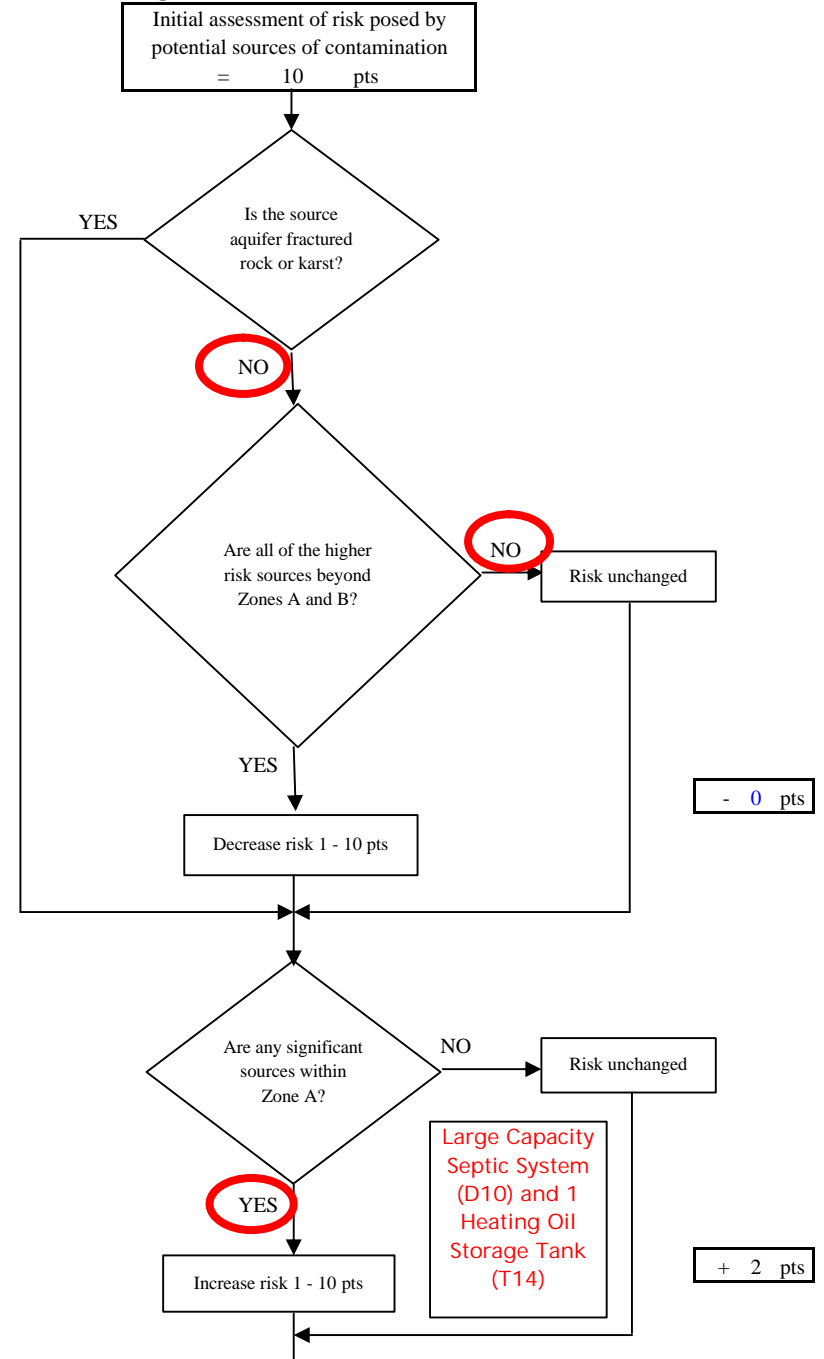
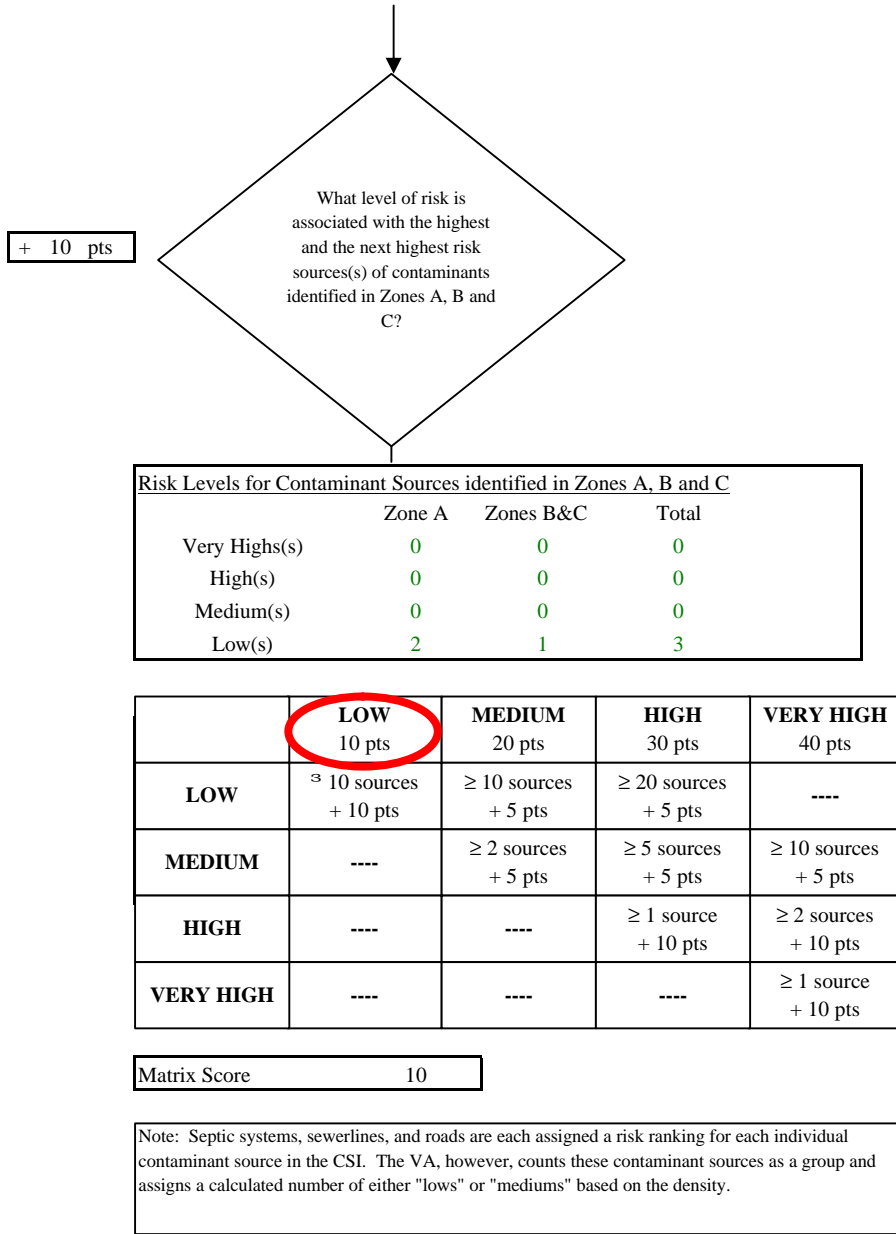
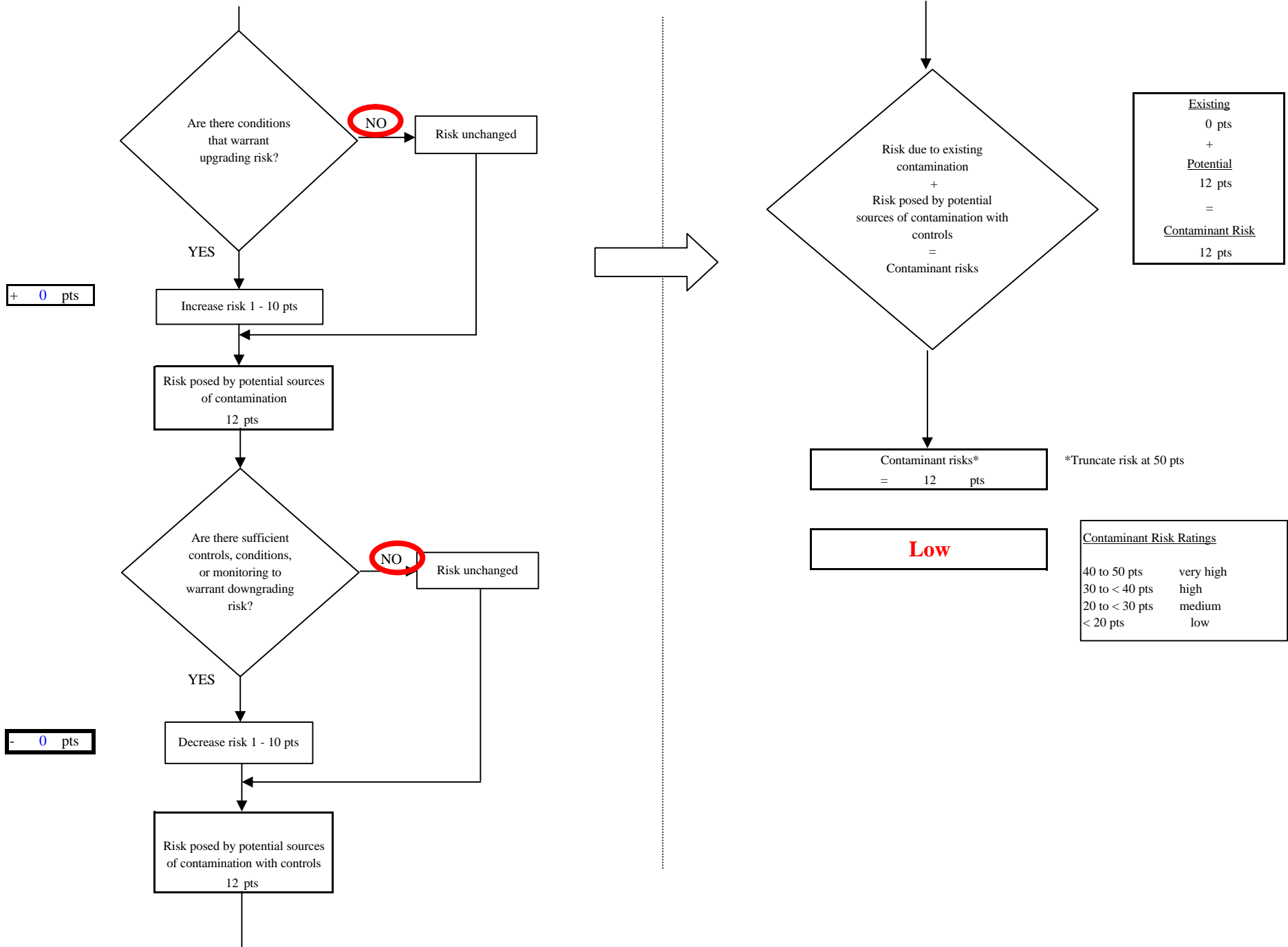


Chart 7. Contaminant risks for Mae's Hamburger Joint - Volatile Organic Chemicals



**Chart 7. Contaminant risks for Mae's Hamburger Joint - Volatile Organic Chemicals**



**Chart 8. Vulnerability analysis for Mae's Hamburger Joint - Volatile Organic Chemicals**

