Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for The Great Wall Hall Restaurant Drinking Water System, Anchorage, Alaska PWSID # 213360.001

DRINKING WATER PROTECTION PROGRAM REPORT # 473
Alaska Department of Environmental Conservation

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

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

CONTENTS

TABLES

ILLUSTRATIONS

APPENDICES

Source Water Assessment for The Great Wall Hall Restaurant's Source of Public Drinking Water, Anchorage, Alaska

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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Great Wall Hall Restaurant is a Class B (transient/non-community) water system consisting of one well in the Anchorage Area. Identified potential and current sources of contaminants for The Great Wall Hall Restaurant's public drinking water source includes hardware stores, motor vehicle dealerships, supply stores and repair shops, appliance repair shops, a glass shop, automotive body shops, a publishing facility, class V injection wells, junk yards, metal finishing shops, ADEC recognized contaminated sites, a car wash, motor vehicle storage yards, a closed leaking underground fuel storage tank site, roads, sewer lines, and recreation trails. 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 The Great Wall Hall Restaurant received a vulnerability rating of **Medium** for bacteria and viruses, nitrates and/or nitrites, and **High** for volatile organic chemicals.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska.

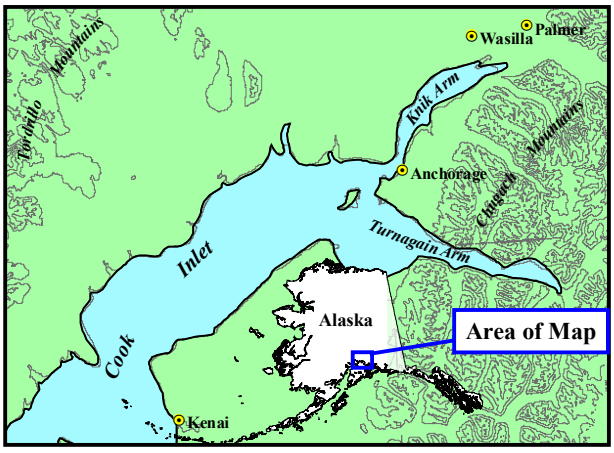

Figure 1. Index map showing the location of Anchorage, Alaska

The purpose of this assessment is to provide public water system owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. 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.

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 ANCHORAGE AREA, ALASKA

Location

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

Climate

The Anchorage area climate is somewhat transitional in that it does not experience large daily and annual temperature fluctuations like those experienced in the interior of Alaska nor does it experience high amounts of precipitation typified by gulf coast regions. Mean annual precipitation at the Anchorage International Airport is approximately 16 inches per year. On average, Anchorage receives a total snow accumulation

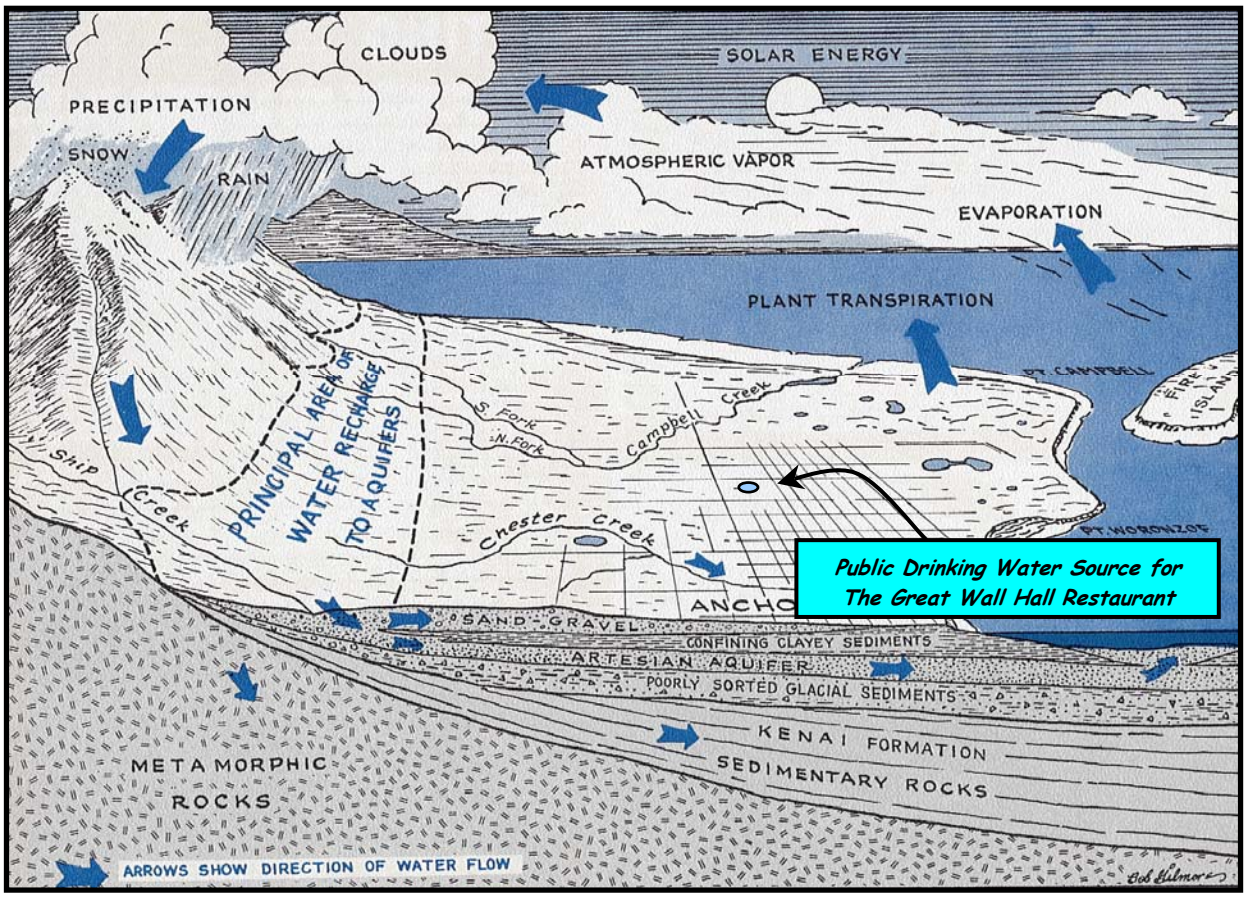

Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

of 69 inches per year. Precipitation generally increases inland toward the Chugach Mountains where annual precipitation may exceed 160 inches per year [*Barnwell, George, Dearborn, Weeks, and Zenone*, 1972]. Mean daily temperature ranges from 65° F during July to 8° F in January [*Western Regional Climate Center*, 2000].

Physiography and Groundwater Conditions

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

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

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

Water enters or recharges these two aquifer systems in several different ways. Along the front of the Chugach Mountains, groundwater seeps from fractures in bedrock into the sediments. At these higher elevations, rain and snowmelt also enters the sediments. This area along the mountain front is considered the principal recharge area for wells in the Anchorage area. Precipitation in the low lands may also percolate directly into the ground. Lastly, aquifers may also be recharged by streams where surface water percolates into surrounding permeable sediments (losing reaches of streams). Groundwater flow in the confined aquifer is generally east to west from the mountain front toward

Cook Inlet and Turnagain Arm, except in areas where the direction of flow is influenced by large municipal or industrial production wells. The direction of groundwater flow in the upper unconfined aquifer is more variable due to the influence from surfacial topography as well as its close connection with surface water bodies.

THE GREAT WALL HALL RESTAURANT'S PUBLIC DRINKING WATER SYSTEM

The Great Wall Hall Restaurant is a Class B (transient/non-community) water system. The system consists of one well off of the Old Seward Highway and 57th Avenue. This area is at an elevation of approximately 100 feet above sea level.

There is no well log available for the well serving The Great Wall Hall Restaurant. The most recent Sanitary Survey (10/28/98) indicates the well has a cap that provides a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The Sanitary Survey also notes that the land surface is appropriately sloped to provide adequate surface water drainage. It is suspected that the well was not grouted according to ADEC regulations during installation. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

As of March 28, 2002 this systems in not actively serving the public. The business has closed and the building has been condemned. According to ADEC records, the Municipality of Anchorage will not allow the business to open until compliance has been met with both the Municipality rules and ADEC requirements. When in operation this systems has the capacity to serve 70 non-residents through one service connection.

THE GREAT WALL HALL RESTAURANT'S DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate the most likely pathways

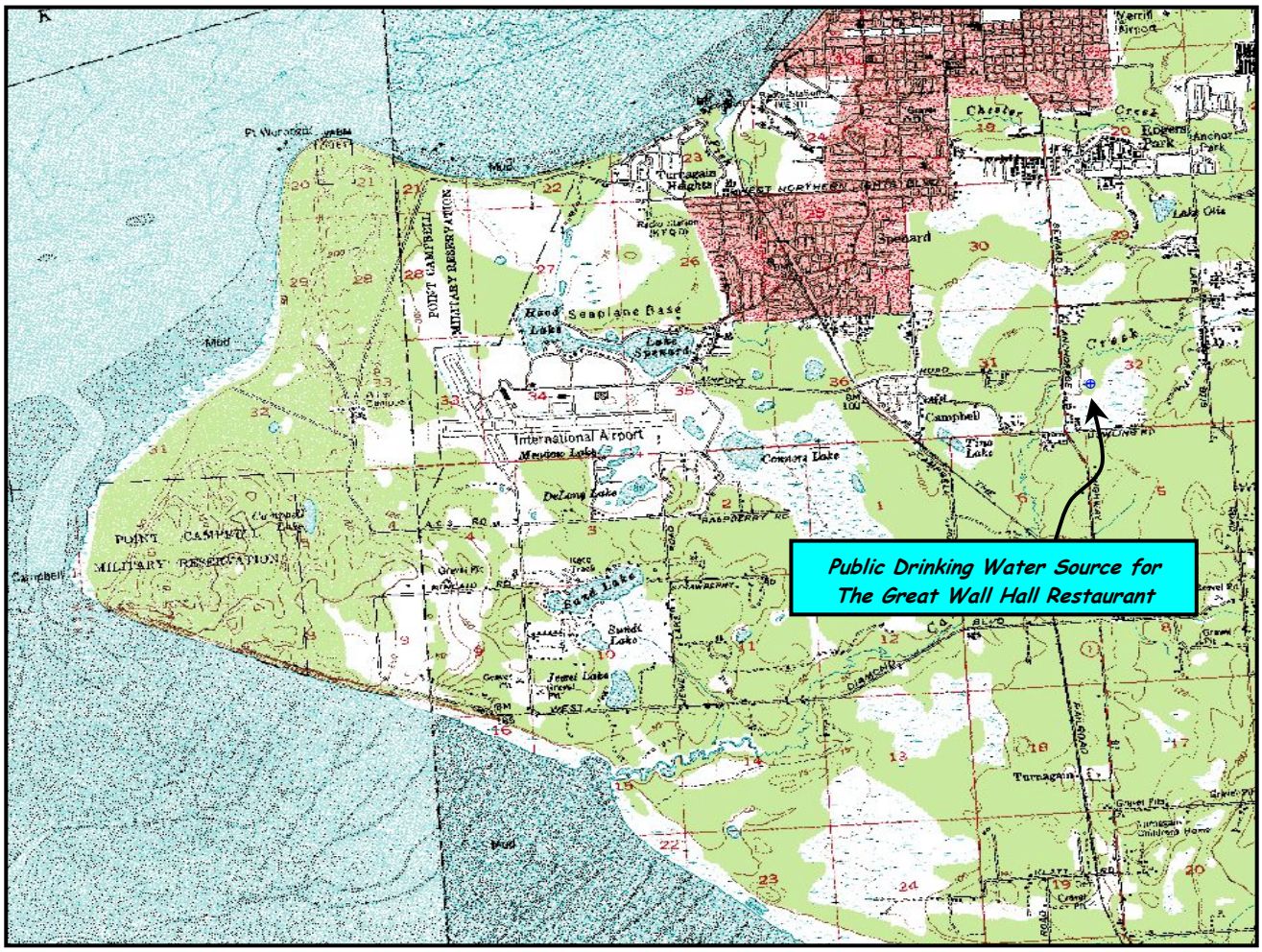

Figure 3. Map showing the location of the drinking water sources for The Great Wall Hall Restaurant [Base: USGS Tyonek A1].

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 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 adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources (*Jokela et. al., 1991*). 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 time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. TOT
B	Less than the 2 year TOT
C	Less Than the five 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 Great Wall Hall Restaurant's 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 source water assessments, three categories of drinking water contaminants were inventoried:

- 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 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.

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 THE THE GREAT WALL HALL RESTAURANT 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)

Because no well log was available, geologic information was gathered from wells within a ¼ mile radius of The Great Wall Hall Restaurant's source of public drinking water. Based on the information gathered, it is suspected that the well for The Great Wall Hall Restaurant is completed in a confined aquifer setting. The depth to the top of the confining layer is approximately 57 feet below land surface and consists of a layer of silty clay with a thickness of approximately 8 feet. This confining layer may provide a protective barrier against the movement of contaminants in the subsurface. However, near the base of the Chugach Mountains, these clay layers tend to be discontinuous and thin toward the mountains. Therefore, contaminants that enter the subsurface near the base of the mountains may enter the confined aquifer uninhibited by the absence of any protective layer. Table 2 shows the Overall Susceptibility score and rating for The Great Wall Hall Restaurant.

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

	Score	Rating
Susceptibility of the Wellhead	10	Medium
Susceptibility of the Aquifer	11	Medium
Natural Susceptibility	21	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	25	Medium
Nitrates and/or Nitrites	25	Medium
Volatile Organic Chemicals	50	Very 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 3 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 The Great Wall Hall Restaurant to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	45	Medium
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	70	Very High

Tables 2 through 5 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.

Bacteria and Viruses

The residential sewer lines, roads, and the Class V motor vehicle waste disposal wells present the greatest risk for bacteria and viruses. The risk to The Great Wall

Hall Restaurant's source of public drinking water with regard to bacteria and viruses is medium after combining the scores for contaminant risk and vulnerability.

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 (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Nitrates and/or Nitrites

The residential sewer lines within the protection area present the greatest risk for nitrates and/or nitrites. Other potential sources of nitrates and/or nitrites that exist within the protection area include a hardware store, highways and roads, and recreation trials. The risk to The Great Wall Hall Restaurant's source of public drinking water with regard to nitrates and/or nitrites is medium after combining the scores for contaminant risk and vulnerability.

Nitrates and/or nitrites are found in natural background concentration 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 [Wang, Strelakos, Jokela, 2000].

Sampling history for The Great Wall Hall Restaurant indicates that no nitrates and/or nitrites have been detected (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Volatile Organic Chemicals

The motor vehicle repair shops, automotive body shops, junk yard, Class V motor vehicle waste disposal well, and ADEC recognized contaminated sites pose the greatest risk for volatile organic chemical contamination. Other potential sources of volatile organic chemicals within the protection area include hardware stores, motor vehicle supply stores and storage yards, metal finishing shops, glass shops, a car wash, publishing facilities, highways and roads, and residential sewer lines. The risk to The Great Wall Hall Restaurant's source of public drinking water with regard to volatile organic chemicals is high after combining the scores for contaminant risk and vulnerability.

The high vulnerability for volatile organic chemicals to The Great Wall Hall Restaurant's source of public drinking water relates to the fact that there are Class V motor vehicle waste disposal wells and ADEC recognized contaminates sites located within Zones A and C.

According to the United States Environmental Protection Agency's (USEPA) Office on Water, a motor vehicle waste disposal well is a type of Class V injection well which is typically a shallow disposal system that receives or has received fluids from vehicular repair or maintenance activities, such as an auto body repair shop, automotive repair shops, new and used car dealerships, specialty repair shop (e.g., transmission and muffler repair shop), or any area where vehicular repair work is performed.

The USEPA's Office on Water describes motor vehicle waste disposal wells as floor drains or sinks in service bays that are tied into a shallow disposal system (see Figure 4). Most commonly, these shallow systems are septic systems or drywells, but any underground system that receives motor vehicle waste would be considered a motor vehicle waste disposal well. A variety of names are used to describe shallow disposal systems including: cesspools, catchbasins, sink holes, underground vaults, or drain tanks.

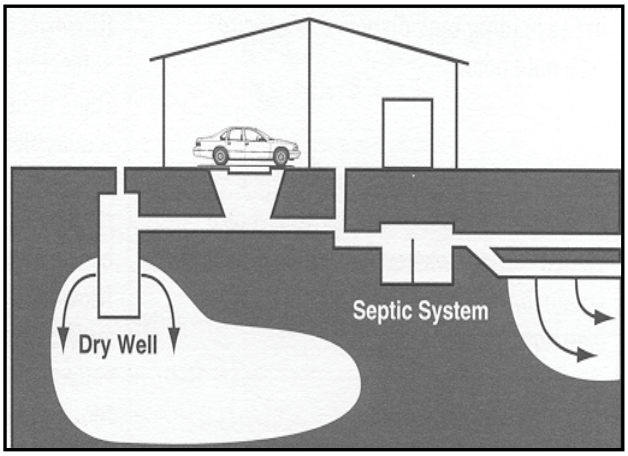

Figure 4. Motor vehicle waste disposal system

The contaminated site located within Zone A (U4-1) is associated with an automobile salvage yard. A notice of violation reached the ADEC in September, 1995. According to ADEC files, the wrecking yard was using a pick ax to puncture gasoline tanks resulting in high levels of volatile organic chemicals. Remedial actions have taken place and contaminated soils were excavated and transported off site.

The contaminated site located within Zone C (U4-2) is associated with a bus maintenance facility. In December, 1991, a spill of petroleum product was reported to ADEC. According to ADEC files, cleanup of the spill revealed further signs of past spillage at the site. The total extent of contamination is unknown. The site remains open for remedial action.

Review of historical sampling data indicates that no volatile organic chemicals have been detected that the well (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals).

SUMMARY

A *Source Water Assessment* has been completed for the source of public drinking water serving The Great Wall Hall Restaurant. The overall vulnerability of this source to contamination is **Medium** for bacteria and viruses, nitrates and/or nitrites, and **High** for volatile organic chemicals. 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 The Great Wall Hall Restaurant 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 The Great Wall Hall Restaurant's public drinking water source.

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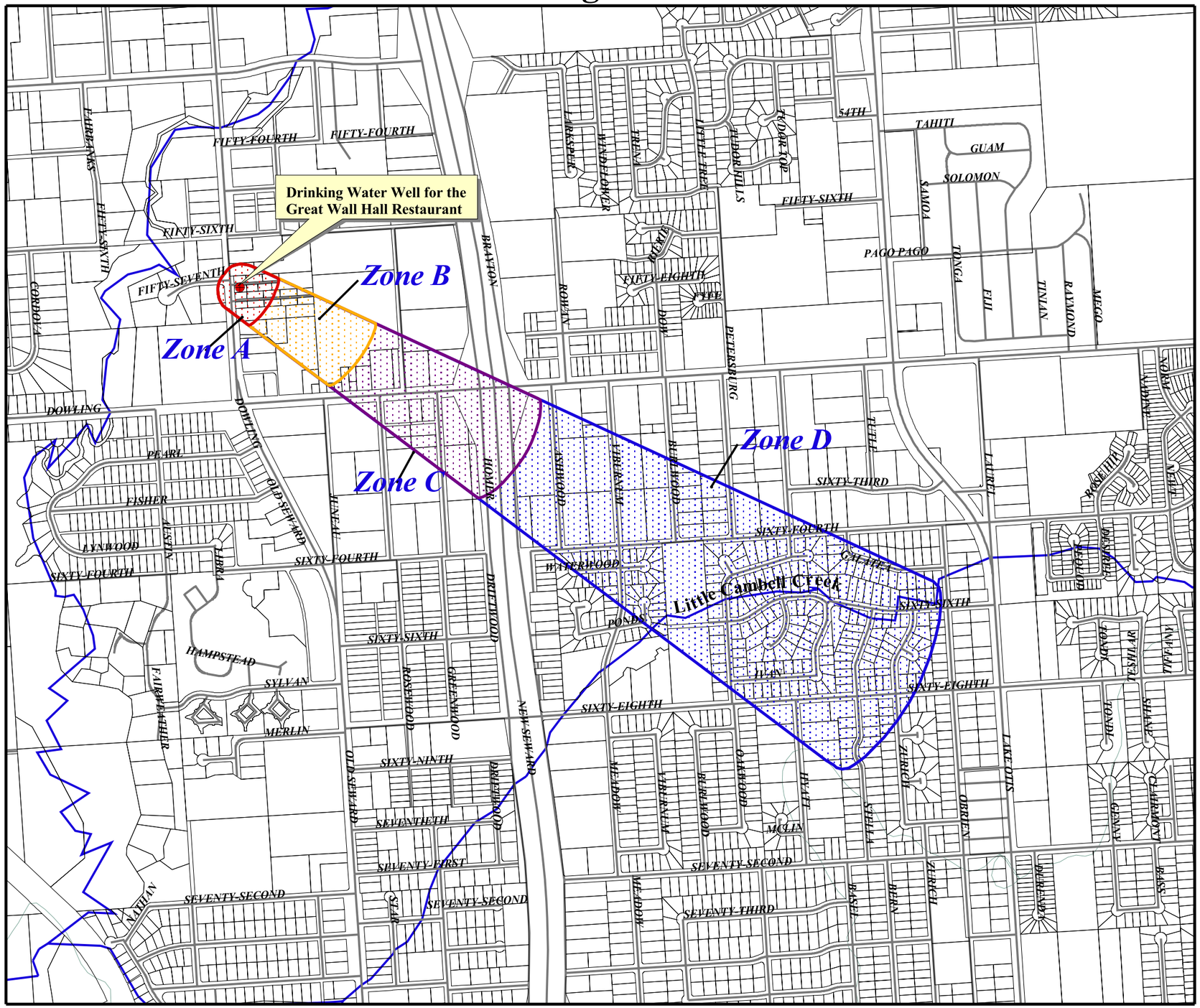
APPENDIX A

The Great Wall Hall Restaurant's Drinking Water Protection Area (Map 1)

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for The Great Wall Hall Restaurant



- Great Wall Hall Restaurant

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
- Land Parcels
- Anchorage Roads
- Anchorage Streams
- Elevation Contours

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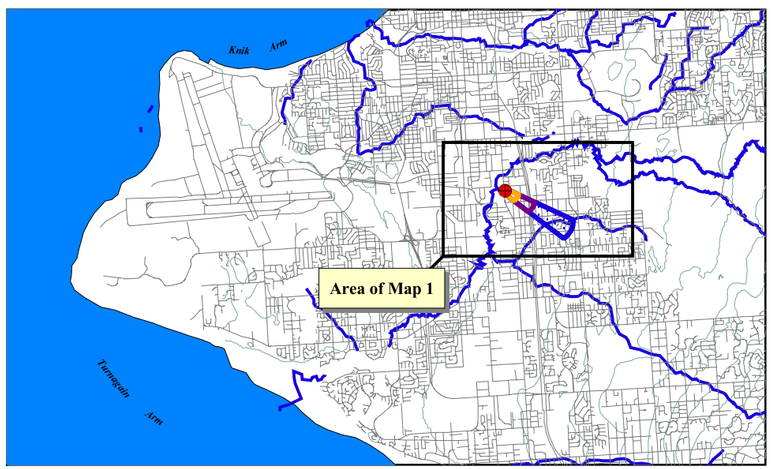


1000 0 1000 2000 Feet

PWSID 213360.001

Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for The Great Wall Hall Restaurant (Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 213360.001***

The Great Wall Hall Restaurant

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Hardware stores	C17	C17-1	A	Off of the Old Seward Highway	2	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27-1	A	Off of the Old Seward Highway	2	
Motor/motor vehicle supplies stores	C28	C28-1	A	Off of the Old Seward Highway	2	
Appliance repair shops	C03	C3-1	A	Off of the Old Seward Highway	2	
Motor /motor vehicle repair shops	C31	C31-1	A	Off of the Old Seward Highway	2	
Motor /motor vehicle repair shops	C31	C31-2	A	Off of the Old Seward Highway	2	
Windshield/glass shops	C44	C44-1	A	Off of the Old Seward Highway	2	
Body shops (automotive)	C05	C5-1	A	Off of the Old Seward Highway	2	
Body shops (automotive)	C05	C5-2	A	Off of the Old Seward Highway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Along Fifty-seventh Place	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Perpendicular to Fifty-seventh Court	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	A	Off of the Old Seward Highway	2	
Scrap, salvage, or junk yards	D59	D59-1	A	Off of Fifty-seventh Court	3	
Scrap, salvage, or junk yards	D59	D59-1	A	Off of the Old Seward Highway	2	
Metal finishing	I26	I26-1	A	Off of the Old Seward Highway	2	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-1	A	Off of the Old Seward Highway	2	Site is associated with an automobile salvage yard.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Old Seward Highway	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Fifty-seventh Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Fifty-seventh Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A,B	Fifty-eighth Court	2	
Motor vehicle/general storage yards/facilities	X27	X27-1	A,B	Off of Fifty-eighth Court	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Intersecting Zone B	3	
Motor/motor vehicle supplies stores	C28	C28-2	C	Off of Dowling Road	4	
Motor/motor vehicle supplies stores	C28	C28-3	C	Off of Dowling Road	4	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30-1	C	Off of Dowling Road	4	
Motor /motor vehicle repair shops	C31	C31-1	C	Off of Latouch Street	3	
Motor /motor vehicle repair shops	C31	C31-3	C	Off of Dowling Road	4	
Body shops (automotive)	C05	C5-3	C	Off of Dowling Road	4	
Body shops (automotive)	C05	C5-4	C	Off of Dowling Road	4	
Car washes with engine or undercarriage cleaning	C08	C8-1	C	Off of Dowling Road	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4-7	C	Sewer lines located within Zone C	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	C	Off of Dowling Road	4	
Beverage industry	I07	I7-1	C	Off of Dowling Road	4	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-2	C	Off of Dowling Road	4	Site is associated with a bus maintenance facility.
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-1	C	Off of Dowling Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5-21	C	Roads located within Zone C	4	
Motor vehicle/general storage yards/facilities	X27	X27-1	C	Off of Dowling Road	4	
Motor vehicle/general storage yards/facilities	X27	X27-2	C	Off of Dowling Road	3	
Motor vehicle/general storage yards/facilities	X27	X27-3	C	Off of Dowline Road	3	
Dog walking areas/foot trails	X46	X46-1-4	C	Trails located within Zone C	3	
Printers, publishers, copiers	C37	C37-1	D	Off of Petersburg Street	5	

Table 2

Contaminant Source Inventory and Risk Ranking for The Great Wall Hall Restaurant Sources of Bacteria and Viruses

PWSID 213360.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	Along Fifty-seventh Place	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Medium	Perpendicular to Fifty-seventh Court	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	A	Low	Off of the Old Seward Highway	2	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Old Seward Highway	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	Fifty-seventh Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	Fifty-seventh Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A,B	Low	Fifty-eighth Court	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Medium	Intersecting Zone B	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4-7	C	Medium	Sewer lines located within Zone C	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	C	Low	Off of Dowling Road	4	
Beverage industry	I07	I7-1	C	Low	Off of Dowling Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5-21	C	Low	Roads located within Zone C	4	
Dog walking areas/foot trails	X46	X46-1-4	C	Low	Trails located within Zone C	3	

Table 3

Contaminant Source Inventory and Risk Ranking for The Great Wall Hall Restaurant Sources of Nitrates/Nitrites

PWSID 213360.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Location***	***Map Number***	***Comments***
Hardware stores	C17	C17-1	A	Low	Off of the Old Seward Highway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Medium	Along Fifty-seventh Place	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Medium	Perpendicular to Fifty-seventh Court	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Old Seward Highway	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	Fifty-seventh Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	Fifty-seventh Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A,B	Low	Fifty-eighth Court	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Medium	Intersecting Zone B	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4-7	C	Medium	Sewer lines located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-5-21	C	Low	Roads located within Zone C	4	
Dog walking areas/foot trails	X46	X46-1-4	C	Low	Trails located within Zone C	3	

Table 4

Contaminant Source Inventory and Risk Ranking for The Great Wall Hall Restaurant Sources of Volatile Organic Chemicals

PWSID 213360.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Hardware stores	C17	C17-1	A	Low	Off of the Old Seward Highway	2	
Motor vehicle dealerships - cars, trucks, motor cycles, ATV's, snow machines, boats (with service department)	C27	C27-1	A	Medium	Off of the Old Seward Highway	2	
Motor/motor vehicle supplies stores	C28	C28-1	A	Low	Off of the Old Seward Highway	2	
Appliance repair shops	C03	C3-1	A	Low	Off of the Old Seward Highway	2	
Motor /motor vehicle repair shops	C31	C31-1	A	Medium	Off of the Old Seward Highway	2	
Motor /motor vehicle repair shops	C31	C31-2	A	Medium	Off of the Old Seward Highway	2	
Windshield/glass shops	C44	C44-1	A	Low	Off of the Old Seward Highway	2	
Body shops (automotive)	C05	C5-1	A	Medium	Off of the Old Seward Highway	2	
Body shops (automotive)	C05	C5-2	A	Medium	Off of the Old Seward Highway	2	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-1	A	Low	Along Fifty-seventh Place	3	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-2	A	Low	Perpendicular to Fifty-seventh Court	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	A	High	Off of the Old Seward Highway	2	
Scrap, salvage, or junk yards	D59	D59-1	A	Low	Off of Fifty-seventh Court	3	
Scrap, salvage, or junk yards	D59	D59-1	A	Low	Off of the Old Seward Highway	2	
Metal finishing	I26	I26-1	A	High	Off of the Old Seward Highway	2	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-1	A	Medium	Off of the Old Seward Highway	2	Site is associated with an automobile salvage yard.
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Old Seward Highway	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	A	Low	Fifty-seventh Place	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	A	Low	Fifty-seventh Court	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	A,B	Low	Fifty-eighth Court	2	
Motor vehicle/general storage yards/facilities	X27	X27-1	A,B	Low	Off of Fifty-eighth Court	3	

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for The Great Wall Hall Restaurant Sources of Volatile Organic Chemicals

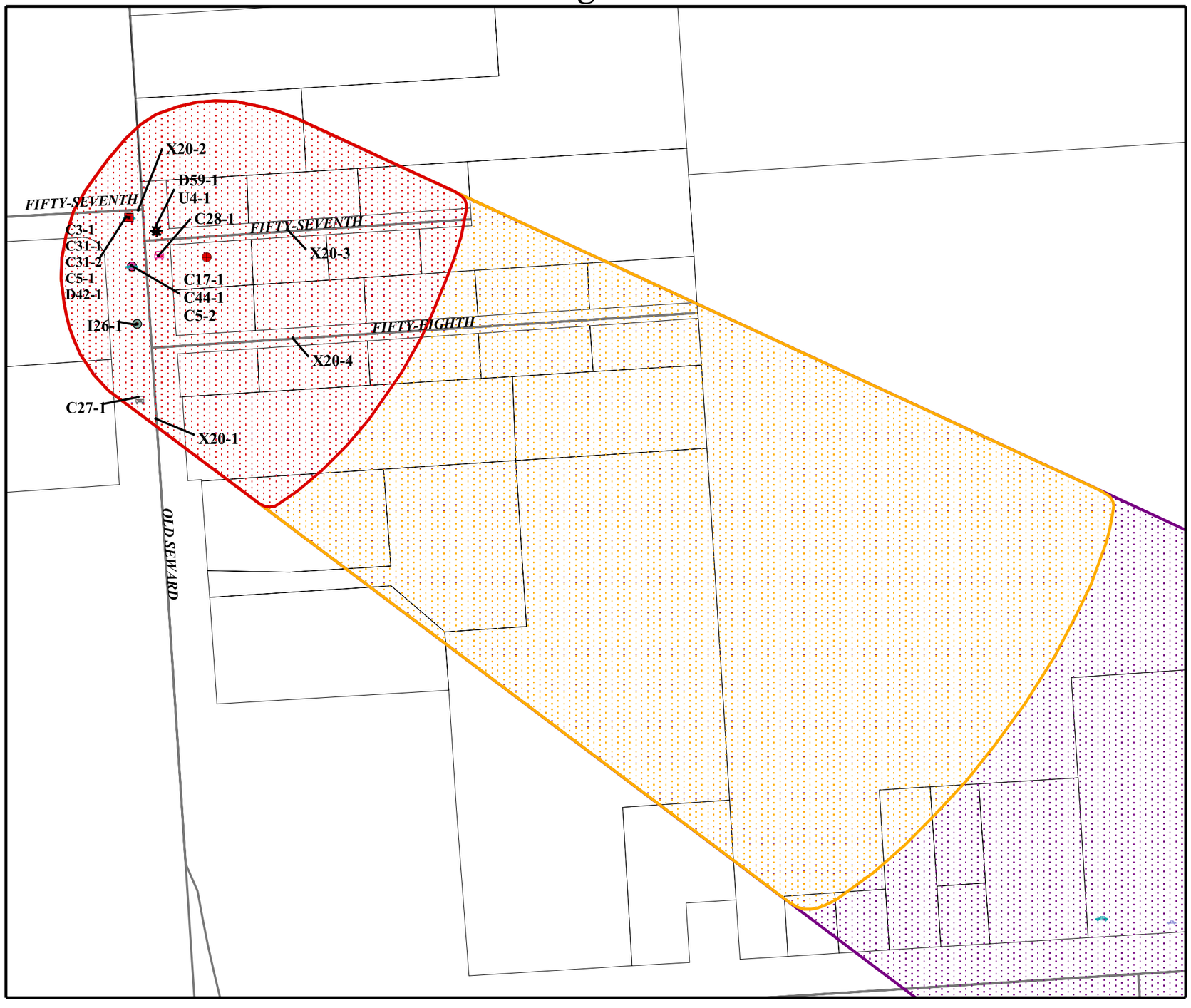
PWSID 213360.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-3	B	Low	Intersecting Zone B	3	
Motor/motor vehicle supplies stores	C28	C28-2	C	Low	Off of Dowling Road	4	
Motor/motor vehicle supplies stores	C28	C28-3	C	Low	Off of Dowling Road	4	
Motor vehicle rental facilities - cars, trucks, ATV's, snow machines (with service department)	C30	C30-1	C	Medium	Off of Dowling Road	4	
Motor /motor vehicle repair shops	C31	C31-1	C	Medium	Off of Latouch Street	3	
Motor /motor vehicle repair shops	C31	C31-3	C	Medium	Off of Dowling Road	4	
Body shops (automotive)	C05	C5-3	C	Medium	Off of Dowling Road	4	
Body shops (automotive)	C05	C5-4	C	Medium	Off of Dowling Road	4	
Car washes with engine or undercarriage cleaning	C08	C8-1	C	High	Off of Dowling Road	4	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D1-4-7	C	Low	Sewer lines located within Zone C	3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-2	C	High	Off of Dowling Road	4	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-2	C	Medium	Off of Dowling Road	4	Site is associated with a bus maintenance facility.
Closed Leaking Underground Fuel Storage Tank (LUST) Sites	U08	U8-1	C	Low	Off of Dowling Road	4	
Highways and roads, paved (cement or asphalt)	X20	X20-5-21	C	Low	Roads located within Zone C	4	
Motor vehicle/general storage yards/facilities	X27	X27-1	C	Low	Off of Dowling Road	4	
Motor vehicle/general storage yards/facilities	X27	X27-2	C	Low	Off of Dowling Road	3	
Motor vehicle/general storage yards/facilities	X27	X27-3	C	Low	Off of Dowline Road	3	
Printers, publishers, copiers	C37	C37-1	D	High	Off of Petersburg Street	5	

APPENDIX C

The Great Wall Hall Restaurant's Drinking Water Protection Area and Potential and Existing Contaminant Sources (Maps 2-4)

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for The Great Wall Hall Restaurant



- Great Wall Hall Restaurant

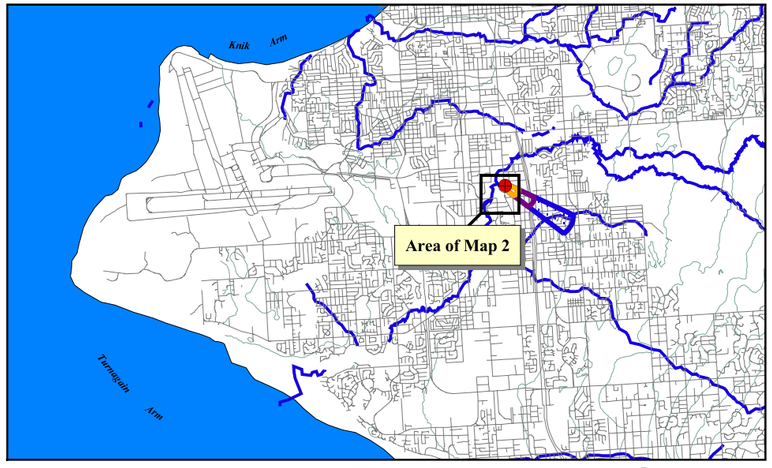
Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Potential Contaminant Sources
- Hardware Stores (C17)
- Motor Vehicle Dealerships - With Service Departments (C27)
- Motor/Motor Vehicle Supply Stores (C28)
- Appliance Repair Shops (C3)
- Motor Vehicle Rental Facilities (C30)
- Motor/Motor Vehicle Repair Shops (C31)
- Printers, Publishers, Copiers (C37)
- Windshield/Glass Shops (C44)
- Body Shops - Automotive (C5)
- Car Washes - No Engine or Undercarriage Cleaning (C8)
- Class V Injection Wells - Motor Vehicle Waste Disposal (D42)
- Scrap, Salvage or Junk Yards (D59)
- Metal Finishing (I26)
- Beverage Industry (I7)
- Contaminated Site, DEC Recognized (U4)
- Motor Vehicle/General Storage Yards/Facilities (X27)
- Anchorage Land Parcels
- Anchorage Roads (X20)
- Elevation Contours

N W E S

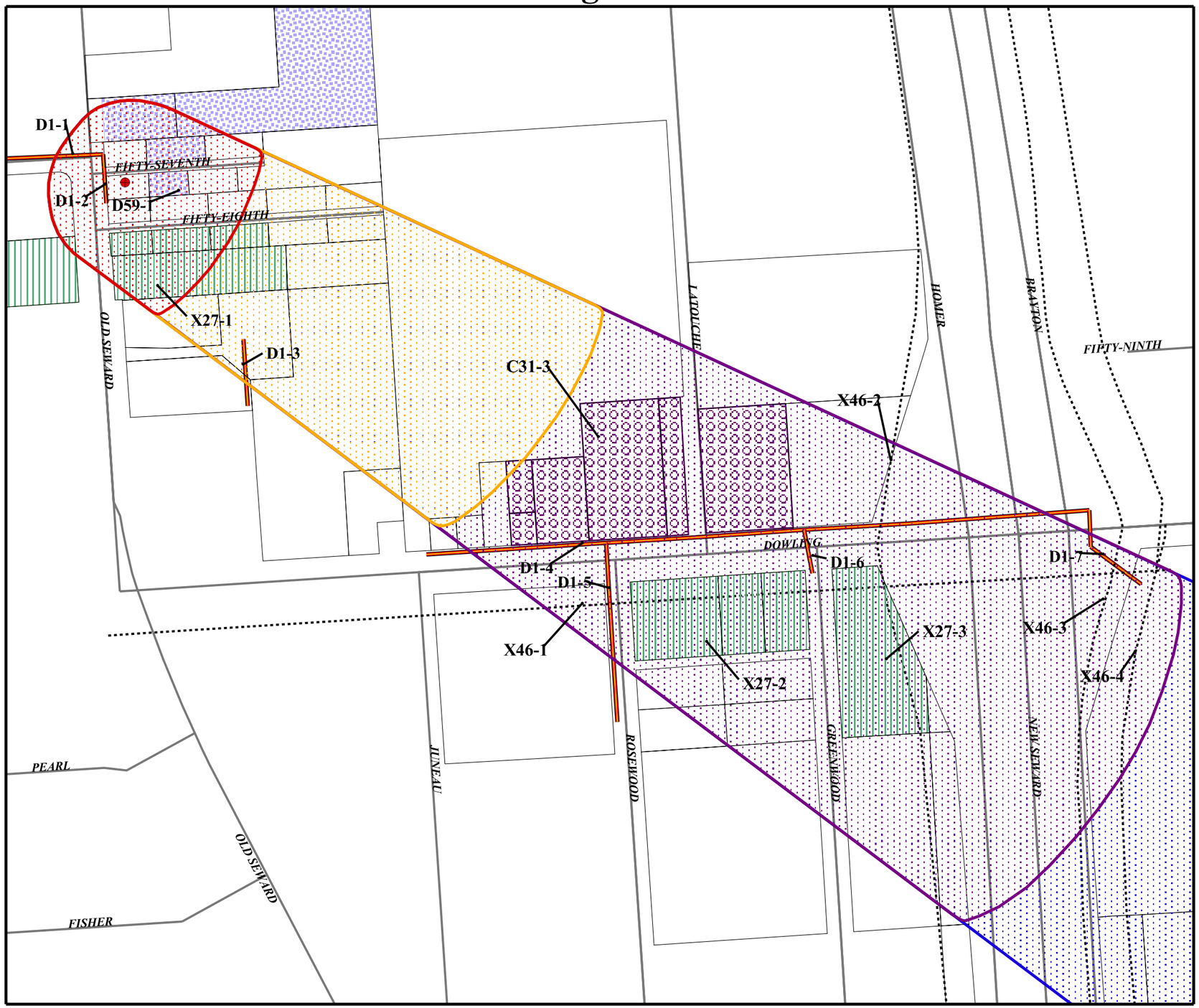


200 0 200 400 Feet

PWSID 213360.001

Map 2

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for The Great Wall Hall Restaurant



- Great Wall Hall Restaurant DW Well

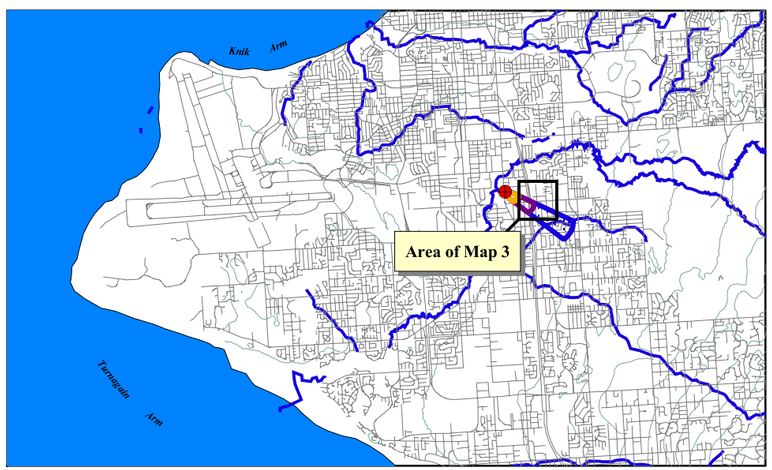
Zone A Protection Area
- Several Months Travel Time

Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Anchorage Land Parcels
- Motor Vehicle/General Storage Yards/Facilities (X27)
- Motor/Motor Vehicle Repair Shops (C31)
- Scrap, Salvage or Junk Yards (D59)
- Trails (X46)
- Sewer Lines (D1)
- Anchorage Roads (X20)
- Elevation Contours

N
W E
S

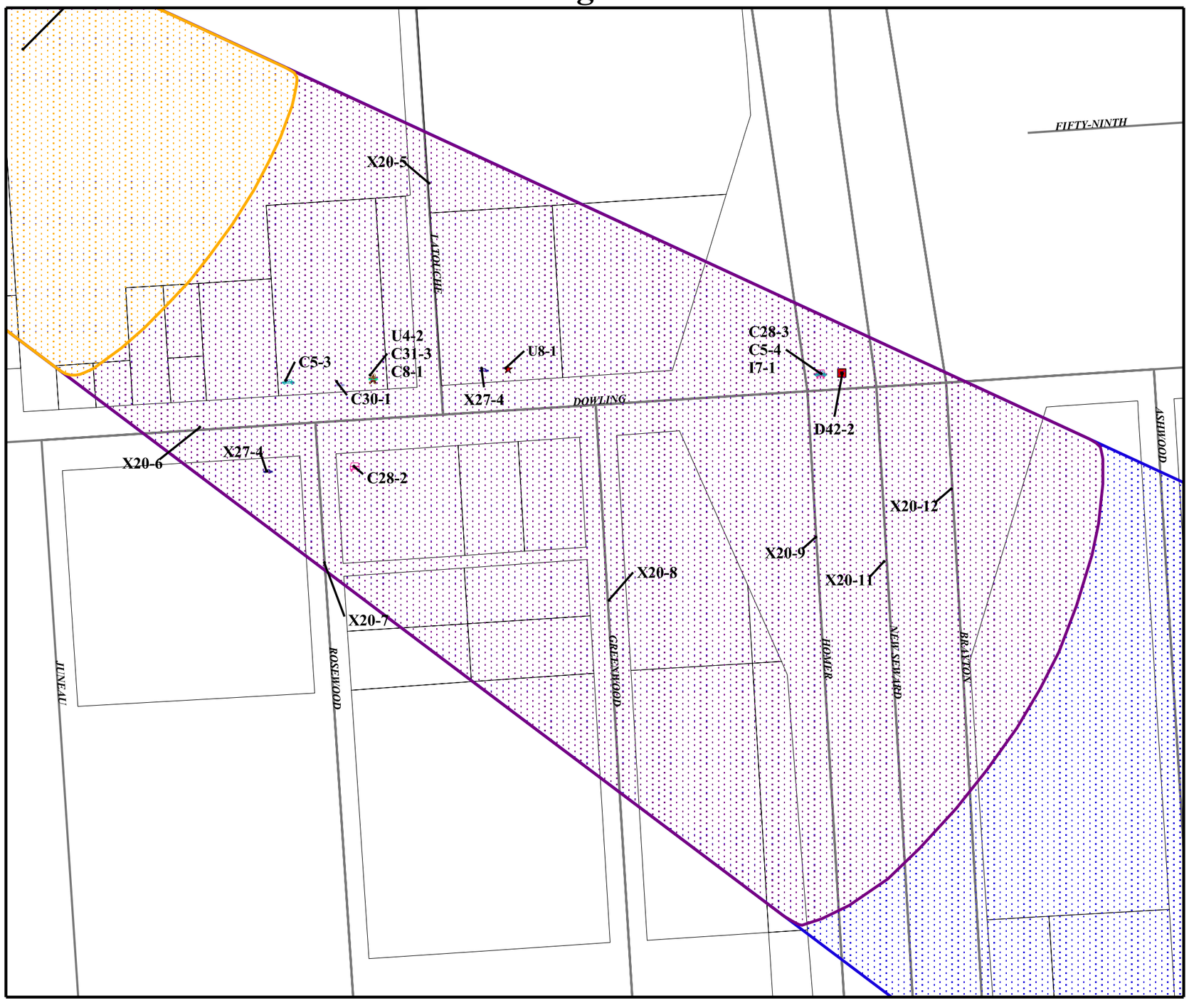


300 0 300 600 Feet

PWSID 213360.001

Map 3

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for The Great Wall Hall Restaurant



Zone B Protection Area
- Less Than 2 Years Travel Time

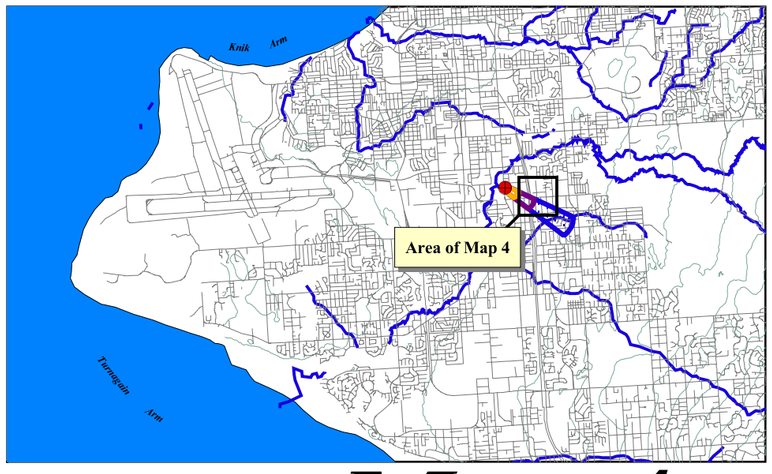
Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

Potential Contaminant Sources
- Hardware Stores (C17)
- Motor Vehicle Dealerships - With Service Departments (C27)
- Motor/Motor Vehicle Supply Stores (C28)
- Appliance Repair Shops (C3)
- Motor Vehicle Rental Facilities (C30)
- Motor/Motor Vehicle Repair Shops (C31)
- Printers, Publishers, Copiers (C37)
- Windshield/Glass Shops (C44)
- Body Shops - Automotive (C5)
- Car Washes - No Engine or Undercarriage Cleaning (C8)
- Class V Injection Wells - Motor Vehicle Waste Disposal (D42)
- Scrap, Salvage or Junk Yards (D59)
- Metal Finishing (I26)
- Beverage Industry (I7)
- Contaminated Site, DEC Recognized (U4)
- Motor Vehicle/General Storage Yards/Facilities (X27)

- Anchorage Land Parcels
- Anchorage Roads (X20)
- Elevation Contours

N
W E
S

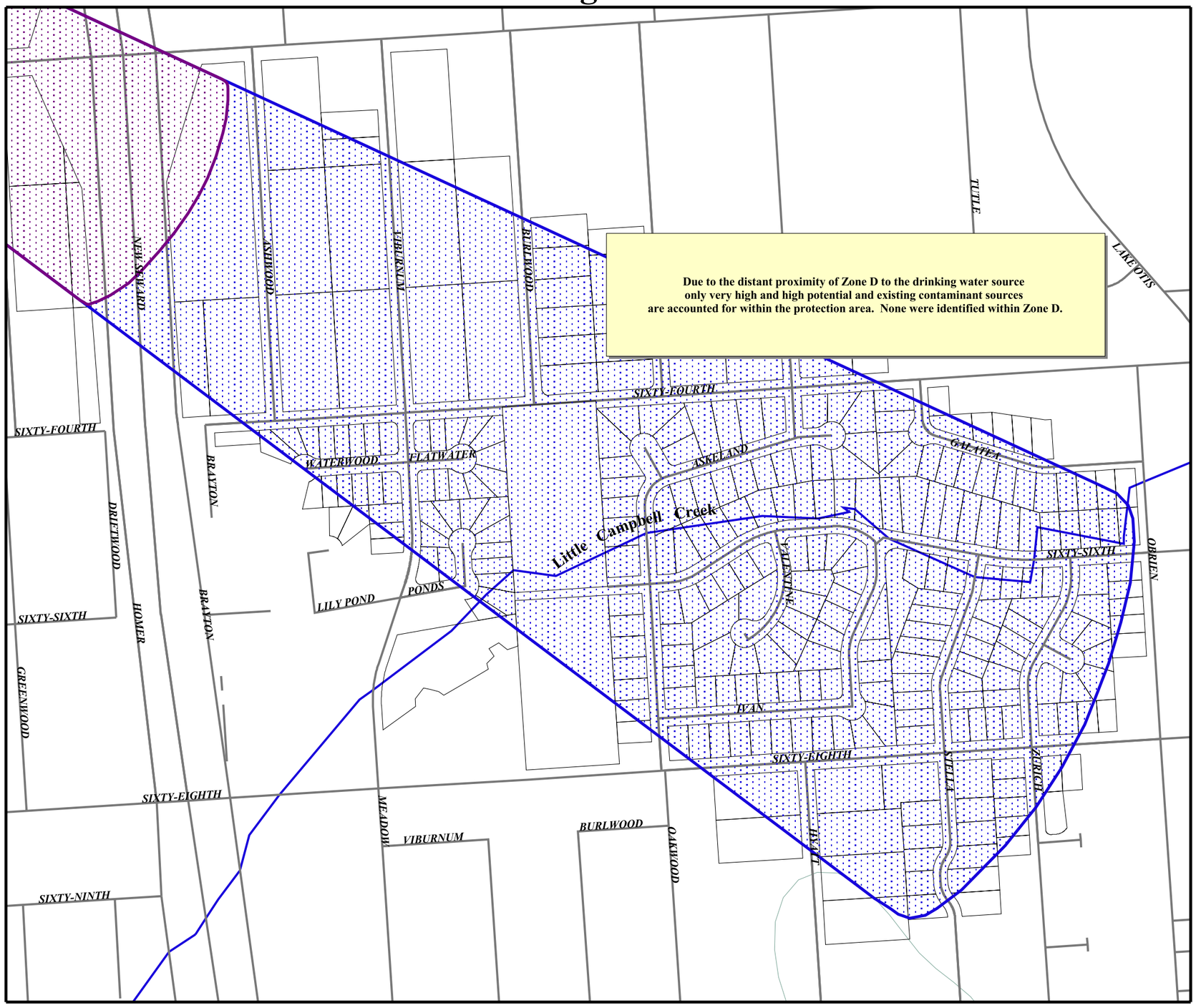


200 0 200 400 Feet

PWSID 213360.001

Map 4

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for The Great Wall Hall Restaurant



Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time
- Anchorage Land Parcels
- Scrap, Salvage or Junk Yards (D59)
- Anchorage Roads (X20)
- Anchorage Streams
- Elevation Contours

N
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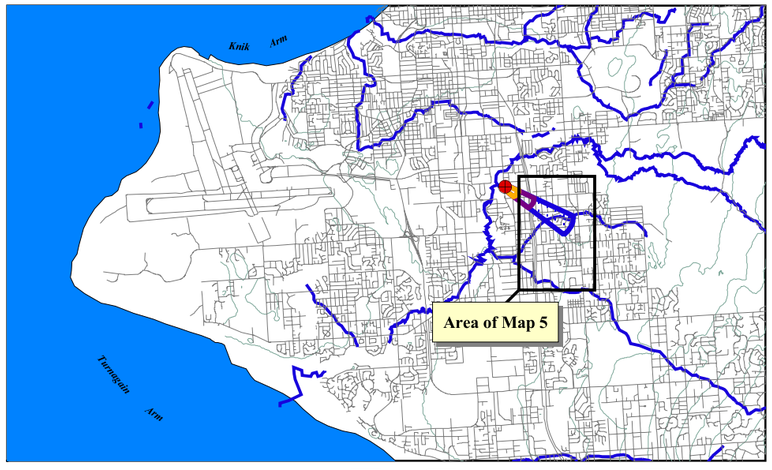
S



PWSID 213360.001

Map 5

APPENDIX D

Vulnerability Analysis for The Great Wall Hall Restaurant's Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - Great Wall Hall Restaurant

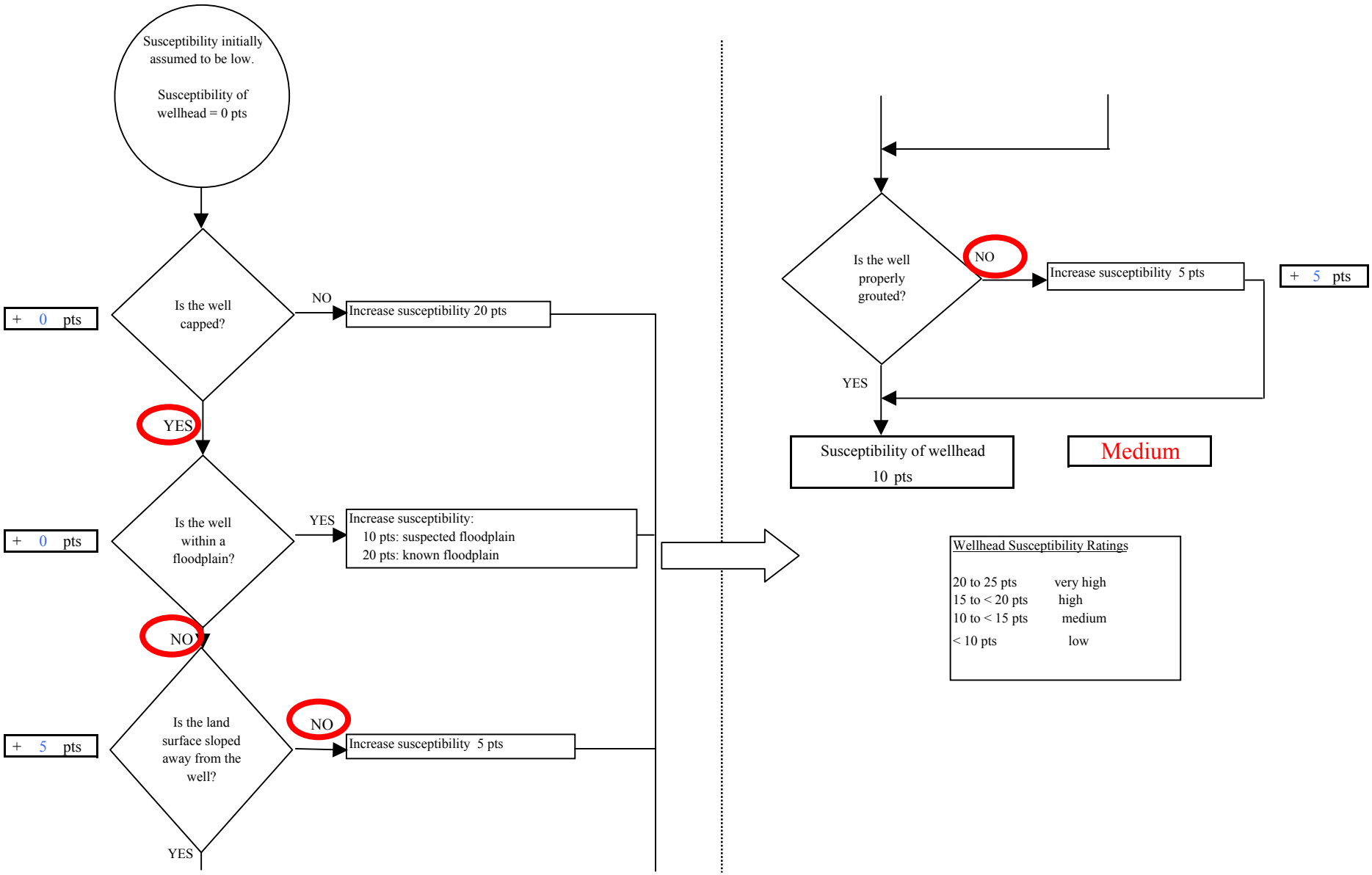


Chart 2. Susceptibility of the aquifer - Great Wall Hall Restaurant

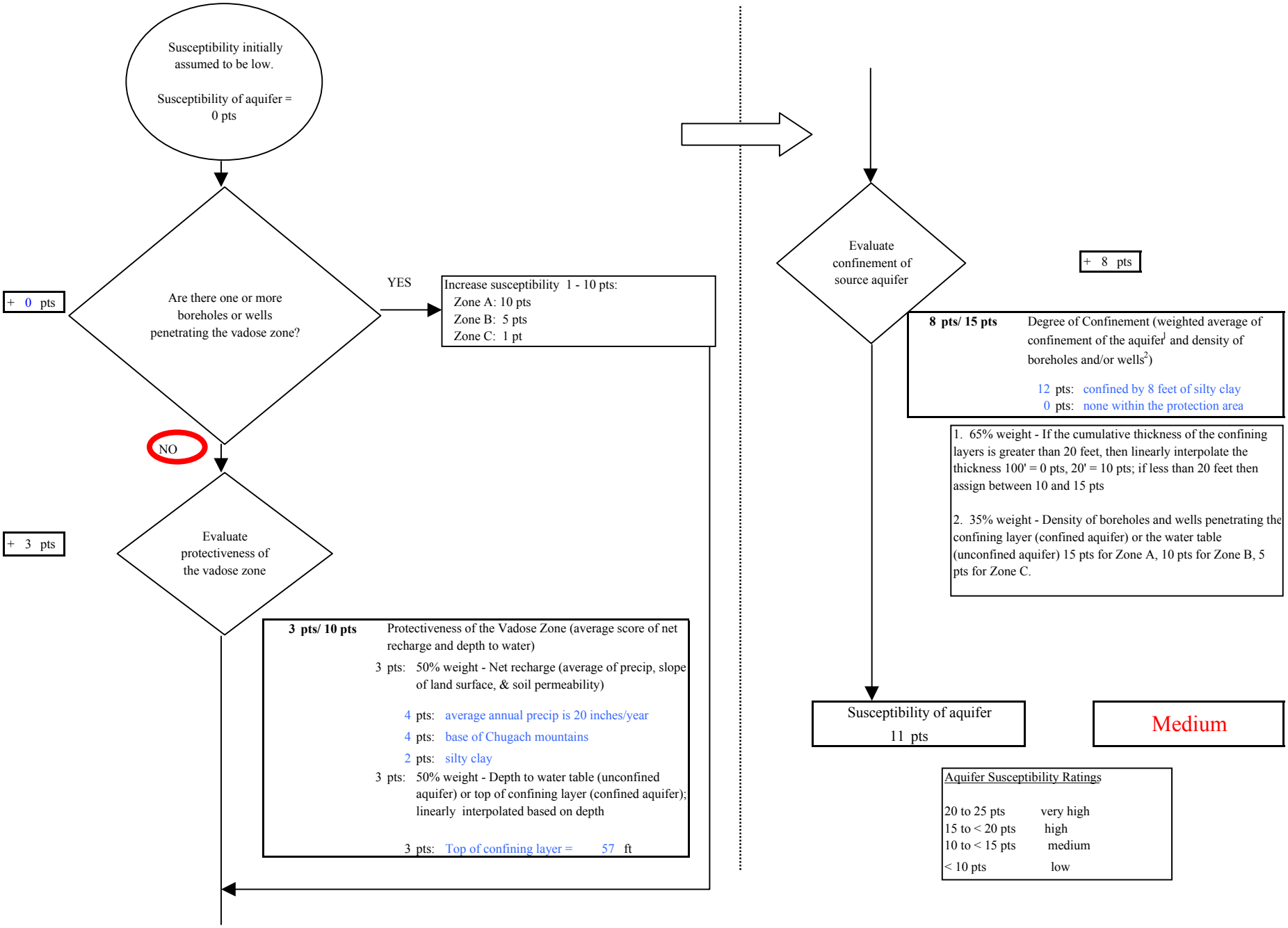
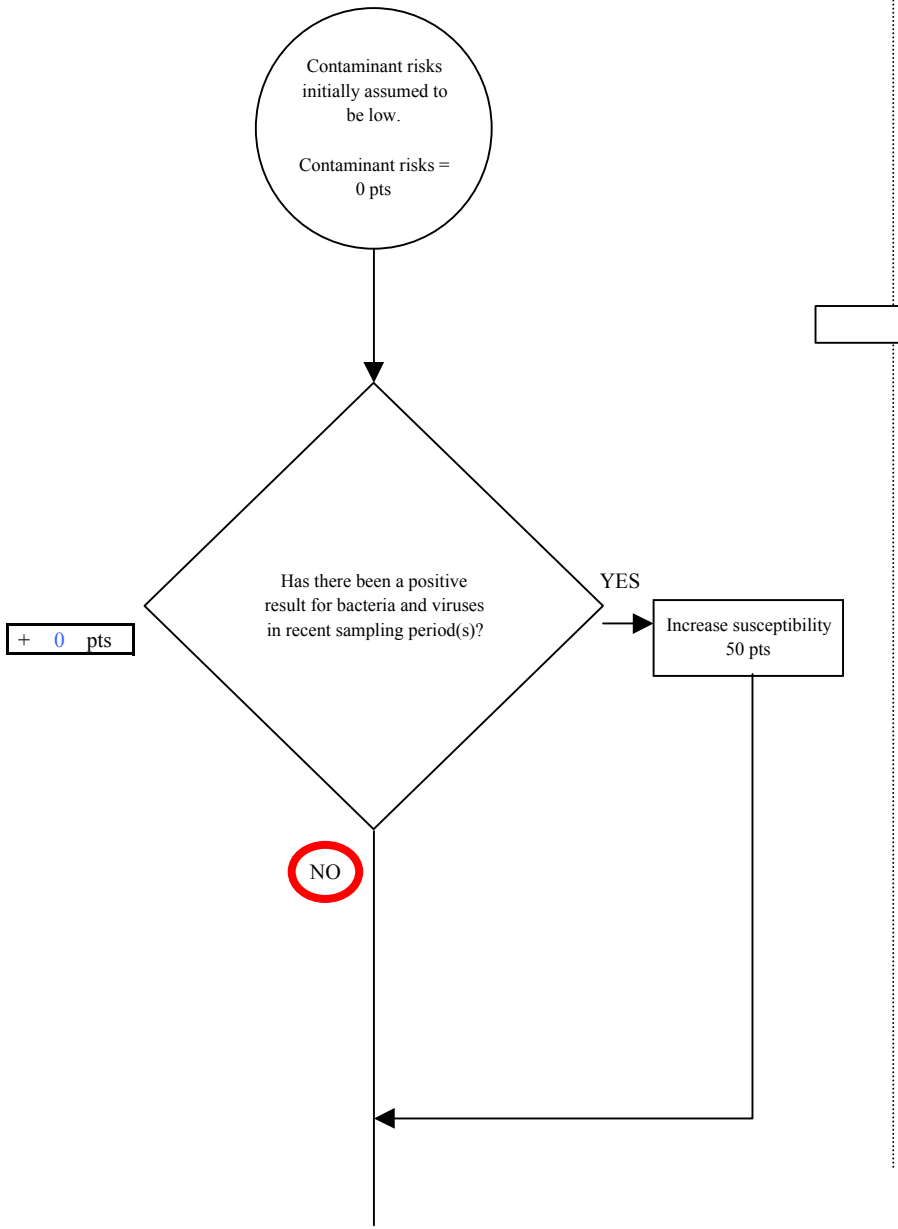
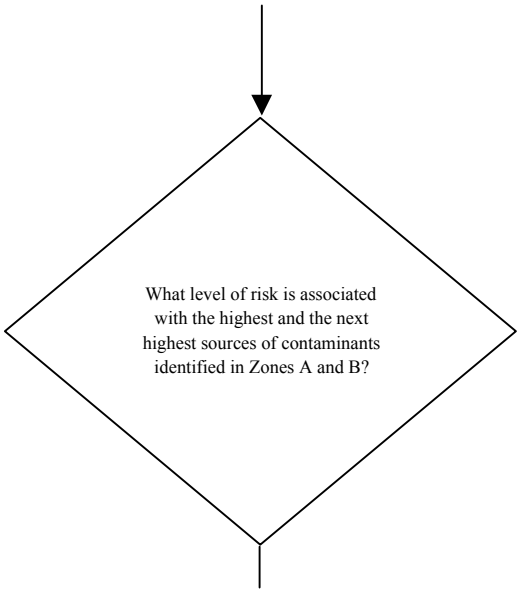


Chart 3. Contaminant risks for the Great Wall Hall Restaurant - Bacteria & Viruses





+ 20 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)	1	0	1
Low(s)	2	1	3

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

Matrix Score 20

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

Chart 3. Contaminant risks for the Great Wall Hall Restaurant - Bacteria & Viruses

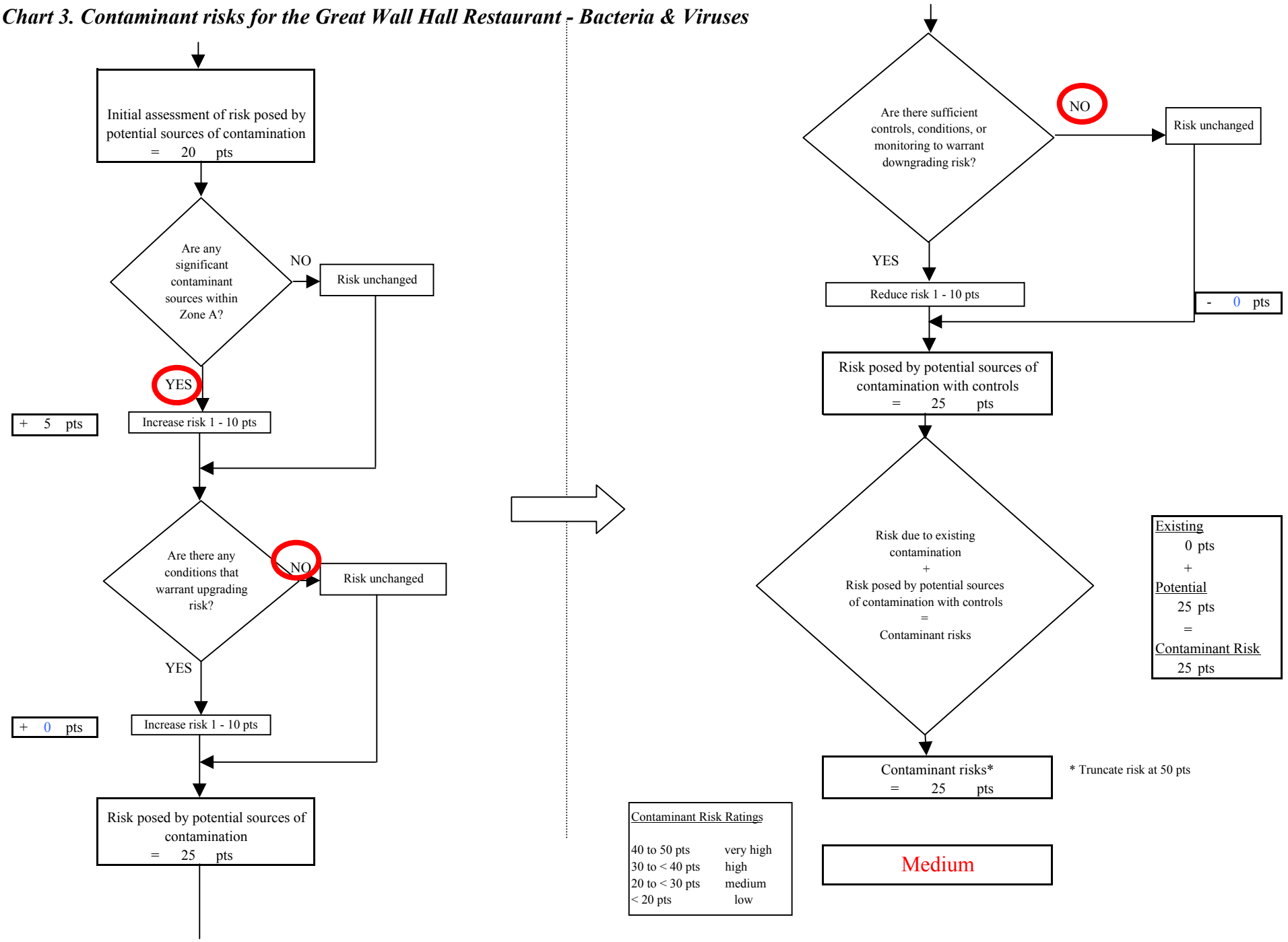


Chart 4. Vulnerability analysis for the Great Wall Hall Restaurant - Bacteria & Viruses

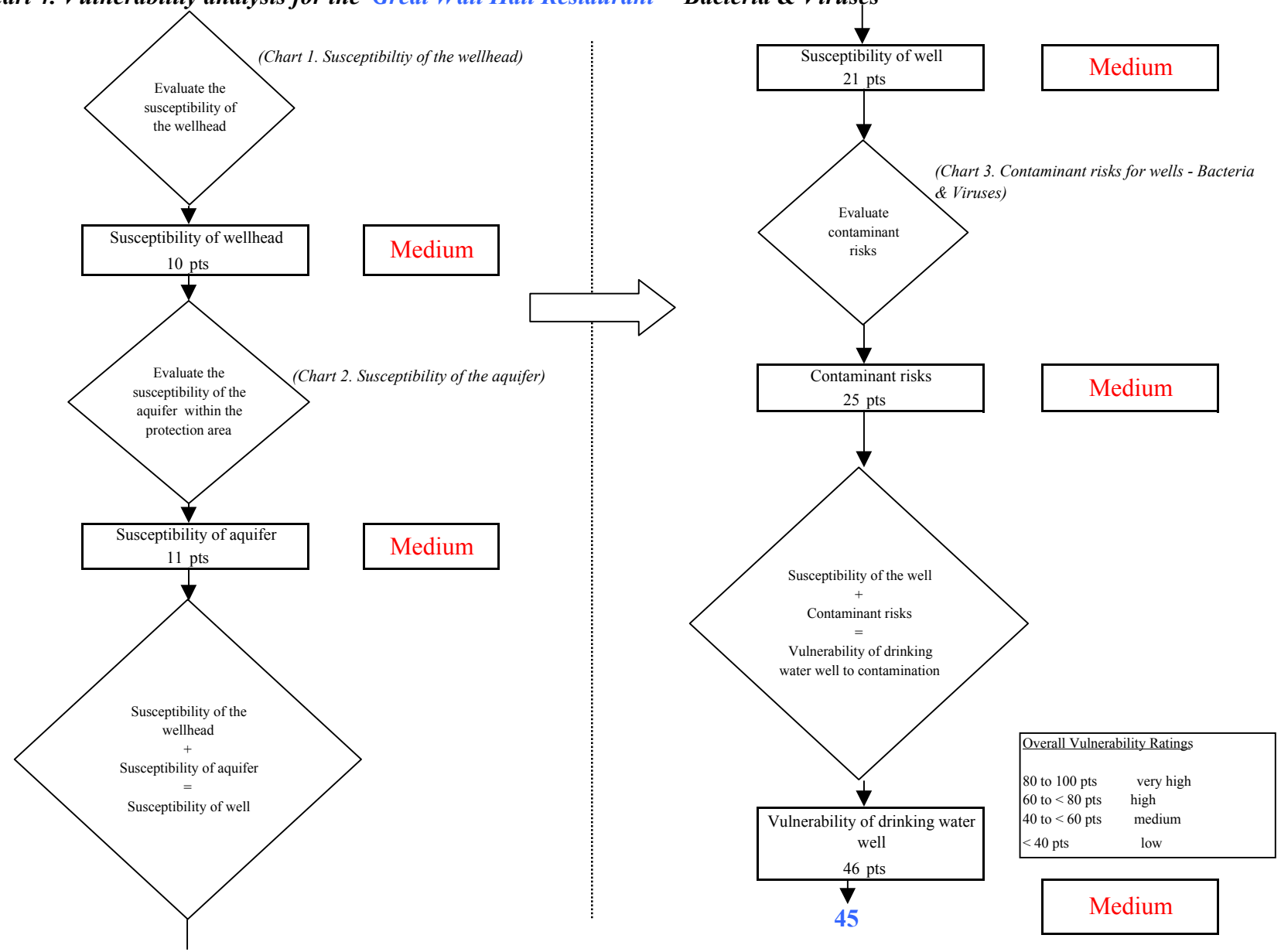


Chart 5. Contaminant risks for the Great Wall Hall Restaurant - Nitrates and Nitrites

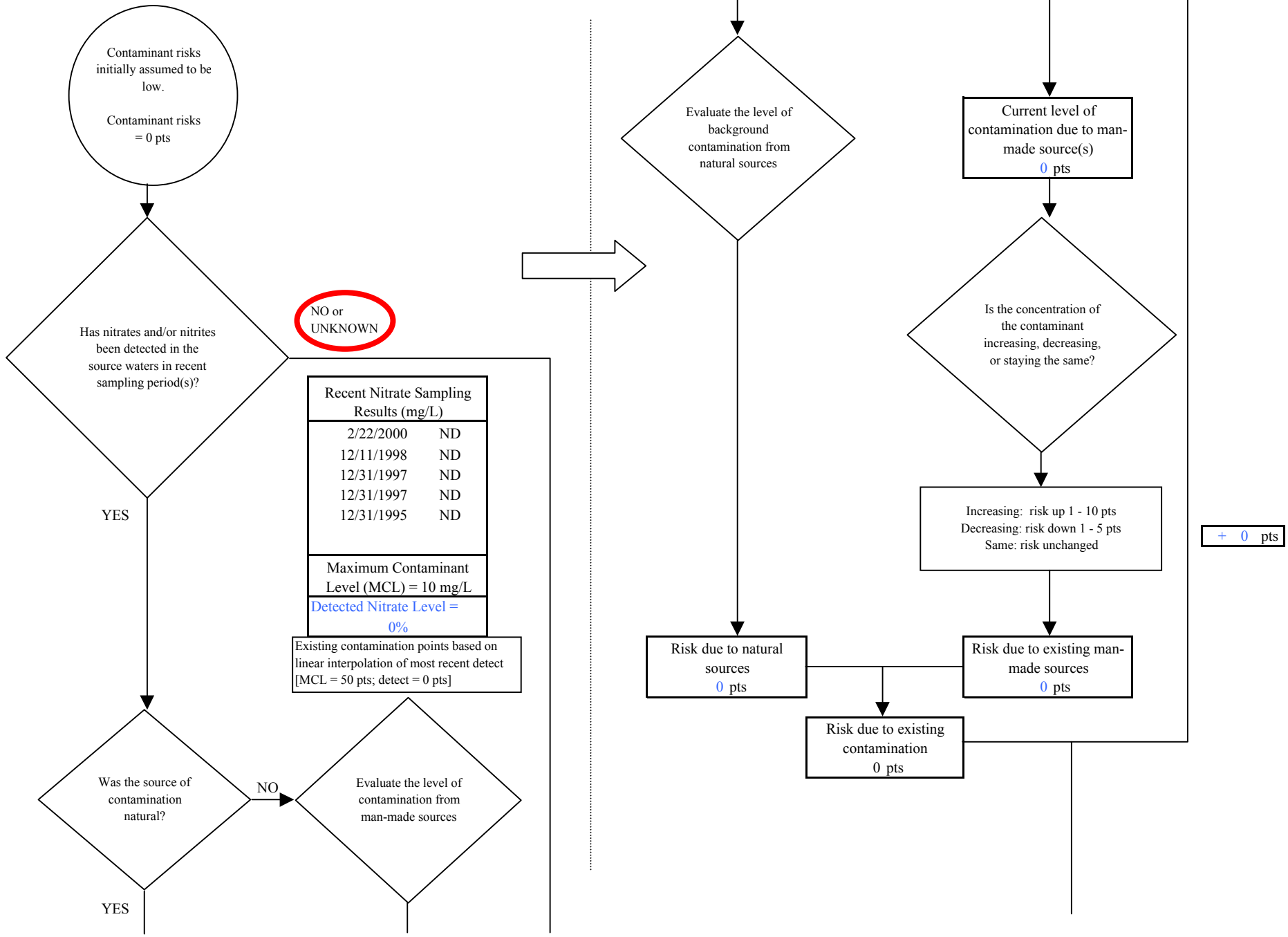


Chart 5. Contaminant risks for the Great Wall Hall Restaurant - Nitrates and Nitrites

+ 20 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	1	0	1
Low(s)	2	3	5

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

Matrix Score 20

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

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

Is the source aquifer fractured rock or karst?

YES

NO

Are all of the higher risk sources beyond Zones A and B?

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 5 pts

Chart 5. Contaminant risks for the Great Wall Hall Restaurant - Nitrates and Nitrites

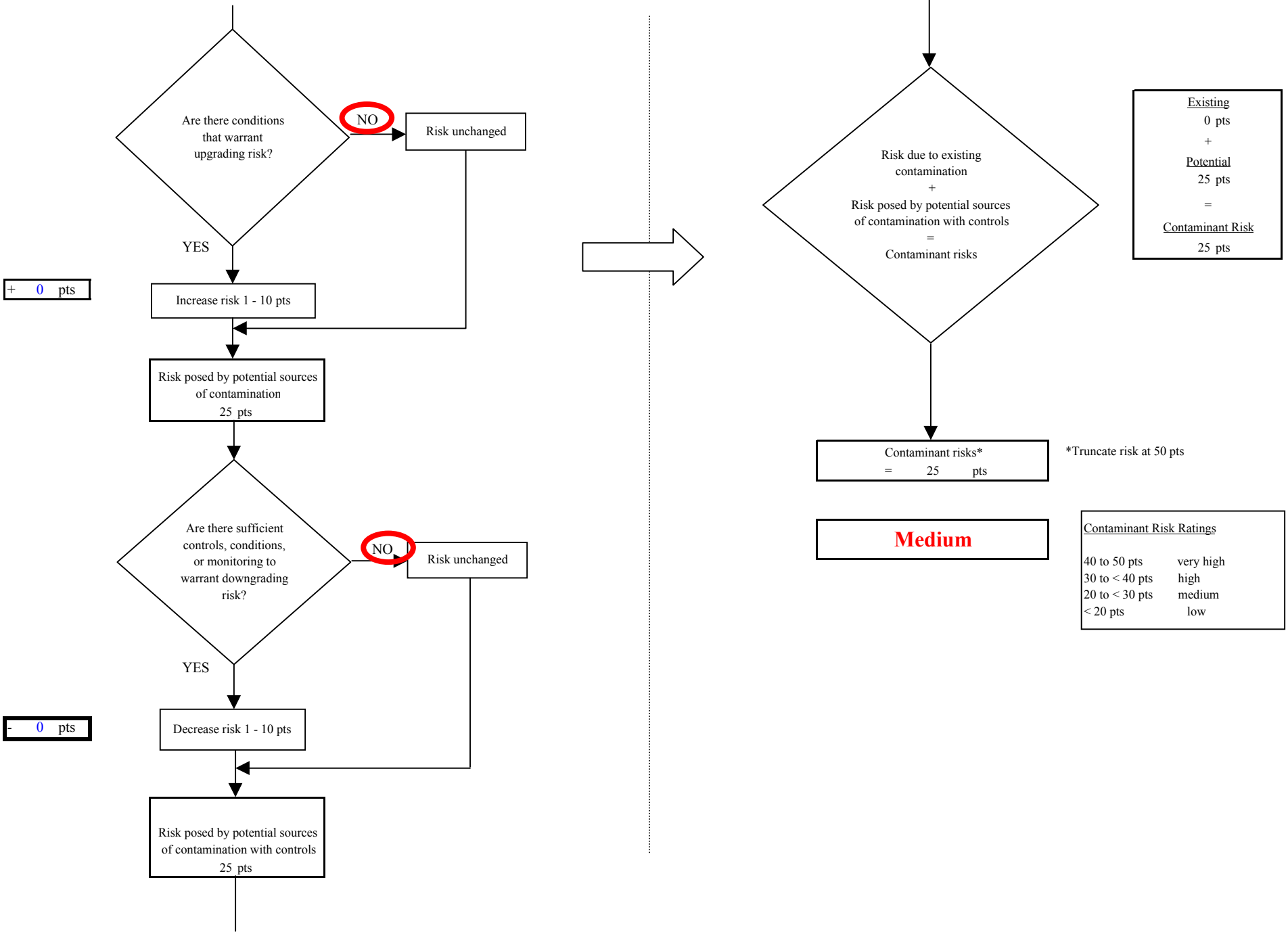


Chart 6. Vulnerability analysis the Great Wall Hall Restaurant - Nitrates and Nitrites

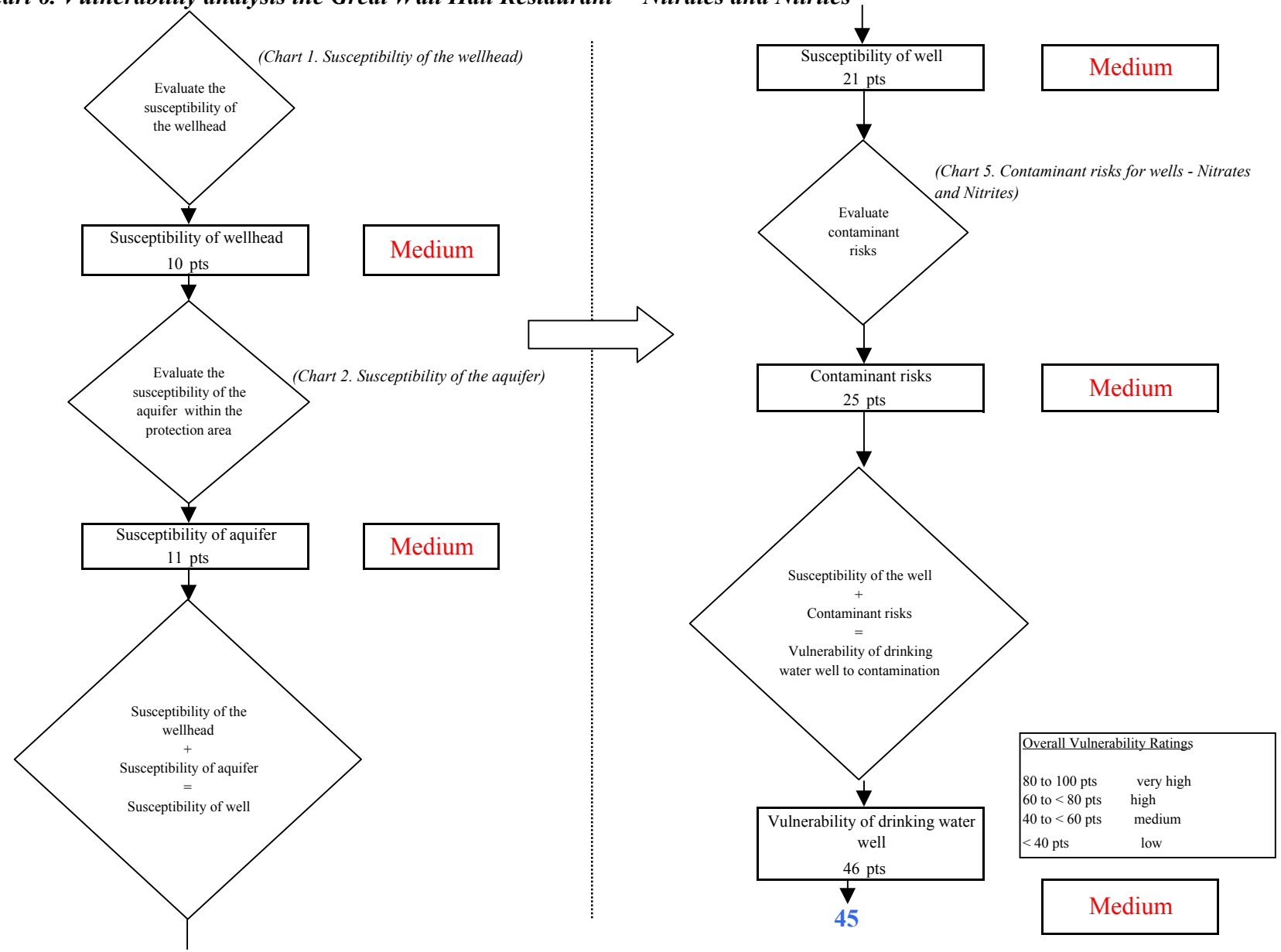


Chart 7. Contaminant risks for the Great Wall Hall Restaurant - Volatile Organic Chemicals

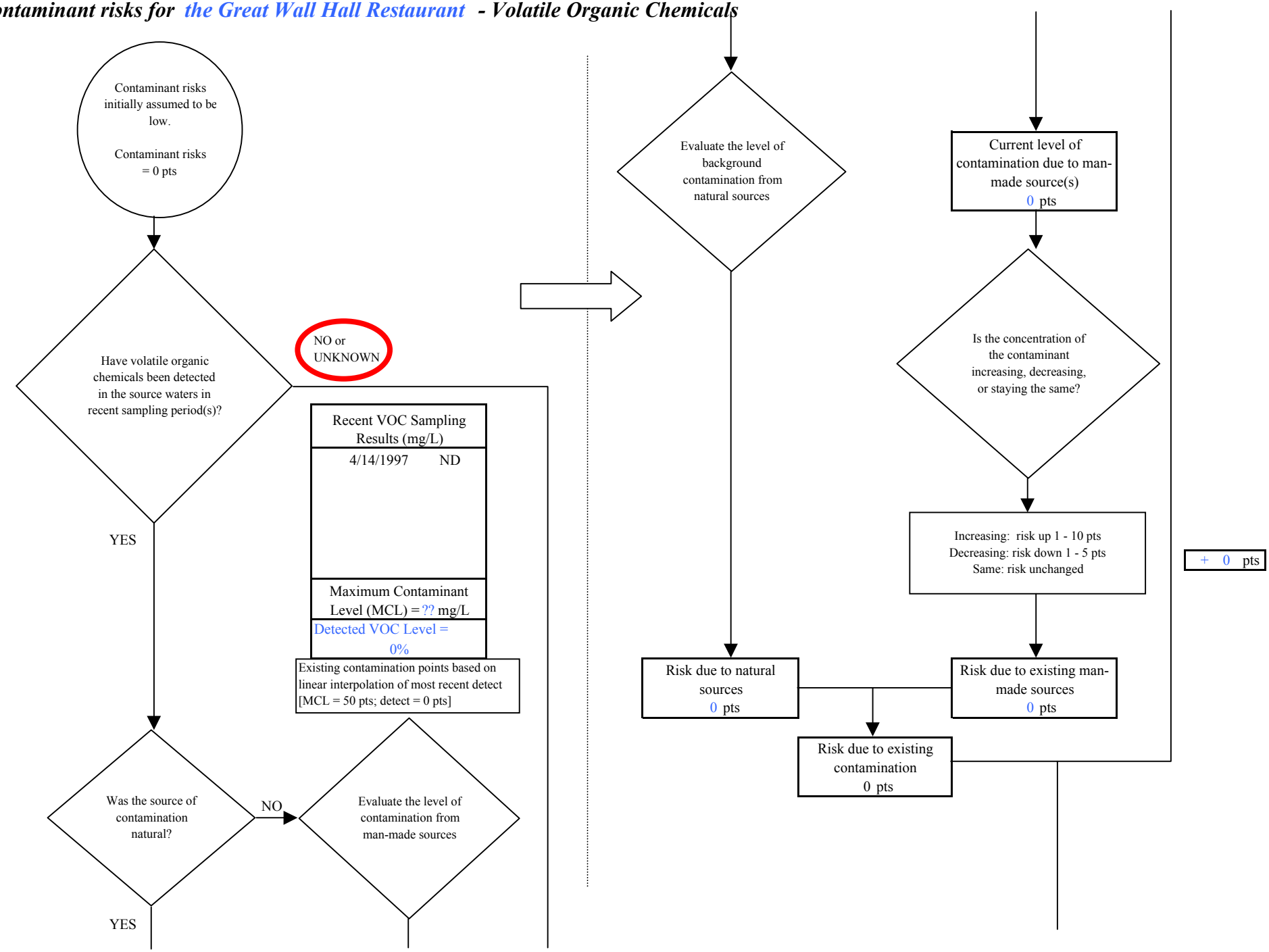
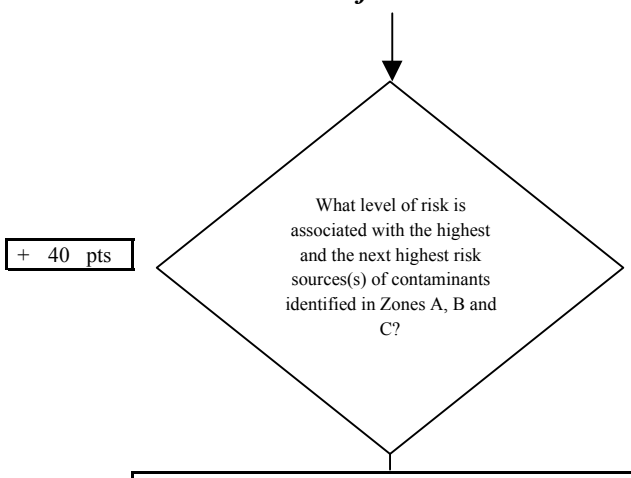


Chart 7. Contaminant risks for the Great Wall Hall Restaurant - Volatile Organic Chemicals



+ 40 pts

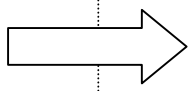
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	2	2	4
Medium(s)	6	6	12
Low(s)	8	8	16

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

Matrix Score 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.



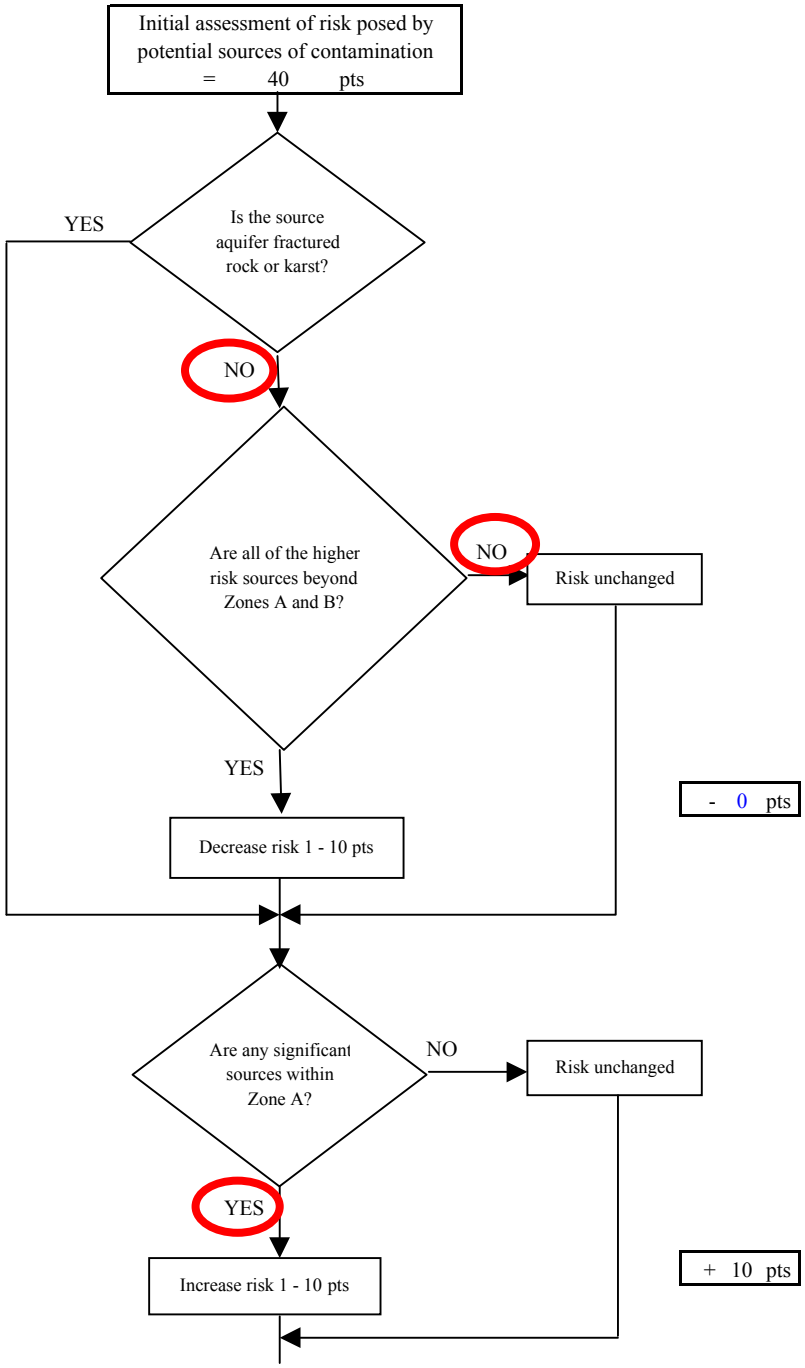


Chart 7. Contaminant risks for the Great Wall Hall Restaurant - Volatile Organic Chemicals

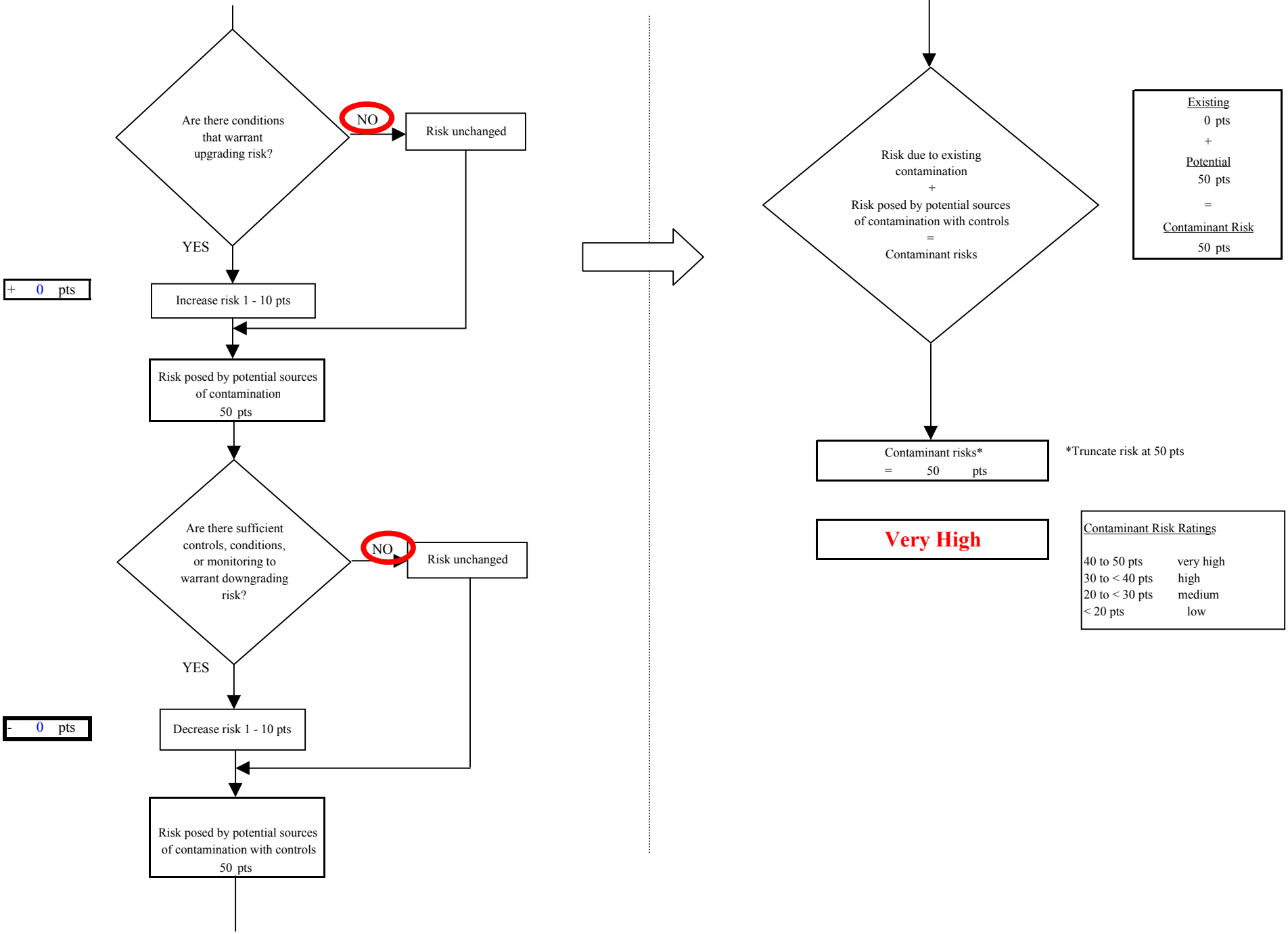


Chart 8. Vulnerability analysis for the Great Wall Hall Restaurant - Volatile Organic Chemicals