Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Boatel Drinking Water System, Fairbanks area, Alaska PWSID 310073

September 2003

DRINKING WATER PROTECTION PROGRAM REPORT Report 1030
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.

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Source Water Assessment for Boatel Source of Public Drinking Water, Fairbanks, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability of the public water system serving the Boatel to potential contamination. This Class B (non-community) water system consists of one well on Riverside Drive off of Airport Way in Fairbanks, Alaska. The well received a natural susceptibility rating of **High**. This rating is a combination of a susceptibility rating of **Very High** for the actual wellhead and a **High** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the Boatel public water system include: sewer lines, residential area, construction trade areas, a laboratory, a photo shop, underground and aboveground fuel storage tanks, roads, body shops, gasoline stations, heavy equipment storage areas, a Class V motor vehicle waste disposal well, tar storage, cement manufacturing, a medical facility, Leaking Underground Fuel Storage Tank sites, and ADEC-recognized contaminated sites. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Combining the natural susceptibility of the well with the contaminant risk, the public water system for Boatel received an overall vulnerability rating of **Very High** for volatile organic chemicals; and a **Medium** for bacteria and viruses, and nitrates and/or nitrites.

BOATEL PUBLIC DRINKING WATER SYSTEM

Boatel public water system is a Class B (non-community) water system. The system consists of one well one well on Riverside Drive off of Airport Way in Fairbanks, Alaska (T1S, R1W, Section 8) (See Map 1 of Appendix A). Fairbanks is located in the Fairbanks North Star Borough which is near the center of Alaska (Please see the inset of Map 1 in Appendix A for location). The Borough's current population is 82,840 making it the second-largest population center in the state (ADCED, 2002). Communities located within the Borough include : College, Eielson Air Force Base, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, and Two Rivers.

City water, sewer and electricity for the city of Fairbanks are provided by Golden Valley Utilities. The majority of residents (approximately 70%) use heating oil (typically stored in both above and below ground 275 to 500-gallon tanks) to heat homes and buildings. Garbage collection services are proved by the city, and refuse is transported to the Fairbanks North Star Borough Class I Landfill on South Cushman Street.

The Fairbanks area includes two distinct topographic areas: the alluvial plain between the Tanana River and the Chena River, and the uplands north of this alluvial plain. The Boatel water system is located in the alluvial plain at an elevation of approximately 425 feet above sea level.

According to the most recent sanitary survey (8/29/01) for this water system, the depth of the well is approximately 90 feet below the ground surface. Most of the wells in this area are screened in a combination of gravel and sand, and it is assumed that this one is also. The alluvial plain consists of alternating layers of sand and gravel up to over 500 feet thick, in some locations overlain by 1 to 10 feet of silt or sandy silt or a few feet of peat (Glass and others, 1996). Discontinuous permafrost (perennially frozen areas) is also common in the alluvial plain. The depth to permafrost in these areas ranges between 2 and 45 feet below the ground surface with the thickness of the permafrost ranging between 5 and 265 feet (Pewe, T.L. 1958). Areas with discontinuous permafrost may locally affect the ground water flow directions.

Primarily the Tanana River, but also the Chena River contribute water to this alluvial aquifer. The Chena River typically only contributes water when its stage is high and the Tanana is low (Nelson, 1978). The Tanana River gets approximately 85% of its water from snowmelt of the Alaska Range and 15% from the Yukon-Tanana uplands (Anderson, 1970).

The Boatel public drinking water system serves approximately 150 non-residents through one service connection.

BOATEL DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. 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 capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different methods for calculating the size of capture zones. The DWPP uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture zone calculated by the DWPP is an estimate using the available information and resources, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the whole alluvial plain and were obtained from various United States Geological Survey (USGS) reports, area well logs, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

The water table in the area of the Boatel, the area between the Tanana and the Chena Rivers, is primarily influenced by the level of water flow in each river. The capture zones were drawn based on three separate configurations of the water table during various stages of the rivers: a period of high stage in the Chena River (October 14-17, 1986), high stage in the Tanana River (July 16-17, 1987), and low stages in both rivers (March 30-April 3, 1988) (Glass and others, 1996). High water levels in the Chena usually occur in the spring due to runoff from the uplands and in late summer due to rainstorms (Nelson, 1978). The Tanana usually experiences high flow during the hot, dry periods of mid-summer when maximum snowmelt from the Alaska Range occurs (Nelson, 1978). Groundwater in this area generally flows toward the northwest, from the Tanana River to the Chena River, however flow is reversed very near the Chena River during its high stage periods (Glass and others, 1996). These flow reversals are of short duration (i.e. days versus months) and of limited extent, generally within 1000 feet of the river (Nakanishi, et all, 1998).

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into four zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the four 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 2 years time-of-travel
C	Less than 5 years time-of-travel
D	Less than 10 years time-of-travel

The time of travel for contaminants within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the Boatel on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program (DWPP) has completed an inventory of potential and existing sources of contamination within the Boatel protection area. This inventory was completed through a search of agency records and other publicly available information. 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 each 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 combination of toxicity and volume associated with that source. Rankings include:

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

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 inventoried potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

VULNERABILITY OF BOATEL 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 properties of the aquifer and the presence of other wells or boreholes in the area. 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 the water system's contaminant sample results. Lastly, Chart 4 combines the results of the first three charts to produce 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

he wellhead for the Boatel received a Very High Susceptibility rating. The most recent sanitary survey (8/29/01) indicated the well was not properly capped with a sanitary seal, however subsequent letters indicated the sanitary seal has been replaced. The land surface is sloped away from the well, and the well is grouted. A sanitary seal prevents potential contaminant from entering the well while sloping of the land surface and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer the Boatel well is completed in received a High Susceptibility rating. The highly transmissive aquifer material and the high water table in the area allow contaminants to travel downward from the surface with the precipitation and surface water runoff. Table 2 summarizes the Susceptibility scores and ratings for Boatel.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	20	Very High
Susceptibility of the Aquifer	19	High
Natural Susceptibility	39	High

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources. 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	10	Low
Nitrates and/or Nitrites	5	Low

Volatile Organic Chemicals	40	Very High

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	50	Medium
Nitrates and Nitrites	45	Medium
Volatile Organic Chemicals	80	Very High

Bacteria and Viruses

The residential septic systems in the protection area represent the greatest risk to the drinking water well.

Only a small amount of bacteria and viruses are required to endanger public health. Coli forms are found naturally in the environment and although they aren't necessarily a health threat, it is an indicator of other potentially harmful bacteria in the water, more specifically, fecal coli forms and E. coli which only come from human and animal fecal waste (EPA, 2002). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2002). Coli forms have not been detected in this water system.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is medium.

Nitrates and Nitrites

The residential septic systems in the protection area also represent the greatest risk to to nitrates and nitrites for this source of public drinking water.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have not been sampled for in the Boatel well.

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

Volatile Organic Chemicals

The gasoline station and its underground storage tanks represent the greatest risk for volatile organic chemical contamination to the well.

Four LUST sites are located in the drinking water protection area. The LUST site in Zone A of the protection area is located at 3300 Airport Way at Loomis Armored (RecKey 1989310029204). Contaminated soil was discovered during the removal of a gasoline underground storage tank on 9/5/89. Most of the contaminated soil was excavated; however contaminated soil beneath a building foundation could not be removed. The remaining three LUST sites are located in Zone C (RecKey #s: 1997310017401, 1990310032701, and 1991310007201).

The two ADEC-recognized contaminated sites are located in Zone C of the protection area, both on 2060 Peger Road occurring at different times. In 1992, contamination associated with a floor drain and a heating oil underground storage tank was discovered (RecKey 1992310916901). The contaminated soil was excavated and the site closed later that year. Petroleum contamination was later discovered in 2000 during excavation (RecKey 2000310114601). Contaminant concentrations in this discovery did not warrant removal of the soil and the site was closed.

Although only one heating oil tank was located in the Boatel protection area, both underground and above ground heating oil tanks are common in Fairbanks and it is likely there are many more. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Regular system maintenance and proper decommissioning can help prevent many of these harmful fuel leaks.

Volatile Organic Chemicals have not been sampled for in the Boatel public water system. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is very high.

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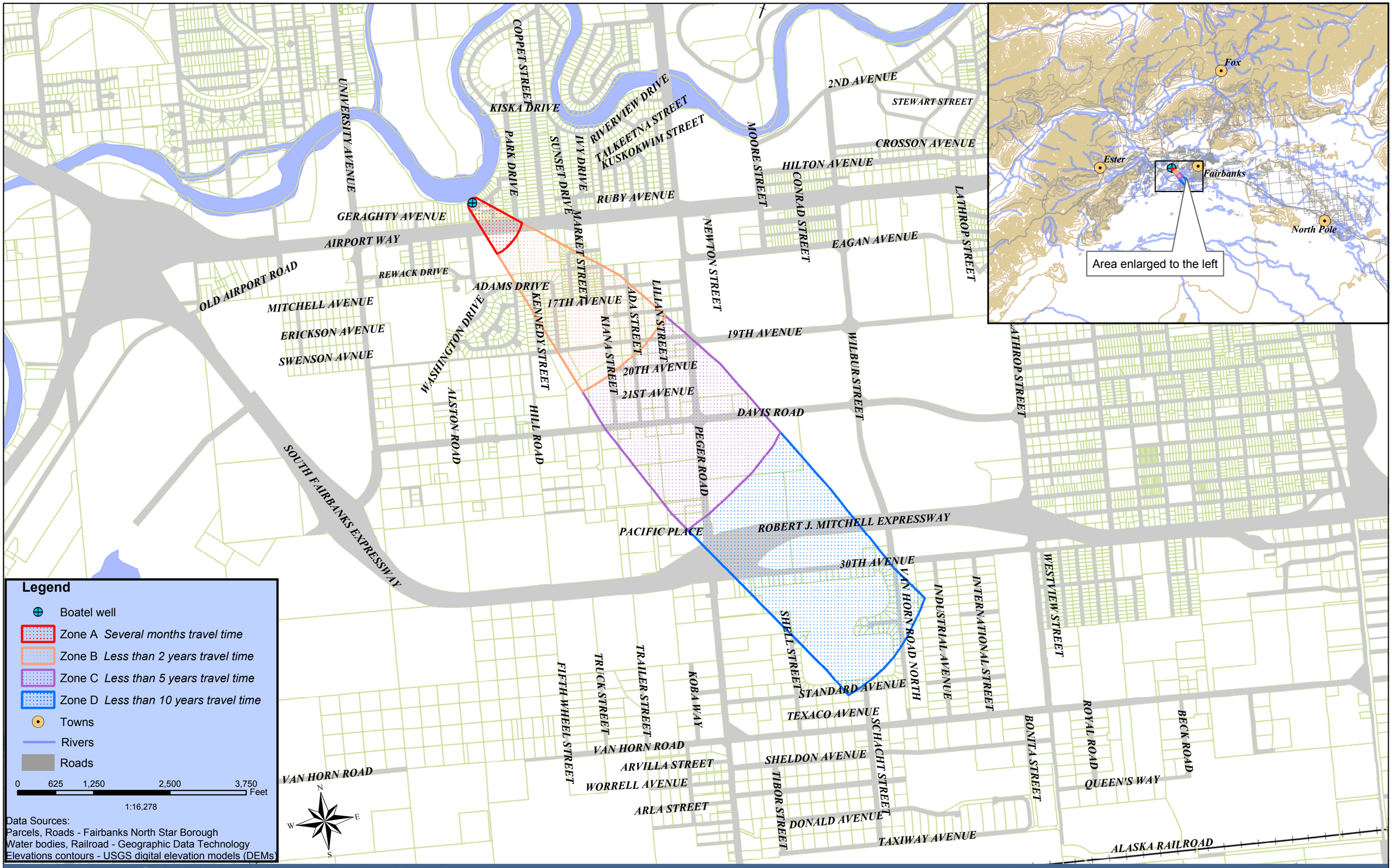
APPENDIX A

Boatel
Drinking Water Protection Area Location Map
(Map 1)



Map 1. Boatel Drinking Water Protection Area

PWSID 310073

APPENDIX B

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

Table 1

Contaminant Source Inventory for ***Boatel***

PWSID 310073.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-1	A	2	3300 Airport Rd; File Number 102.26.012
Highways and roads, paved (cement or asphalt)	X20		A	2	Riverside Drive; Bartlett Avenue; Airport Way
Construction trade areas and materials	C09	C09-1	B	2	1713 Kennedy Street
Laboratories (chemical, soils, and research)	C20	C20-1	B	2	3110 17th Avenue
Photography supplies/photo processing laboratories	C36	C36-1	B	2	3115 Airport Way
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	2	Estimated 13 sewerlines in Zone B
Residential Areas	R01	R01-1	B	2	Approximately 35 acres of residential area in Zone B
Tanks, heating oil, nonresidential (underground)	T16	T16-1	B	2	1949 Ada Street
Highways and roads, paved (cement or asphalt)	X20		B	2	11 roads in Zone B
Body shops (automotive)	C05	C05-1	C	2	2720 Davis Rd
Body shops (automotive)	C05	C05-2	C	2	2513 Davis Road
Construction trade areas and materials	C09	C09-2	C	2	1949 Ada Steet
Gasoline stations (without repair shop)	C15	C15-1	C	2	2110 Peger Road
Heavy equipment rental/storage	C18	C18-1	C	2	2615 20 Avenue
Motor /motor vehicle repair shops	C31	C31-1	C	2	2720 Davis Road
Motor /motor vehicle repair shops	C31	C31-2	C	2	2607 Picket Place #6
Domestic wastewater collection systems (sewer lines or lift stations)	D01		C	2	Estimated 4 sewer lines in Zone C
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	C	2	2720 Davis Road
Asphalt and tar processing/storage	I03	I03-1	C	2	2301 Peger Road
Cement manufacturing	I08	I08-1	C	2	1952 Ada Street
Residential Areas	R01	R01-1	C	2	Approximately 10 acres of residential area in Zone C
Tanks, diesel (underground)	T08	T08-1	C	2	2110 Peger Road
Tanks, diesel (underground)	T08	T08-2	C	2	2121 Peger Road

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Tanks, diesel (underground)	T08	T08-3	C	2	2121 Peger Road
Tanks, gasoline (underground)	T12	T12-1	C	2	2110 Peger Road
Tanks, gasoline (underground)	T12	T12-1	C	2	1906 Lillian Street
Tanks, gasoline (underground)	T12	T12-2	C	2	2110 Peger Road
Tanks, gasoline (underground)	T12	T12-3	C	2	2110 Peger Road
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-1	C	2	2060 Peger Road; RecKey 1992310916901
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-2	C	2	2720 Davis Road
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-2	C	2	2615 20th Avenue; file number 102.36.130
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-3	C	2	2110 Peger Road; file number 102.26.106
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-4	C	2	2301 Peger Road; RecKey 1991310107201
Government vehicle maintenance facilities	X19	X19-1	C	2	2301 Peger Road
Highways and roads, paved (cement or asphalt)	X20		C	2	4 roads in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	C	2	2702 Peger Road

Table 2

Contaminant Source Inventory and Risk Ranking for Boatel

Sources of Bacteria and Viruses

PWSID 310073.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Riverside Drive; Bartlett Avenue; Airport Way
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Medium	2	Estimated 13 sewerlines in Zone B
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	11 roads in Zone B
Residential Areas	R01	R01-1	B	Low	2	Approximately 35 acres of residential area in Zone B
Domestic wastewater collection systems (sewer lines or lift stations)	D01		C	Medium	2	Estimated 4 sewer lines in Zone C

Table 3

Contaminant Source Inventory and Risk Ranking for Boatel

Sources of Nitrates/Nitrites

PWSID 310073.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Riverside Drive; Bartlett Avenue; Airport Way
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Medium	2	Estimated 13 sewerlines in Zone B
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	11 roads in Zone B
Residential Areas	R01	R01-1	B	Low	2	Approximately 35 acres of residential area in Zone B
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	4 roads in Zone C
Domestic wastewater collection systems (sewer lines or lift stations)	D01		C	Medium	2	Estimated 4 sewer lines in Zone C
Residential Areas	R01	R01-1	C	Low	2	Approximately 10 acres of residential area in Zone C
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	C	Low	2	2702 Peger Road

Table 4

Contaminant Source Inventory and Risk Ranking for Boatel

Sources of Volatile Organic Chemicals

PWSID 310073.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	Low	2	Riverside Drive; Bartlett Avenue; Airport Way
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-1	A	High	2	3300 Airport Rd; File Number 102.26.012
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	11 roads in Zone B
Domestic wastewater collection systems (sewer lines or lift stations)	D01		B	Low	2	Estimated 13 sewerlines in Zone B
Construction trade areas and materials	C09	C09-1	B	Low	2	1713 Kennedy Street
Laboratories (chemical, soils, and research)	C20	C20-1	B	Low	2	3110 17th Avenue
Photography supplies/photo processing laboratories	C36	C36-1	B	Medium	2	3115 Airport Way
Residential Areas	R01	R01-1	B	Low	2	Approximately 35 acres of residential area in Zone B
Tanks, heating oil, nonresidential (underground)	T16	T16-1	B	Low	2	1949 Ada Street
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	4 roads in Zone C
Domestic wastewater collection systems (sewer lines or lift stations)	D01		C	Low	2	Estimated 4 sewer lines in Zone C
Body shops (automotive)	C05	C05-1	C	Medium	2	2720 Davis Rd
Body shops (automotive)	C05	C05-2	C	Medium	2	2513 Davis Road
Construction trade areas and materials	C09	C09-2	C	Low	2	1949 Ada Steet
Gasoline stations (without repair shop)	C15	C15-1	C	High	2	2110 Peger Road
Heavy equipment rental/storage	C18	C18-1	C	Medium	2	2615 20 Avenue
Motor /motor vehicle repair shops	C31	C31-1	C	Medium	2	2720 Davis Road
Motor /motor vehicle repair shops	C31	C31-2	C	Medium	2	2607 Picket Place #6
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	C	High	2	2720 Davis Road
Asphalt and tar processing/storage	I03	I03-1	C	Medium	2	2301 Peger Road
Cement manufacturing	I08	I08-1	C	High	2	1952 Ada Street
Residential Areas	R01	R01-1	C	Low	2	Approximately 10 acres of residential area in Zone C

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Boatel

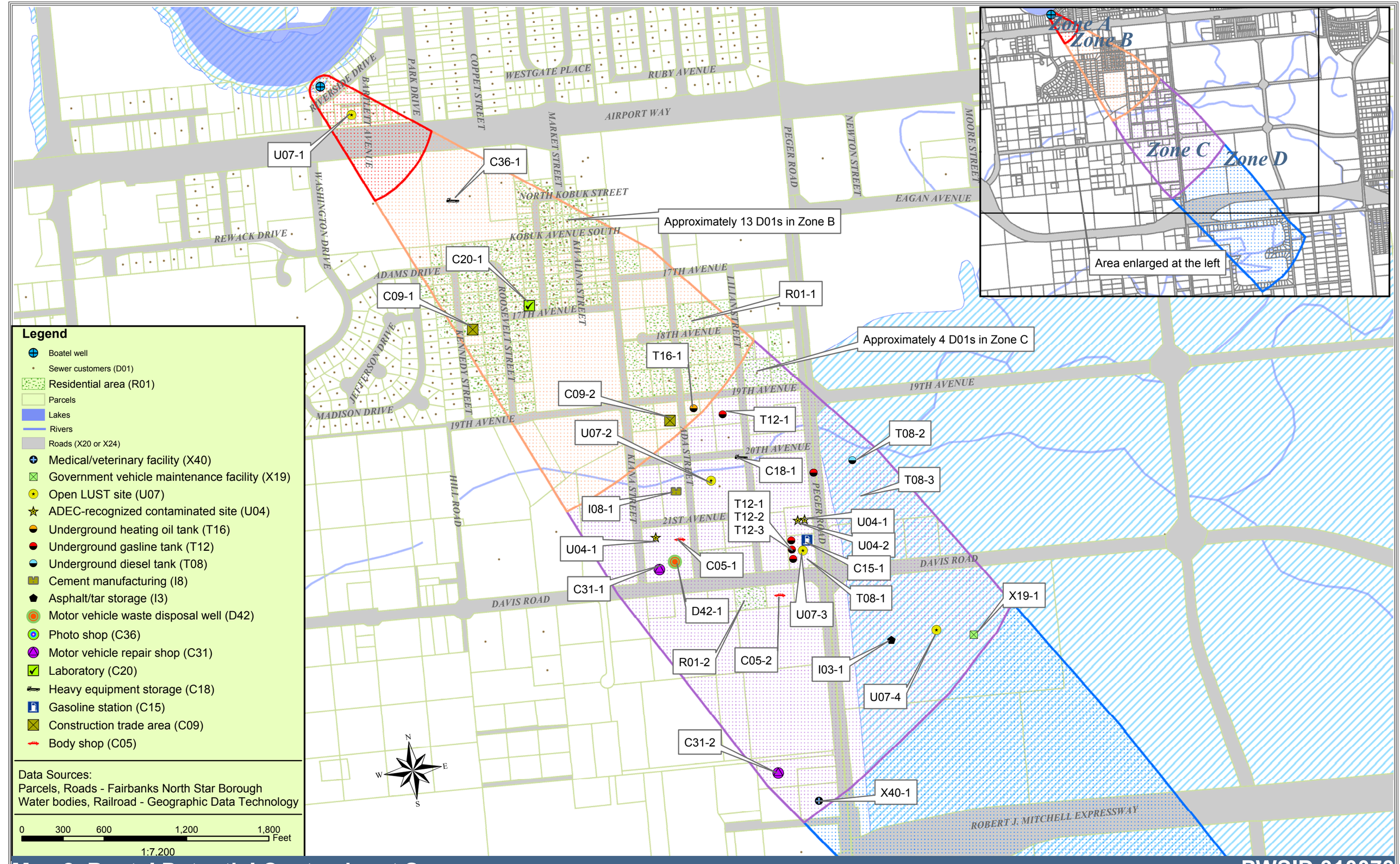
Sources of Volatile Organic Chemicals

PWSID 310073.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Tanks, diesel (underground)	T08	T08-1	C	High	2	2110 Peger Road
Tanks, diesel (underground)	T08	T08-2	C	High	2	2121 Peger Road
Tanks, diesel (underground)	T08	T08-3	C	High	2	2121 Peger Road
Tanks, gasoline (underground)	T12	T12-1	C	High	2	1906 Lillian Street
Tanks, gasoline (underground)	T12	T12-1	C	High	2	2110 Peger Road
Tanks, gasoline (underground)	T12	T12-2	C	High	2	2110 Peger Road
Tanks, gasoline (underground)	T12	T12-3	C	High	2	2110 Peger Road
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-1	C	Medium	2	2060 Peger Road; RecKey 1992310916901
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-2	C	High	2	2720 Davis Road
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-2	C	Medium	2	2615 20th Avenue; file number 102.36.130
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-3	C	Medium	2	2110 Peger Road; file number 102.26.106
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-4	C	High	2	2301 Peger Road; RecKey 1991310107201
Government vehicle maintenance facilities	X19	X19-1	C	Medium	2	2301 Peger Road
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-1	C	Low	2	2702 Peger Road

APPENDIX C

Boatel
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)



Legend

- Boatel well
- Sewer customers (D01)
- Residential area (R01)
- Parcels
- Lakes
- Rivers
- Roads (X20 or X24)
- Medical/veterinary facility (X40)
- Government vehicle maintenance facility (X19)
- Open LUST site (U07)
- ADEC-recognized contaminated site (U04)
- Underground heating oil tank (T16)
- Underground gasline tank (T12)
- Underground diesel tank (T08)
- Cement manufacturing (I8)
- Asphalt/tar storage (I3)
- Motor vehicle waste disposal well (D42)
- Photo shop (C36)
- Motor vehicle repair shop (C31)
- Laboratory (C20)
- Heavy equipment storage (C18)
- Gasoline station (C15)
- Construction trade area (C09)
- Body shop (C05)

Data Sources:
Parcels, Roads - Fairbanks North Star Borough
Water bodies, Railroad - Geographic Data Technology

0 300 600 1,200 1,800 Feet

1:7,200

Map 2. Boatel Potential Contaminant Sources

PWSID 310073

APPENDIX D

Vulnerability Analysis for Boatel Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - Boatel

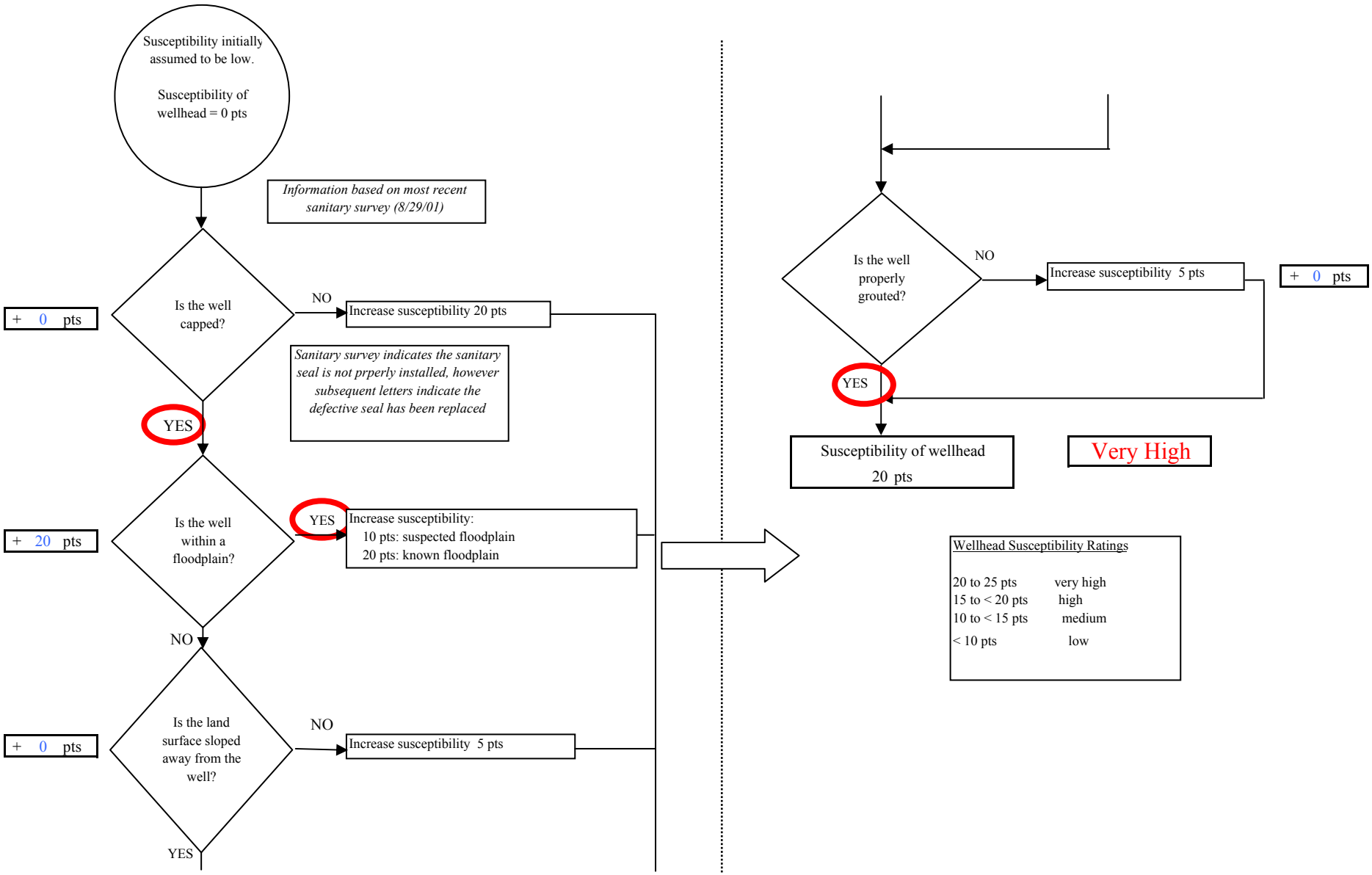


Chart 2. Susceptibility of the aquifer - Boatel

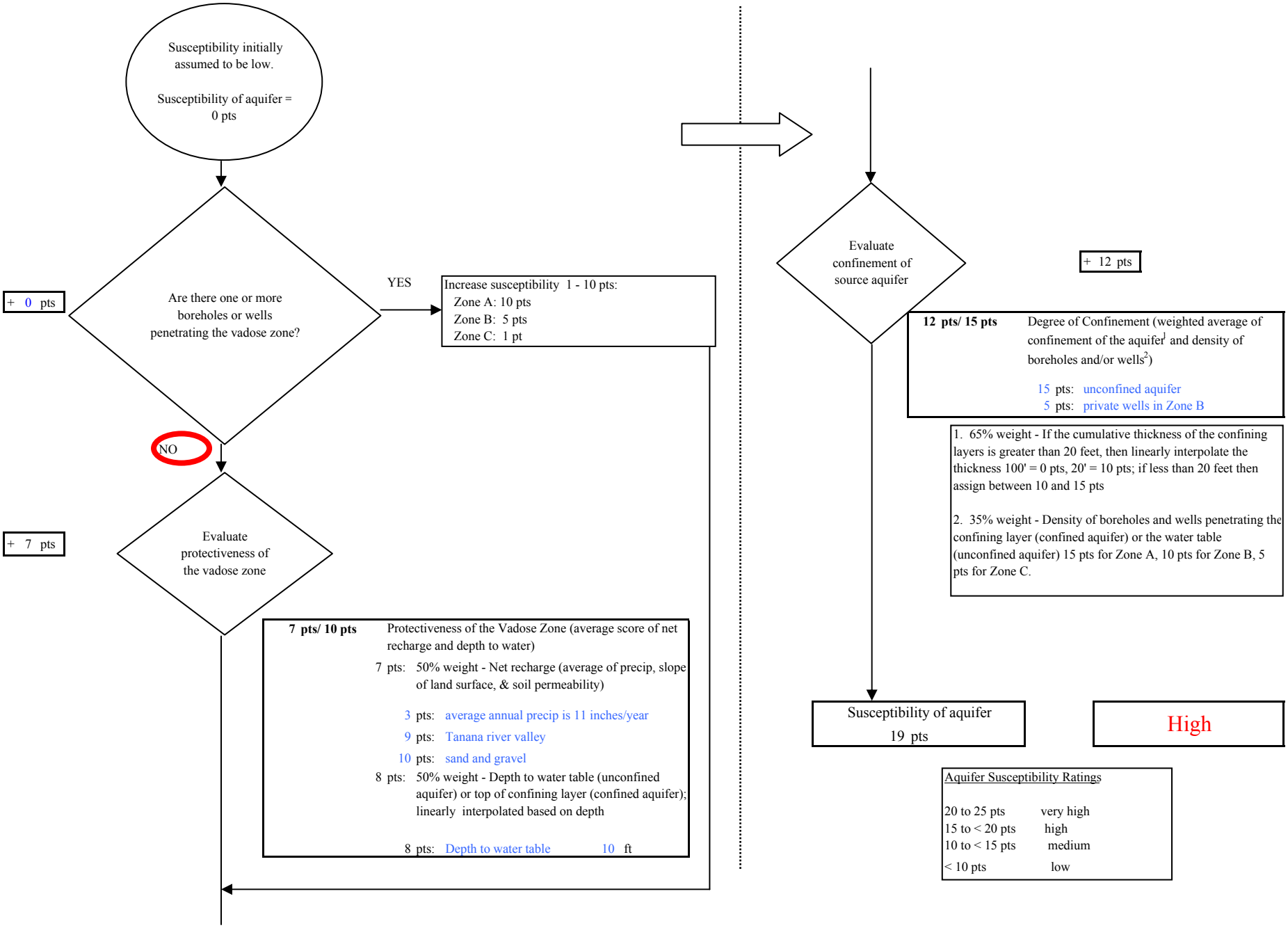
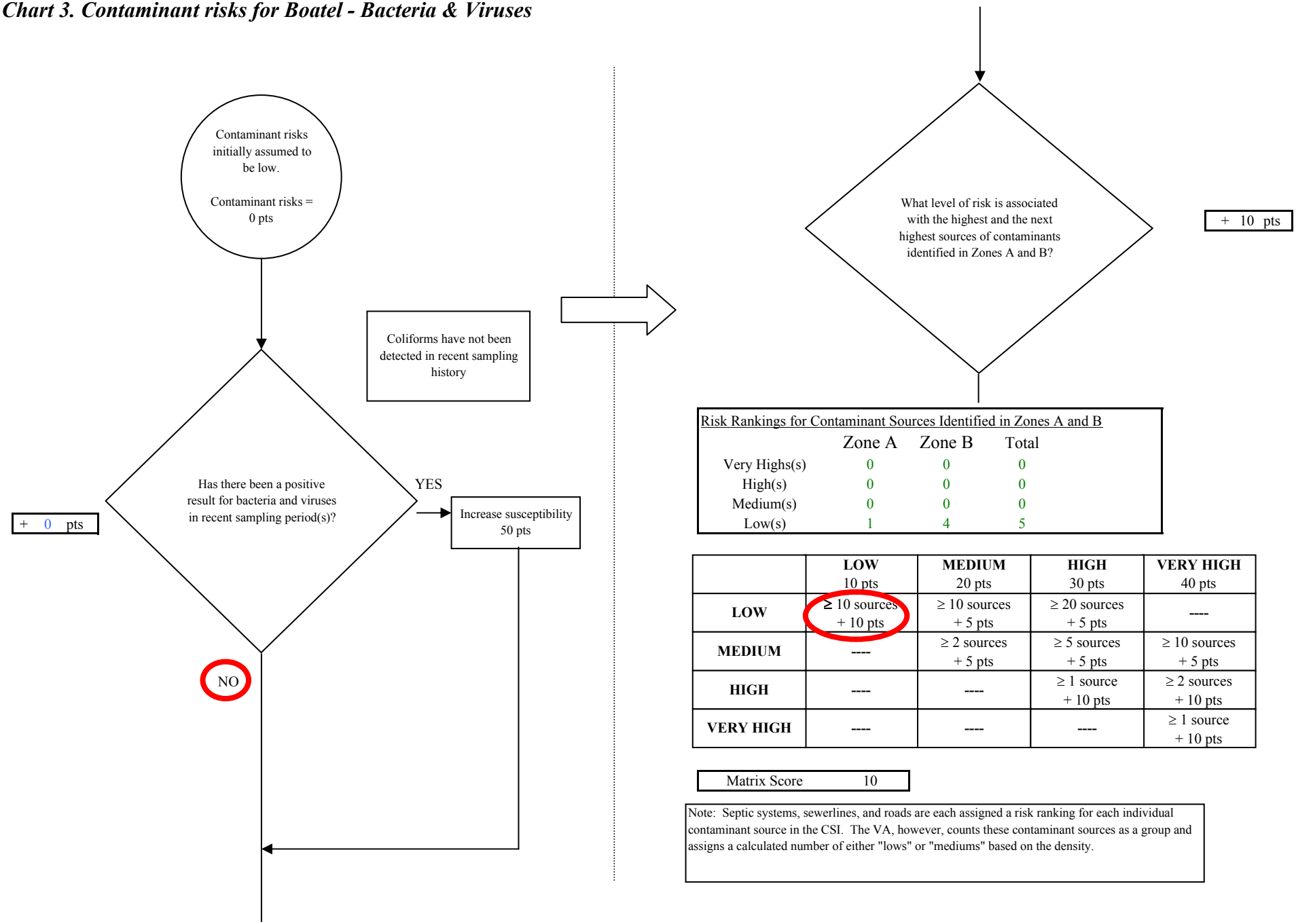


Chart 3. Contaminant risks for Boatel - Bacteria & Viruses



Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	1	4	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 10

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

Chart 3. Contaminant risks for Boatel - Bacteria & Viruses

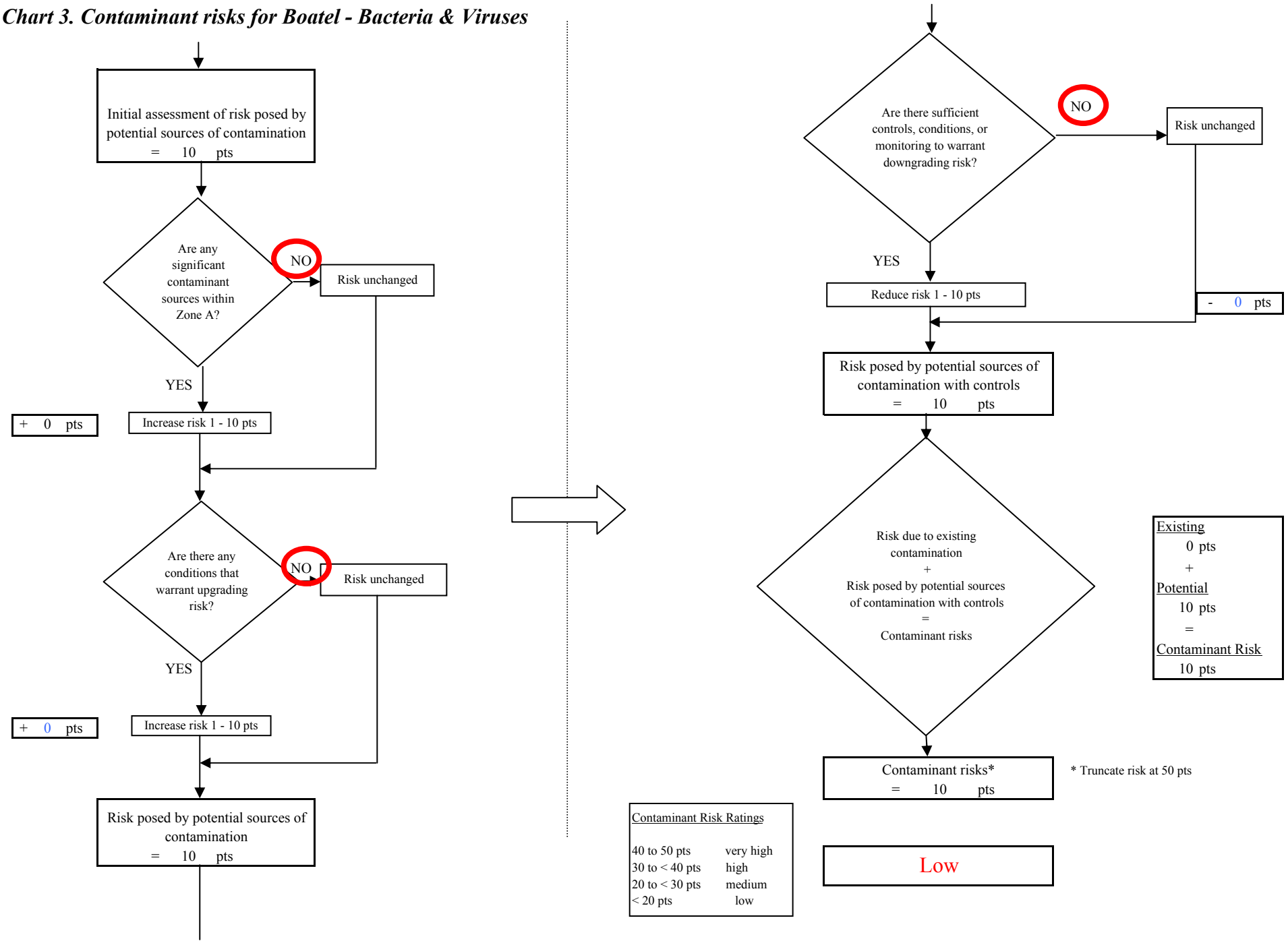


Chart 4. Vulnerability analysis for Boatel - Bacteria & Viruses

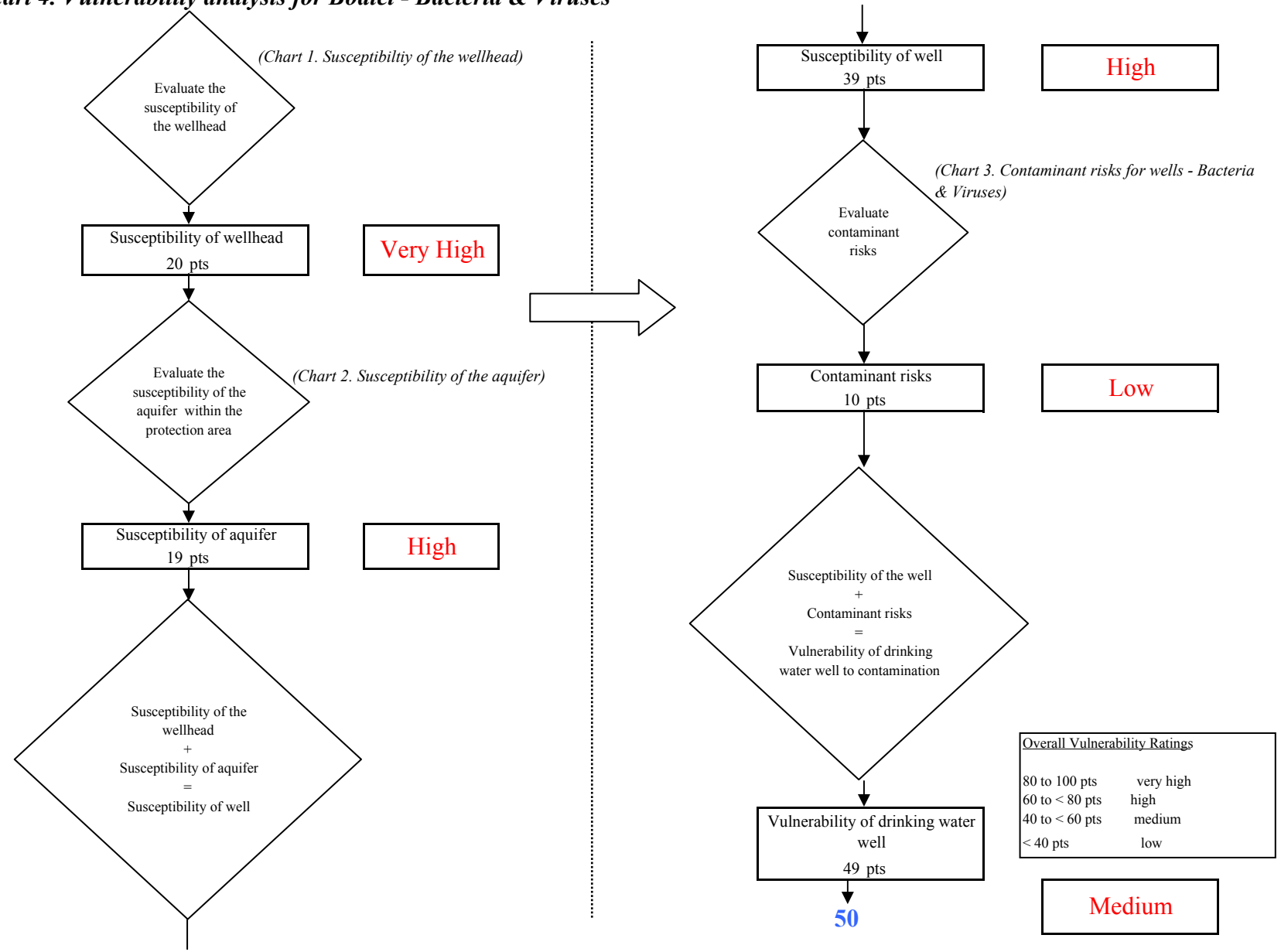


Chart 5. Contaminant risks for Boatel - Nitrates and Nitrites

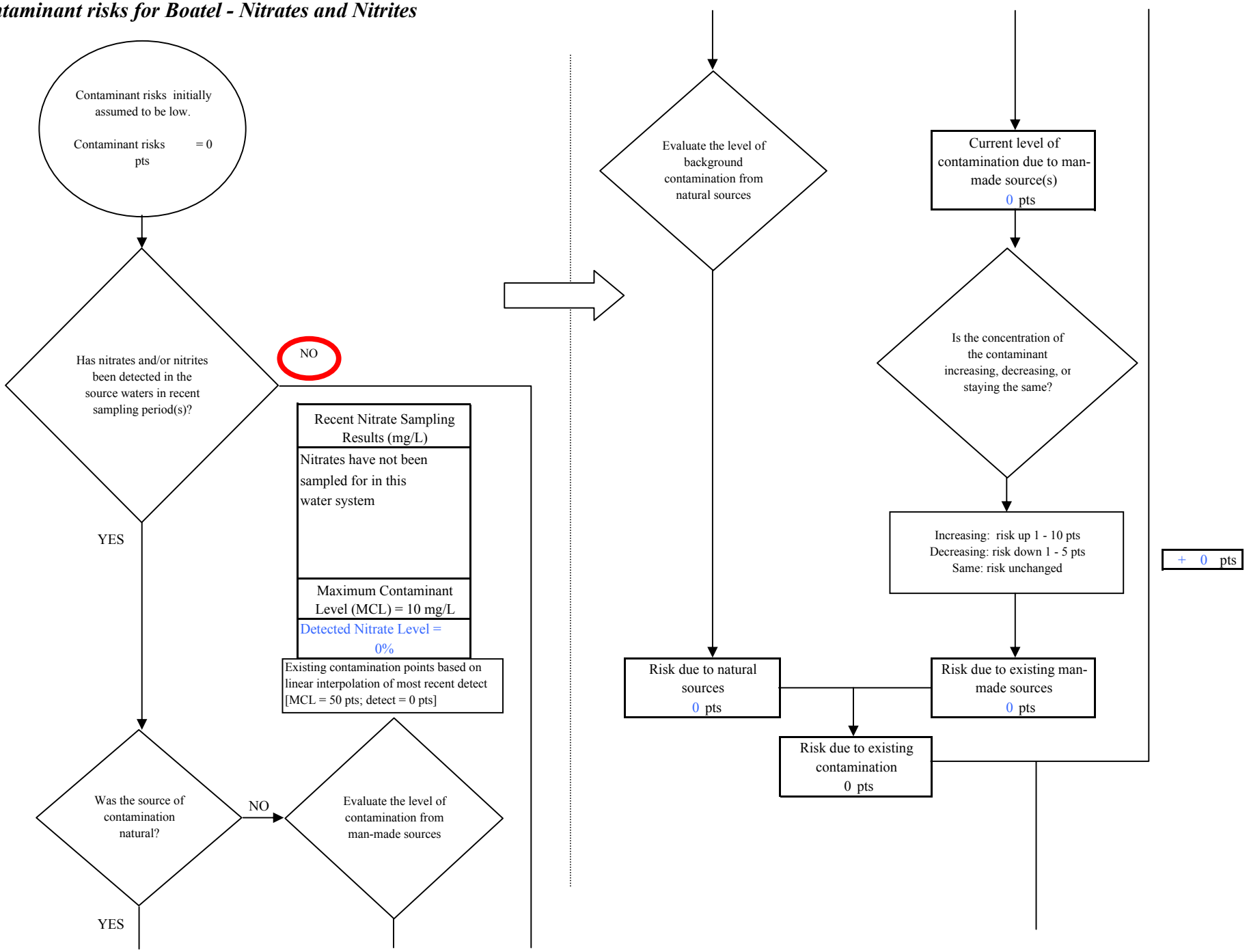


Chart 5. Contaminant risks for Boatel - Nitrates and Nitrites

+ 10 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	1	5	6

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

Matrix Score 10

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

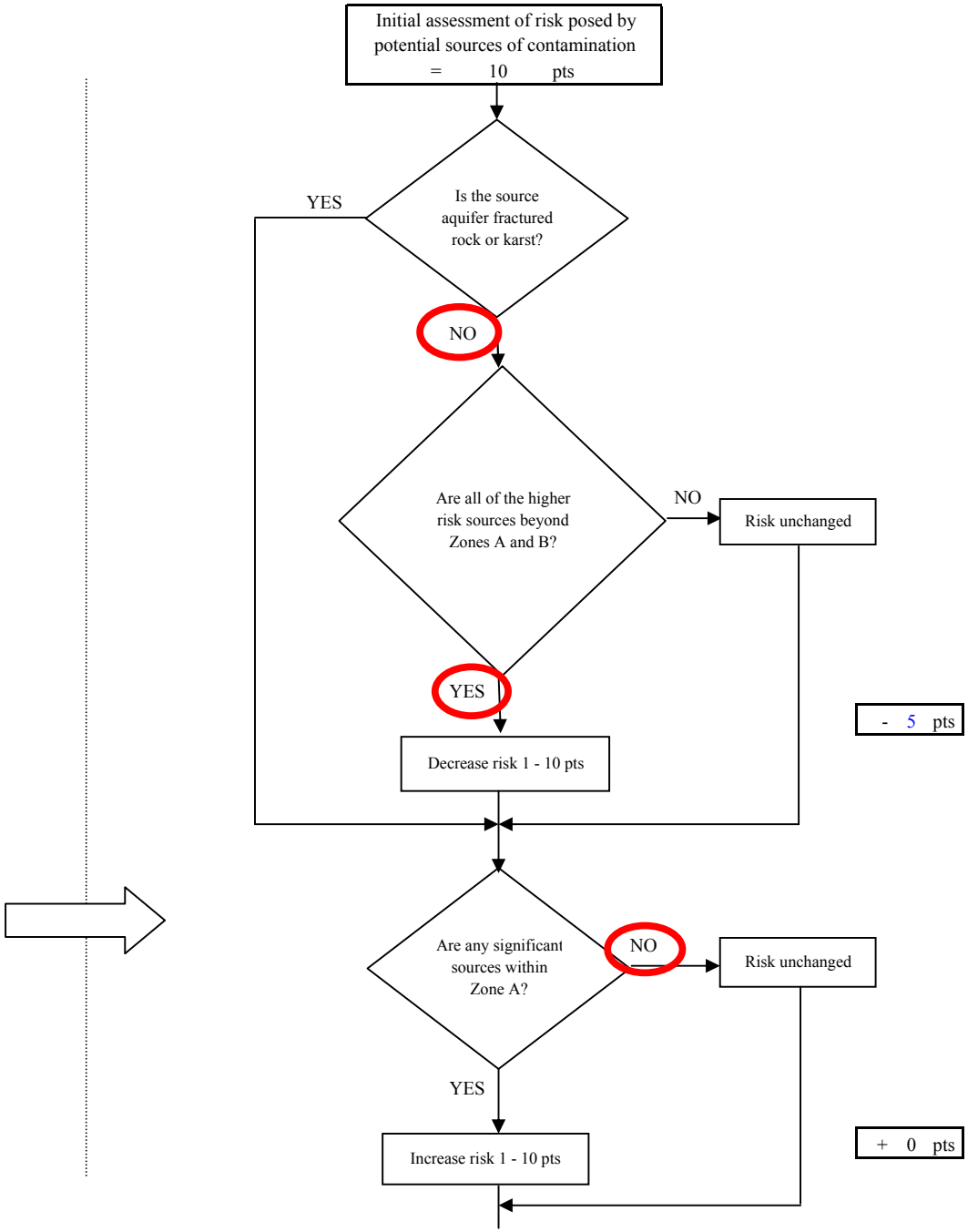


Chart 5. Contaminant risks for Boatel - Nitrates and Nitrites

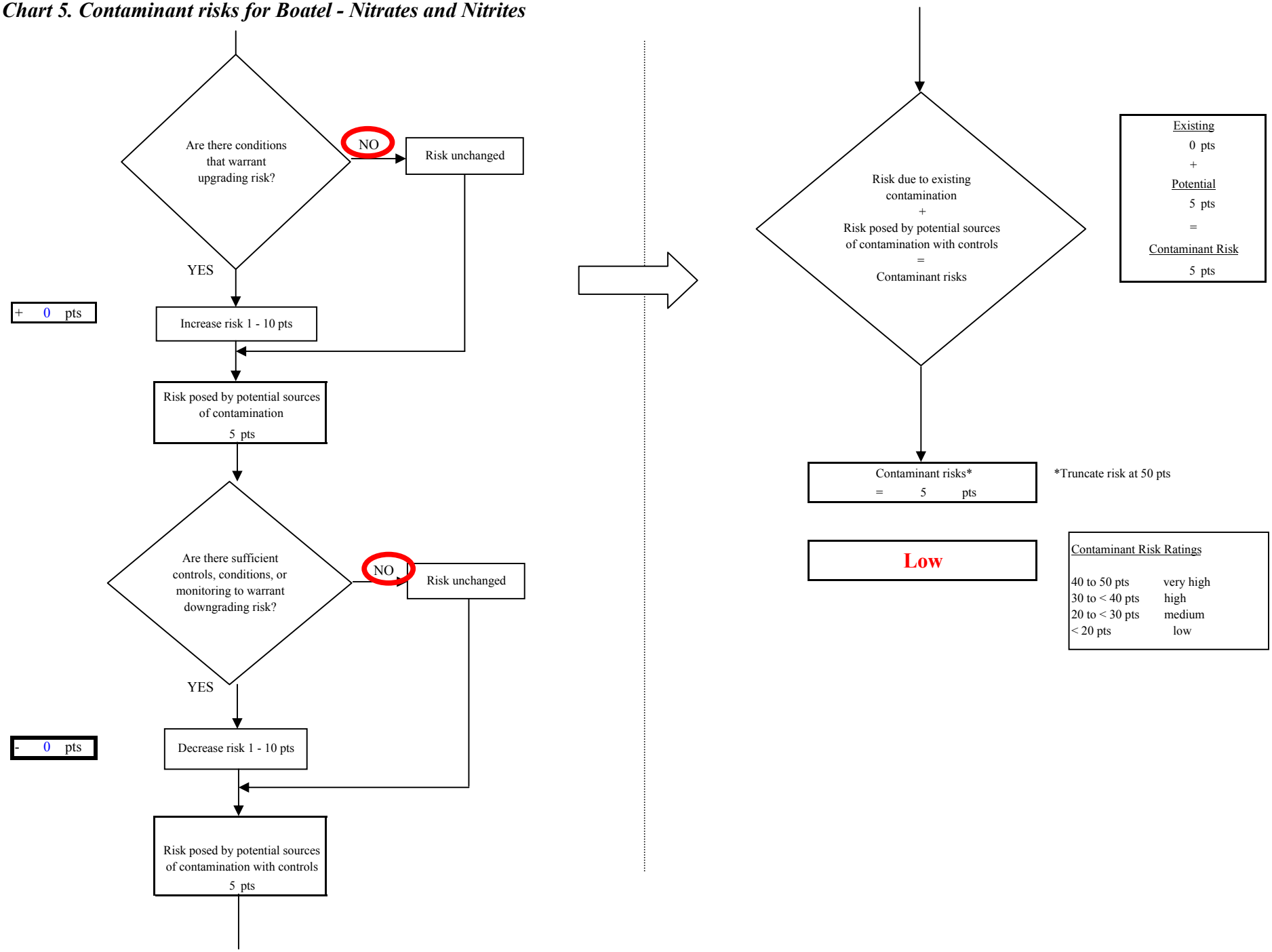


Chart 6. Vulnerability analysis for Boatel - Nitrates and Nitrites

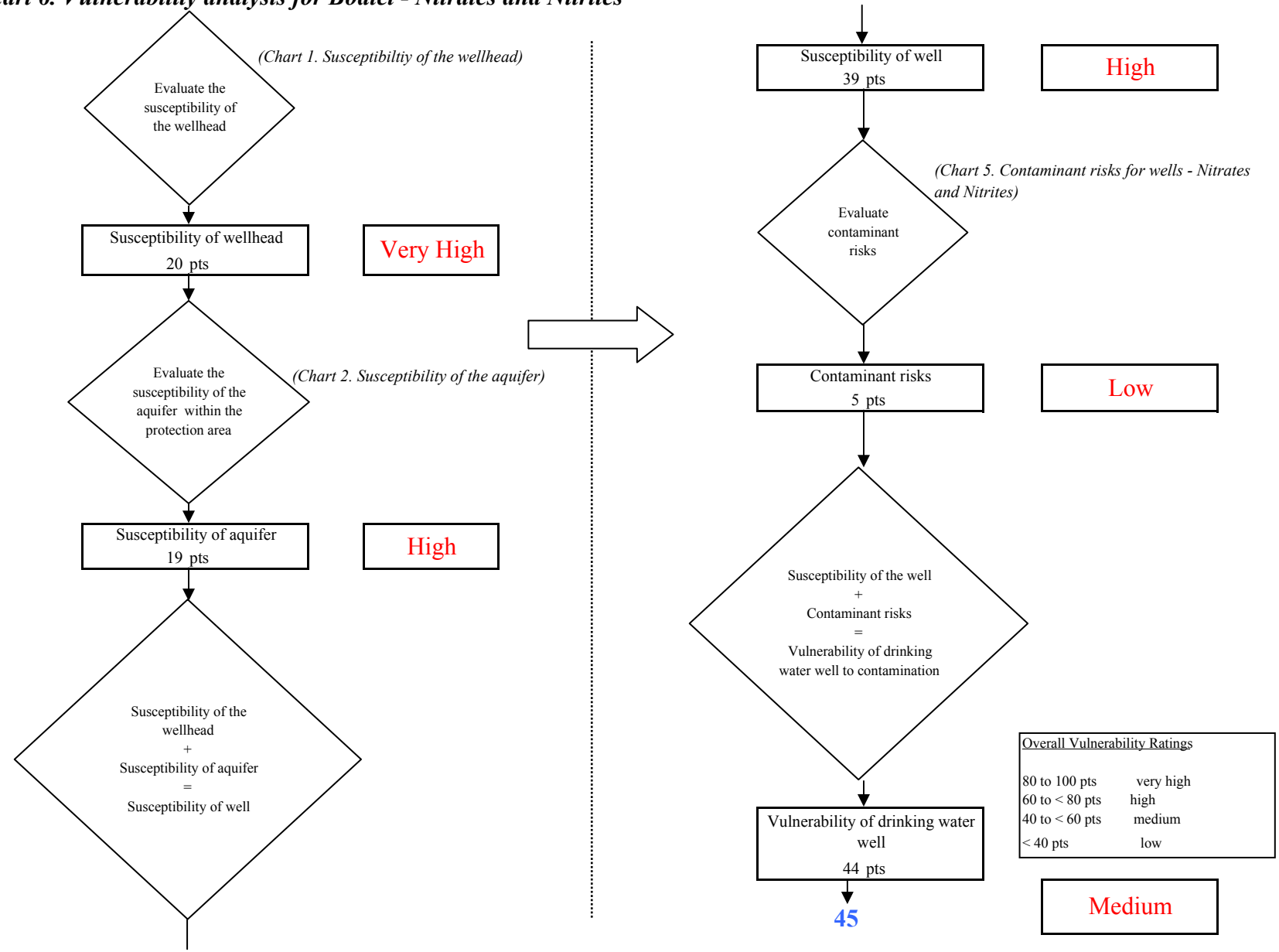


Chart 7. Contaminant risks for Boatel - Volatile Organic Chemicals

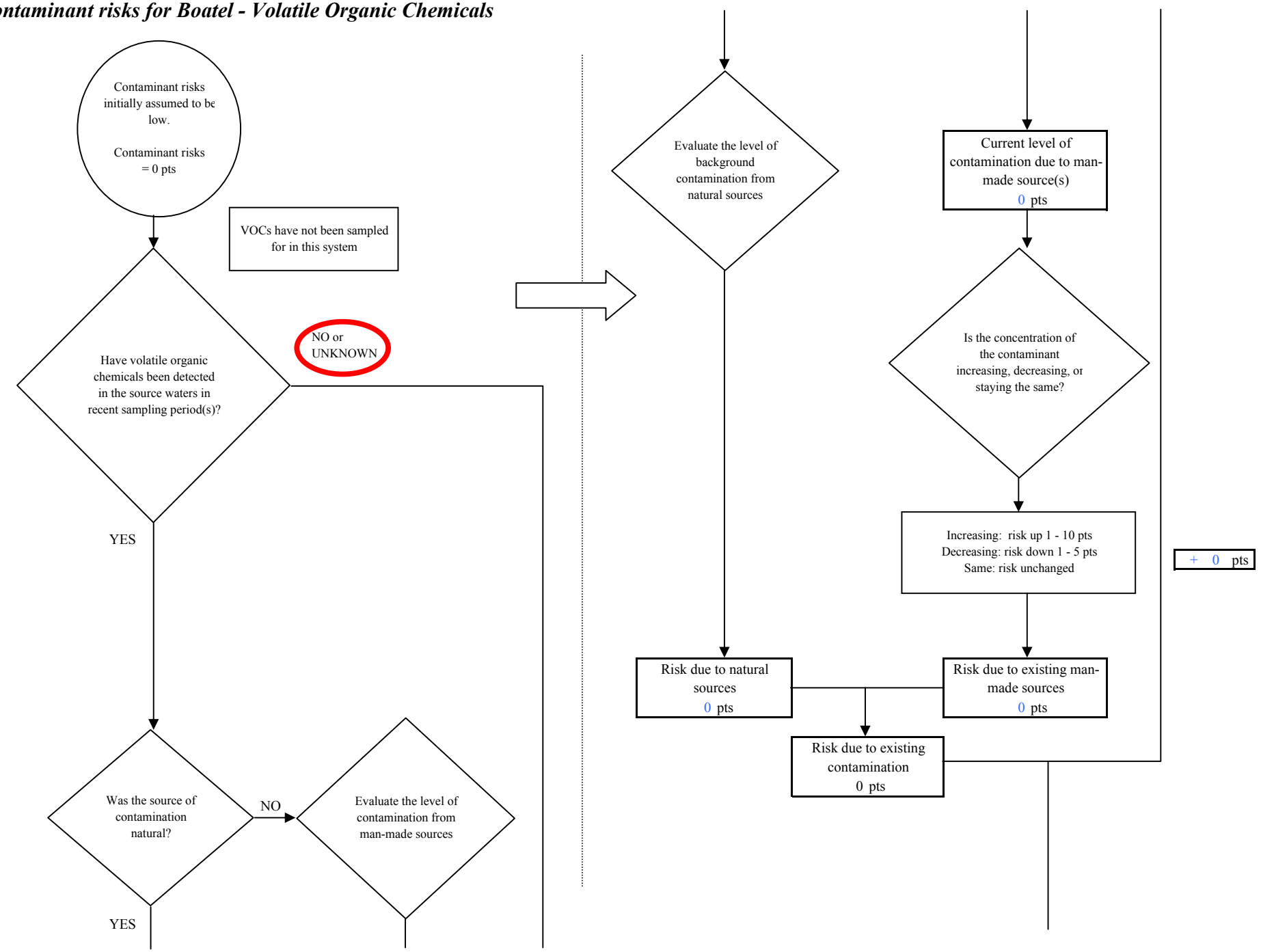


Chart 7. Contaminant risks for Boatel - Volatile Organic Chemicals

+ 40 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	12	13
Medium(s)	0	11	11
Low(s)	1	8	9

	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.

Initial assessment of risk posed by potential sources of contamination = 40 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 7. Contaminant risks for Boatel - Volatile Organic Chemicals

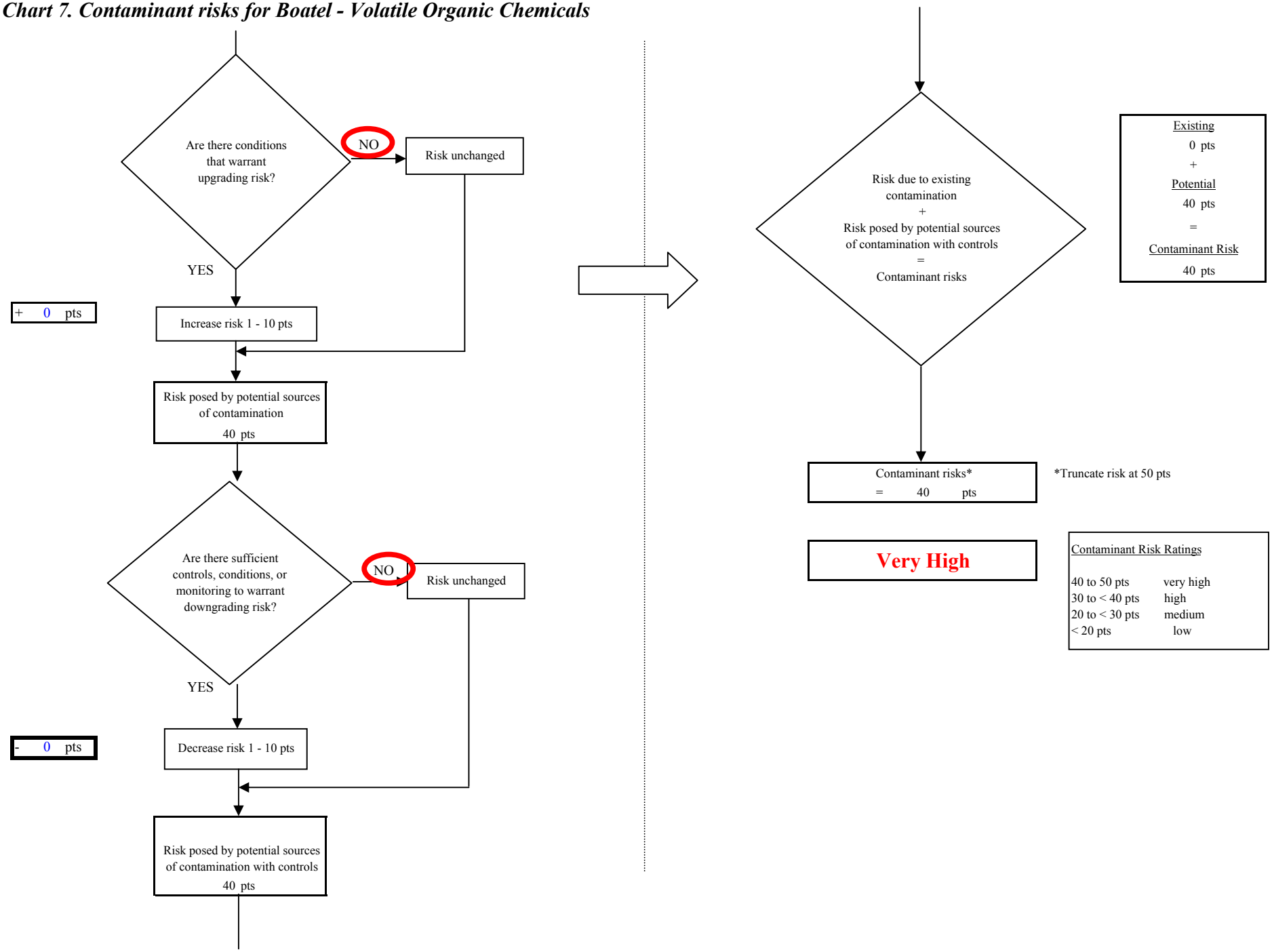


Chart 8. Vulnerability analysis for Boatel - Volatile Organic Chemicals