Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Fairbanks Christian Center Drinking Water System,
Fairbanks area, Alaska
PWSID # 314378

July 2003

DRINKING WATER PROTECTION PROGRAM REPORT Report 1017
Alaska Department of Environmental Conservation

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

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

CONTENTS

TABLES

APPENDICES

Source Water Assessment for Fairbanks Christian Center Source of Public Drinking Water,
Fairbanks Area, 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 Fairbanks Christian Center to potential contamination. This Class B (non-community) water system consists of one well near the intersection of the Richardson Highway and Cobb Road approximately 7 miles northwest of North Pole, Alaska. The well received a natural susceptibility rating of **Medium**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **Very High** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the Fairbanks Christian Center public water system include: residential heating oil storage tanks, residential septic systems, roads, residential area, a mine, a cement manufacturing plant, 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 Fairbanks Christian Center received an overall vulnerability rating of **High** for volatile organic chemicals; and a **Low** for bacteria and viruses, and nitrates and/or nitrites.

FAIRBANKS CHRISTIAN CENTER PUBLIC DRINKING WATER SYSTEM

Fairbanks Christian Center public water system is a Class B (non-community) water system. The system consists of one well near the intersection of the Richardson Highway and Cobb Road approximately 7 miles northwest of North Pole, Alaska (T1S, R1E, Section 28) (See Map 1 of Appendix A). North Pole is located southeast of Fairbanks 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.

The majority of residents located in the area surrounding the city of Fairbanks use individual water wells or hauled water, and septic systems (ADCED, 2002). Heating oil (typically stored in both above and below ground 275 to 500-gallon tanks) is used for heating homes and buildings. Refuse is transported to the Fairbanks North Star Borough landfill.

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 Fairbanks Christian Center water system is located in the alluvial plain at an elevation of approximately 425 feet above sea level.

According to the well log for this well, the depth of the well is 42 feet below the ground surface and is screened in a combination of gravel and sand. The alluvial plain consists of alternating layers of silt, 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).

FAIRBANKS CHRISTIAN CENTER 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 Fairbanks Christian Center, 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 Fairbanks Christian Center 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 Fairbanks Christian Center 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 FAIRBANKS CHRISTIAN CENTER 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

The wellhead for the Fairbanks Christian Center received a Low Susceptibility rating. Because this is a new system, it is assumed the well is capped with a sanitary seal, 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 Fairbanks Christian Center well is completed in received a Very 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 Fairbanks Christian Center.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	25	Medium

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	10	Low
Volatile Organic Chemicals	50	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	35	Low
Nitrates and Nitrites	35	Low
Volatile Organic Chemicals	75	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). A sample collected on 8/23/01 tested positive for total coli form but negative for fecal coli form. All other samples did not detect coli forms in the water.

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 low.

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 detected in significant levels in recent sampling history for the Fairbanks Christian Center 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 low.

Volatile Organic Chemicals

The ADEC-recognized contaminated sites and the residential heating oil tanks represent the greatest risk for volatile organic chemical contamination to the well.

The ADEC-recognized contaminated site in Zone A of the protection area is located at 1455 Richardson Highway at the Six-Mile Truck Stop (RecKey 1987310924701). A large number of transformers were found on the property, as well as approximately 80 drums filled with unknown liquids, possibly waste oil. Hazardous wasted was shipped off the site and empty barrels and transformers were stacked on top of a liner in 1998. Groundwater sampling found little contamination from the transformers but did identify a trichloroethylene plume possibly originating from the Holder Property site and the McCall Property site.

The ADEC-recognized contaminated site in Zone A and Zone B is the Walsky Property (RecKey 1995310933501). Three sources of trichloroethene (TCE) and one source of 1,1,1,-trichloroethane (TCA) have been identified on the property. A minor source of TCE exists in Zone A. Major sources of TCE and TCA are located together in Zone B, and a minor source of TCE also exists in Zone B. The approximate location of the plume of the TCE (concentrations ranging up to 0.005 mg/L or 5 parts per billion) is shown on Map 3.

The Holder Property (RecKey 1995310909101) and the McCall Property (RecKey 1989310902501) are located in Zone B of the protection area and have been identified as two sources of a local trichloroethylene groundwater plume. Monitoring is ongoing.

The fourth ADEC-recognized contaminated site is located at mile 7.5 of the Old Richardson Highway and Zone D of the protection area. Approximately 2000 gallons of diesel fuel were spilled due to a tank rollover on 3/14/89 (RecKey 1989310107301). Contaminated snow and soil were removed later that year. Additional contaminated soil was removed in 1993, and in 1995 the ADEC determined that the site was adequately cleaned up and the site was closed.

Both underground and above ground heating oil storage tanks are the standard way of heating homes and businesses in the area surrounding Fairbanks. 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 can help prevent many of these harmful fuel leaks.

Trichloroethylene was detected above its Maximum Contaminant Level (MCL) of 0.005 mg/L on 11/4/98 (0.0158 mg/L) and 10/12/98 (0.0153 mg/L). A water treatment system was installed and trichloroethylene has not been detected since. 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 high.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2002 [WWW document]. URL http://www.dced.state.ak.us/mra/CF_BLOCK.cfm.

Anderson, G.S., 1970, Hydrologic reconnaissance of the Tanana basin, central Alaska: U.S. Geological Survey Hydrologic Investigations Atlas HA-319.

Forbes, R.B. and Weber, F.R., 1981. Bedrock Geologic Map of the Fairbanks Mining District, Alaska. Funded by the State of Alaska, US Geological Survey, and The National Science Foundation.

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

Glass, Roy L., Lilly, Micheal R., and Meyer, David F., 1996. Ground-Water Levels in an Alluvial Plain Between the Tanana and Chena Rivers Near Fairbanks, Alaska 1986-93. US Geological Survey Water Resources Investigations Report 96-4060, 39p.

Nakanishi, Allan S. and Lilly, Micheal R., 1998. Estimate of Aquifer Properties by Numerically Simulating Ground-Water/Surface-Water Interactions, Fort Wainwright, Alaska. US Geological Survey Water Resources Investigations Report 98-4088, 27p.

Nelson, Gordon L., 1978, Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska. US Department of the Interior Geological Survey Open File Report 78-959, 47p.

Pewe, T. L., 1958, Geologic map of the Fairbanks D-2 quadrangle, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ-110, scale 1:63,360.

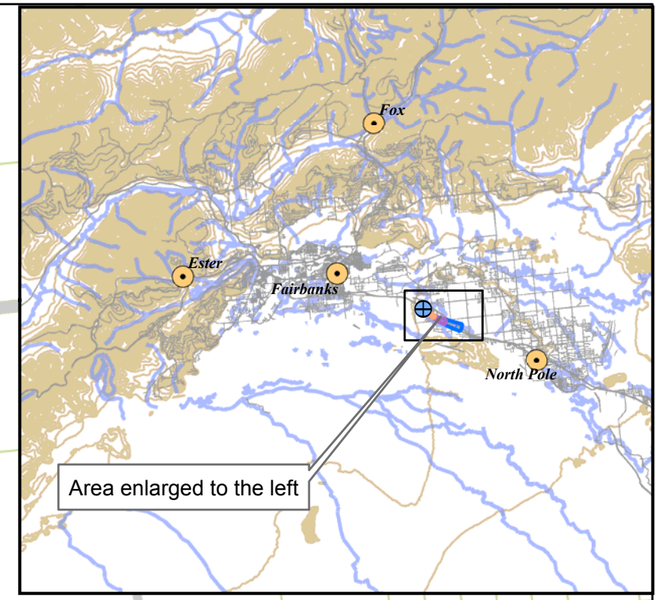
United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Fairbanks Christian Center
Drinking Water Protection Area Location Map
(Map 1)

CLEAR CREEK
CLEAR STREET
COPPER STREET
SIRLIN DRIVE
BADGER ROAD
ALASKA RAILROAD
SMITHSON STREET
SLOAN STREET
LESLIE STREET
GIANNA'S COURT
WARNER ROAD
CONLEY AVENUE
TAMARACK WOODS DRIVE
SNOWBIRD DRIVE
PHEASANT DRIVE
LOON LANE
MOSES DRIVE
BRADWAY ROAD
ANTHONY COURT
TYRONE WAY
MORNING GLORY LOOP
DANIEL STREET
LAKLOEY DRIVE
PATRICK AVENUE
TAW ROAD
BLO STREET
IS ROAD
COBB ROAD
LU ANNE ROAD
DAVIDSON STREET
JUANITA STREET
PEGGY STREET
HENRY STREET
WOJO AVENUE
BAY STREET
OLD RICHARDSON HIGHWAY
RICHARDSON HIGHWAY
DAVISON ST
BETHANY STREET
EL PASO STREET
SINCLAIR AVENUE
TOOTIE STREET
ROZAK ROAD
O'NEAL ROAD
PAIGE AVENUE
MANNA WAY
LEVEE WAY

Zone A
Zone B
Zone C
Zone D



Legend

- Fairbanks Christian Center well
- Railroads
- Roads
- Parcels
- Surface water
- Zone A *Several months travel time*
- Zone B *Less than 2 years travel time*
- Zone C *Less than 5 years travel time*
- Zone D *Less than 10 years travel time*

0 700 1,400 2,800 4,200 Feet

1:16,800

Data Sources:
Parcels, Roads - Fairbanks North Star Borough
Water bodies, Railroad - Geographic Data Technology
Elevations contours - USGS digital elevation models (DEMs)

Map 1. Fairbanks Christian Center Drinking Water Protection Area

PWSID 370502

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Fairbanks Christian Center (Tables 1-4)

Table 1

Contaminant Source Inventory for ***Fairbanks Christian Center***

PWSID 314378.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-1	A	2	Six-Mile Truck Stop (RecKey #1987310924701) 1455 Richardson Highway
Highways and roads, paved (cement or asphalt)	X20		A	2	Luanne Road
Residential Areas	R01	R01-1	B	2	Less than 1 acre of residential area in Zone A
Septic systems (serves one single-family home)	R02	R02-1	B	2	Assumed one septic tank based on number of parcels designated as residential
Tanks, heating oil, residential (above ground)	R08	R08-1	B	2	Assumed one heating oil tank based on number of parcels designated as residential
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-2	B	2	Walsky Property (RecKey #1995310933501)
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-3	B	2	Holder Property (RecKey #1995310909101) 1569 Davison
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-4	B	2	McCall Property (RecKey #1989310902501) Bethany Street & Frontage Road
Highways and roads, paved (cement or asphalt)	X20		B	2	Davison Street; Bethany Street; Richardson Highway
Residential Areas	R01	R01-2	C	2	Approximately 7 acres of residential area in Zone C
Septic systems (serves one single-family home)	R02		C	2	Assumed 7 septic systems
Tanks, heating oil, residential (above ground)	R08		C	2	Assumed 7 heating oil tanks
Highways and roads, paved (cement or asphalt)	X20		C	2	El Paso Street; Monterey Court
Metals mining, placer (inactive)	E04	E04-1	D	2	Spur Mine; past producer
Cement manufacturing	I08	I08-1	D	2	900 Old Richardson Highway
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-5	D	2 inset	Site is now closed. MatSu, Inc (RecKey #1989310107301) Mile 7.5 Old Richardson Hwy

Table 2

Contaminant Source Inventory and Risk Ranking for Fairbanks Christian Center Sources of Bacteria and Viruses

PWSID 314378.001

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	Luanne Road
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Davison Street; Bethany Street; Richardson Highway
Residential Areas	R01	R01-1	B	Low	2	Less than 1 acre of residential area in Zone A
Septic systems (serves one single-family home)	R02	R02-1	B	Low	2	Assumed one septic tank based on number of parcels designated as residential
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	El Paso Street; Monterey Court
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 7 septic systems
Residential Areas	R01	R01-2	C	Low	2	Approximately 7 acres of residential area in Zone C

Table 3

Contaminant Source Inventory and Risk Ranking for Fairbanks Christian Center Sources of Nitrates/Nitrites

PWSID 314378.001

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	Luanne Road
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Davison Street; Bethany Street; Richardson Highway
Residential Areas	R01	R01-1	B	Low	2	Less than 1 acre of residential area in Zone A
Septic systems (serves one single-family home)	R02	R02-1	B	Low	2	Assumed one septic tank based on number of parcels designated as residential
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 7 septic systems
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	El Paso Street; Monterey Court
Residential Areas	R01	R01-2	C	Low	2	Approximately 7 acres of residential area in Zone C

Table 4

Contaminant Source Inventory and Risk Ranking for Fairbanks Christian Center Sources of Volatile Organic Chemicals

PWSID 314378.001

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	Luanne Road
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-1	A	Medium	2	Six-Mile Truck Stop (RecKey #1987310924701) 1455 Richardson Highway
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	Davison Street; Bethany Street; Richardson Highway
Residential Areas	R01	R01-1	B	Low	2	Less than 1 acre of residential area in Zone A
Septic systems (serves one single-family home)	R02	R02-1	B	Low	2	Assumed one septic tank based on number of parcels designated as residential
Tanks, heating oil, residential (above ground)	R08	R08-1	B	Medium	2	Assumed one heating oil tank based on number of parcels designated as residential
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-4	B	Very High	2	McCall Property (RecKey #1989310902501) Bethany Street & Frontage Road
Highways and roads, paved (cement or asphalt)	X20		C	Low	2	El Paso Street; Monterey Court
Tanks, heating oil, residential (above ground)	R08		C	Medium	2	Assumed 7 heating oil tanks
Septic systems (serves one single-family home)	R02		C	Low	2	Assumed 7 septic systems
Residential Areas	R01	R01-2	C	Low	2	Approximately 7 acres of residential area in Zone C
Cement manufacturing	I08	I08-1	D	High	2	900 Old Richardson Highway

APPENDIX C

Fairbanks Christian Center
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Zone A
Zone B
Zone C
Zone D
U04-1
R01-1
R02-1
R08-1
U04-2
U04-3
E04-1
U04-4
I08-1
7 R08s
R01-2
7 R02s
DODGE AVENUE
GRACE AVENUE
DAVIDSON STREET
JUANITA STREET
PEGGY STREET
HENRY STREET
CUBE AVENUE
WOJO AVENUE
BARRACK AVENUE
ALASKA RAILROAD
OLD RICHA
BAY STREET
HEALY ROAD
LEANNE ROAD
ENSLEY ROAD
RICHARDSON HIGHWAY
DAVISON STREET
BETHANY STREET
EL PASO STREET
MONTEREY COURT
MANNA WAY
SINCLAIR AVENUE
N
W
E
S

Legend

- Fairbanks Christian Center well
- Cement manufacturing (I8)
- ADEC recognized contaminated site (U04)
- Residential septic tank (R02)
- Residential area (R01)
- Residential heating oil tank (R08)
- approximate TCE plume
- Parcels
- Roads (X20 or X24)
- Railroads (X30)
- Surface water

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

0 200 400 800 1,200 Feet

1:4,800

Map 2. Fairbanks Christian Center Potential Contaminant Sources **PWSID 314378**

APPENDIX D

Vulnerability Analysis for Fairbanks Christian Center Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - Fairbanks Christian Center

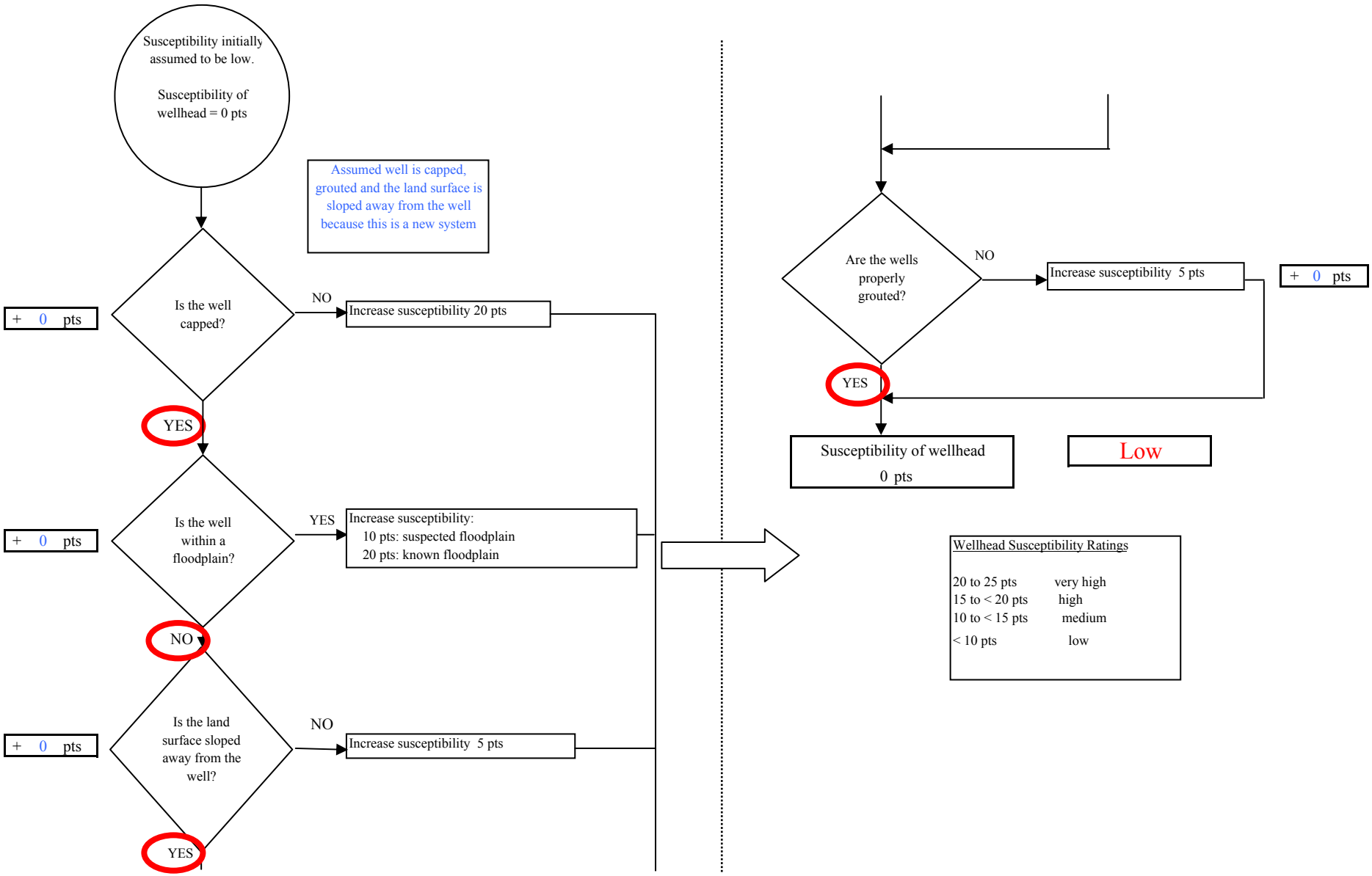


Chart 2. Susceptibility of the aquifer - Fairbanks Christian Center

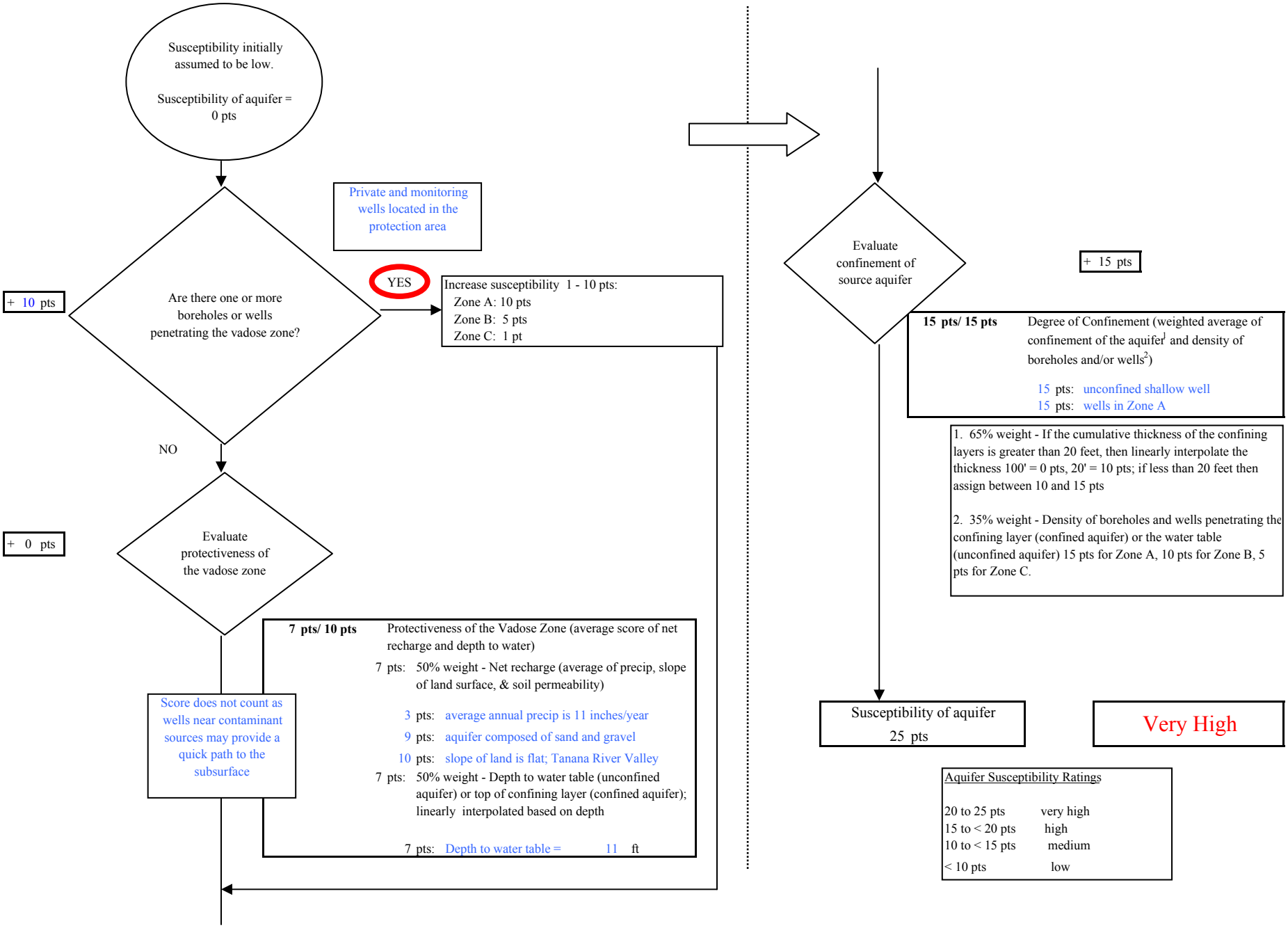
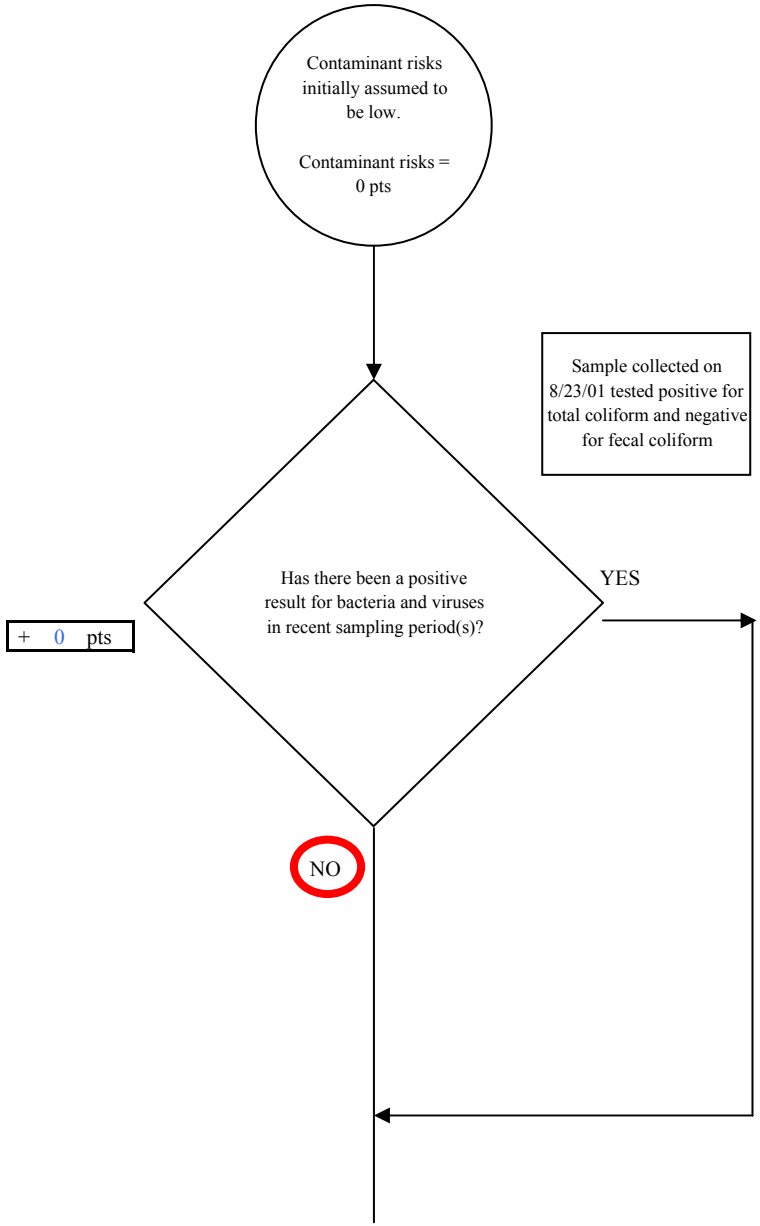
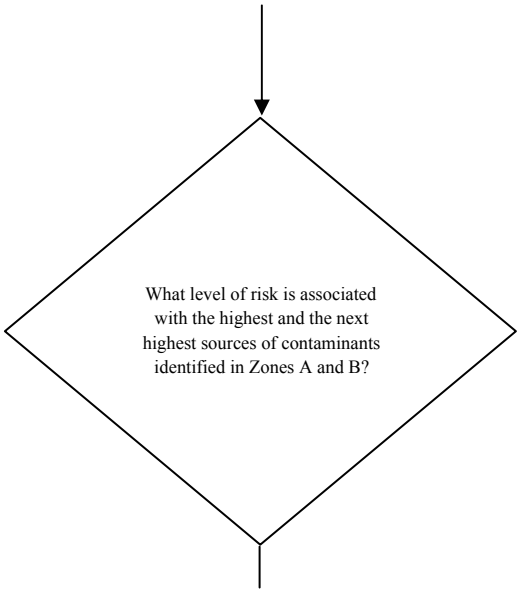


Chart 3. Contaminant risks for Fairbanks Christian Center - Bacteria & Viruses



Sample collected on 8/23/01 tested positive for total coliform and negative for fecal coliform



+ 10 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

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

	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 Fairbanks Christian Center - Bacteria & Viruses

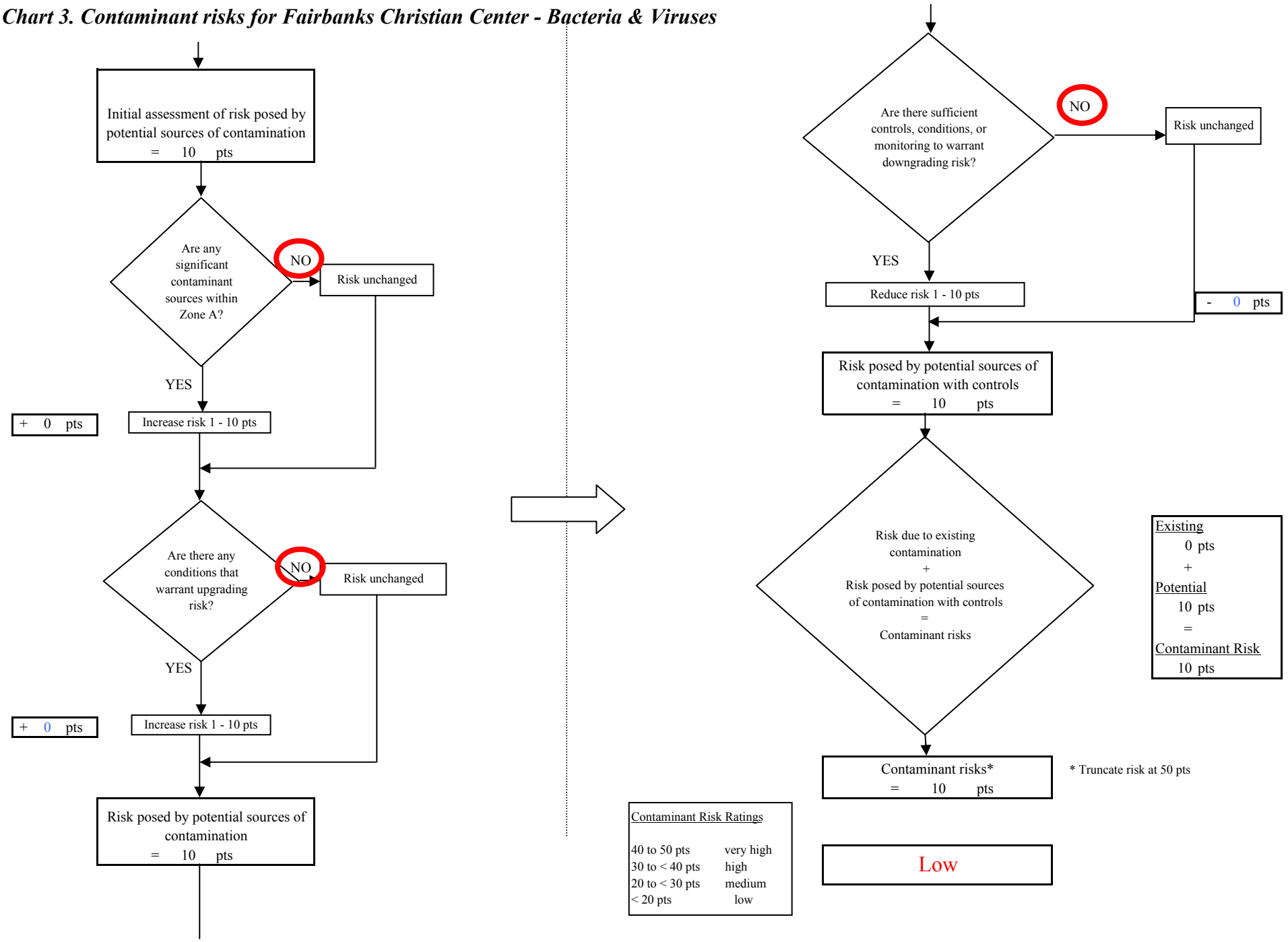


Chart 4. Vulnerability analysis for Fairbanks Christian Center - Bacteria & Viruses

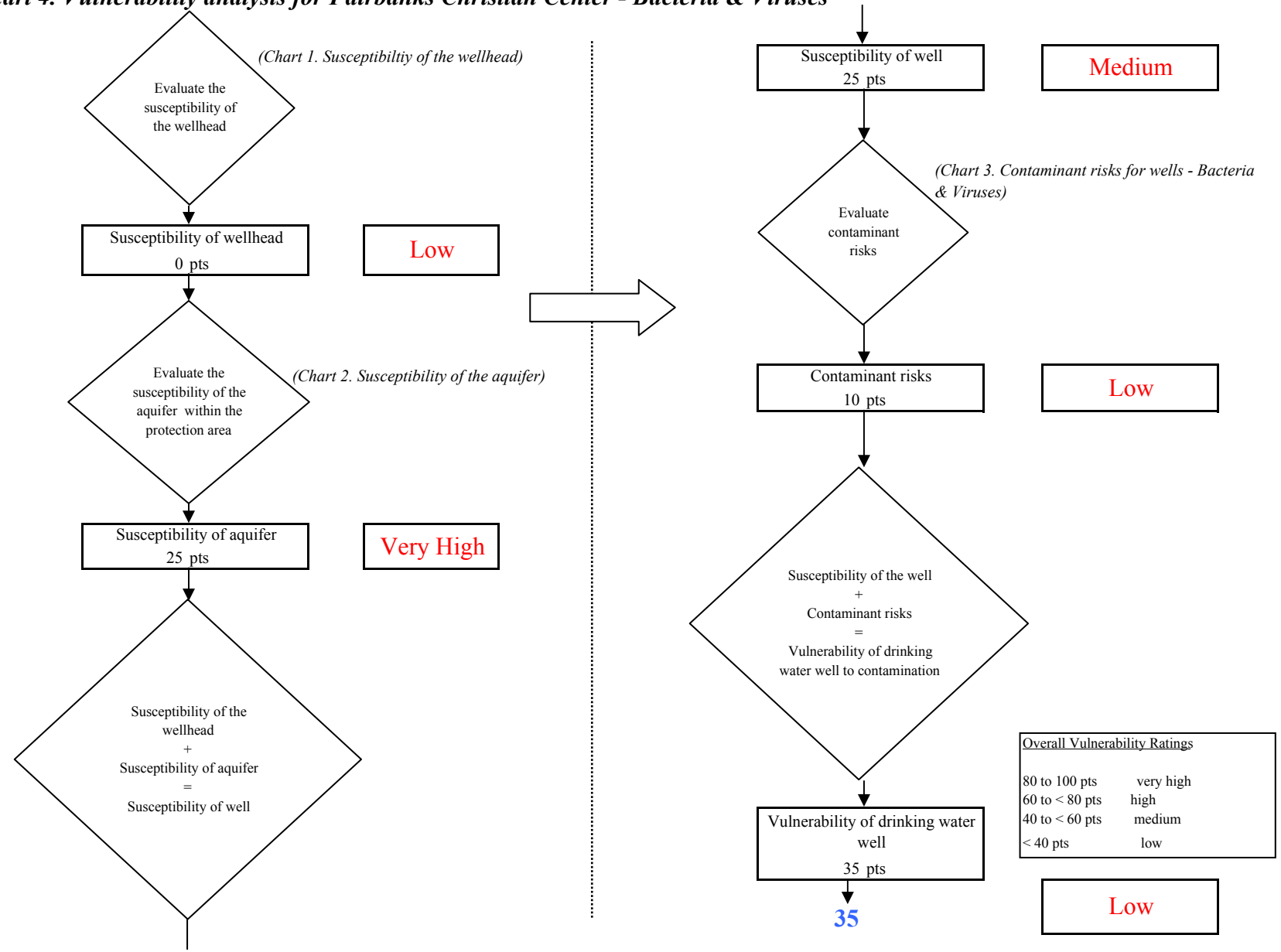


Chart 5. Contaminant risks for Fairbanks Christian Center - Nitrates and Nitrites

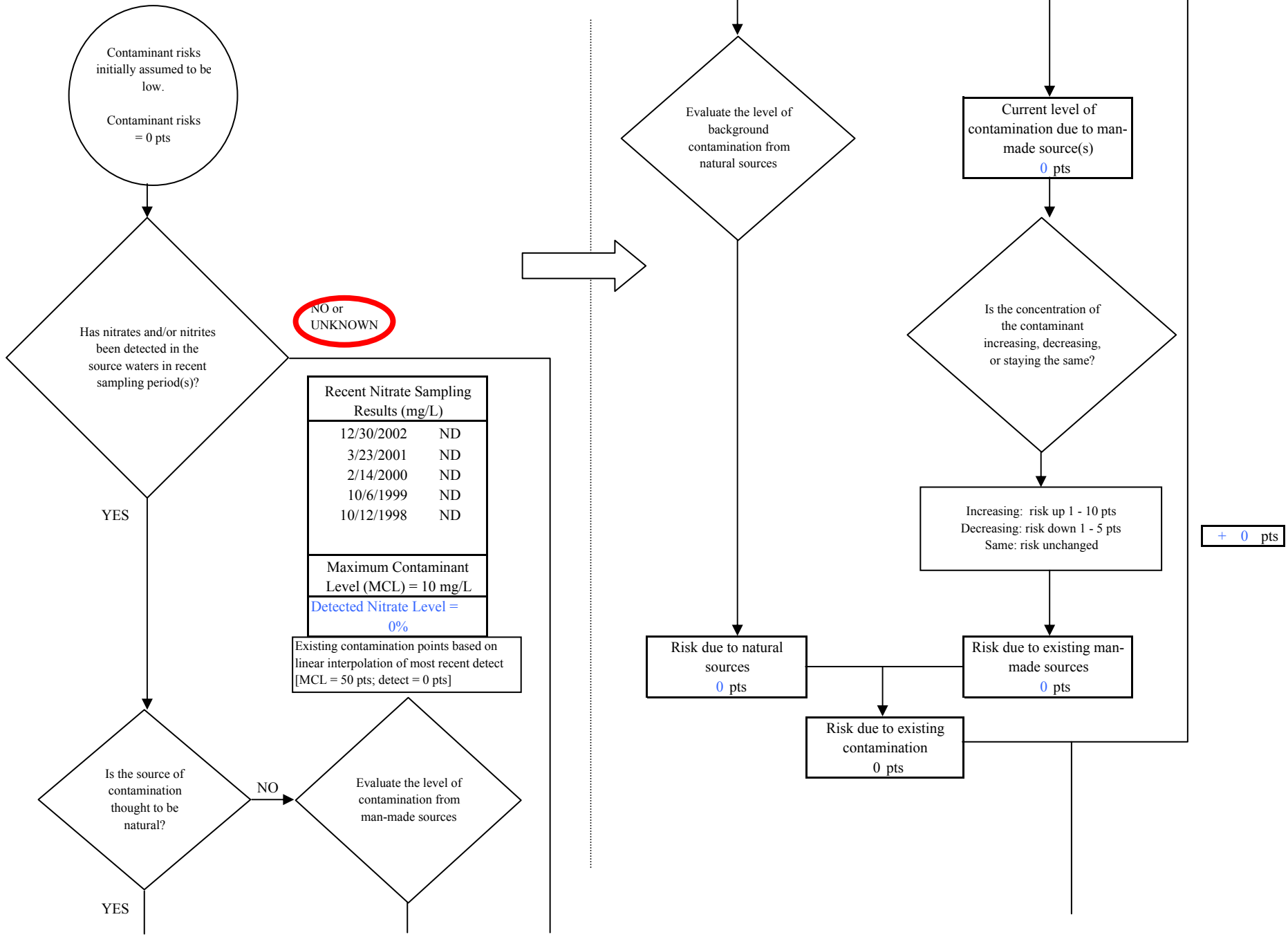


Chart 5. Contaminant risks for Fairbanks Christian Center - Nitrates and Nitrites

+ 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	3	4

	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.

Initial assessment of risk posed by potential sources of contamination = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

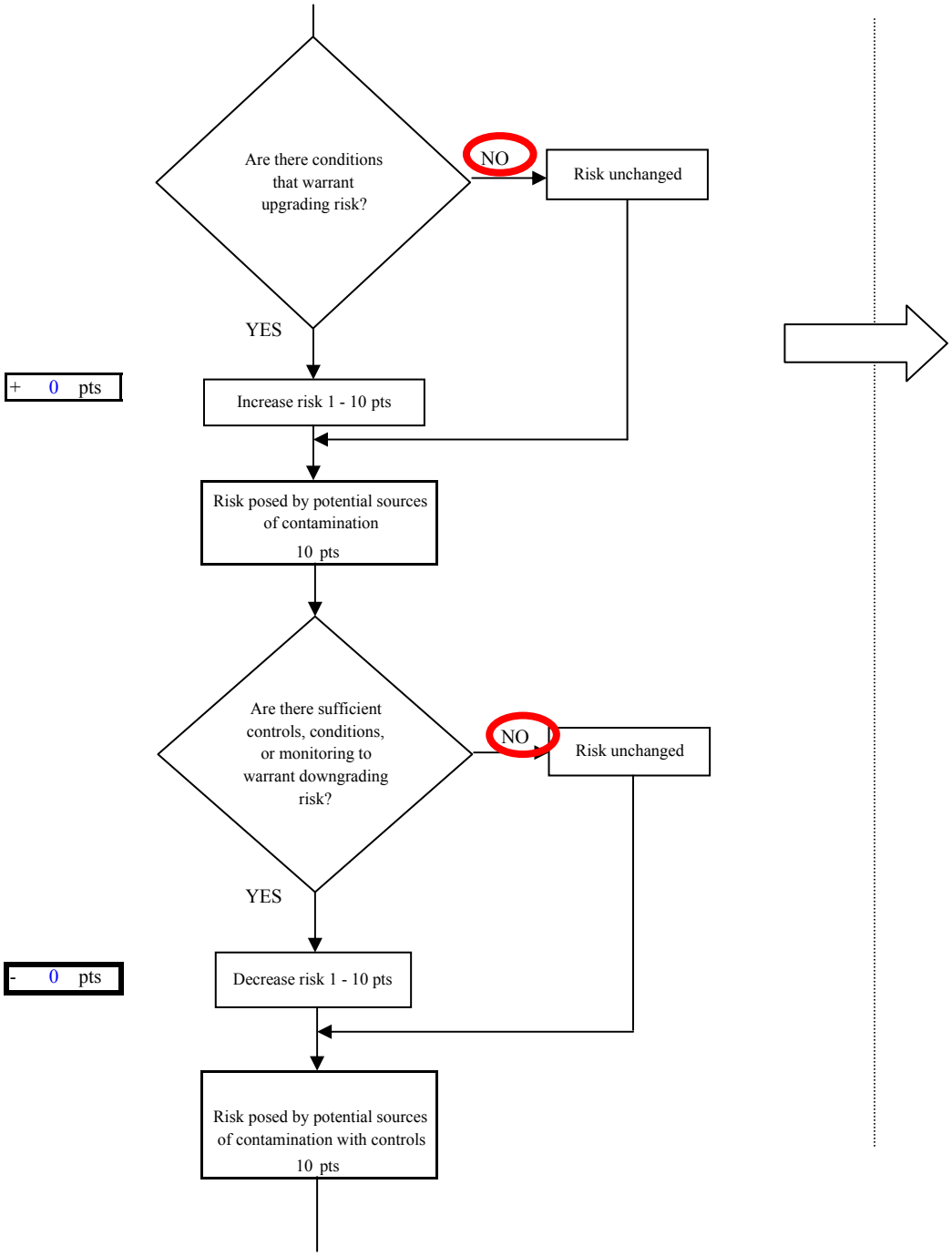
Risk unchanged

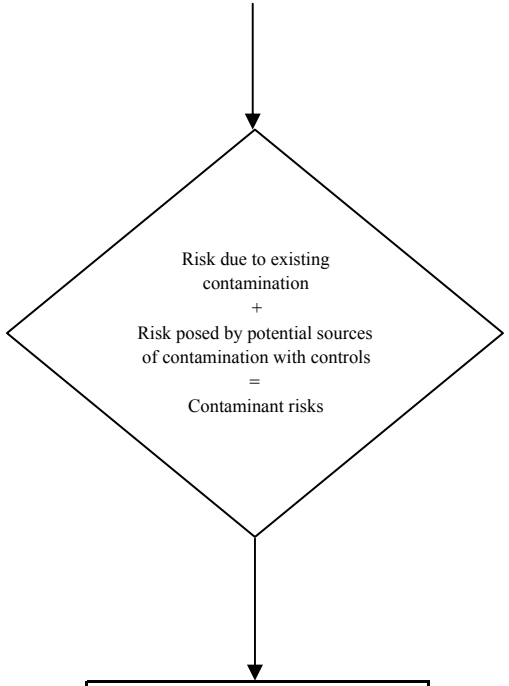
YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 5. Contaminant risks for Fairbanks Christian Center - Nitrates and Nitrites





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

Contaminant risks*
= 10 pts

*Truncate risk at 50 pts

Low

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 6. Vulnerability analysis for Fairbanks Christian Center - Nitrates and Nitrites

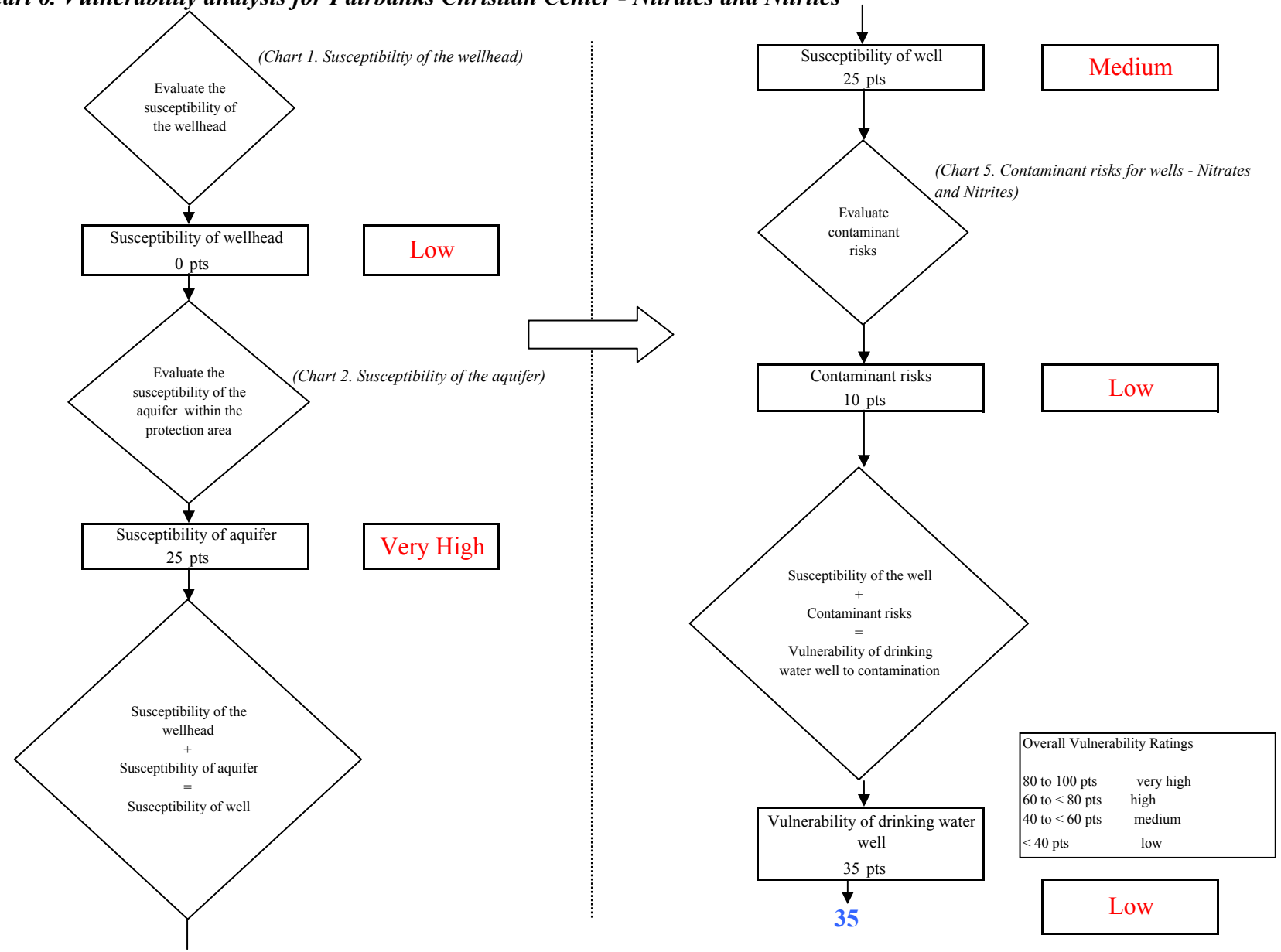


Chart 7. Contaminant risks for Fairbanks Christian Center - Volatile Organic Chemicals

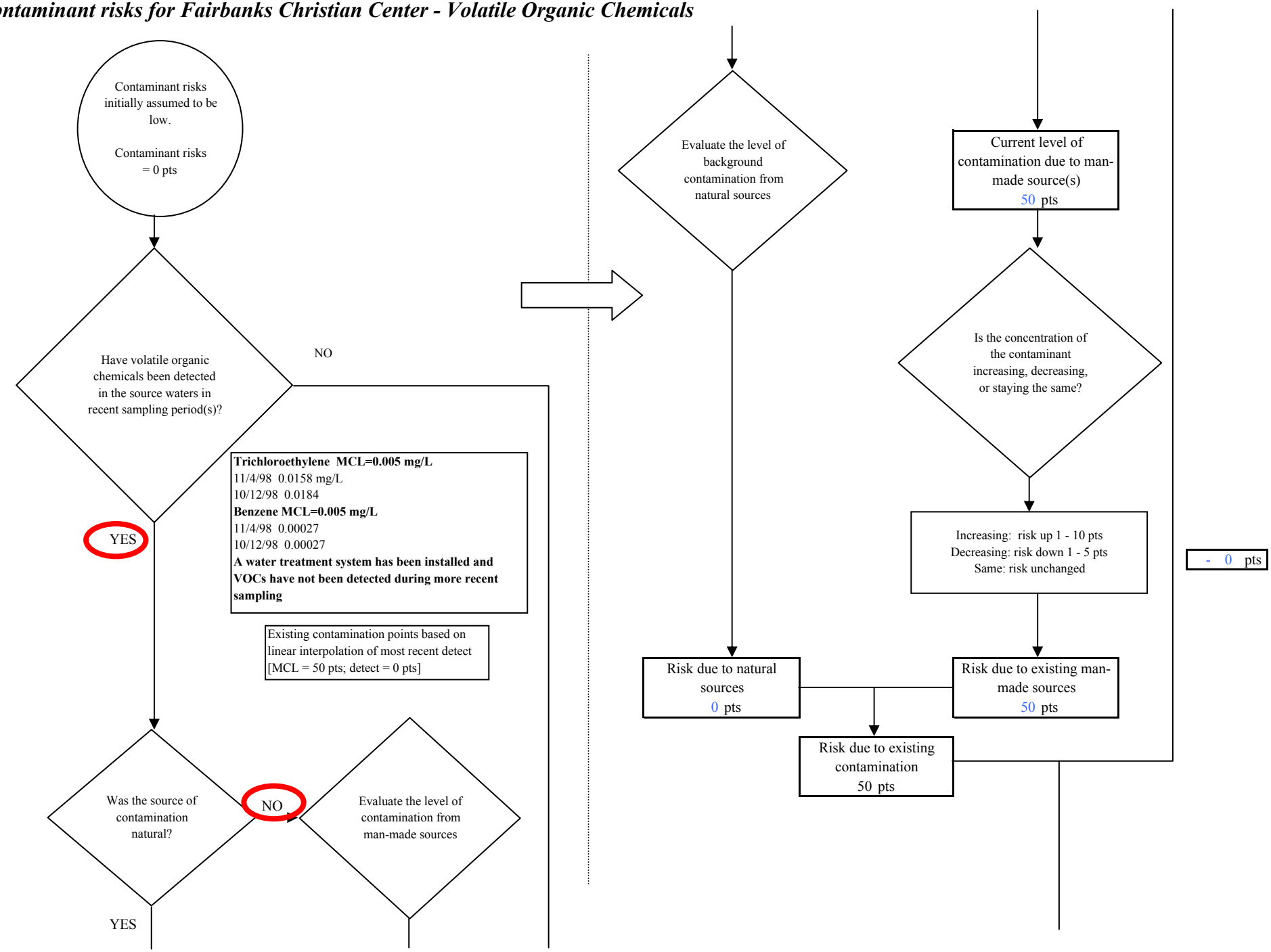


Chart 7. Contaminant risks for Fairbanks Christian Center - Volatile Organic Chemicals

+ 45 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	1	1
High(s)	0	0	0
Medium(s)	1	10	11
Low(s)	1	3	4

	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 45

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.

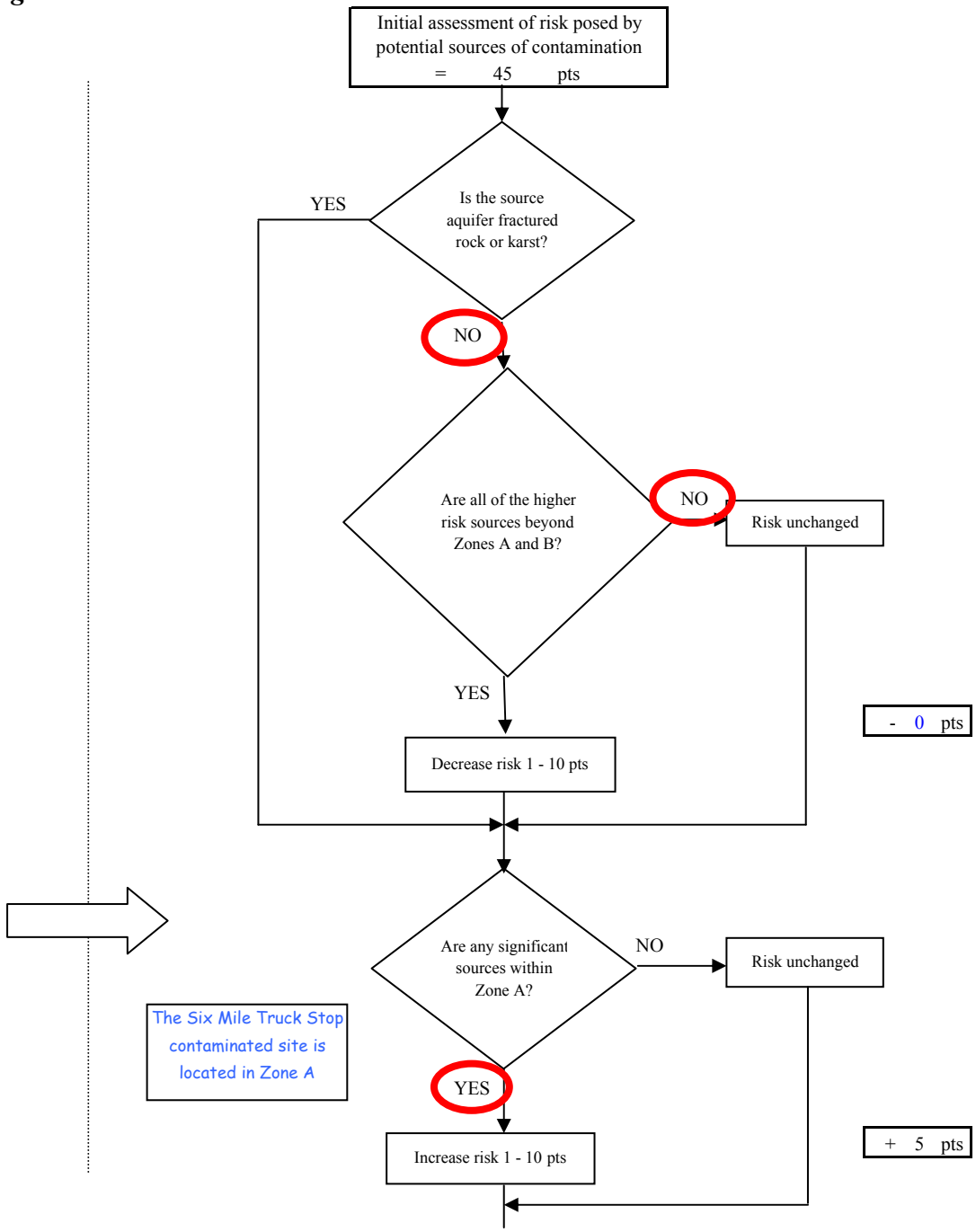
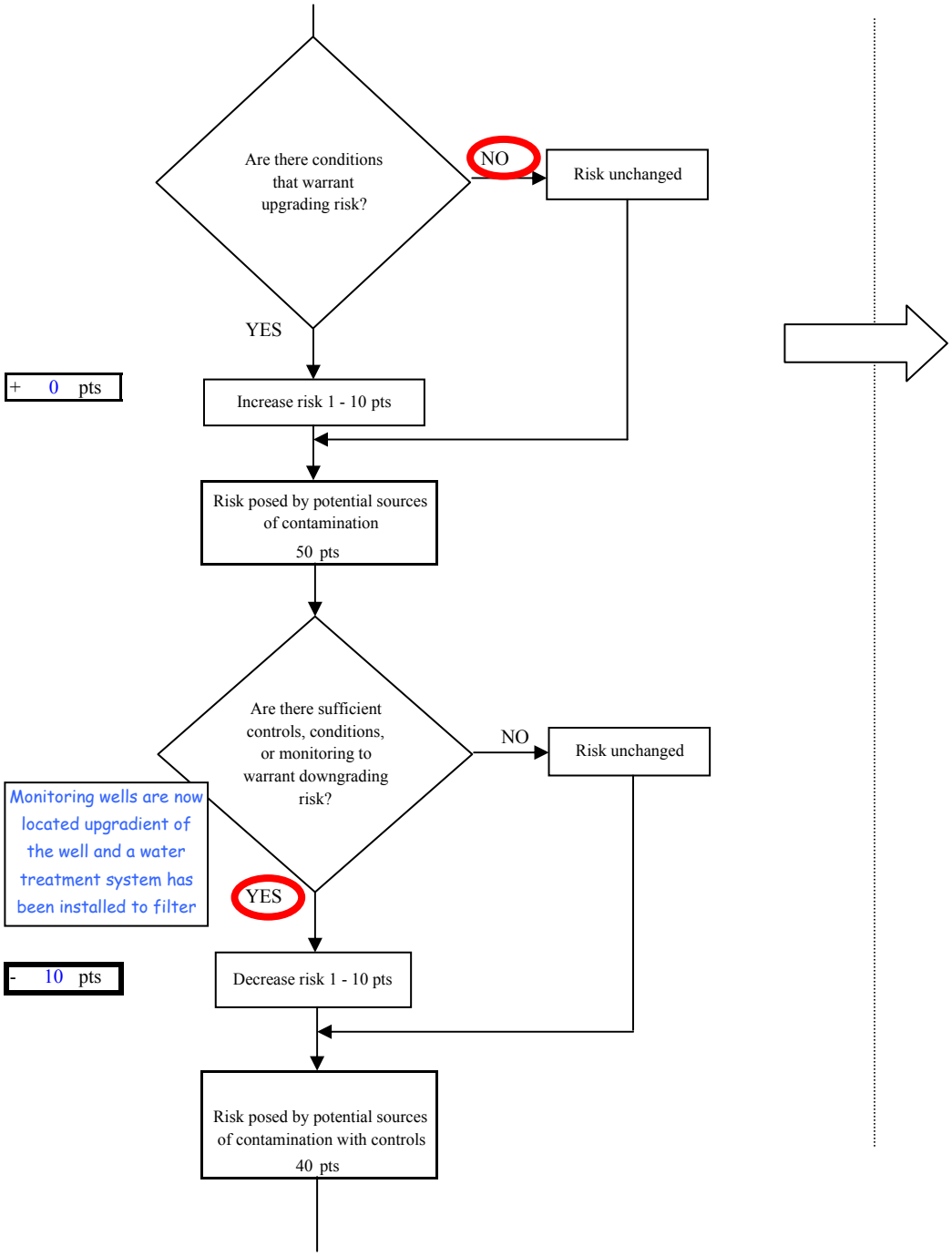
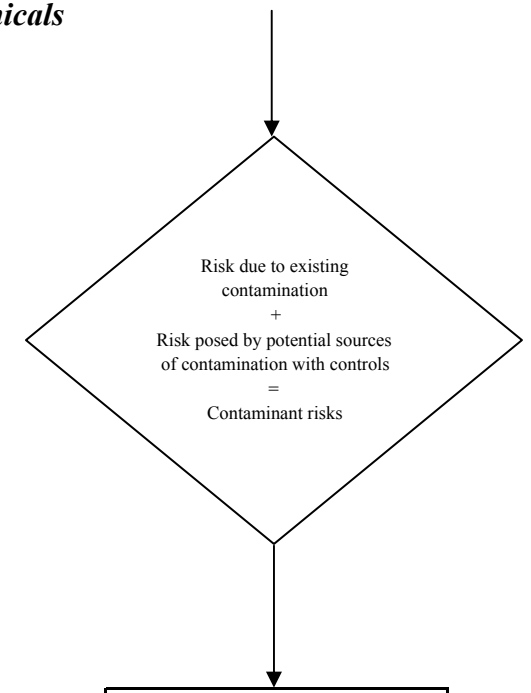


Chart 7. Contaminant risks for Fairbanks Christian Center - Volatile Organic Chemicals





Existing
50 pts
+
Potential
40 pts
=
Contaminant Risk
90 pts

Contaminant risks*
= 50 pts

*Truncate risk at 50 pts

Very High

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 8. Vulnerability analysis for Fairbanks Christian Center - Volatile Organic Chemicals