Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Fort Wainwright Water Treatment Plant Wells 3563, 3565, 3559A, and 3559B, Fort Wainwright, Alaska PWSID 310918

February 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1285
Alaska Department of Environmental Conservation

Source Water Assessment for Fort Wainwright Water Treatment Plant Wells 3563, 3565, 3559A, and 3559B Fort Wainwright, Alaska PWSID 310918

February 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1285

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 Fort Wainwright Water Treatment Plant Wells 3563, 3565, 3559A, and 3559B
Fort Wainwright, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability to potential contamination of four of the nine wells making up the public water system serving Fort Wainwright Water Treatment Plant. This Class A (community) water system consists of nine wells in Fort Wainwright, Alaska. This report is an assessment of wells 3563 (PWSID 310918.001), 3565 (310918.2), 3559A (310918.3), and 3559B (310918.4). Only wells 3559A and 3559B are active at this time. Wells 3563 and 3565 are used primarily for fire protection but also serve as backup wells for the public water system. The wells received a natural susceptibility rating of **Medium.** This rating is a combination of a susceptibility rating of **Low** for the actual wellheads and a **Very High** rating for the aquifer in which the wells are drawing water from. Identified potential and current sources of contamination for the Fort Wainwright Water Treatment Plant wells public water system include: roads and ADEC-recognized contaminated sites. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals. Combining the natural susceptibility of the well with the contaminant risk, the public water system for Fort Wainwright Water Treatment Plant wells received an overall vulnerability rating of **High** for bacteria and viruses, and **Low** for nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

FORT WAINWRIGHT WATER TREATMENT PLANT WELLS PUBLIC DRINKING WATER SYSTEM

Fort Wainwright Water Treatment Plant public water system is a Class A (community) water system. This is an assessment of four of the nine wells making up the public drinking water system serving Fort Wainwright: wells 3563 (PWSID 310918.001), 3565 (310918.2), 3559A (310918.3), and 3559B (310918.4). Only wells 3559A and 3559B are active at this time. Wells 3563 and 3565 are used primarily for fire protection but also serve as backup wells for the public water system.

These four wells are located south of Neely Road between 9th Street and Meridan Road in Fort Wainwright, Alaska (T1S, R1W, Section 13) (See Map 1 of Appendix A). Fort Wainwright is located on the southeast side of the town of Fairbanks which is located in the Fairbanks North Star Borough 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 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 Fort Wainwright Water Treatment Plant wells water system is located in the alluvial plain at an elevation of approximately 450 feet above sea level.

According to the 4/26/01 Sanitary Survey for this water system, the depths of the four well of this assessment range between 109 and 200 feet below the ground surface. Most wells in this area are screened in a combination of sand and gravel, and it is assumed these are also. 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. Geology of the Fairbanks (D-2) Quadrangle, Alaska. USGS). 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 Fort Wainwright Water Treatment Plant public drinking water system serves approximately 6,000

residents through approximately 600 service connections.

FORT WAINWRIGHT WATER TREATMENT PLANT WELLS 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 wells 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 ways of calculating the size of capture zones. This assessment 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 in this assessment is only a best guess using the information and resources available to us, 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 State Geological Survey (USGS) reports, well logs in the area, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

The water table in the area of these Fort Wainwright Water Treatment Plant wells, 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 Fort Wainwright Water Treatment Plant wells 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 Fort Wainwright Water Treatment Plant wells 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 A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses;
- Nitrates and/or nitrites;
- Volatile organic chemicals;
- Heavy metals, cyanide, and other inorganic chemicals;

- Synthetic organic chemicals; and
- Other inorganic 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 7 in Appendix B contain the ranking of inventoried potential and existing sources of contamination with respect to the six contaminant categories.

VULNERABILITY OF FORT WAINWRIGHT WATER TREATMENT PLANT WELLS 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 fourteen 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 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals, and other 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 wellheads for the Fort Wainwright Water Treatment Plant received a Low Susceptibility rating. The 4/26/01 Sanitary Survey indicates it is unknown if the wells are capped with a sanitary seal, this assessment assumes a sanitary seal is correctly installed on each of the wells. The land surface is sloped away from each of the wells; and all four wells are grouted. A sanitary seal prevents potential contaminants from entering the well from the inside while sloping the land surface away from the well and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer in the area the Fort Wainwright Water Treatment Plant wells well is completed in received a Very High Susceptibility rating. The highly transmissive aquifer material (sand and gravel) in the area allows contaminants to travel downward from the surface with the precipitation and surface water runoff. The shallow water table allows potential contaminants to come into contact with the water table with little natural filtering where they can disperse quickly. Additionally, wells in the area can provide a quick pathway for contaminants to reach the aquifer. Table 2 summarizes the Susceptibility scores and ratings for Fort Wainwright Water Treatment Plant wells.

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	50	Very High
Nitrates and/or Nitrites	10	Low
Volatile Organic Chemicals	10	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	10	Low
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	10	Low

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

Natural Susceptibility (0 – 50 points)
+
Contaminant Risks (0 – 50 points)
=
Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80 to 100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

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

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	75	High
Nitrates and/or Nitrites	35	Low
Volatile Organic Chemicals	35	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	35	Low
Synthetic Organic Chemicals	25	Low
Other Organic Chemicals	35	Low

Bacteria and Viruses

The roads are the only identified risk of Bacteria and Viruses to this water system.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms (a bacteria) 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 coliforms 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). Routine sampling has most recently detected coliforms in the water on 9/4/01 (verified on 9/6/01). Fecal coliform and E. Coli were not detected 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 high.

Nitrates and Nitrites

The residential roads are also the only identified risk of 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 sampling history for the Fort Wainwright Water Treatment Plant wells.

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

Again, the roads represent the only identified risk for volatile organic chemical contamination to the well.

Although none have been identified, there is probably a large number of heating oil tanks located within the protection area. These also represent risk to the drinking water system. 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 detected during routine sampling of this 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 low.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The roads also represent the only risk to to heavy metals for this source of public drinking water.

Barium, Chromium, and Fluoride have all been detected in extremely small concentrations with respect to their Maximum Contaminant Levels (MCL). A MCL is the concentration of a contaminant allowed in the drinking water by the Environmental Protection Area (EPA). No other heavy metals were detected during recent sampling.

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Synthetic Organic Chemicals

No potential sources of risk of synthetic organic chemicals were identified for this source of public drinking water.

Synthetic Organic Chemicals have not been detected during recent sampling of this water system.

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Other Organic Chemicals

Again, the roads represent the only identified risk of other organic chemicals for this source of public drinking water.

Other Organic Chemicals have not been detected during recent sampling of this water system.

After combining the contaminant risk for other organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is low.

Existing Contaminated Sites

There are approximately 10 ADEC-recognized contaminated sites located within the protection area (displayed on Map 2 Appendix C). The locations of these sites are approximate and may be located at the center of the zipcode boundaries the actual site is located in. The ADEC Contaminated Sites program has identified, assessed, and is ensuring cleanup of these sites based on their prioritized order. Priority is based on risk to human health and the environment, including risk to public drinking water wells. Specific information on each site can be found on the internet at http://www.dec.state.ak.us/spar/cs/search/csites/csites_search.asp or by calling the ADEC Contaminated Sites Program at (907) 269-7658.

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

Fort Wainwright Water Treatment Plant wells Drinking Water Protection Area Location Map (Map 1)

JOHANSEN EXPRESSWAY
NEW STEESE HIGHWAY
TRAINOR GATE ROAD
RICHARDSON HIGHWAY
BADGER ROAD
DENNIS ROAD
DOYLE DRIVE
BRADWAY ROAD
OLD RICHARDSON HIGHWAY
FLOOD CONTROL LEVEE

310918.9
310918.1
310918.6
310918.3
310918.4
310918.001
310918.7
310918.8
310918.2
310918.5

Map 1: Fort Wainwright Drinking Water Protection Areas

PWSID: 310918

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 2,350 4,700 9,400 14,100 Feet

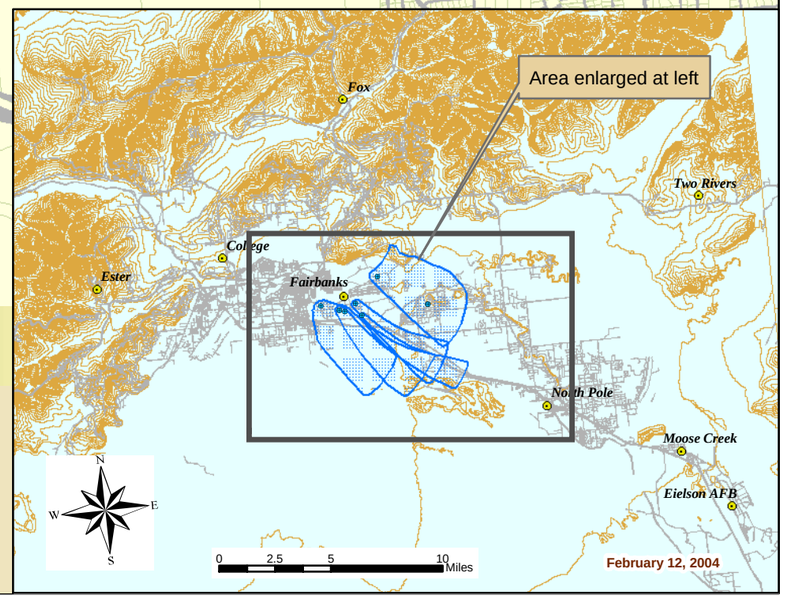
1:56,400

Data Sources:

Parcel, roads - Fairbanks North Star Borough
Water bodies, railroad - Geographic Data Technology
Elevation contours - USGS digital elevation models (DEMs)

Legend

- 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*
- Surface water
- Roads
- Parcels



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Fort Wainwright Water Treatment Plant wells (Tables 1-7)

Table 1

Contaminant Source Inventory for ***Ft Wainwright / Wtr Trtmt Plt***

PWSID 310918.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Highways and roads, paved (cement or asphalt)	X20		A	2	3 Roads in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	B	2	Neely Road & 10th Street; FTWW (2P) Bldg. 3562 PX Gas Station; File Number 108.26.025
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	B	2	near Power Plant; FTWW (OU-4)Pplant Fly Ash Pond; File Number 108.38.070
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	B	2	Neely Road & 11th Street; FTWW (2P) Bldg. 3570 Former PX Gas Station: File Number 108.38.078
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	B	2	South of Bldg 352 NW; FTWW (2P) Bldg 3595 Pplant UST; File Number 108.26.021
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-05	B	2	Off Luzon Avenue: FTWW (2P) Bldg 3485 UST 321: File Number 108.26.020
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-06	B	2	West of Luzon; FTWW (2P) Bldg 3481 (RFA S-11); File Number 108.26.017
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-07	B	2	Motor Pool; FTWW (2P) Bldg 3483/3485; File Number 108.38.041
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-08	B	2	E of Luzon Ave N of 3485; FTWW (2P) Bldg 3483; File Number 108.26.005
Highways and roads, paved (cement or asphalt)	X20		B	2	2 roads in Zone B
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-09	C	2	Adjacent to Artillery Range; FTWW (2P) Bldg 5110, Site 7; File Number 108.38.037
Highways and roads, paved (cement or asphalt)	X20		C	3	1 road in Zone C
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-10	D	2	1792 Tootie Street; FDIC Tootie Stree-North Pole; RecKey 1990310124801

Table 2

Contaminant Source Inventory and Risk Ranking for Ft Wainwright / Wtr Trtmt Plt Sources of Bacteria and Viruses

PWSID 310918.001

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	3 Roads in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B

Table 3

Contaminant Source Inventory and Risk Ranking for Ft Wainwright / Wtr Trtmt Plt Sources of Nitrates/Nitrites

PWSID 310918.001

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	3 Roads in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Highways and roads, paved (cement or asphalt)	X20		C	Low	3	1 road in Zone C

Table 4

Contaminant Source Inventory and Risk Ranking for Ft Wainwright / Wtr Trtmt Plt Sources of Volatile Organic Chemicals

PWSID 310918.001

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	3 Roads in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Highways and roads, paved (cement or asphalt)	X20		C	Low	3	1 road in Zone C

Table 5

Contaminant Source Inventory and Risk Ranking for Ft Wainwright / Wtr Trtmt Plt Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 310918.001

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	3 Roads in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Highways and roads, paved (cement or asphalt)	X20		C	Low	3	1 road in Zone C

Table 6

Contaminant Source Inventory and Risk Ranking for Ft Wainwright / Wtr Trtmt Plt Sources of Other Organic Chemicals

PWSID 310918.001

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	3 Roads in Zone A
Highways and roads, paved (cement or asphalt)	X20		B	Low	2	2 roads in Zone B
Highways and roads, paved (cement or asphalt)	X20		C	Low	3	1 road in Zone C

APPENDIX C

Fort Wainwright Water Treatment Plant wells Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map 2)

Well 3563
Well 3565
Well 3559 A
Well 3559 B
Effluent
Zone A
U04-4
U04-1
U04-2
U04-3
U04-5
U04-6
U04-7
U04-8
Zone B
U04-9
Zone C
U04-10
NEELY ROAD
OAK AVENUE
SANTIAGO AVENUE
LARRAINE AVENUE
LUZON AVENUE
OLD BADGER ROAD
MERIDIAN ROAD
SOUTH GAFFNEY ROAD
ALDER ROAD
ALE DE FRANCE AVENUE
MIHIEL AVENUE
CHIPPEWA AVENUE
NEW RICHARDSON HIGHWAY
Area enlarged to the left

Map 2: Potential Contaminant Sources

PWSID: 310918.001 310918.2 310918.3 310918.4 310918.5

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1,000 2,000 4,000 Feet

1 inch equals 2,000 feet

NOTE: Locations of DEC-contaminanted sites are approximate
Data Sources:
Parcel, roads - Fairbanks North Star Borough
Water bodies - US Tiger2000 Census Data
Elevation contours - USGS digital elevation models (DEMs)

Legend

- 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*
- U04, DEC-recognized contaminated sites
- Roads
- Parcels
- Surface water

N W E S

0 2.5 5 Miles

February 12, 2004

APPENDIX D

Vulnerability Analysis for Fort Wainwright Water Treatment Plant wells
Public Drinking Water Source
(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Ft WW Wells 3563, 3565, 3559 A & B

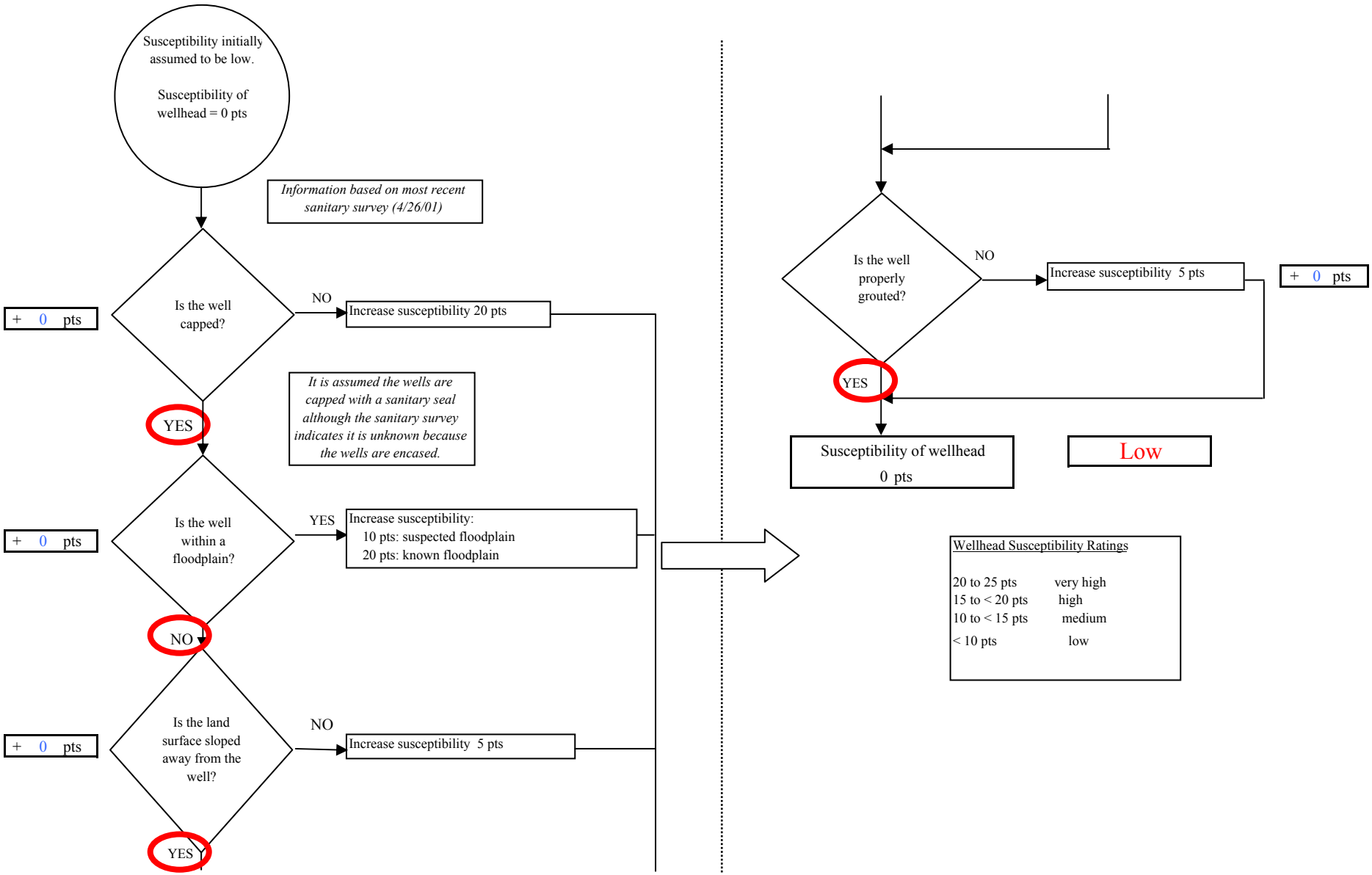


Chart 2. Susceptibility of the aquifer - Ft WW Wells 3563, 3565, 3559 A & B

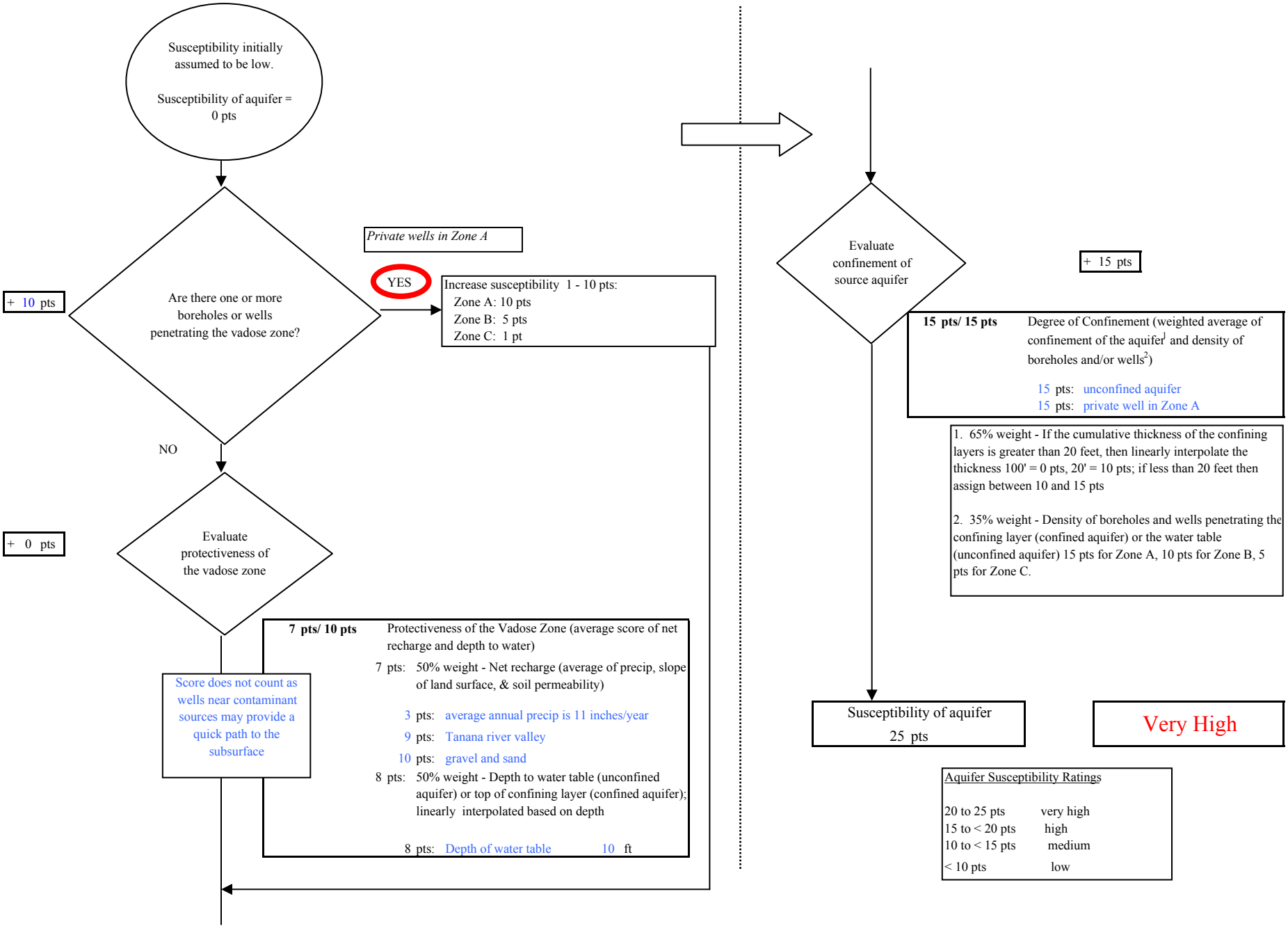
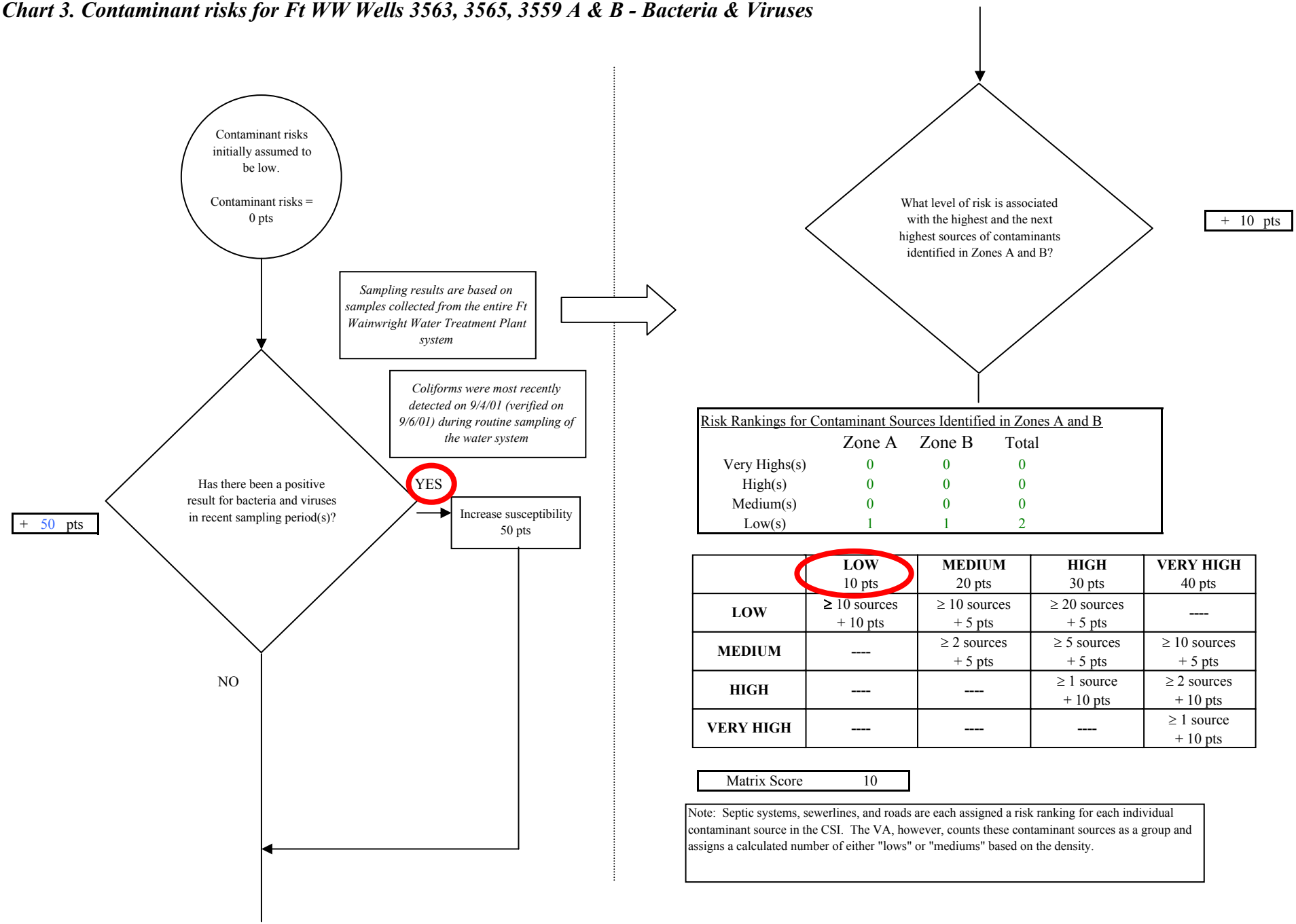


Chart 3. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Bacteria & Viruses



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	1	2

	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 Ft WW Wells 3563, 3565, 3559 A & B - Bacteria & Viruses

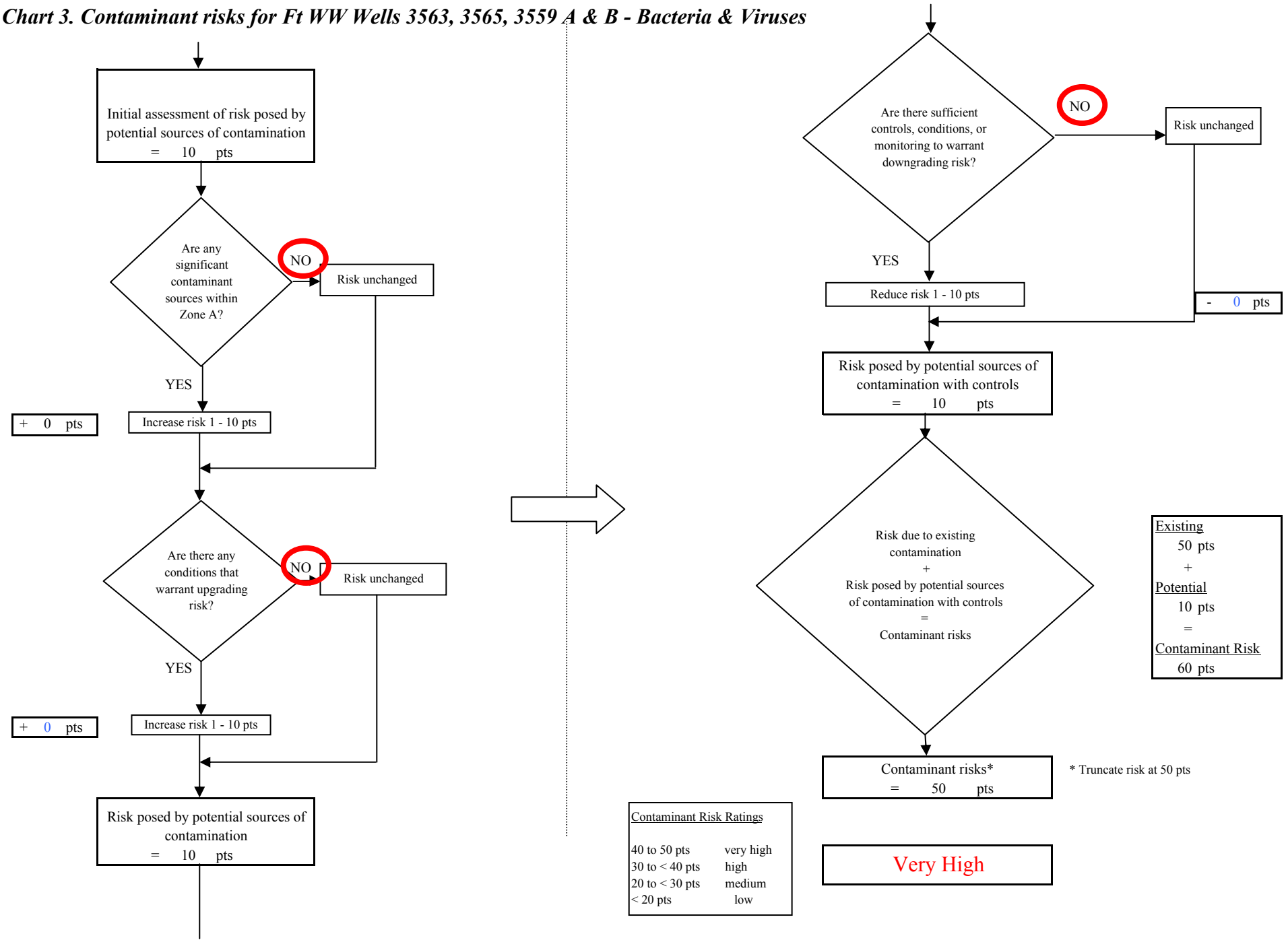


Chart 4. Vulnerability analysis for Ft WW Wells 3563, 3565, 3559 A & B - Bacteria & Viruses

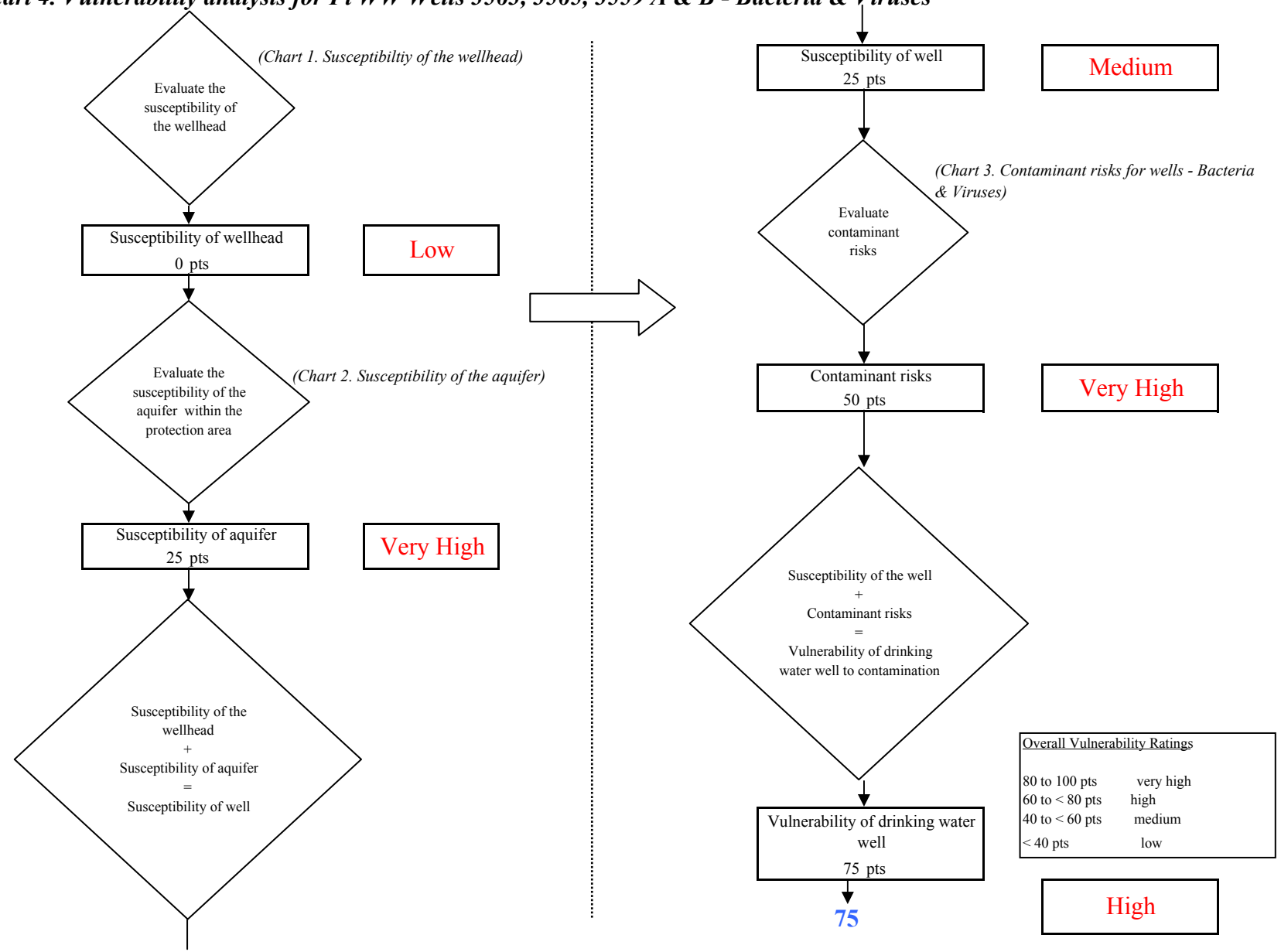


Chart 5. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Nitrates and Nitrites

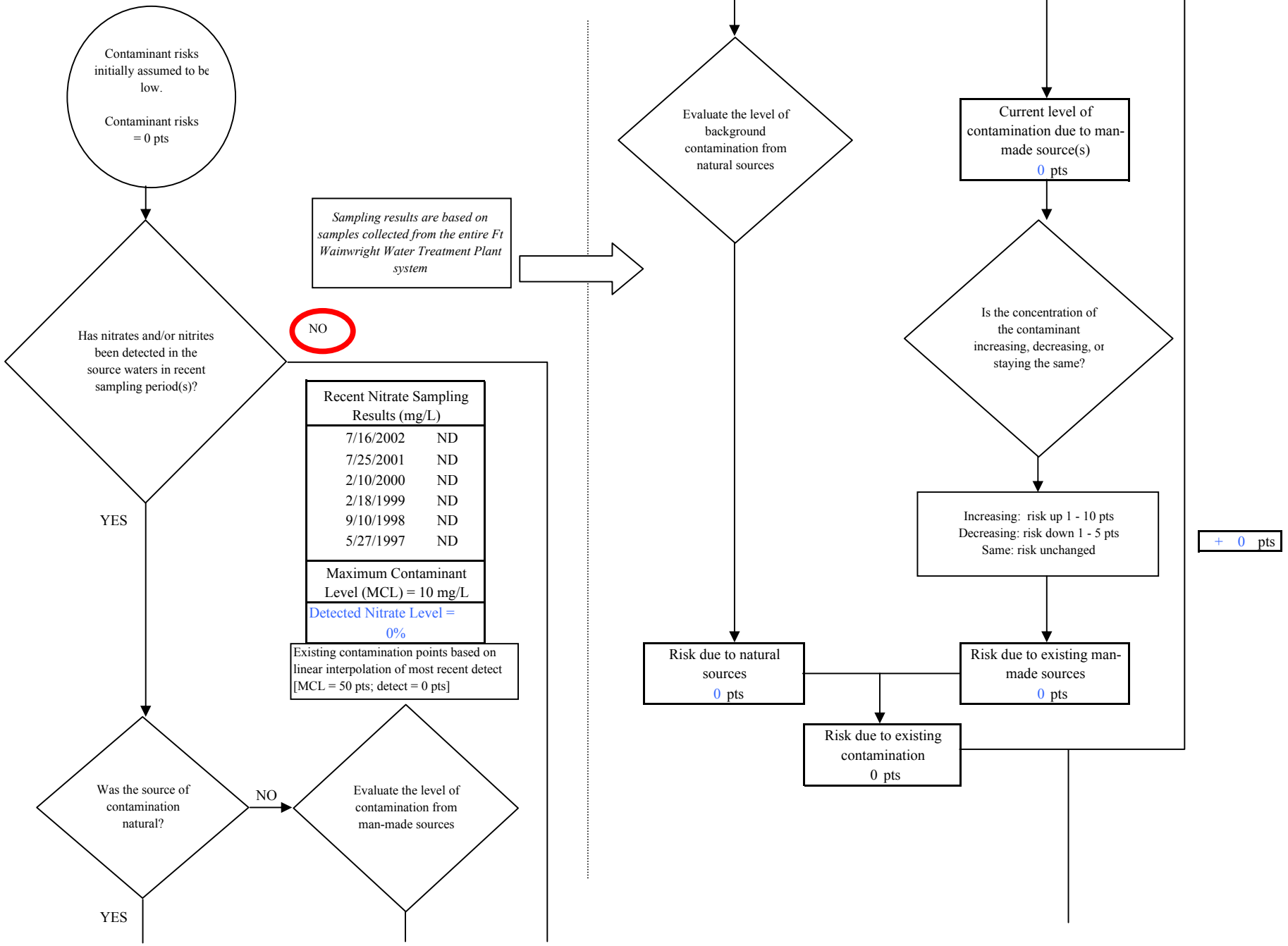


Chart 5. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Nitrates and Nitrites

+ 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?

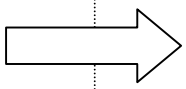
Risk Levels for Contaminant Sources identified in Zones A, B and C

	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	1	2

	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.



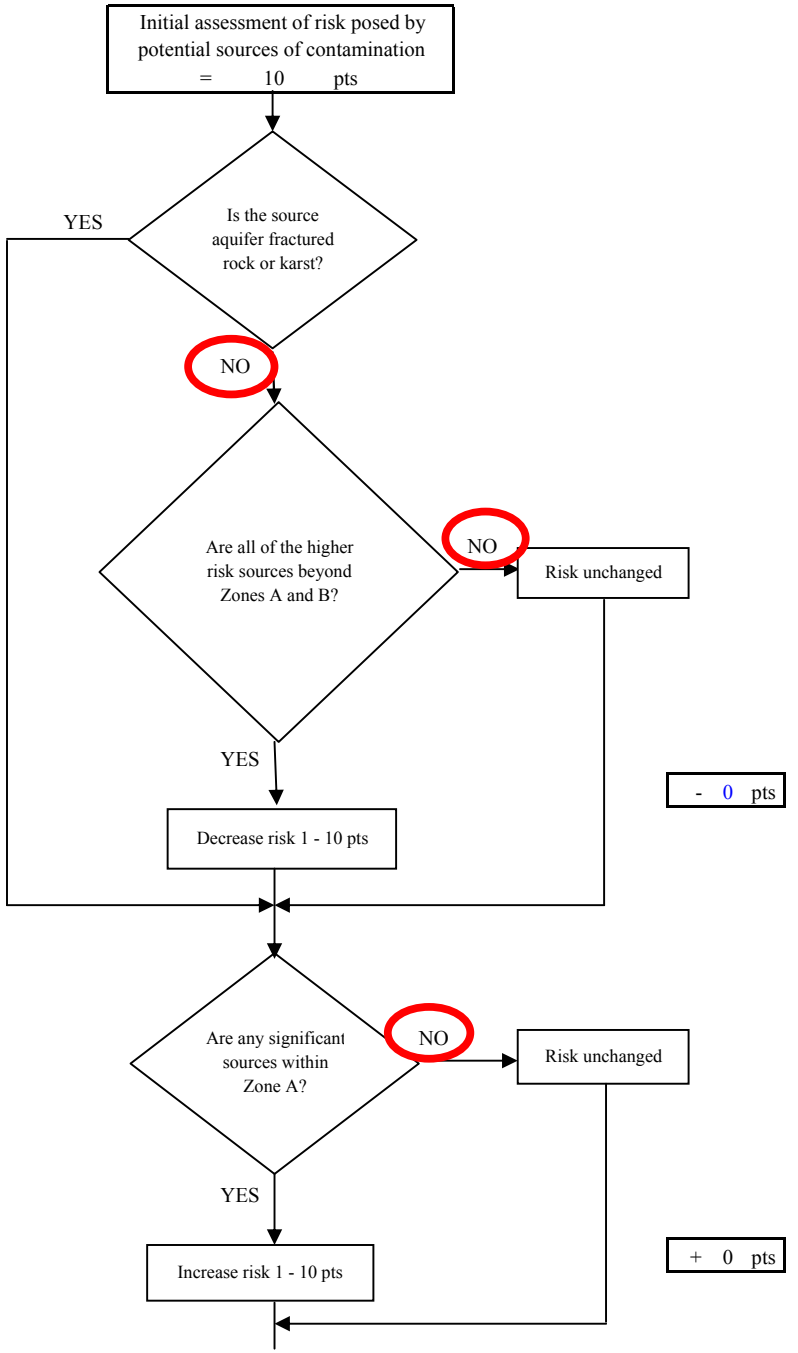


Chart 5. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Nitrates and Nitrites

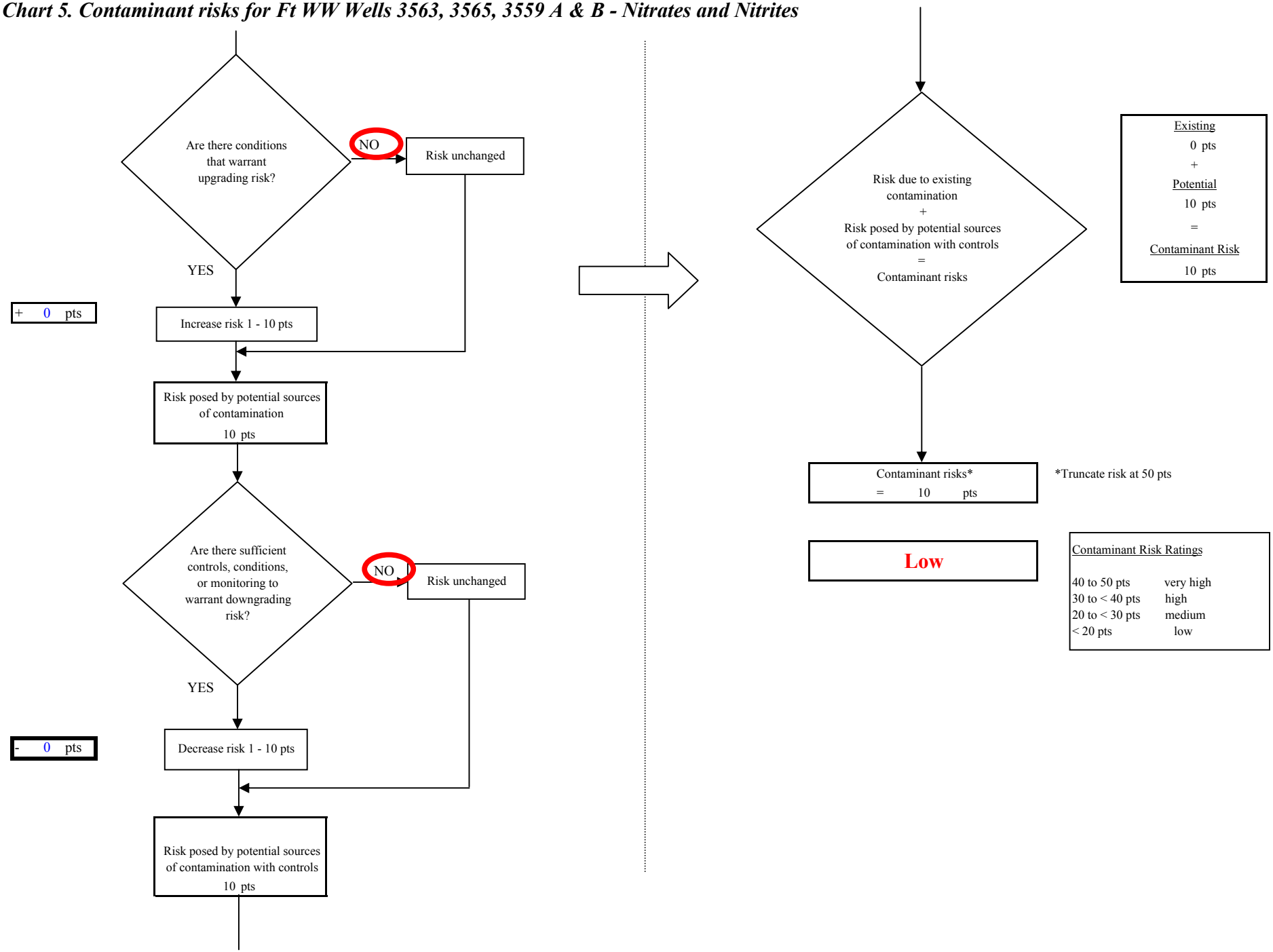


Chart 6. Vulnerability analysis for Ft WW Wells 3563, 3565, 3559 A & B - Nitrates and Nitrites

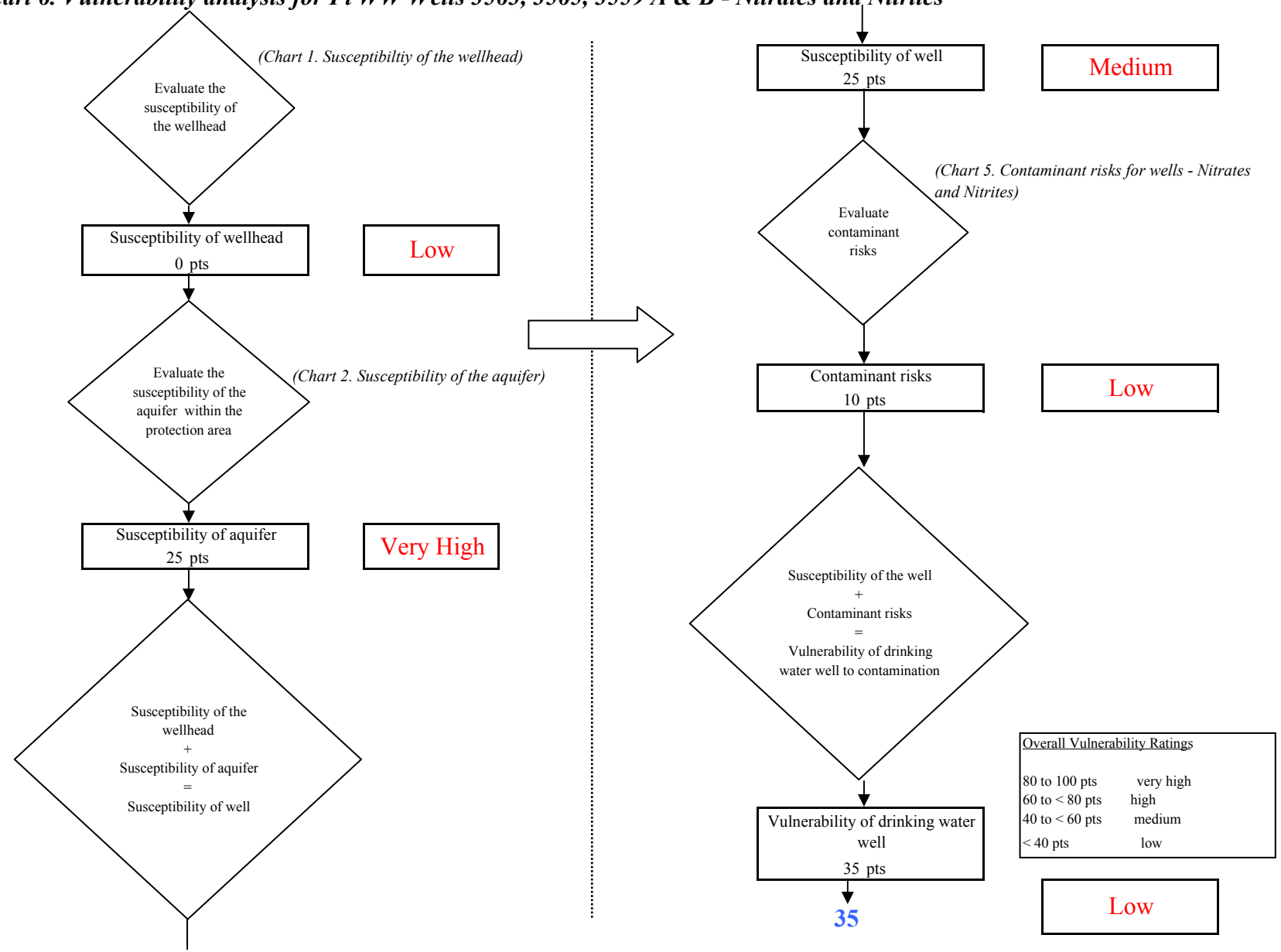


Chart 7. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Volatile Organic Chemicals

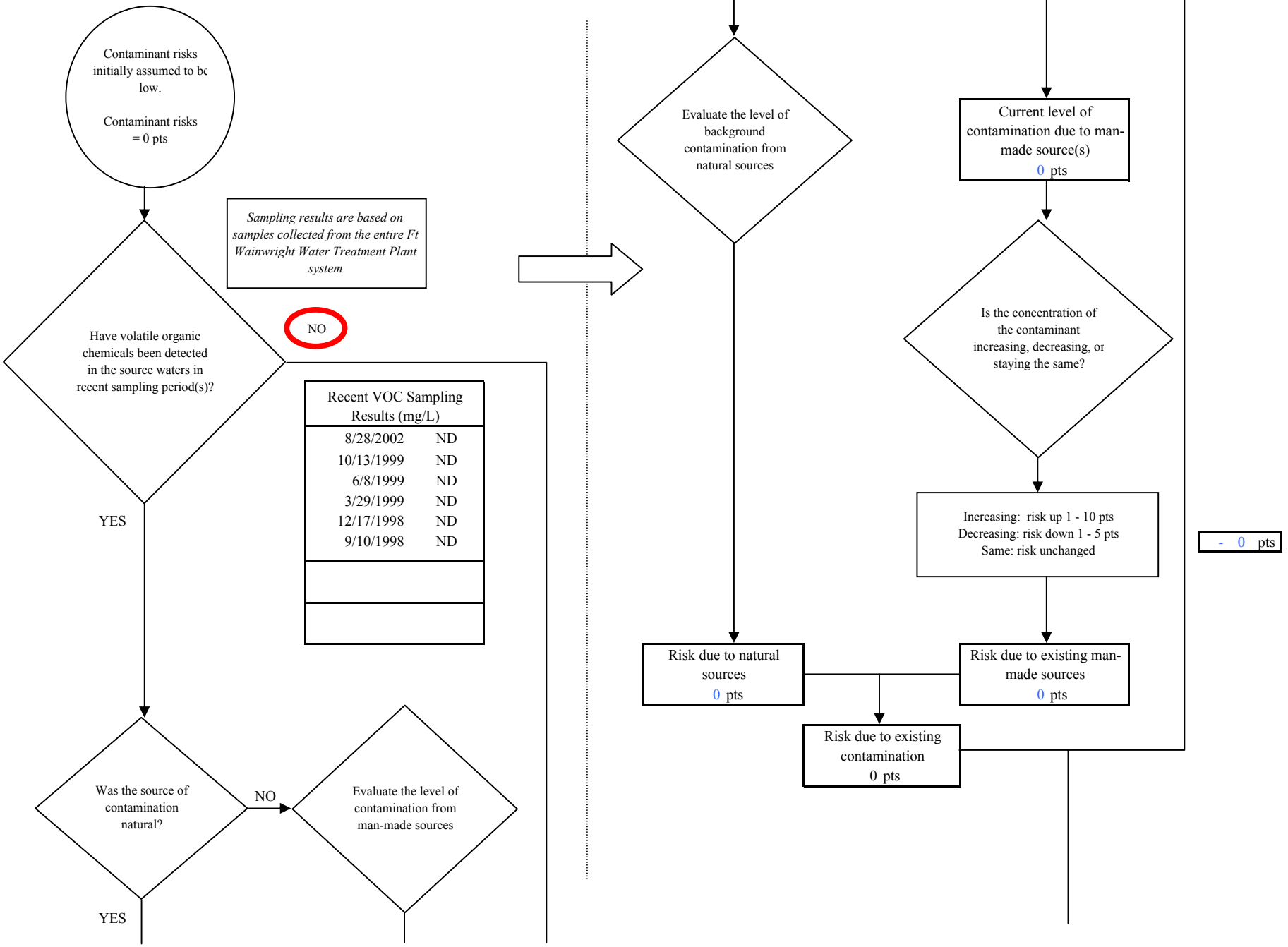
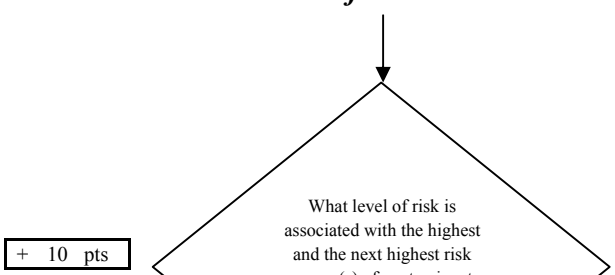


Chart 7. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Volatile Organic Chemicals



+ 10 pts

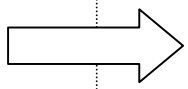
Risk Levels for Contaminant Sources identified in Zones A, B and C

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

	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.



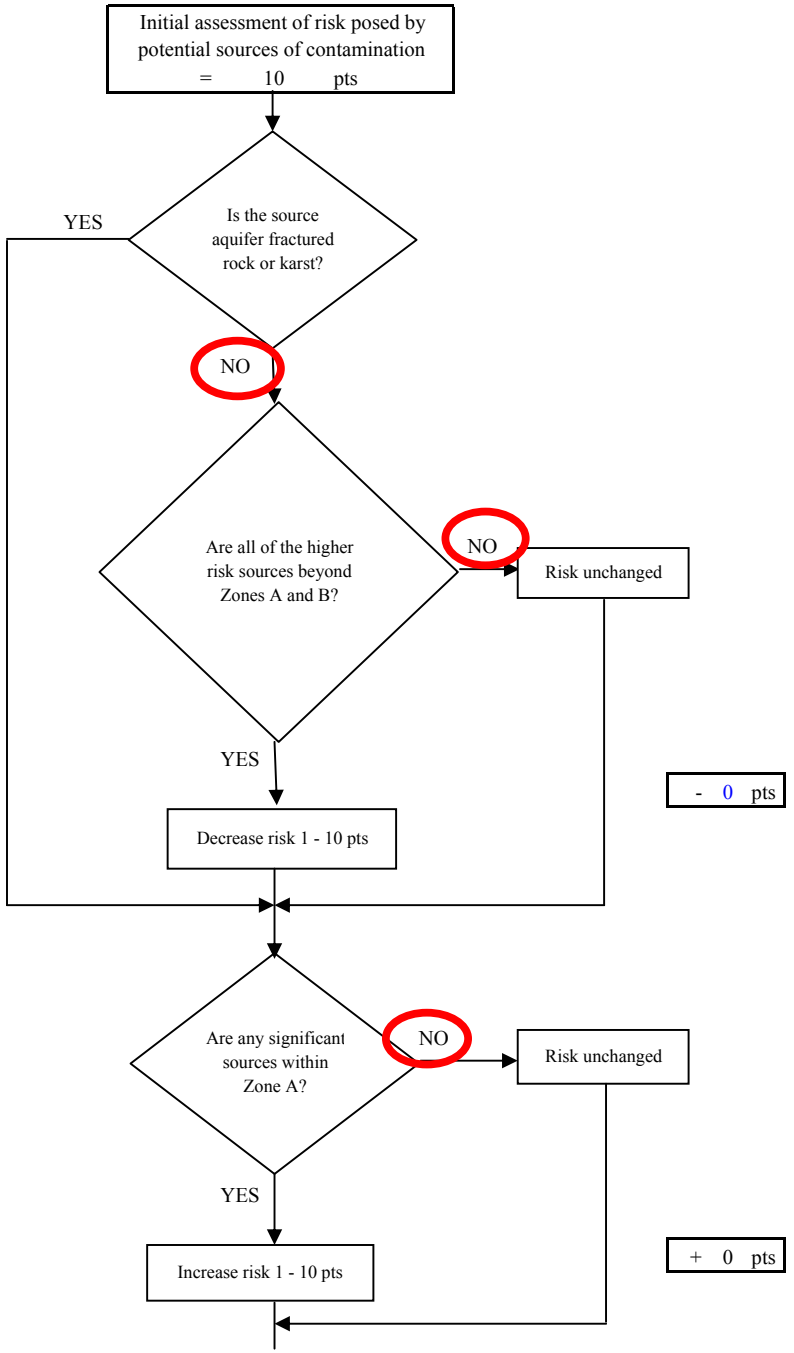


Chart 7. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Volatile Organic Chemicals

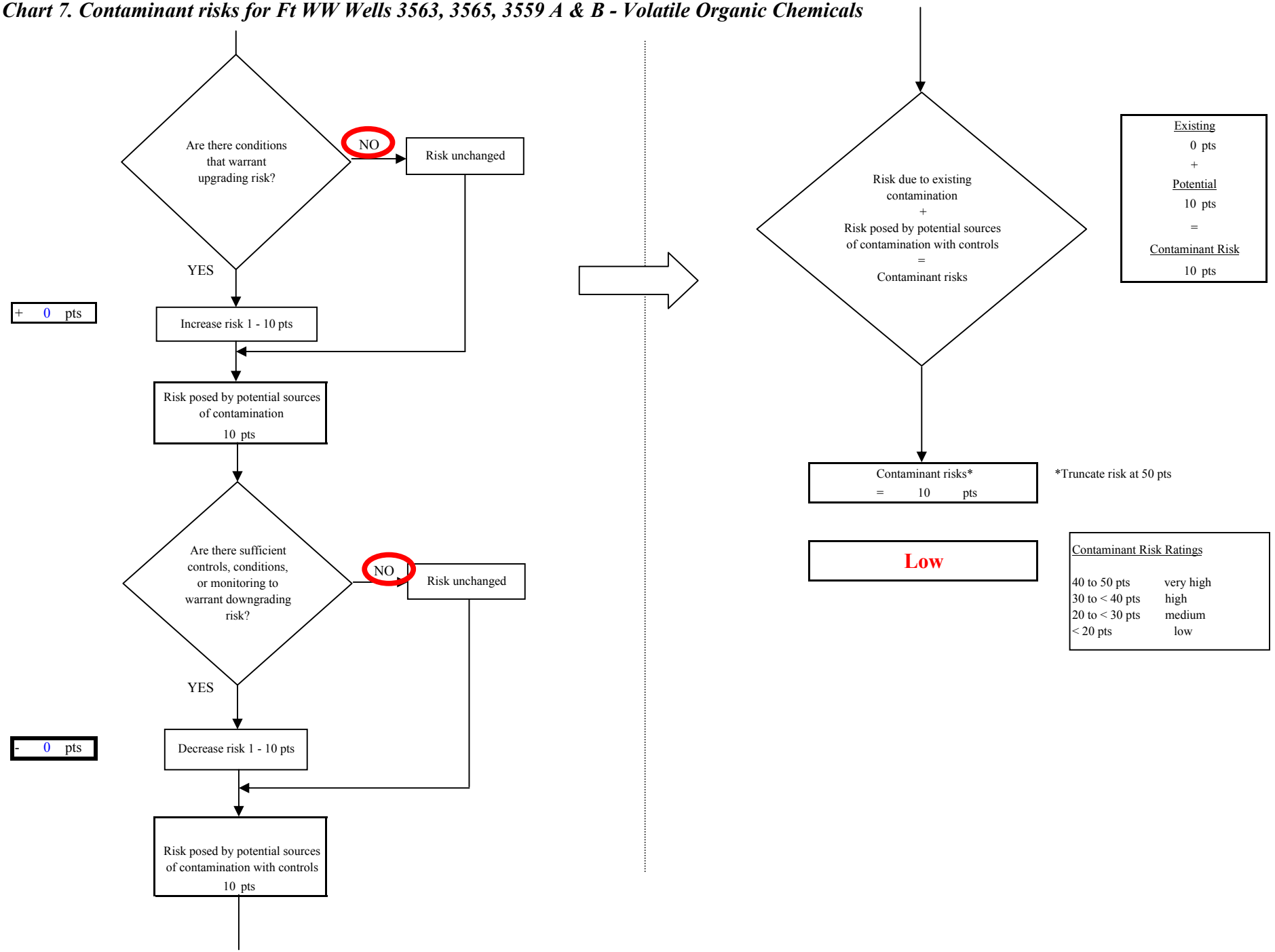


Chart 8. Vulnerability analysis for Ft WW Wells 3563, 3565, 3559 A & B - Volatile Organic Chemicals

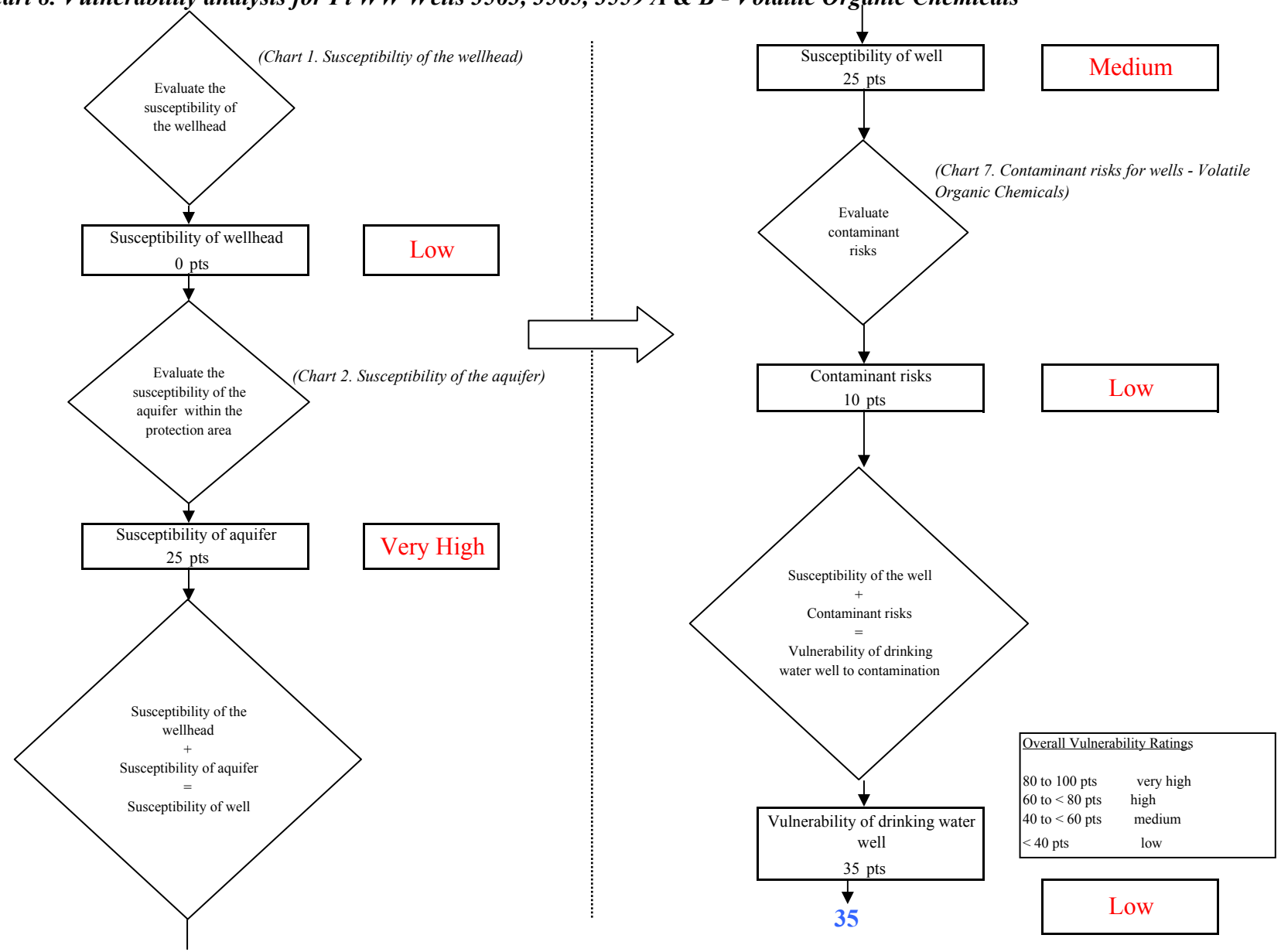


Chart 9. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Heavy Metals, Cyanide and Other Inorganic Chemicals

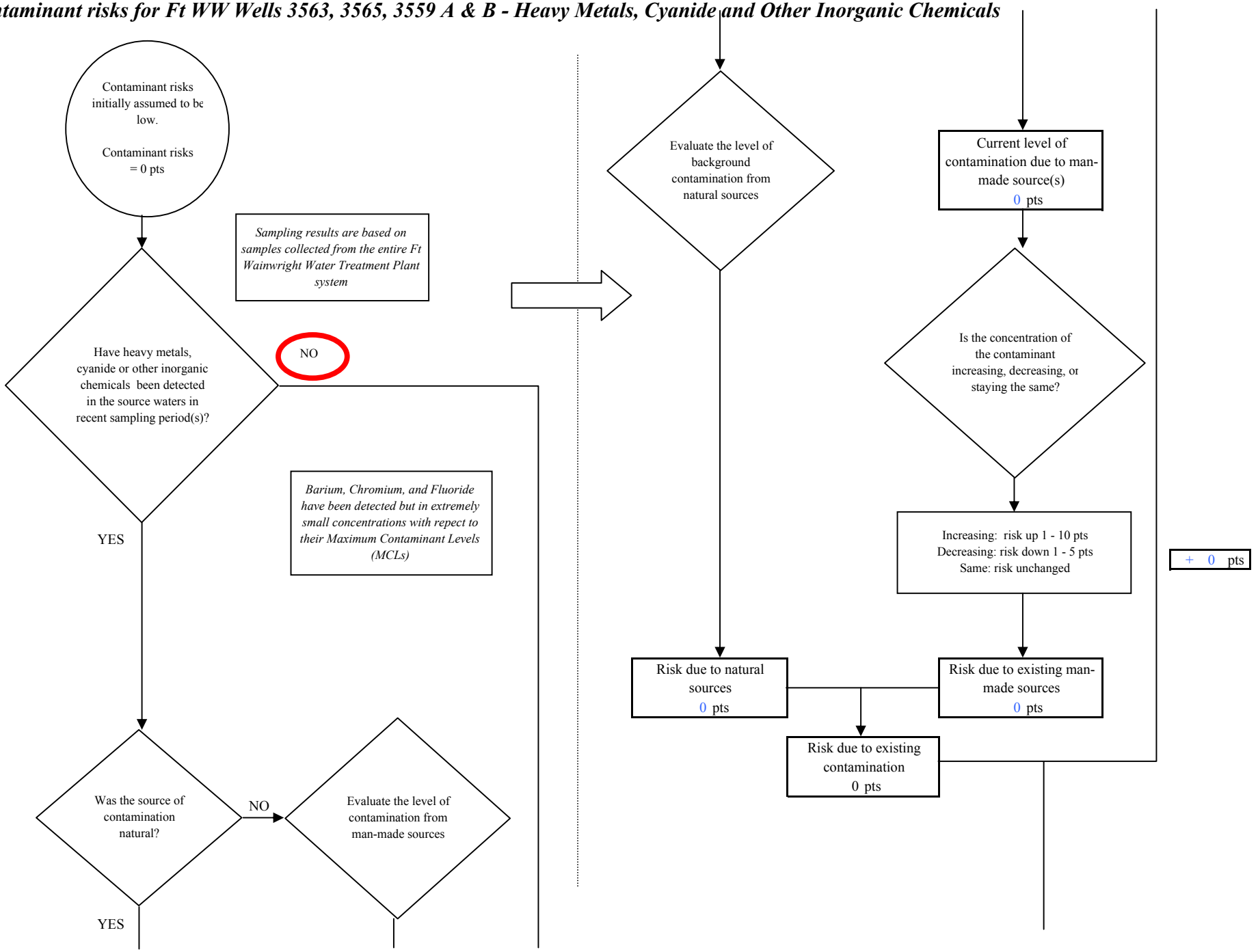
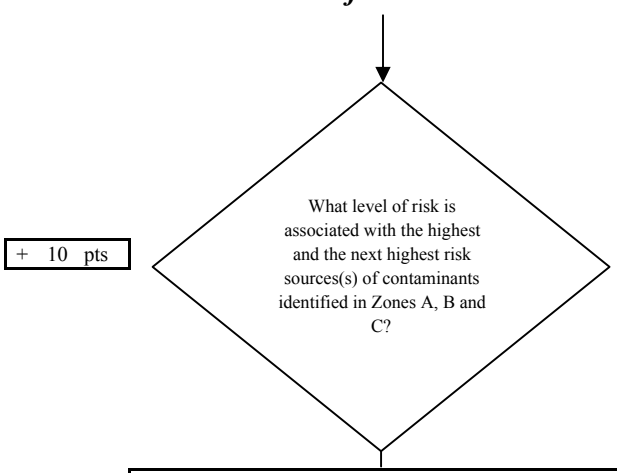


Chart 9. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Heavy Metals, Cyanide and Other Inorganic Chemicals



+ 10 pts

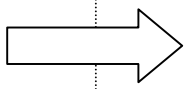
Risk Levels for Contaminant Sources identified in Zones A, B and C

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

	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.



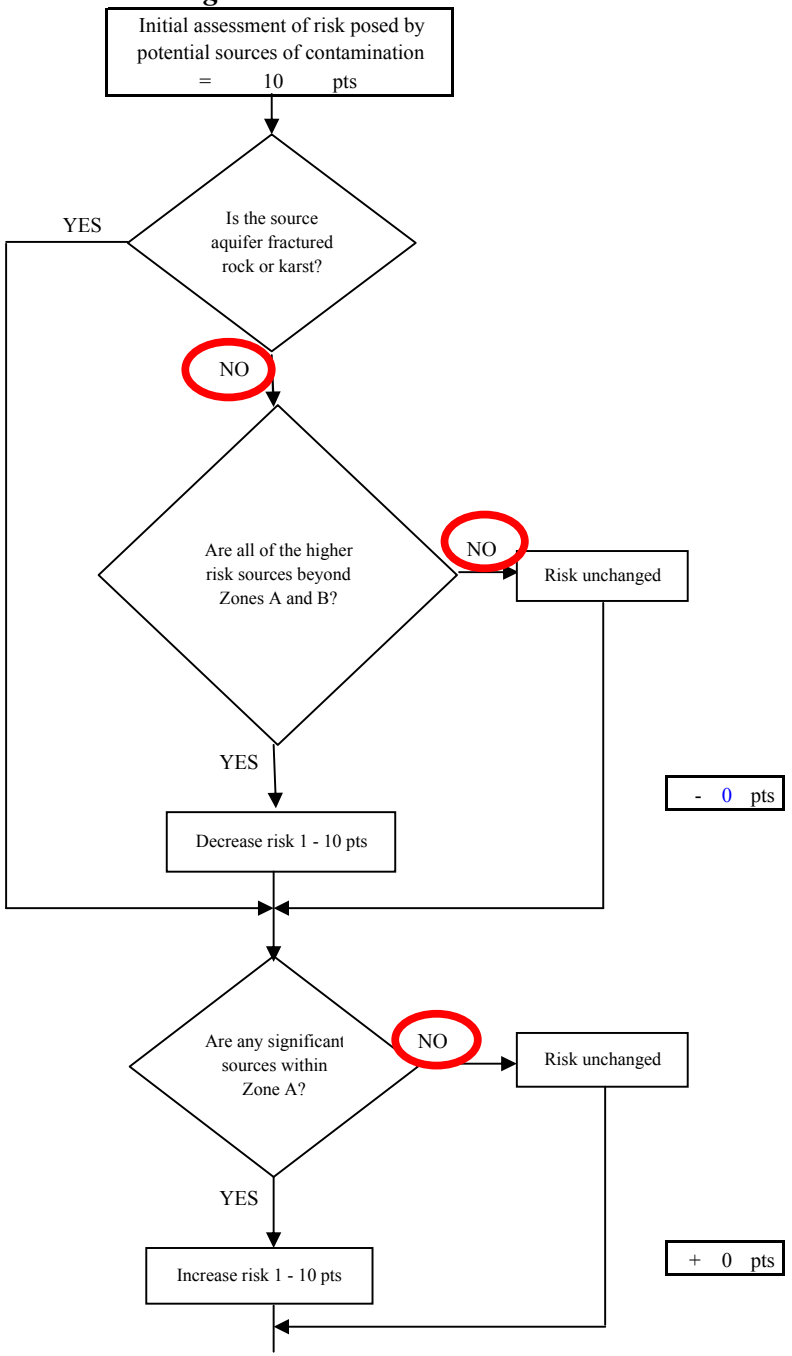


Chart 9. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Heavy Metals, Cyanide and Other Inorganic Chemicals

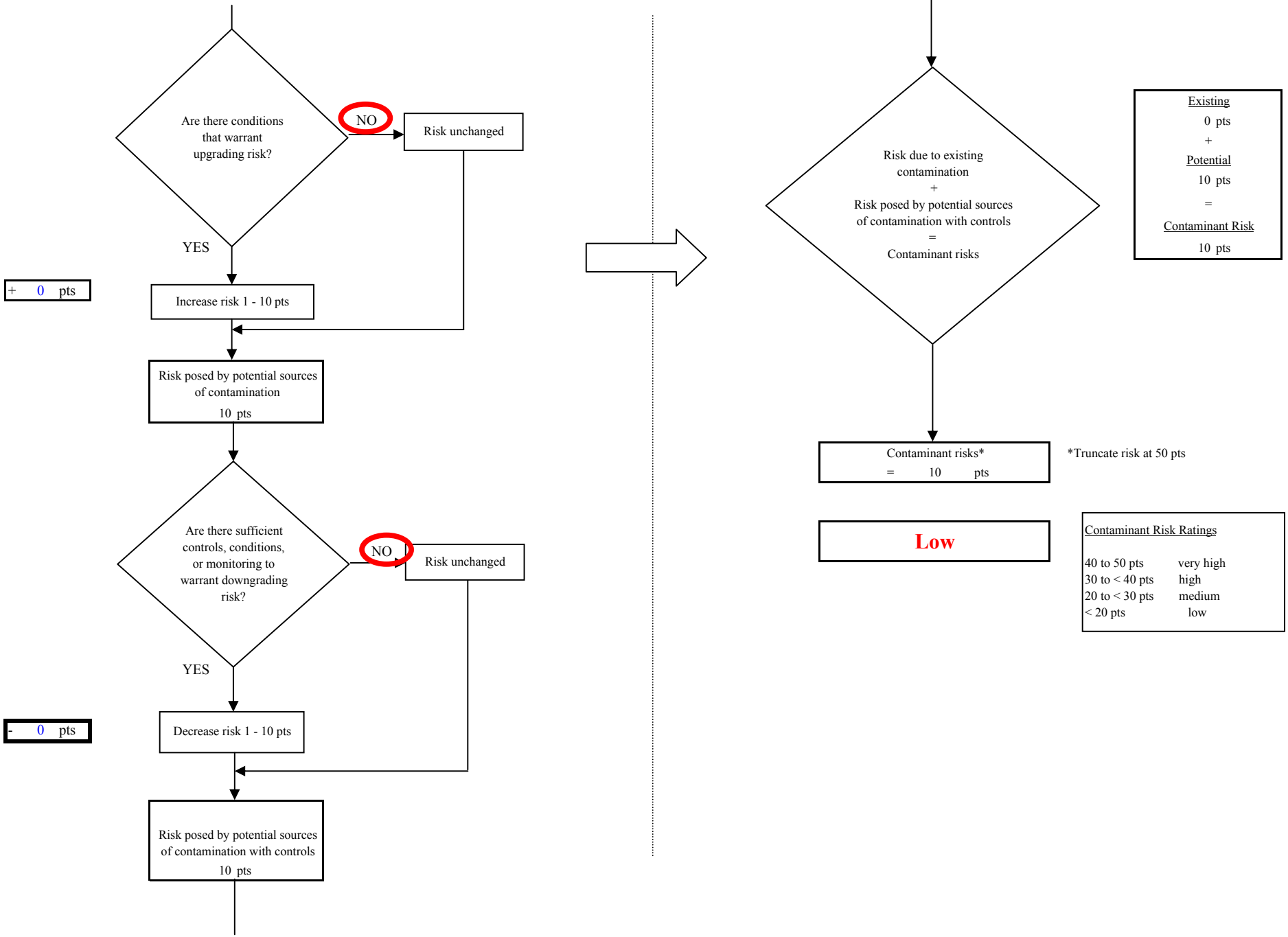


Chart 10. Vulnerability analysis for Ft WW Wells 3563, 3565, 3559 A & B - Heavy Metals, Cyanide and Other Inorganic Chemicals

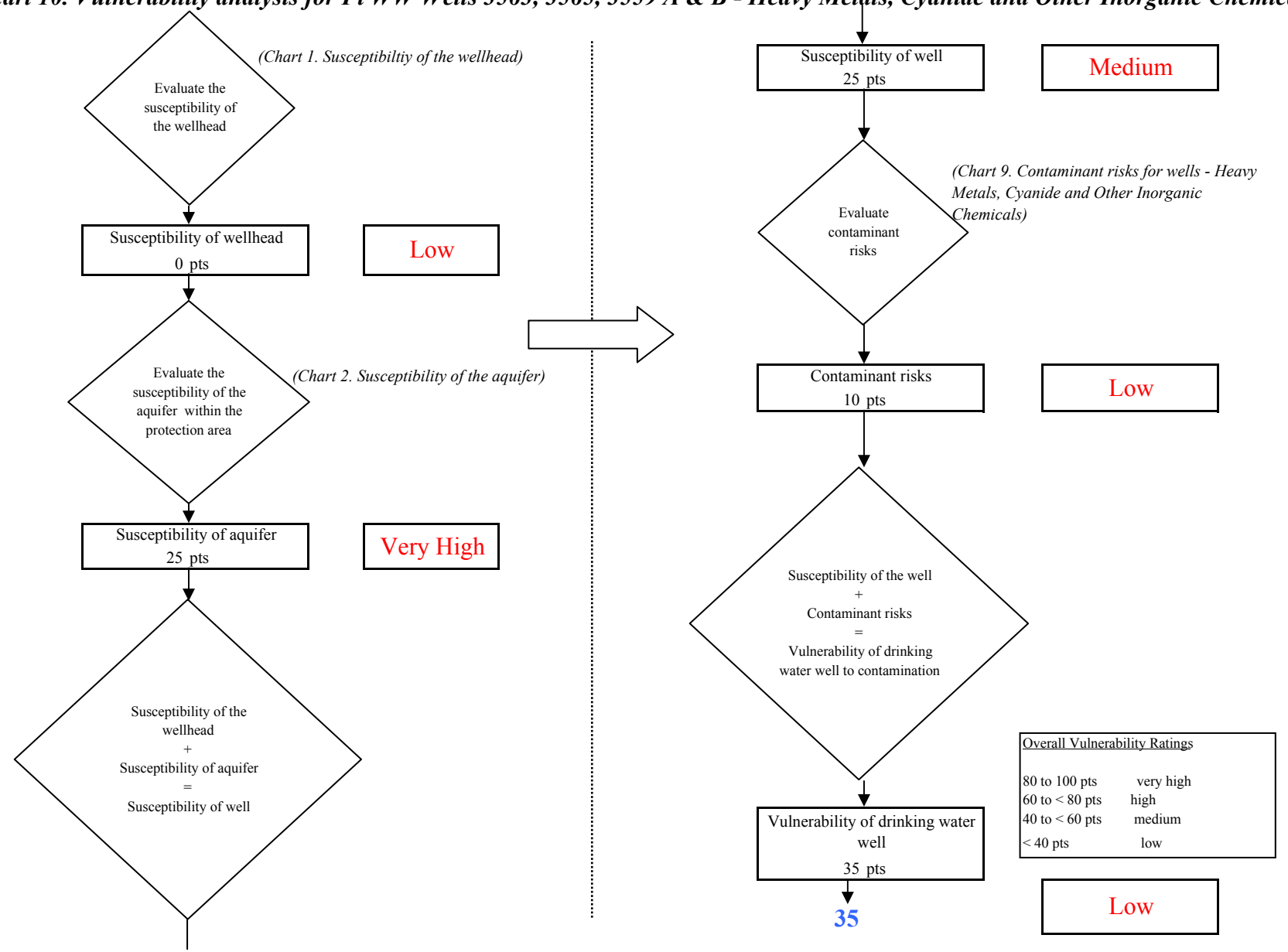


Chart 11. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Synthetic Organic Chemicals

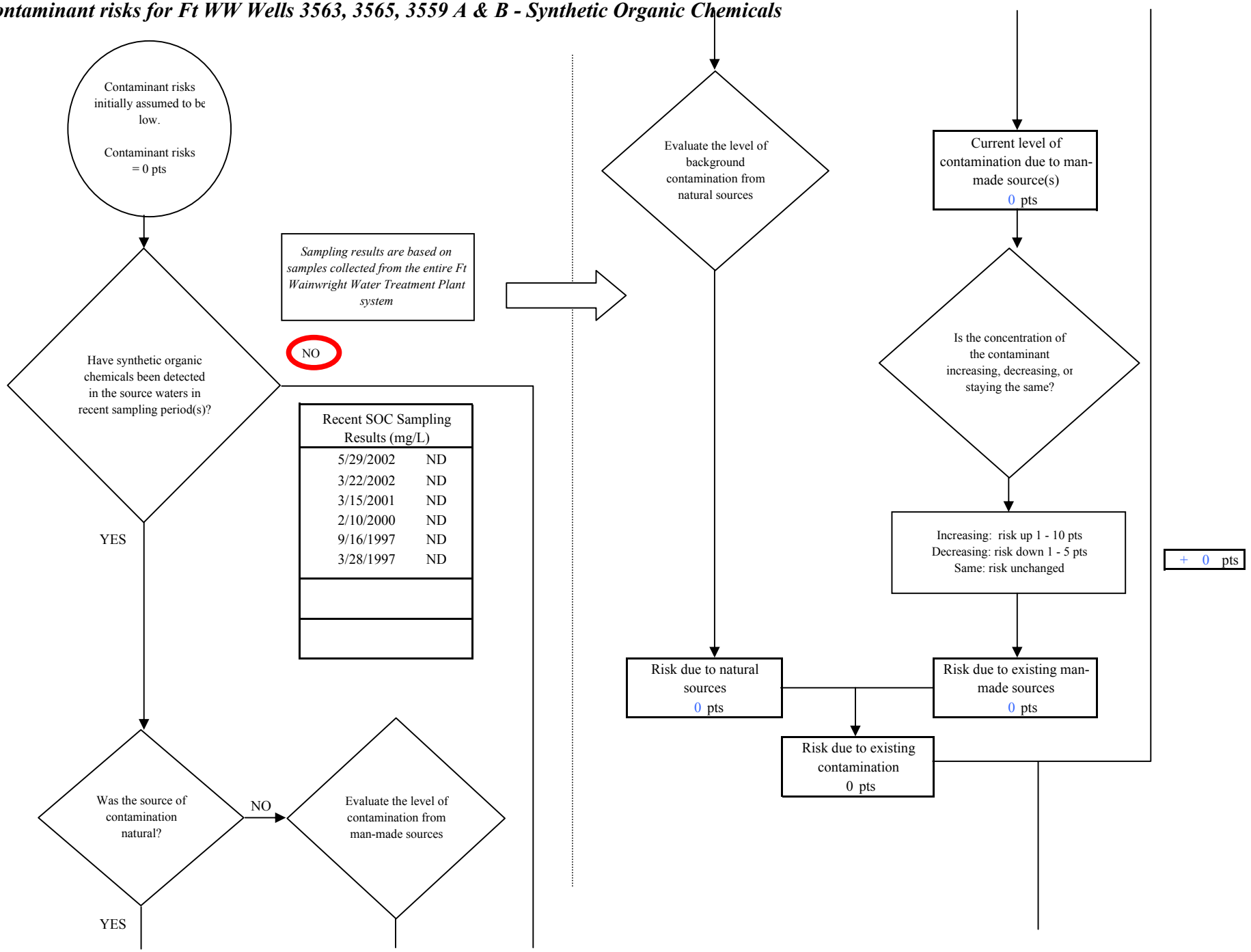
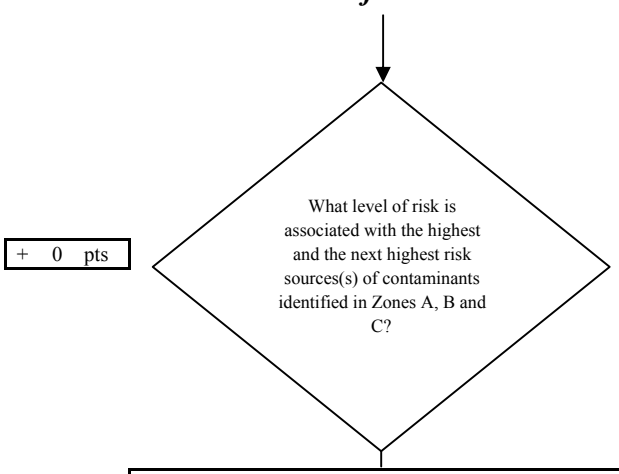


Chart 11. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Synthetic Organic Chemicals



+ 0 pts

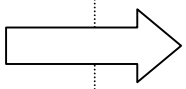
Risk Levels for Contaminant Sources identified in Zones A, B and C

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

	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 0

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.



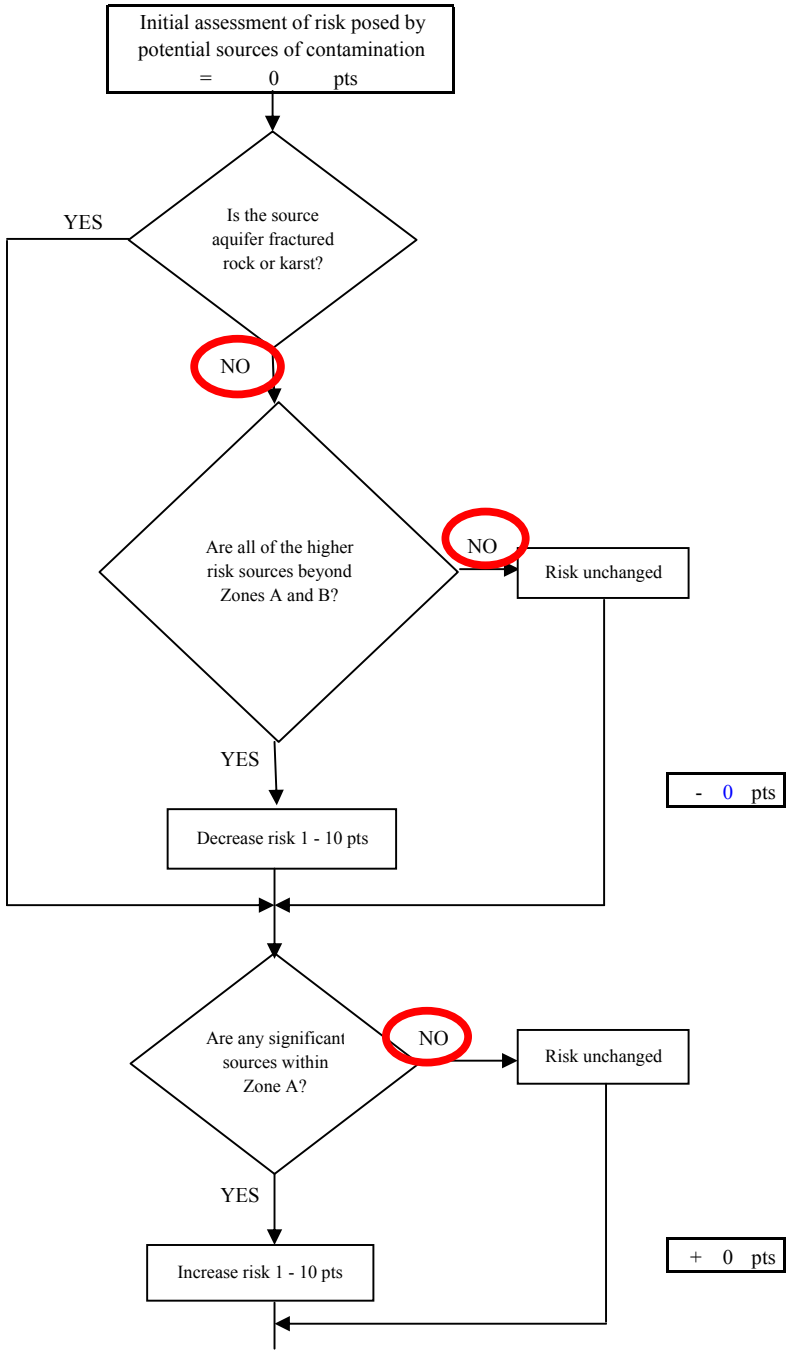


Chart 11. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Synthetic Organic Chemicals

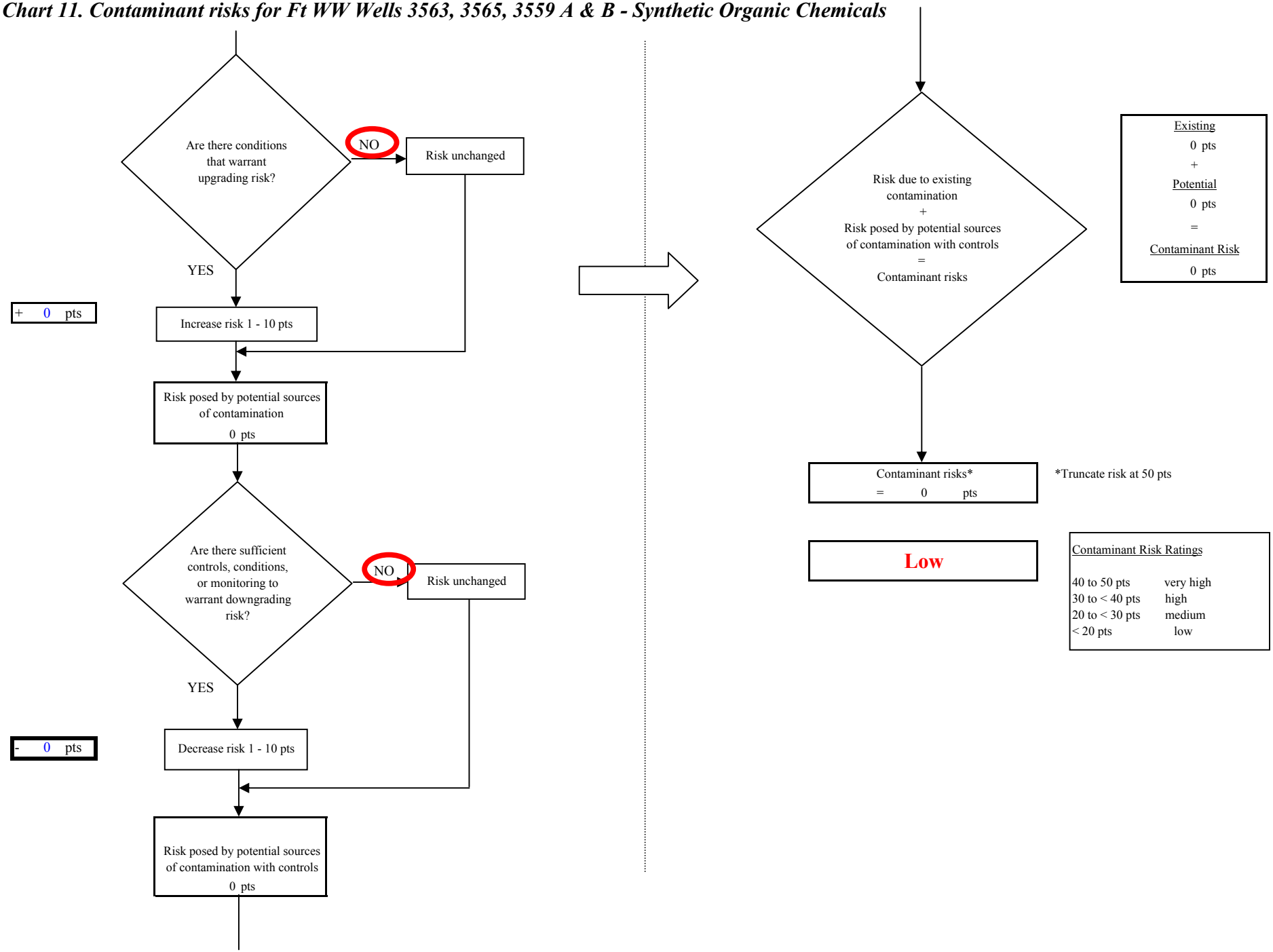


Chart 12. Vulnerability analysis for Ft WW Wells 3563, 3565, 3559 A & B - Synthetic Organic Chemicals

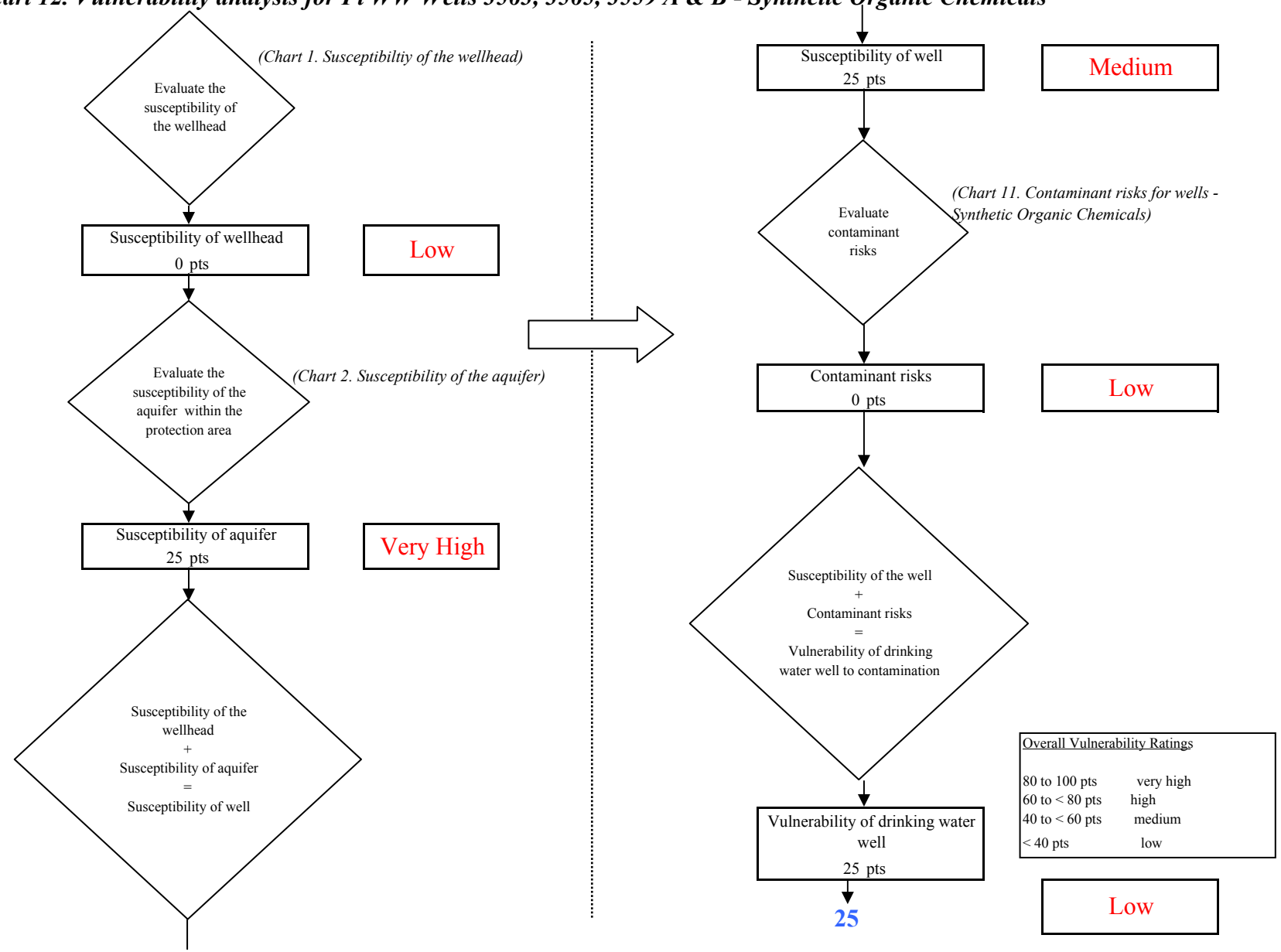


Chart 13. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Other Organic Chemicals

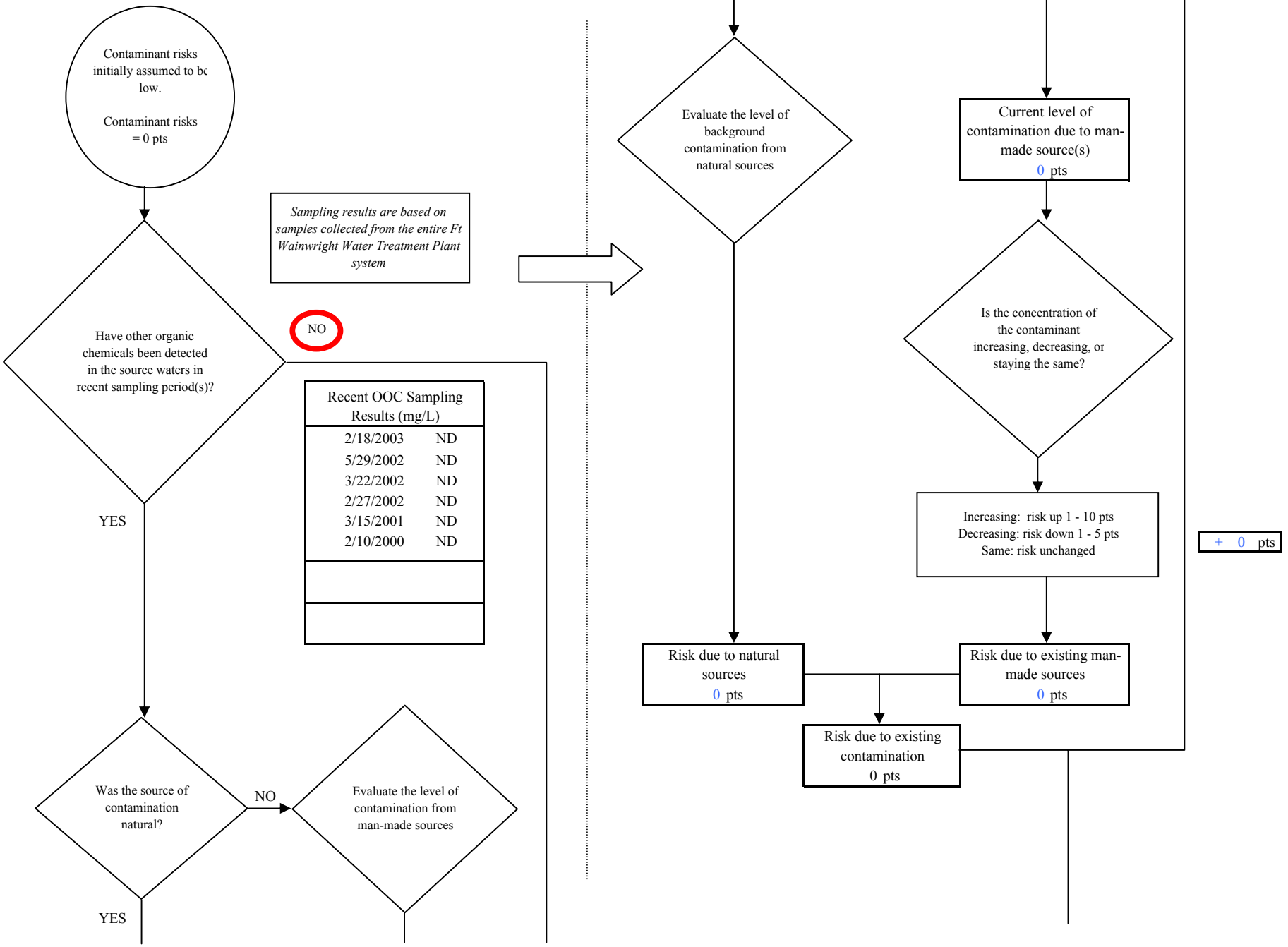


Chart 13. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Other Organic Chemicals

+ 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	1	2

	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 13. Contaminant risks for Ft WW Wells 3563, 3565, 3559 A & B - Other Organic Chemicals

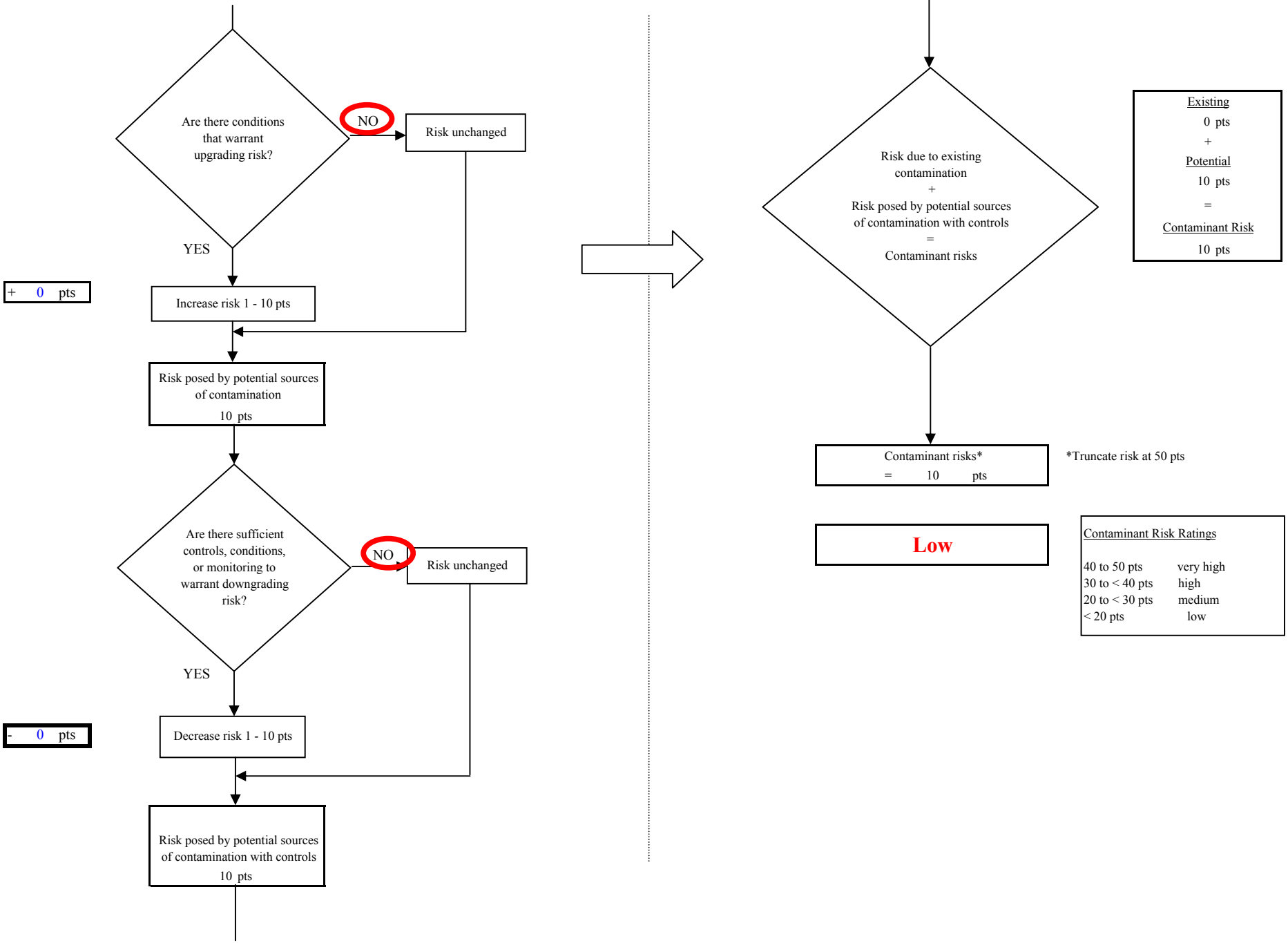


Chart 14. Vulnerability analysis for Ft WW Wells 3563, 3565, 3559 A & B - Other Organic Chemicals