Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the Covenant Life Center Covenant Life, Alaska PWSID 110821

June 2004

DRINKING WATER PROTECTION PROGRAM

Report #: 1560

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 the Covenant Life Center
Covenant Life, 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 the public water system serving Covenant Life Center. This Class A (community) water system consists of one well at Mile 26 of the Haines Highway in Covenant Life, Alaska. The well received a natural susceptibility rating of **Low**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **Low** rating for the aquifer from which the well is drawing water. Identified potential and current sources of contamination for the Covenant Life Center public water system include: residential areas, fuel storage tanks, roads, and cropland. These are considered as a source 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 Covenant Life Center received an overall vulnerability rating of **Medium** for synthetic organic chemicals, and **Low** for bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, and other organic chemicals.

COVENANT LIFE CENTER PUBLIC DRINKING WATER SYSTEM

The Covenant Life Center public water system is a Class A (community) water system. The system consists of one well located at Mile 26 of the Haines Highway in Covenant Life, Alaska (Copper River Meridian, T29S, R55E, Section 4) (See Map 1 of Appendix A). Covenant Life is a small community located at Mile 26 of the Haines Highway near the Klehini River.

The Covenant Life Center public water system provides water for the residents of Covenant Life. Residents use a central septic tank or have their own individual tanks (ADCED, 2002. Electricity is provided by Tlingit-Haida Regional Electrical Authority (ADCED, 2002). Most residents use wood to heat their homes and buildings; others use heating oil (typically stored in both above and below ground 275 to 500-gallon tanks) or bottled gas (ADCED, 2002). Refuse is hauled to the landfill in Haines.

The Covenant Life Center public water system lies between the Klehini and the Chilkat Rivers at an elevation of approximately 400 feet above sea level.

The depth of the well is about 150 feet below the ground surface. The well is not screened but the open end of the well is drawing water from a layer of sand and gravel. This layer of sand and gravel is located beneath a layer of clay with some rocks according to the well log. The static water level is 30 feet below land surface. This level could be influenced by the pressure of the clay layer above the aquifer.

The Covenant Life Center public drinking water system serves approximately 65 residents and 7 non-residents through 20 service connections.

COVENANT LIFE 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 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 area and were obtained from area well logs in the area and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

Only limited information is available for the aquifer Covenant Life Center's public water system well draws its water from. The orientation of the capture zone was drawn based on the assumption that groundwater flow direction is generally the same direction as the topography.

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 Covenant Life 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 Covenant Life 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 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 COVENANT LIFE 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 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 wellhead for the Covenant Life Center received a Low Susceptibility rating. The 9/6/02 Sanitary Survey indicates the well is capped with a sanitary seal and the land surface is sloped away from the well; however the well is not grouted. A sanitary seal prevents potential contaminants from entering the well from the inside while grouting helps to prevent potential contaminants from traveling down the outside of the well casing.

The aquifer the Covenant Life Center well is completed in also received a Low Susceptibility rating. The low permeability clay layer above the aquifer inhibits surface contaminants from traveling down through it. Also the lack of other wells in the area contributes to the low score. Surface contaminants can travel quickly down the outside of well casings that are not grouted correctly. Table 2 summarizes the Susceptibility scores and ratings for Covenant Life Center.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	2	Low
Natural Susceptibility	7	Low

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	30	High
Volatile Organic Chemicals	30	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	20	Medium
Synthetic Organic Chemicals	47	High
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	15	Low
Nitrates and/or Nitrites	35	Low
Volatile Organic Chemicals	35	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	25	Low
Synthetic Organic Chemicals	55	Medium
Other Organic Chemicals	15	Low

Bacteria and Viruses

The residential area and the roads are the identified risks 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 not detected coliforms 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 cropland in Zone B represents the greatest risk of nitrates and nitrites to this water system.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have been not in recent sampling history for the Covenant Life 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 residential fuel oil tanks represent the greatest risk of volatile organic chemical contamination to the well. Both underground and above ground heating oil storage tanks are a common way of heating homes and businesses in this area. 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.

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 cropland, residential areas and roads represent the risk of heavy metals, cyanide, and other inorganic chemicals identified for this water system.

Arsenic has been detected but in concentrations well below its Maximum Contaminant Levels (MCLs). A MCL is the concentration of a contaminant allowed in the drinking water by the Environmental Protection Area (EPA).

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

The cropland in Zone B represents the greatest risk of synthetic organic chemicals to this public water system.

2,4-D was sampled for and detected once on 6/12/84 at a concentration of 0.024 mg/L or 34% of its MCL of 0.07 mg/L. 2,4-D is a common herbicide used in agriculture to control broad –leaf weeds (EPA, 2002). 2,4-D has the potential to cause nervous system damage in people over short term exposures in concentrations above the MCL. Over longer periods of time, 2,4-D has been found to also cause damage to the liver and kidneys (EPA, 2002). No other synthetic organic chemicals have been sampled for in 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 medium.

Other Organic Chemicals

The residential area and the roads are the identified risks of other organic chemicals for this source of public drinking water.

Other Organic Chemicals have not been sampled for in 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.

REFERENCES

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

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

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

APPENDIX A

Covenant Life Center
Drinking Water Protection Area Location Map
(Map 1)

Covenant Life Center-
Drinking Water Protection Area

Map 1: Covenant Life Center - Drinking Water Protection Area

PWSID: 110821.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 3,000 6,000 12,000 18,000 24,000 Feet

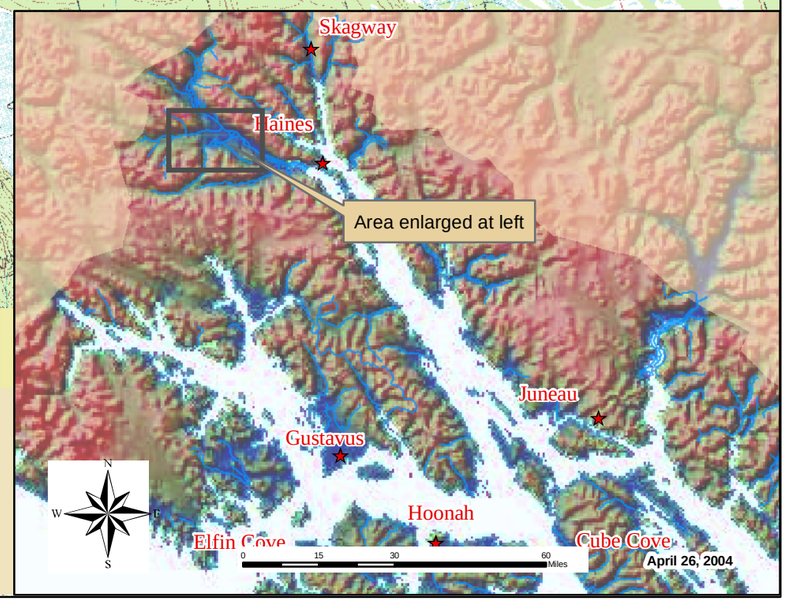
1:72,000

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

Protection zones were delineated based upon groundwater flow data, well information, and streams noted on USGS 1:63,000 mapping.

Legend

- Covenant Life Center - Well
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Zone D Protection Area



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Covenant Life Center (Tables 1-7)

Table 1

Contaminant Source Inventory for

Covenant Life Center

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	2	From ADEC SOC waiver information.
Tanks, fuel, residential (above ground)	R07	R07 1-5	A	2	From ADEC SOC waiver information.
Highways and roads, dirt/gravel	X24	X24 1-3	A	2	From USGS 1:63k topographic mapping.
Cropland	A02	A01-1	B	2	From ADEC SOC waiver information.

Table 2

Contaminant Source Inventory and Risk Ranking for Covenant Life Center Sources of Bacteria and Viruses

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	Low	2	From ADEC SOC waiver information.
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From USGS 1:63k topographic mapping.

Table 3

Contaminant Source Inventory and Risk Ranking for Covenant Life Center Sources of Nitrates/Nitrites

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	Low	2	From ADEC SOC waiver information.
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From USGS 1:63k topographic mapping.
Cropland	A02	A01-1	B	High	2	From ADEC SOC waiver information.

Table 4

Contaminant Source Inventory and Risk Ranking for Covenant Life Center
Sources of Volatile Organic Chemicals

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	Low	2	From ADEC SOC waiver information.
Tanks, fuel, residential (above ground)	R07	R07 1-5	A	Medium	2	From ADEC SOC waiver information.
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From USGS 1:63k topographic mapping.

Table 5

Contaminant Source Inventory and Risk Ranking for Covenant Life Center

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	Low	2	From ADEC SOC waiver information.
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From USGS 1:63k topographic mapping.
Cropland	A02	A01-1	B	Medium	2	From ADEC SOC waiver information.

Table 6

Contaminant Source Inventory and Risk Ranking for Covenant Life Center
Sources of Synthetic Organic Chemicals

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	Low	2	From ADEC SOC waiver information.
Cropland	A02	A01-1	B	High	2	From ADEC SOC waiver information.

Table 7

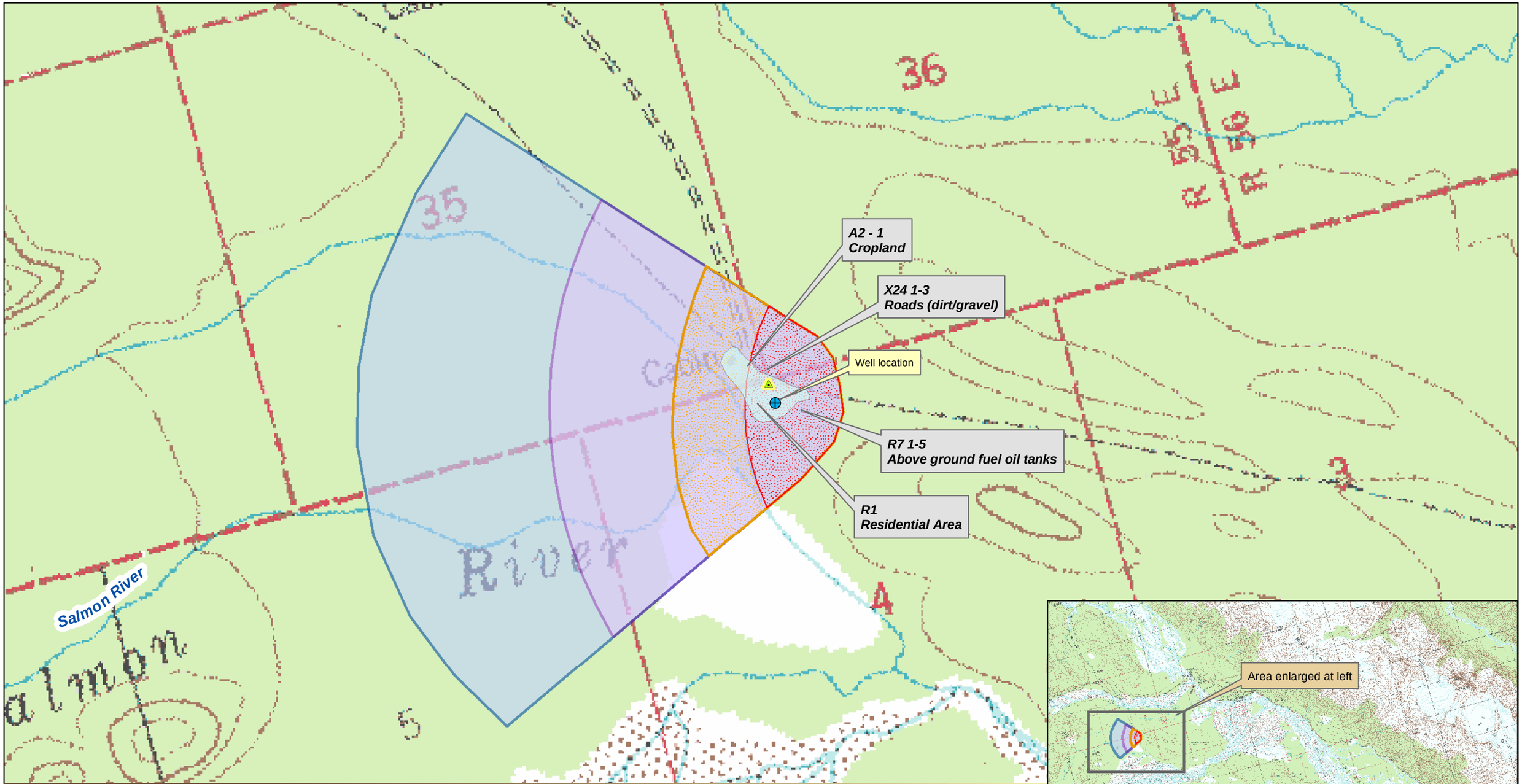
Contaminant Source Inventory and Risk Ranking for Covenant Life Center
Sources of Other Organic Chemicals

PWSID 110821.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Residential Areas	R01	R01	A	Low	2	From ADEC SOC waiver information.
Highways and roads, dirt/gravel	X24	X24 1-3	A	Low	2	From USGS 1:63k topographic mapping.

APPENDIX C

Covenant Life Center
Potential Contaminant Sources
(Map 2)



Map 2: Potential and Existing Contaminant Sources

PWSID: 110821.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 500 1,000 2,000 3,000 4,000 Feet

1:12,000

Data Sources:

1:63,000 mapping - USGS

Protection zones were delineated based upon groundwater flow data, well information, and streams noted on USGS 1:63,000 mapping.

Legend

- Covenant Life Center - Well
- Zone A Protection Area
- Zone B Protection Area
- Zone C Protection Area
- Zone D Protection Area
- Septic System

APPENDIX D

Vulnerability Analysis for Covenant Life Center Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Covenant Life Center

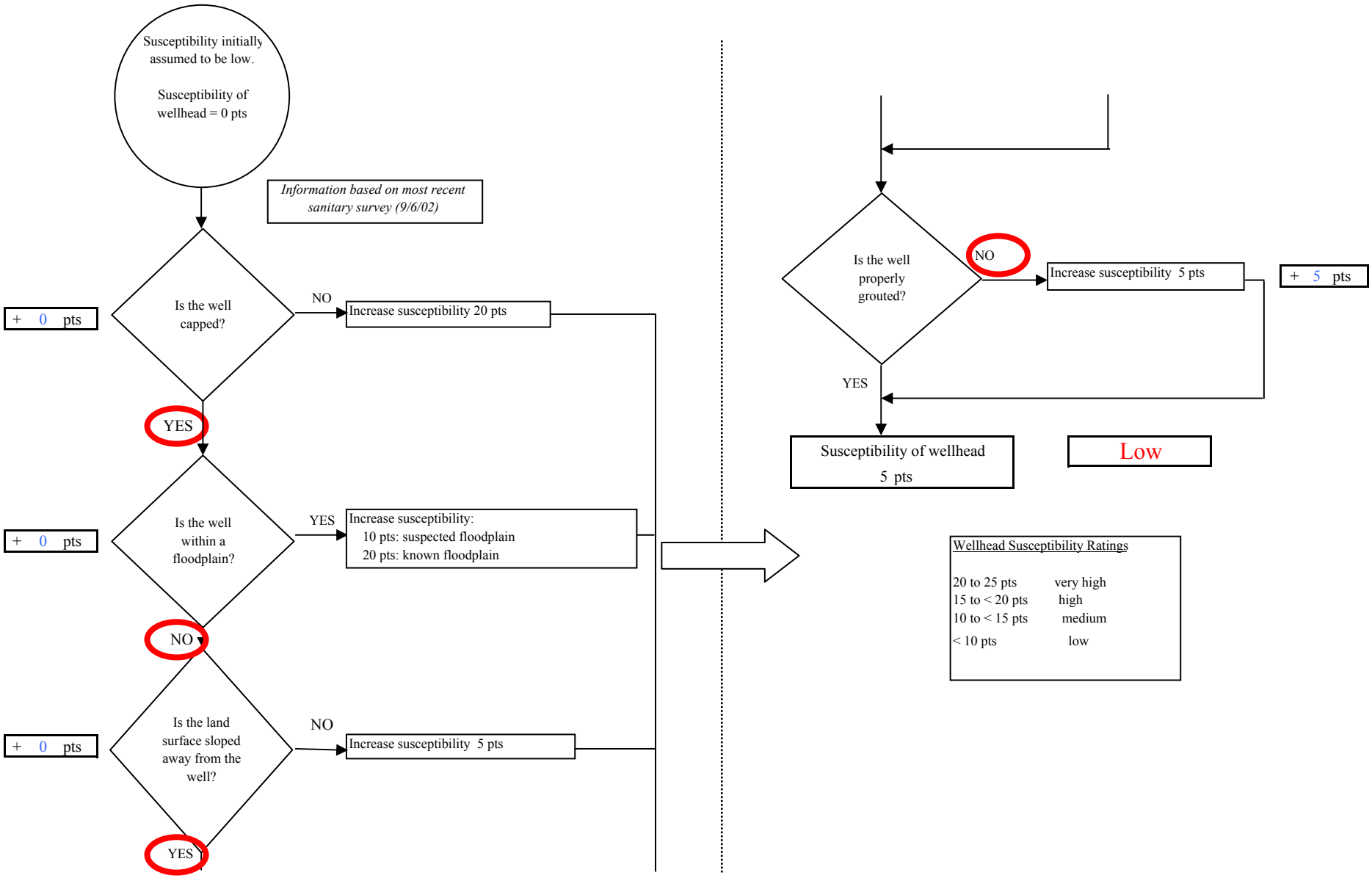


Chart 2. Susceptibility of the aquifer - Covenant Life Center

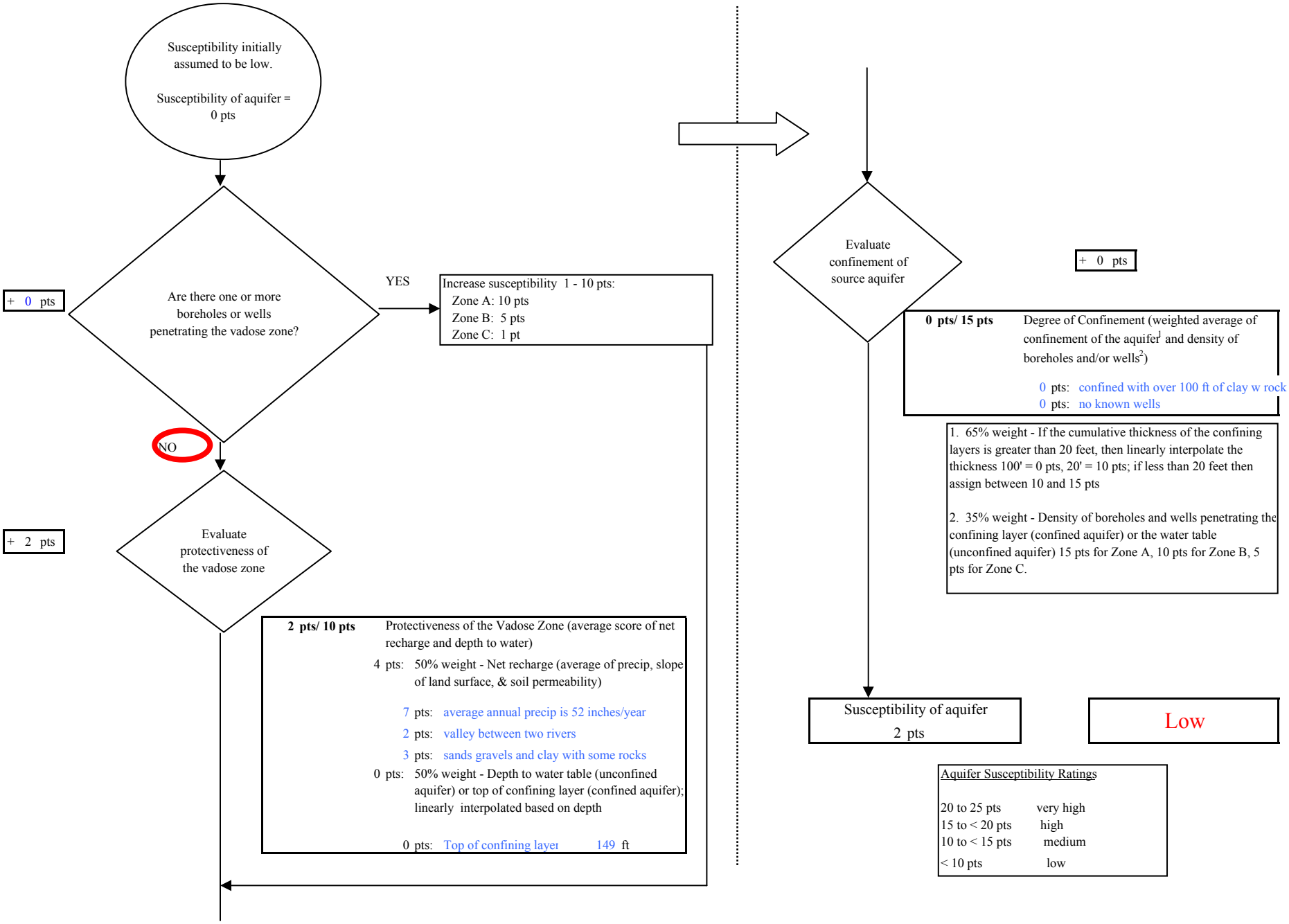
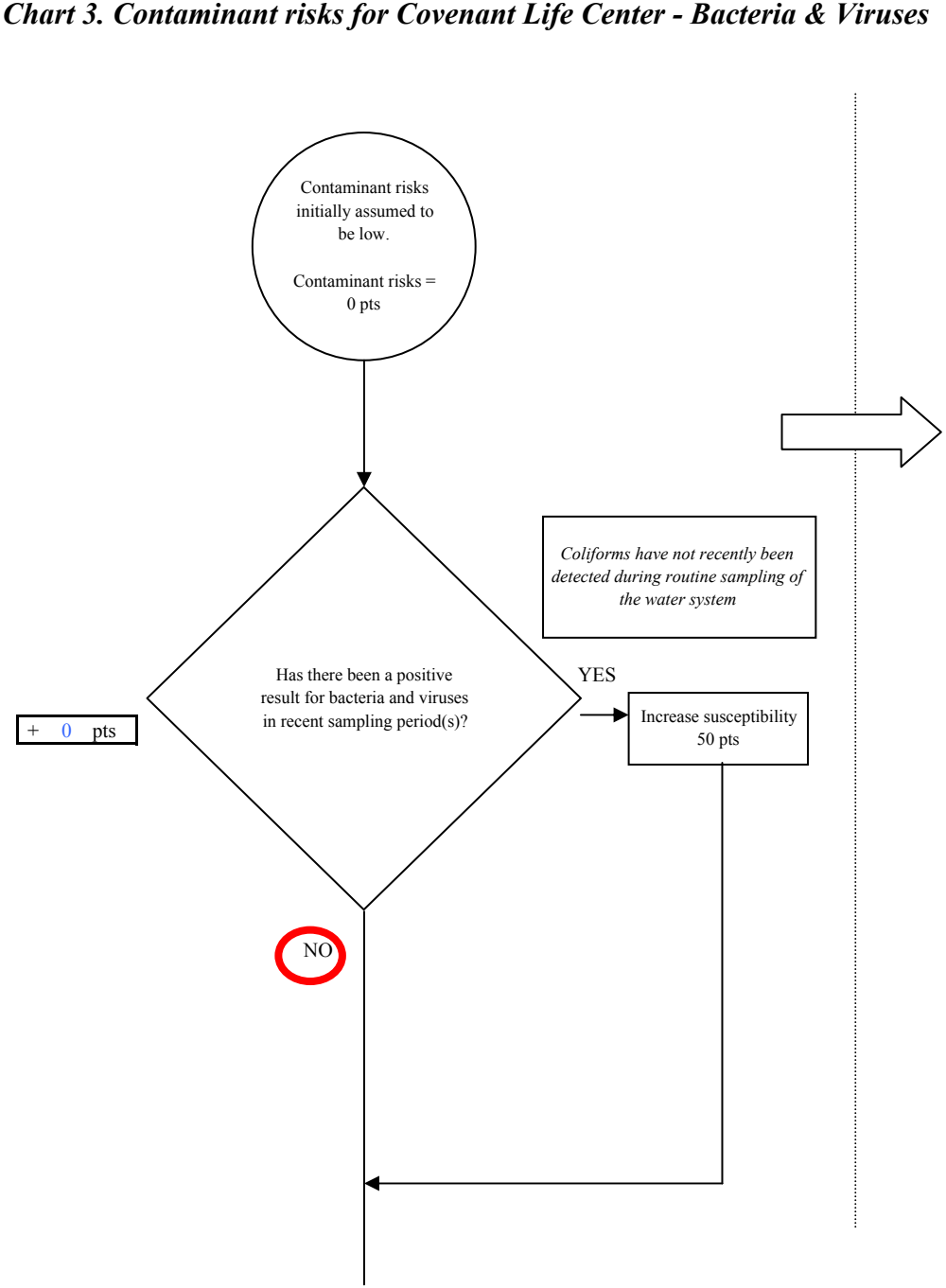
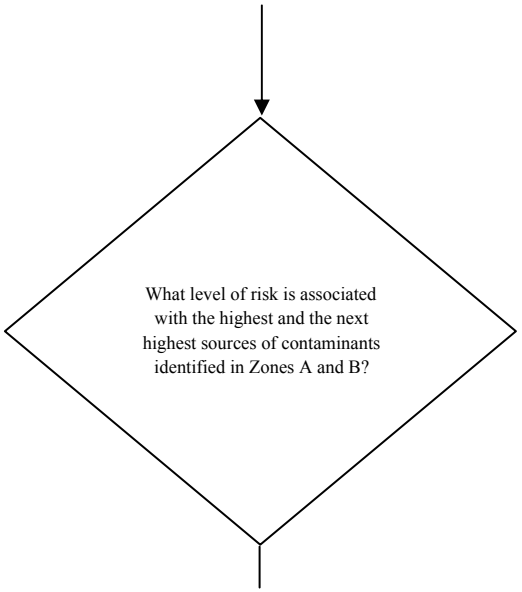


Chart 3. Contaminant risks for Covenant Life Center - Bacteria & Viruses





+ 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)	4	0	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 Covenant Life Center - Bacteria & Viruses

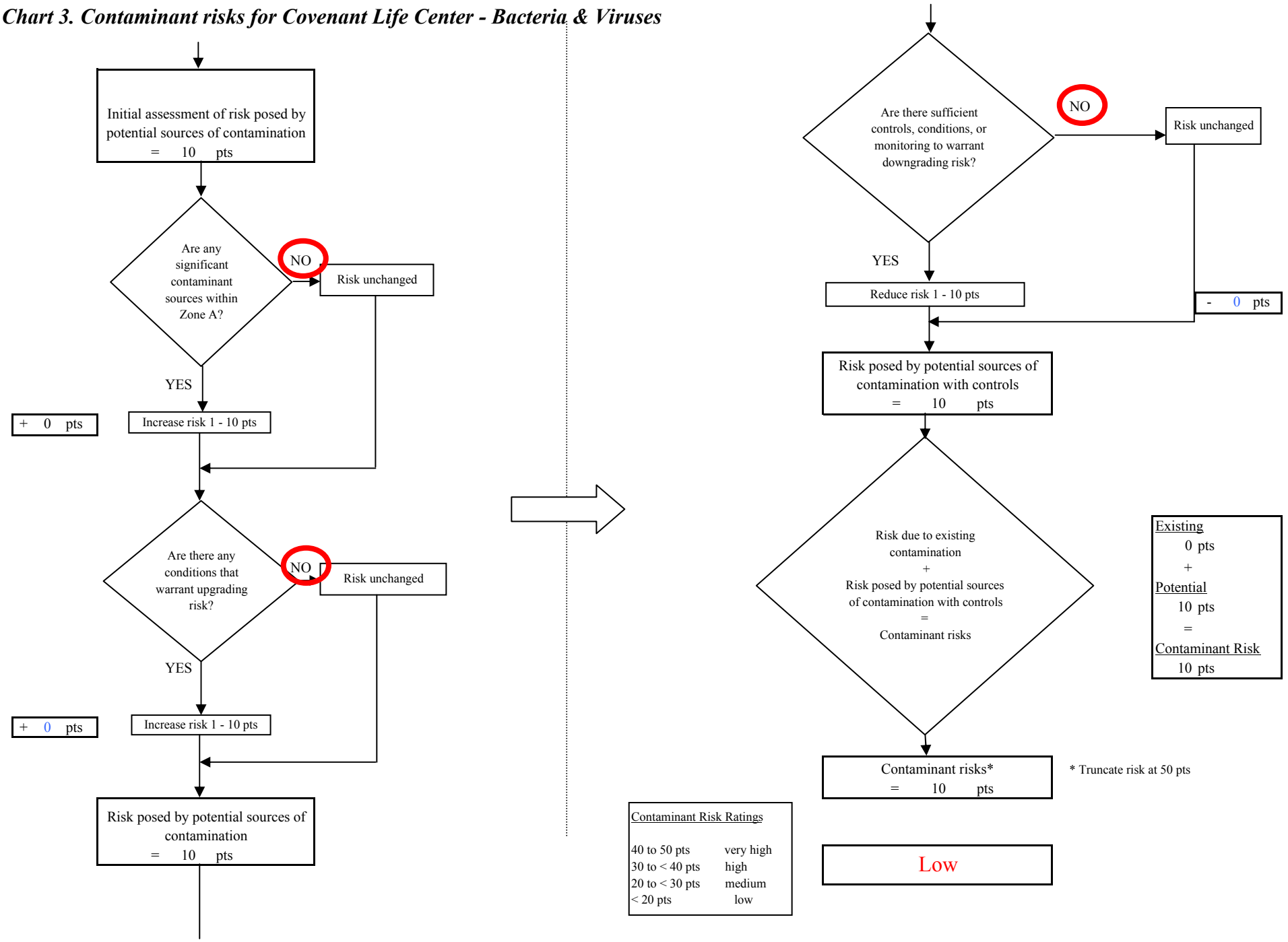


Chart 4. Vulnerability analysis for Covenant Life Center - Bacteria & Viruses

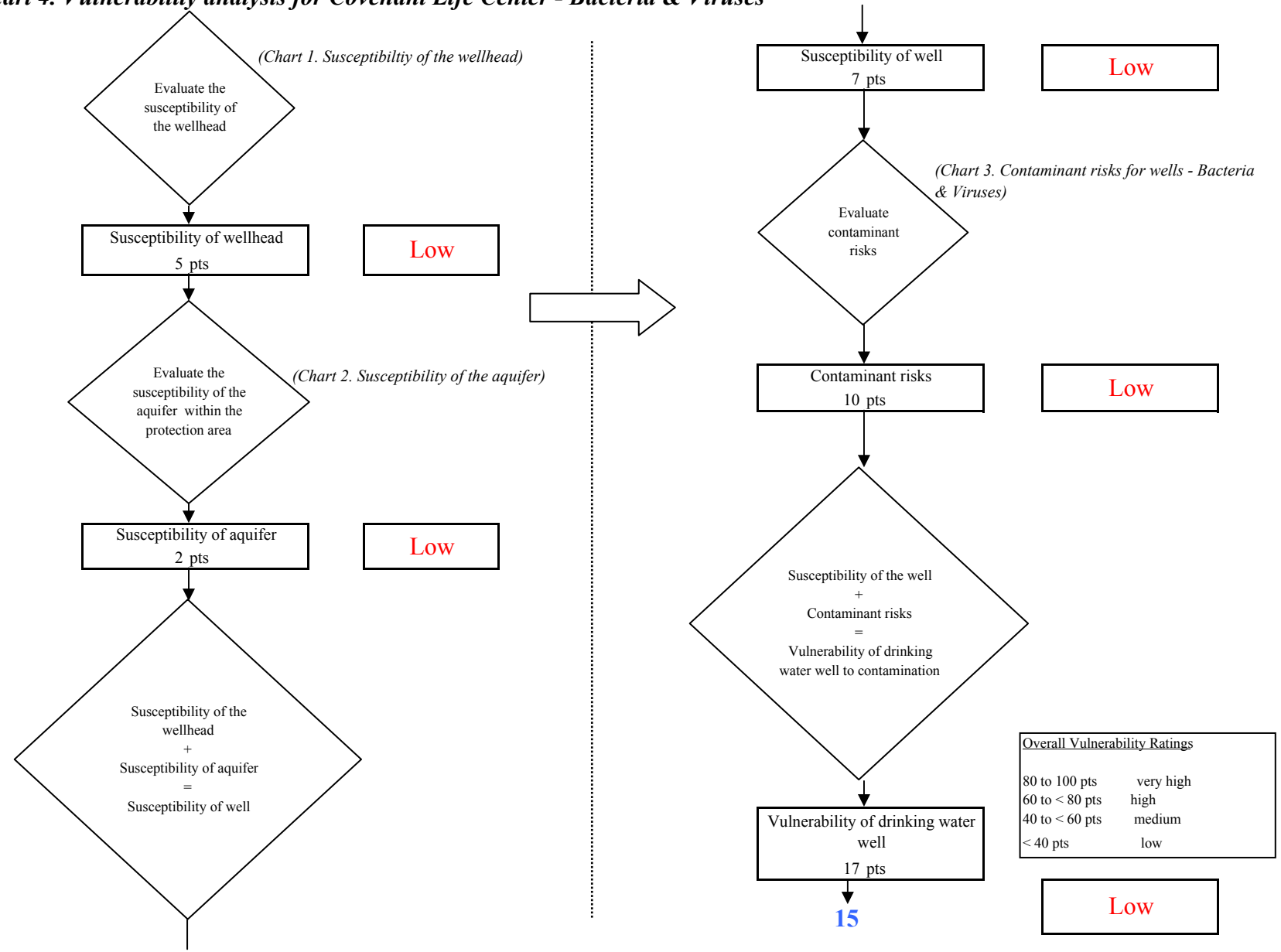


Chart 5. Contaminant risks for Covenant Life Center - Nitrates and Nitrites

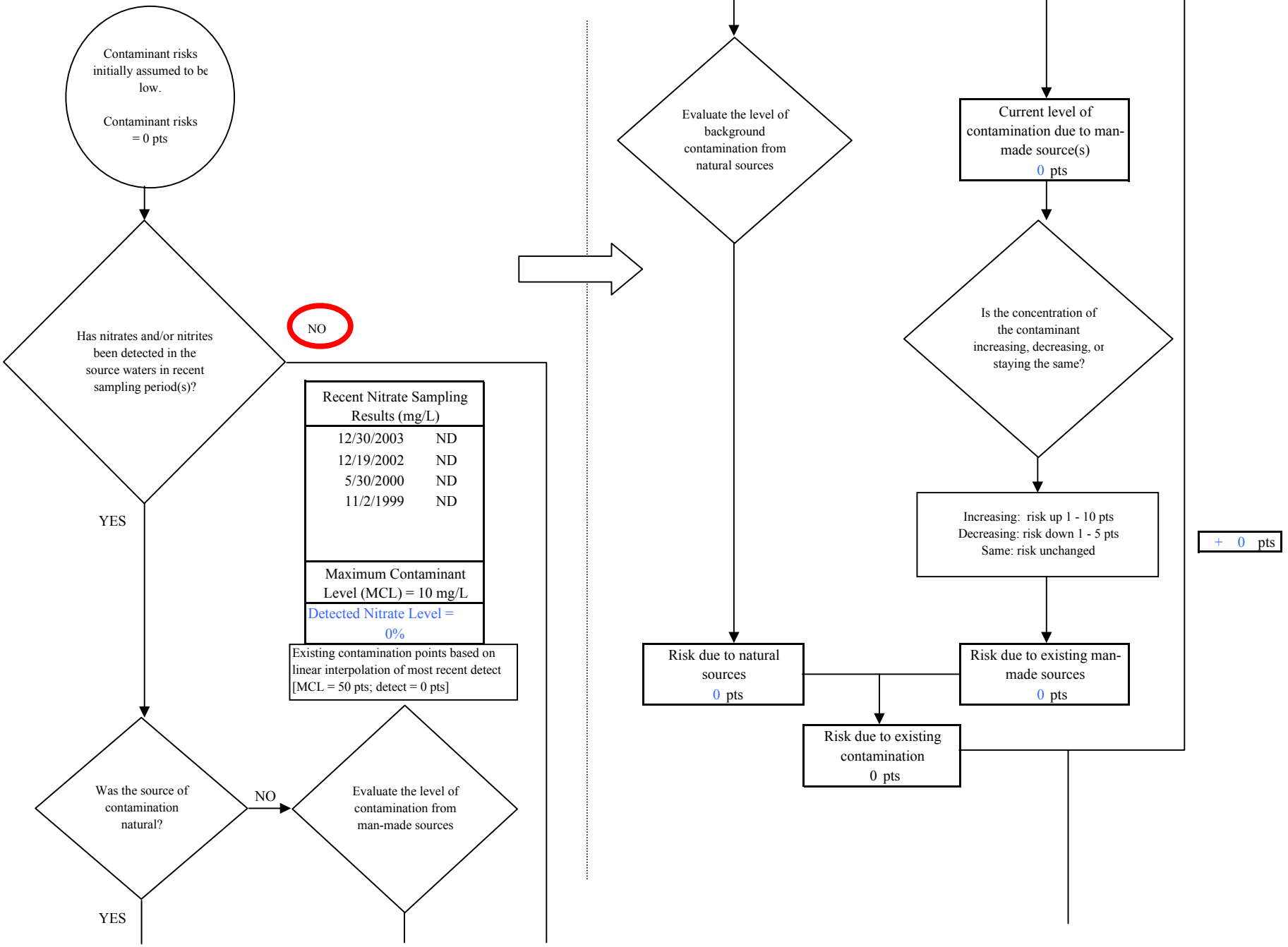


Chart 5. Contaminant risks for Covenant Life Center - Nitrates and Nitrites

+ 30 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	1	1
Medium(s)	0	0	0
Low(s)	4	0	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 30

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

Initial assessment of risk posed by potential sources of contamination = 30 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

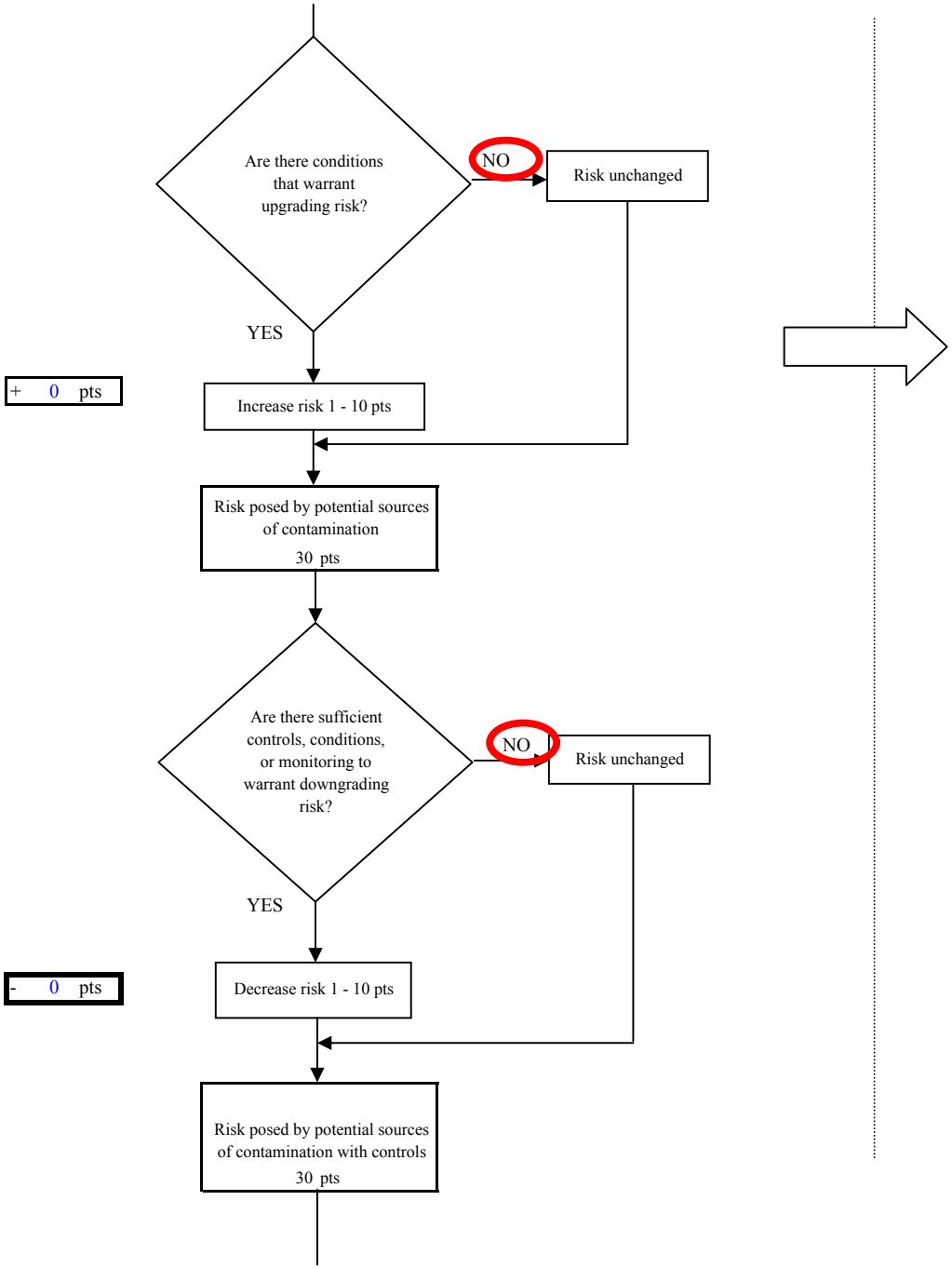
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 5. Contaminant risks for Covenant Life Center - Nitrates and Nitrites



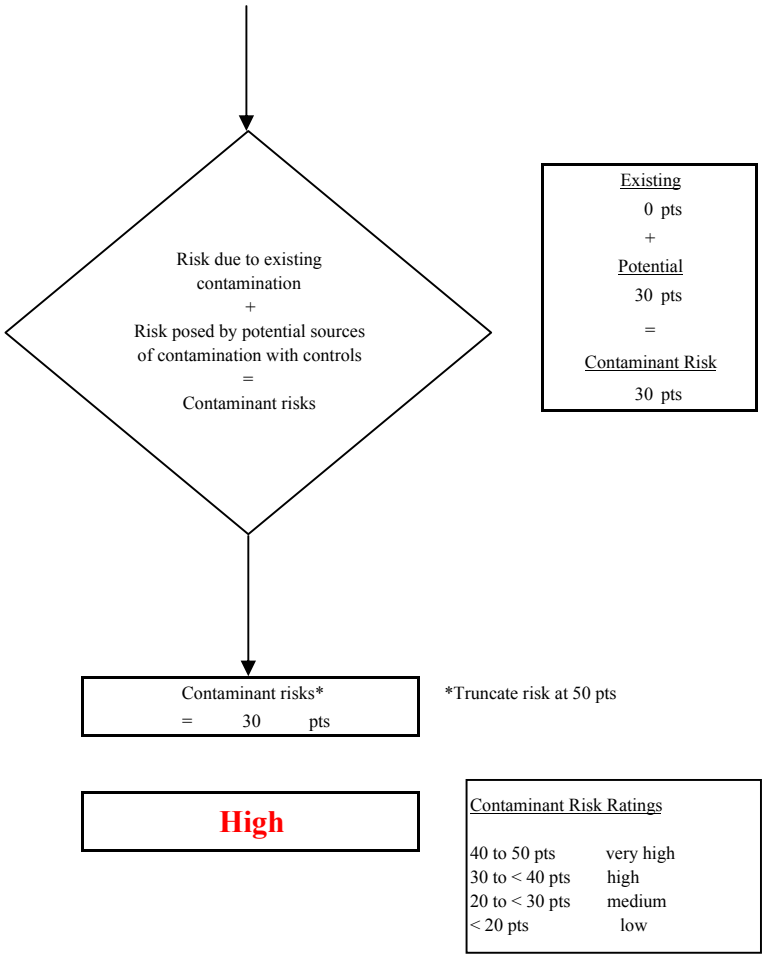


Chart 6. Vulnerability analysis for Covenant Life Center - Nitrates and Nitrites

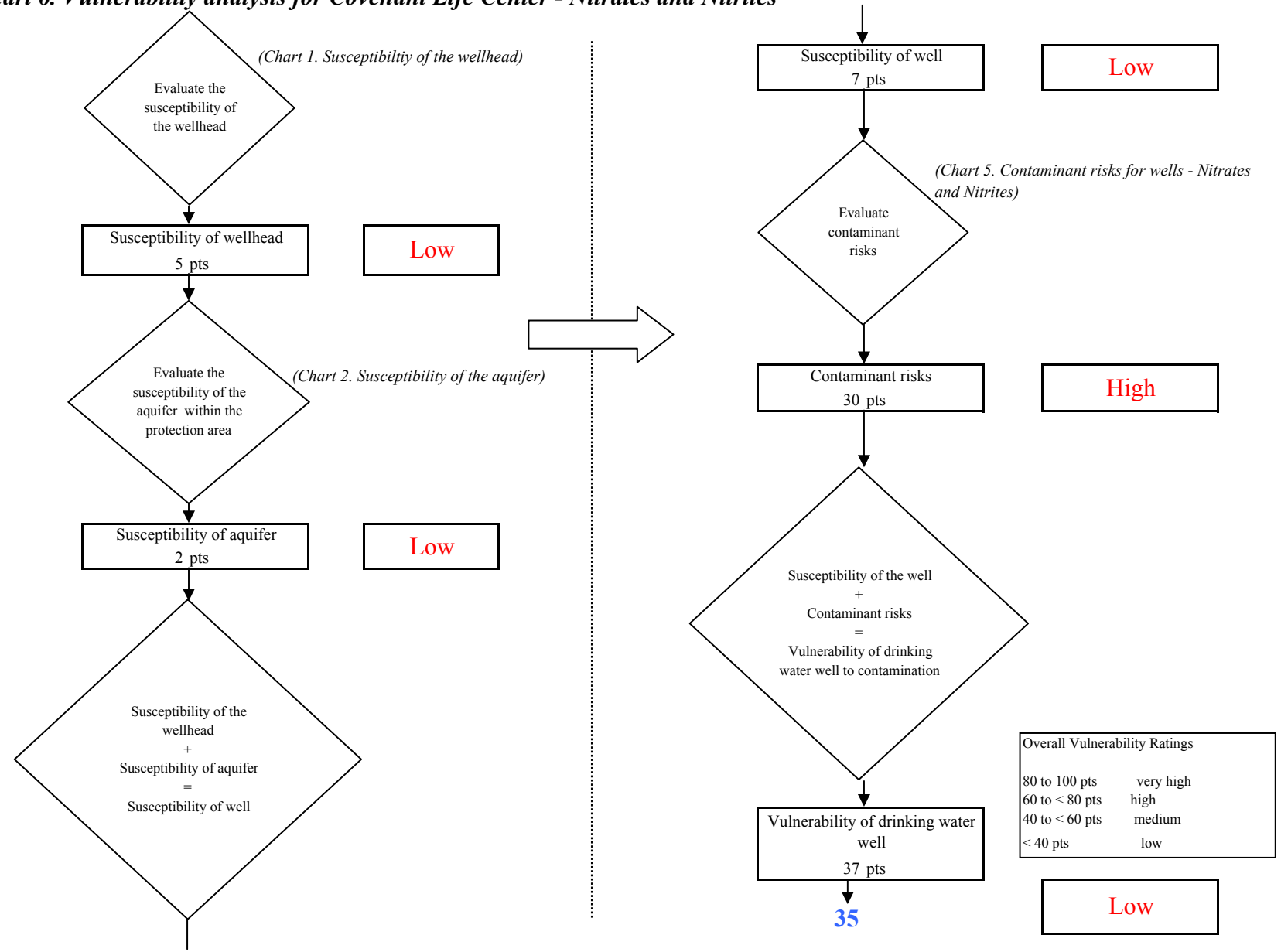


Chart 7. Contaminant risks for Covenant Life Center - Volatile Organic Chemicals

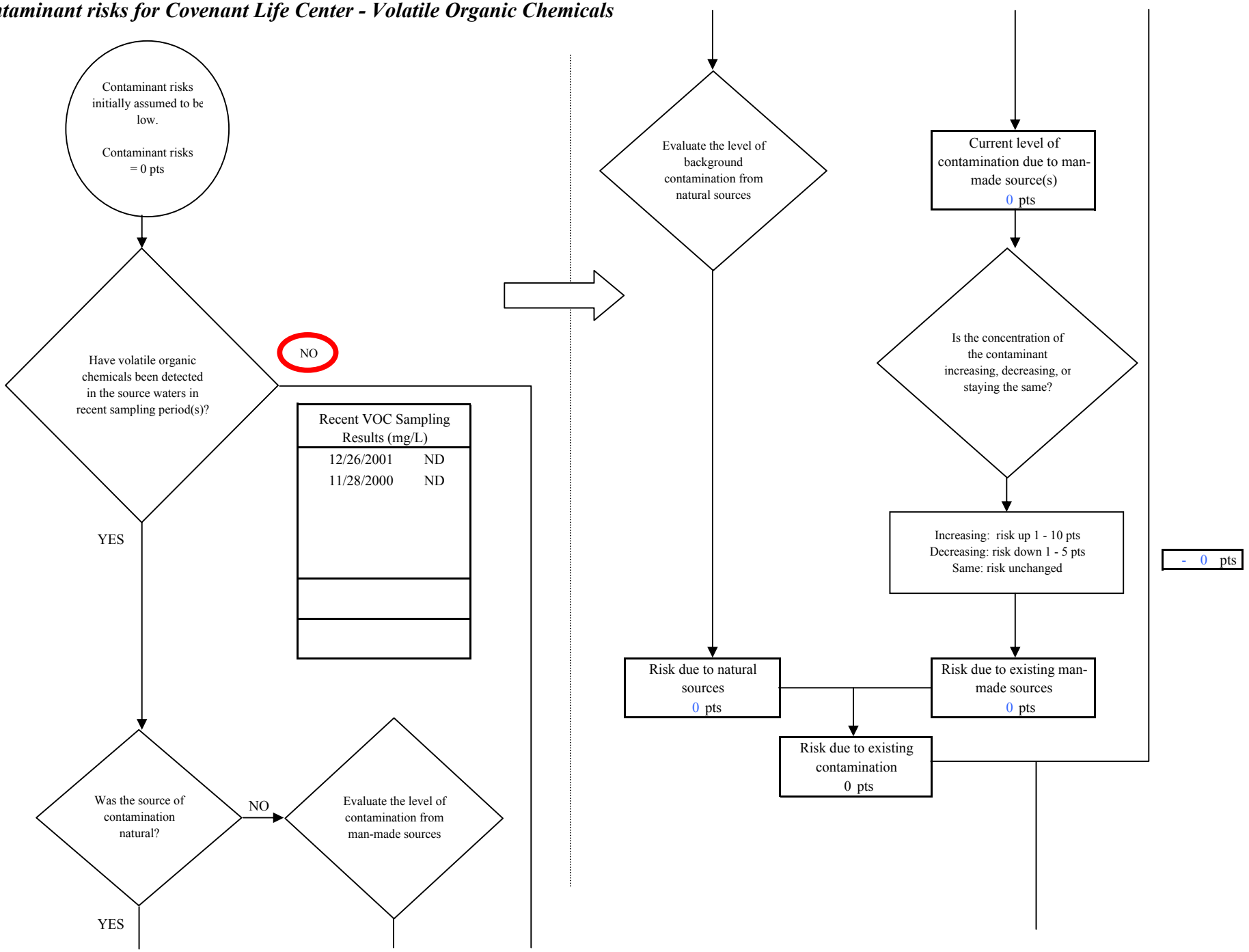


Chart 7. Contaminant risks for Covenant Life Center - Volatile Organic Chemicals

+ 25 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)	5	0	5
Low(s)	3	0	3

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

Matrix Score 25

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 = 25 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

The residential fuel tanks increase the risk

YES → Increase risk 1 - 10 pts

+ 5 pts

Chart 7. Contaminant risks for Covenant Life Center - Volatile Organic Chemicals

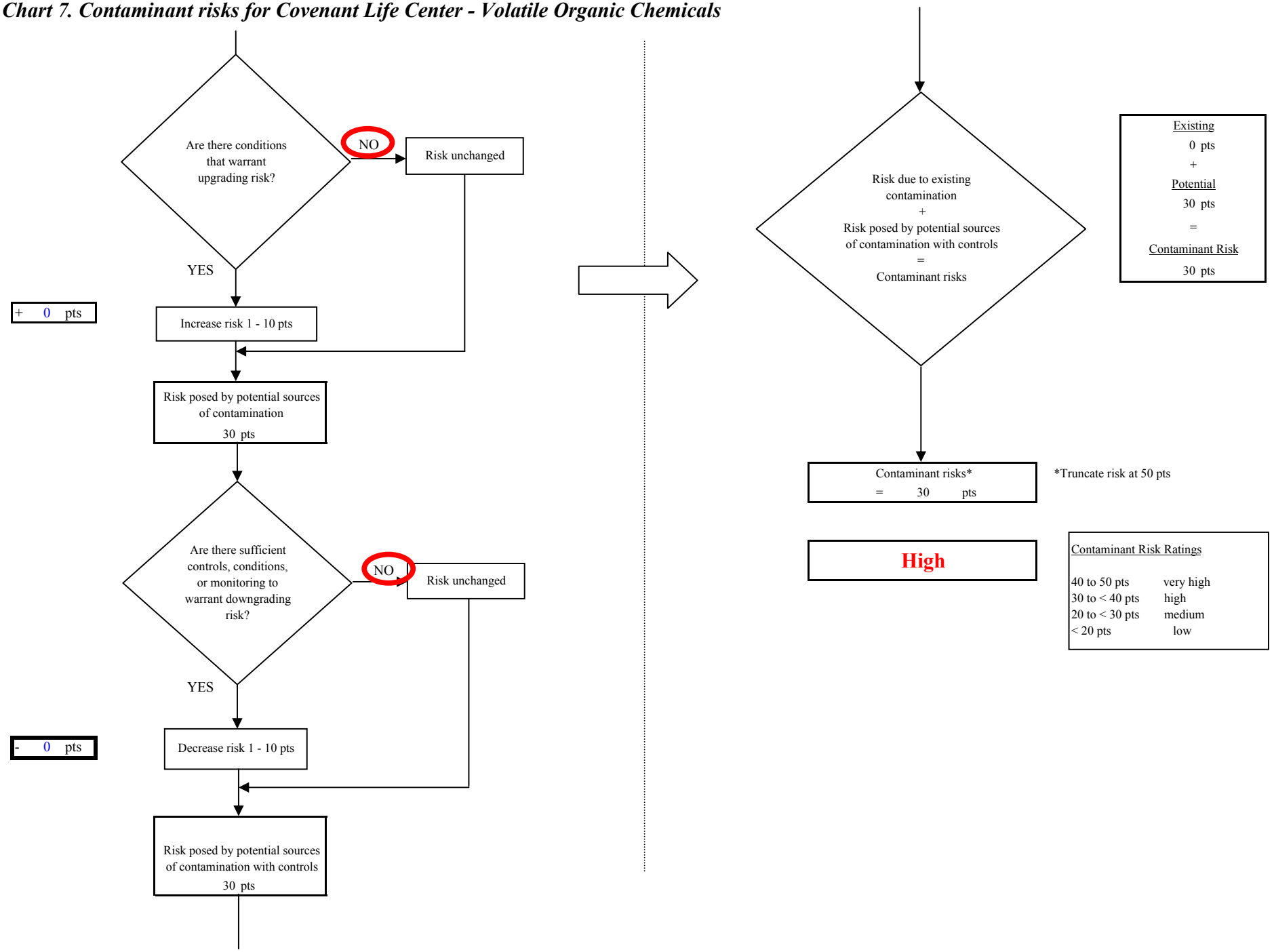


Chart 8. Vulnerability analysis for Covenant Life Center - Volatile Organic Chemicals

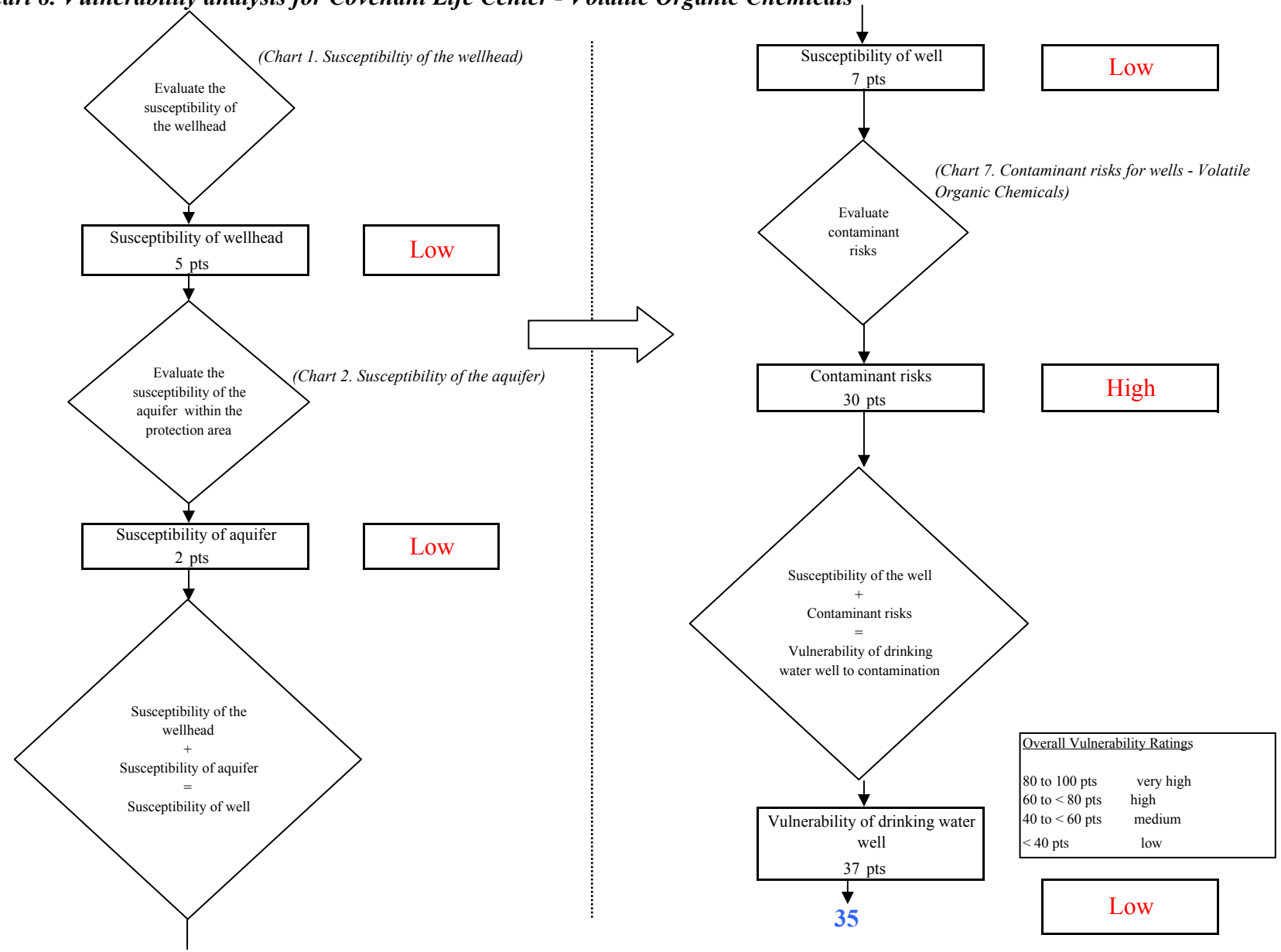


Chart 9. Contaminant risks for Covenant Life Center - Heavy Metals, Cyanide and Other Inorganic Chemicals

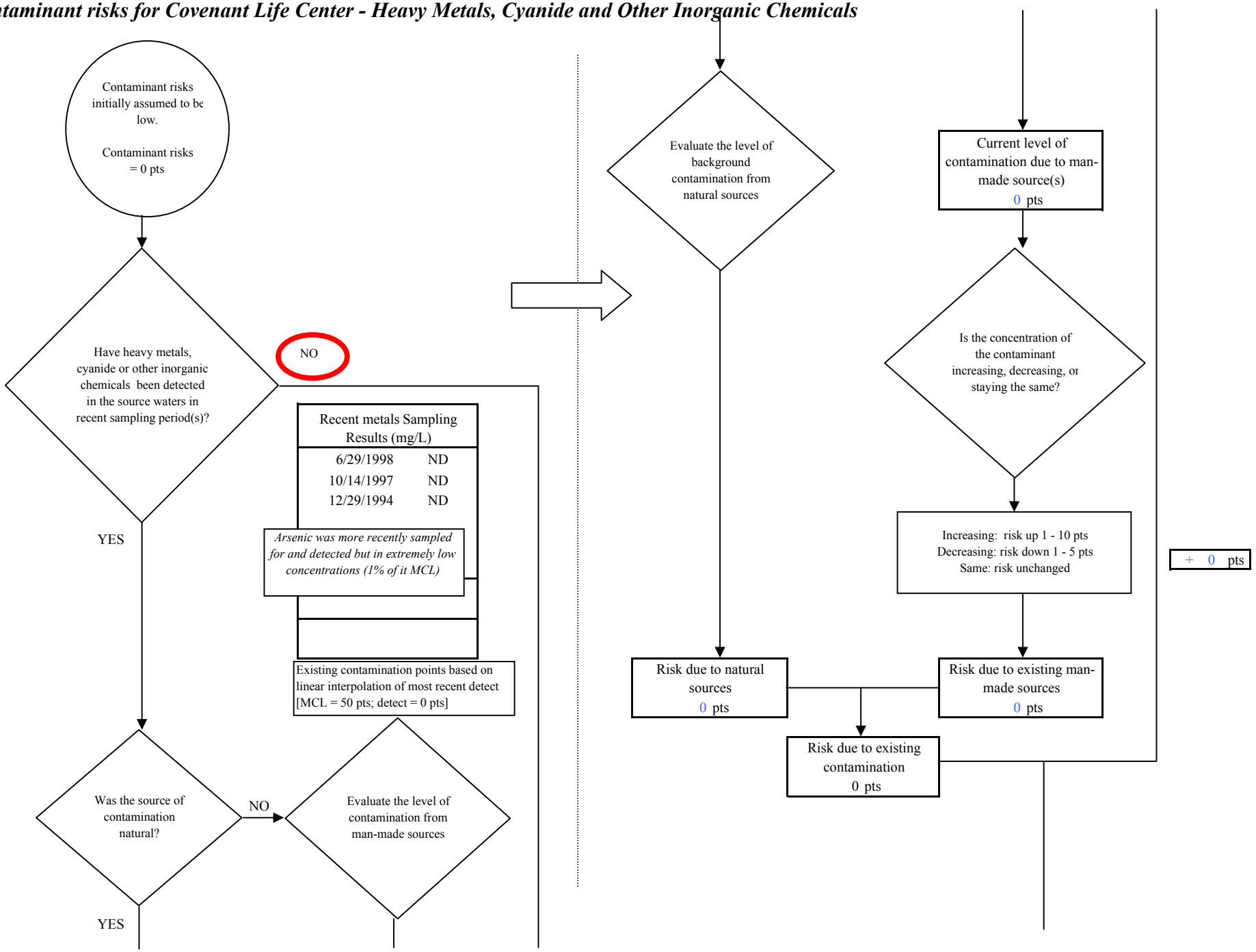


Chart 9. Contaminant risks for Covenant Life Center - Heavy Metals, Cyanide and Other Inorganic Chemicals

+ 20 pts

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

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

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

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

Matrix Score 20

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

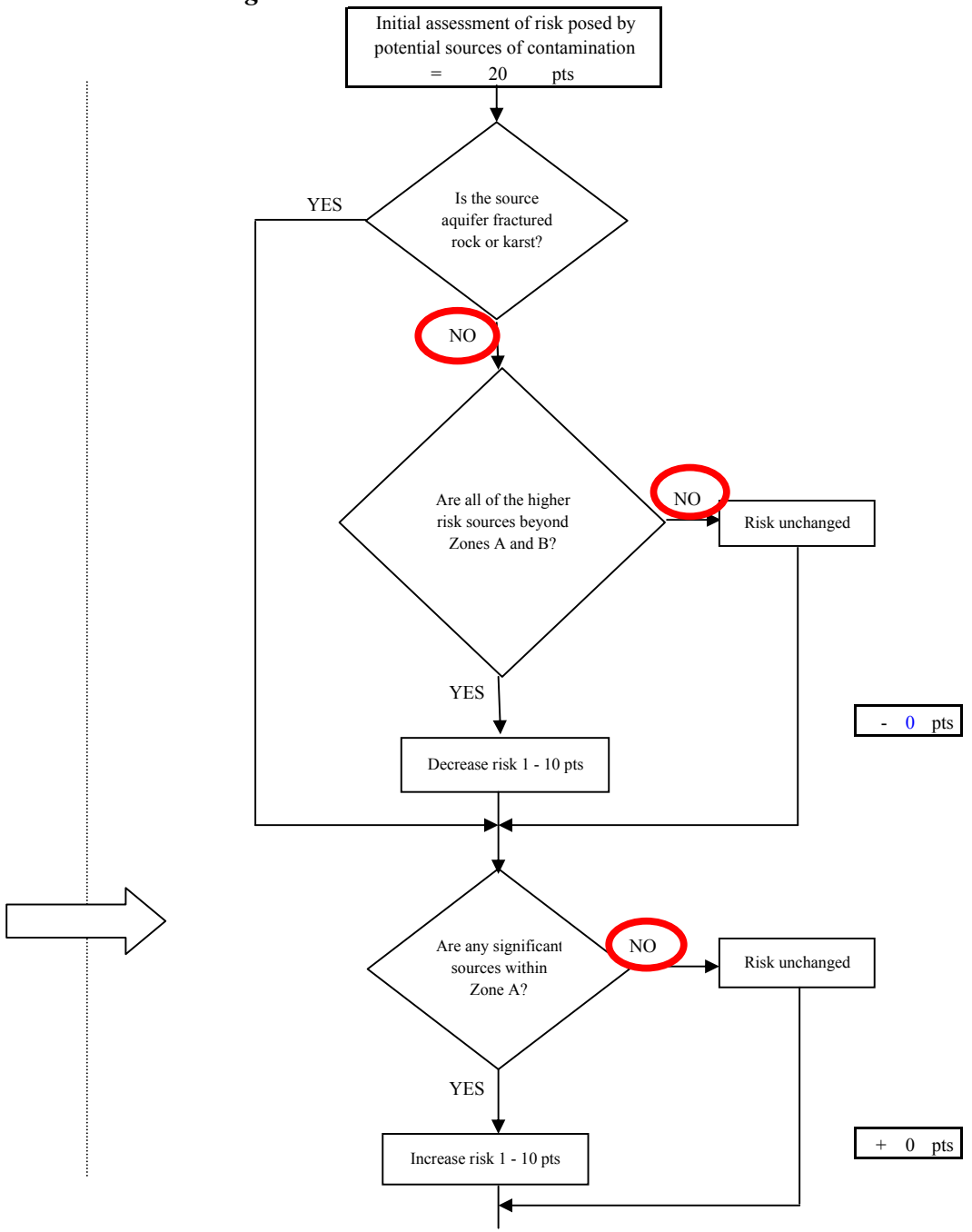


Chart 9. Contaminant risks for Covenant Life Center - Heavy Metals, Cyanide and Other Inorganic Chemicals

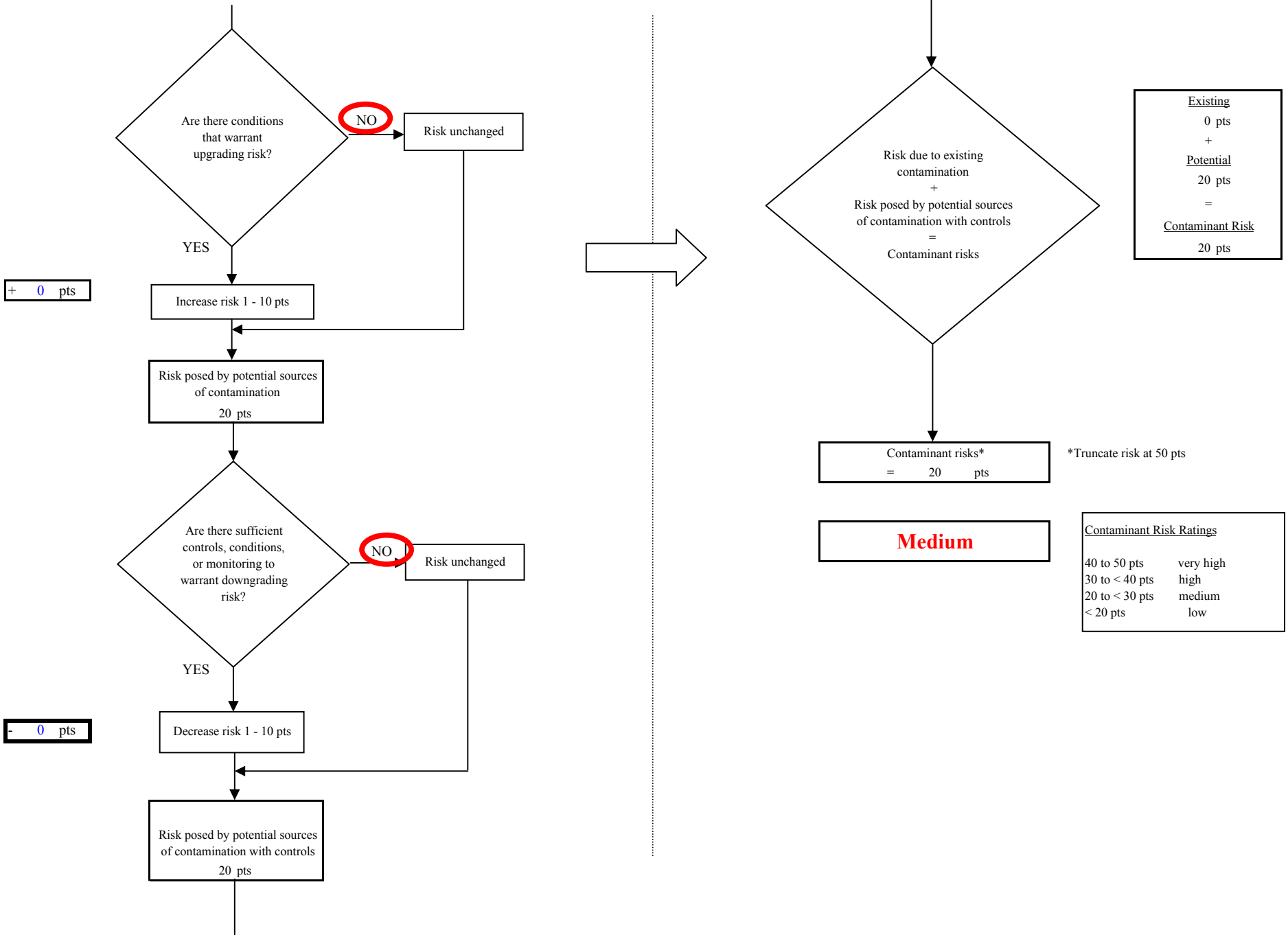


Chart 10. Vulnerability analysis for Covenant Life Center - Heavy Metals, Cyanide and Other Inorganic Chemicals

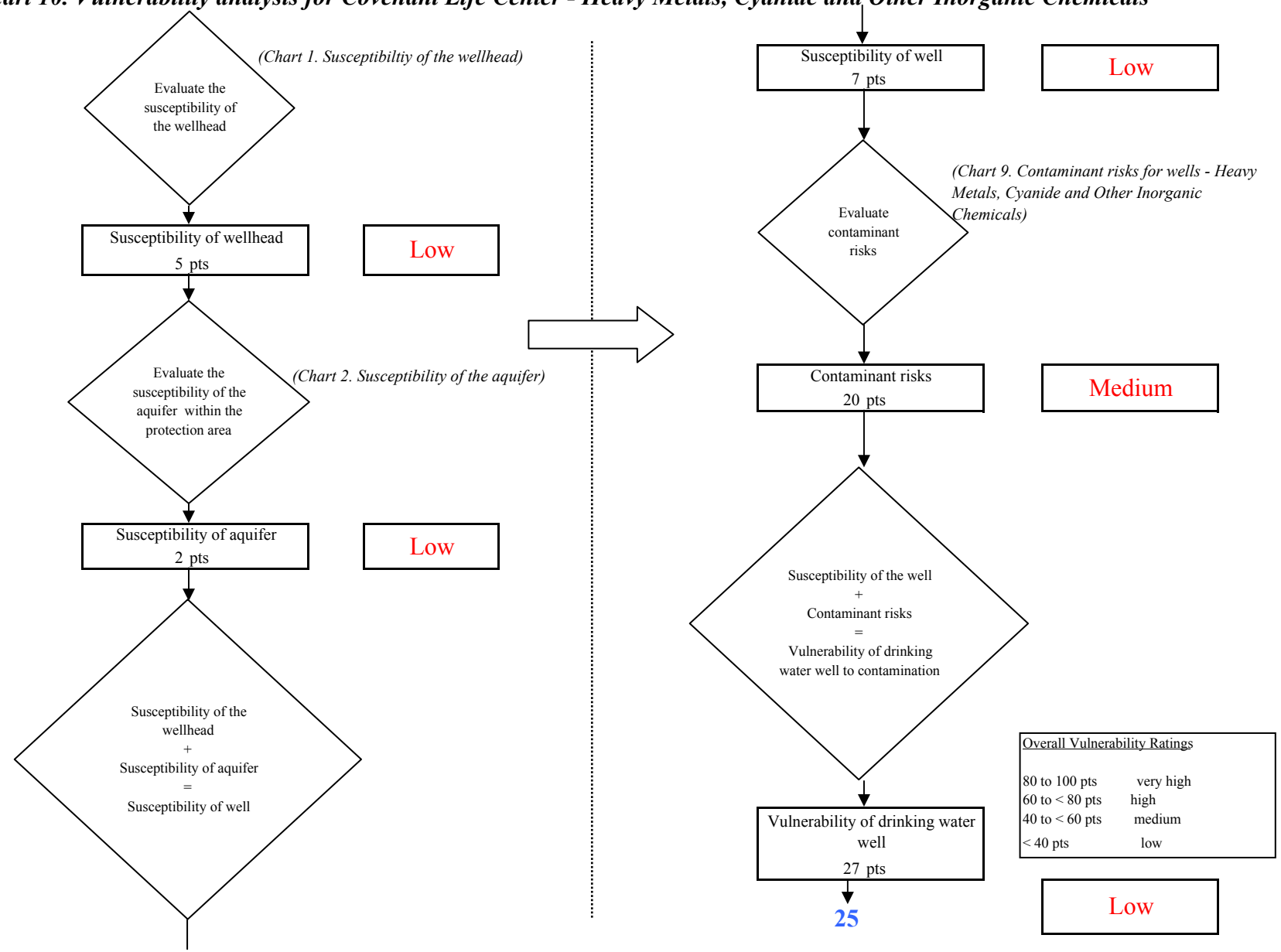


Chart 11. Contaminant risks for Covenant Life Center - Synthetic Organic Chemicals

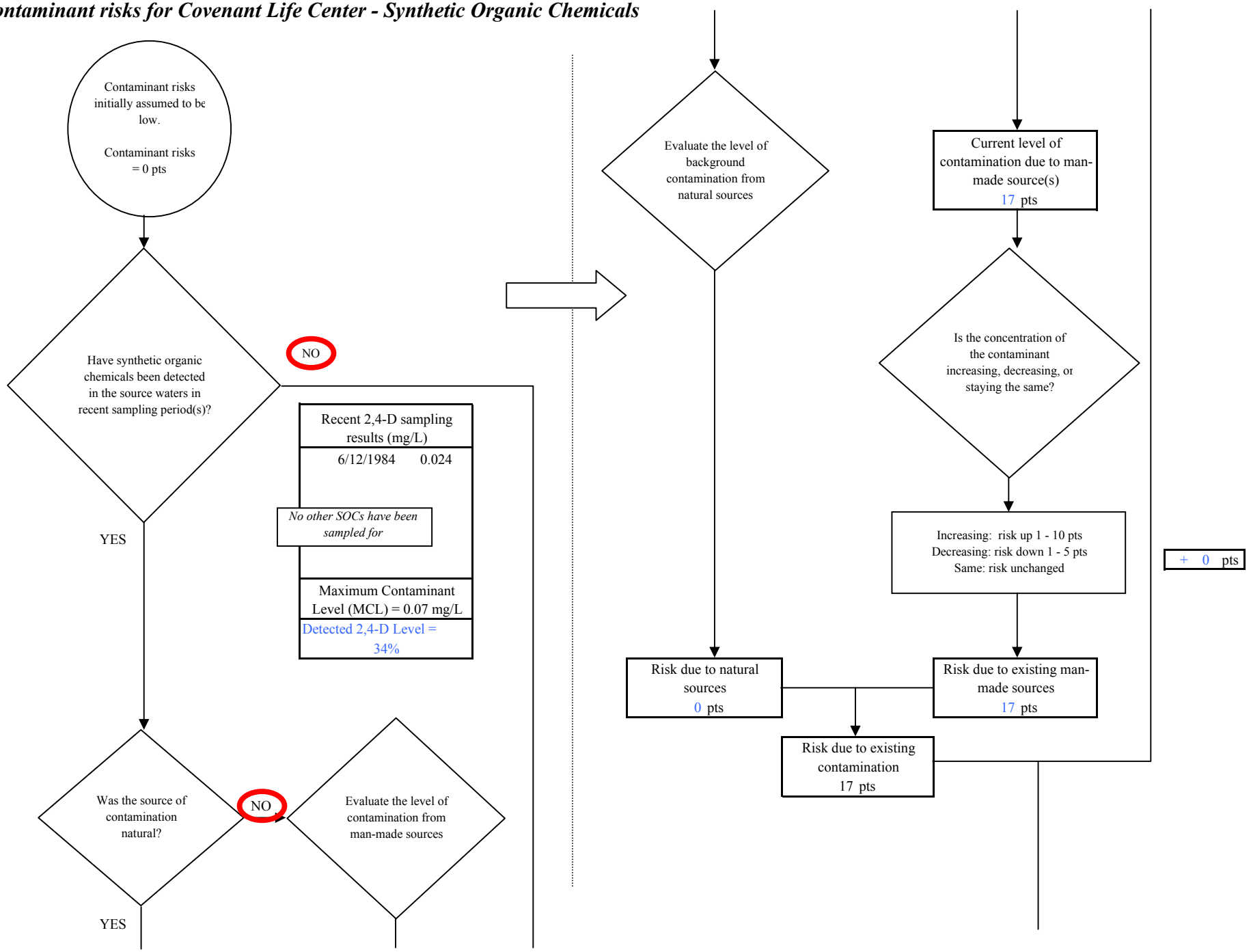


Chart 11. Contaminant risks for Covenant Life Center - Synthetic Organic Chemicals

+ 30 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	1	1
Medium(s)	0	0	0
Low(s)	2	0	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 30

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

Initial assessment of risk posed by potential sources of contamination = 30 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 11. Contaminant risks for Covenant Life Center - Synthetic Organic Chemicals

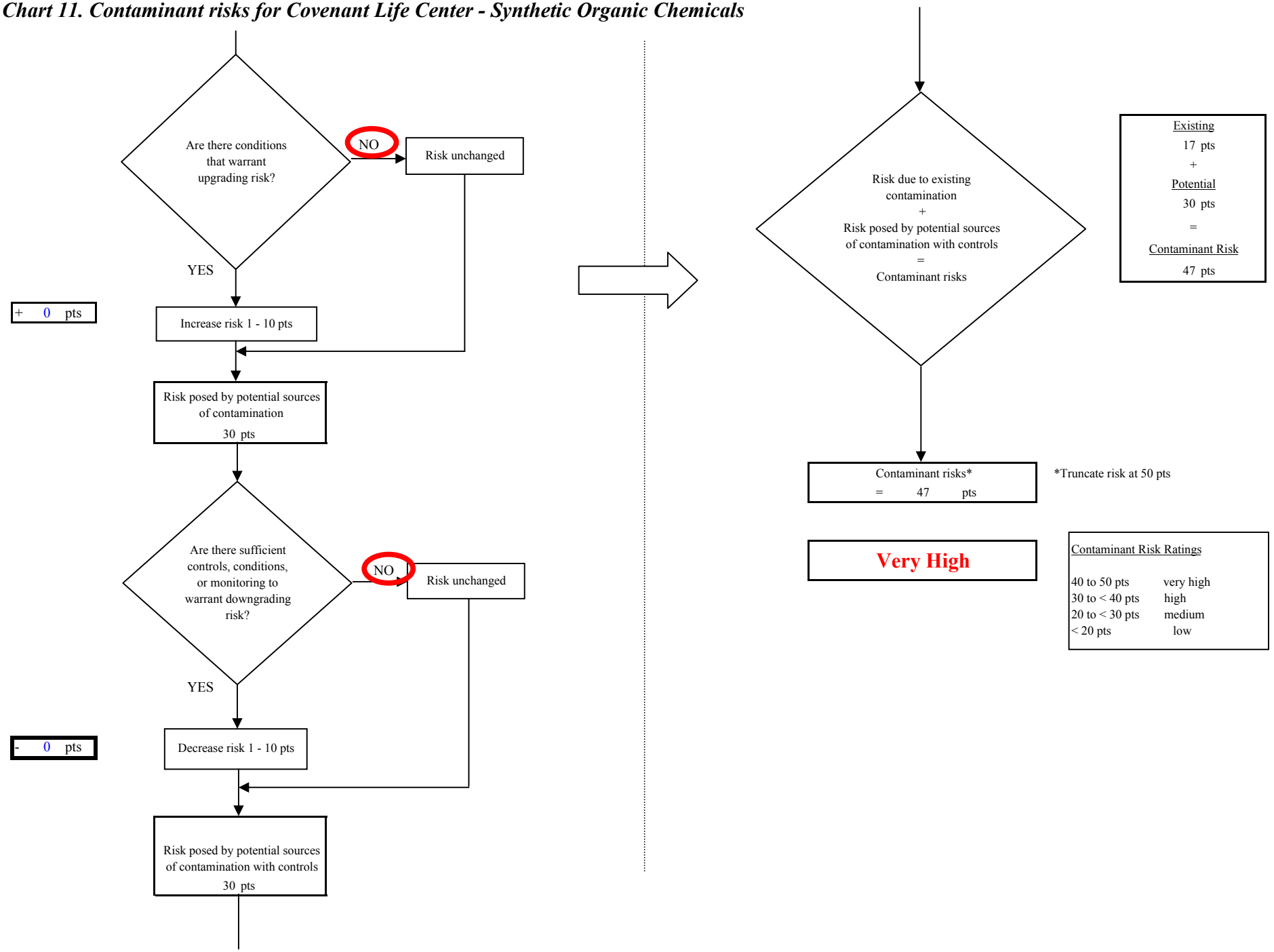


Chart 12. Vulnerability analysis for Covenant Life Center - Synthetic Organic Chemicals

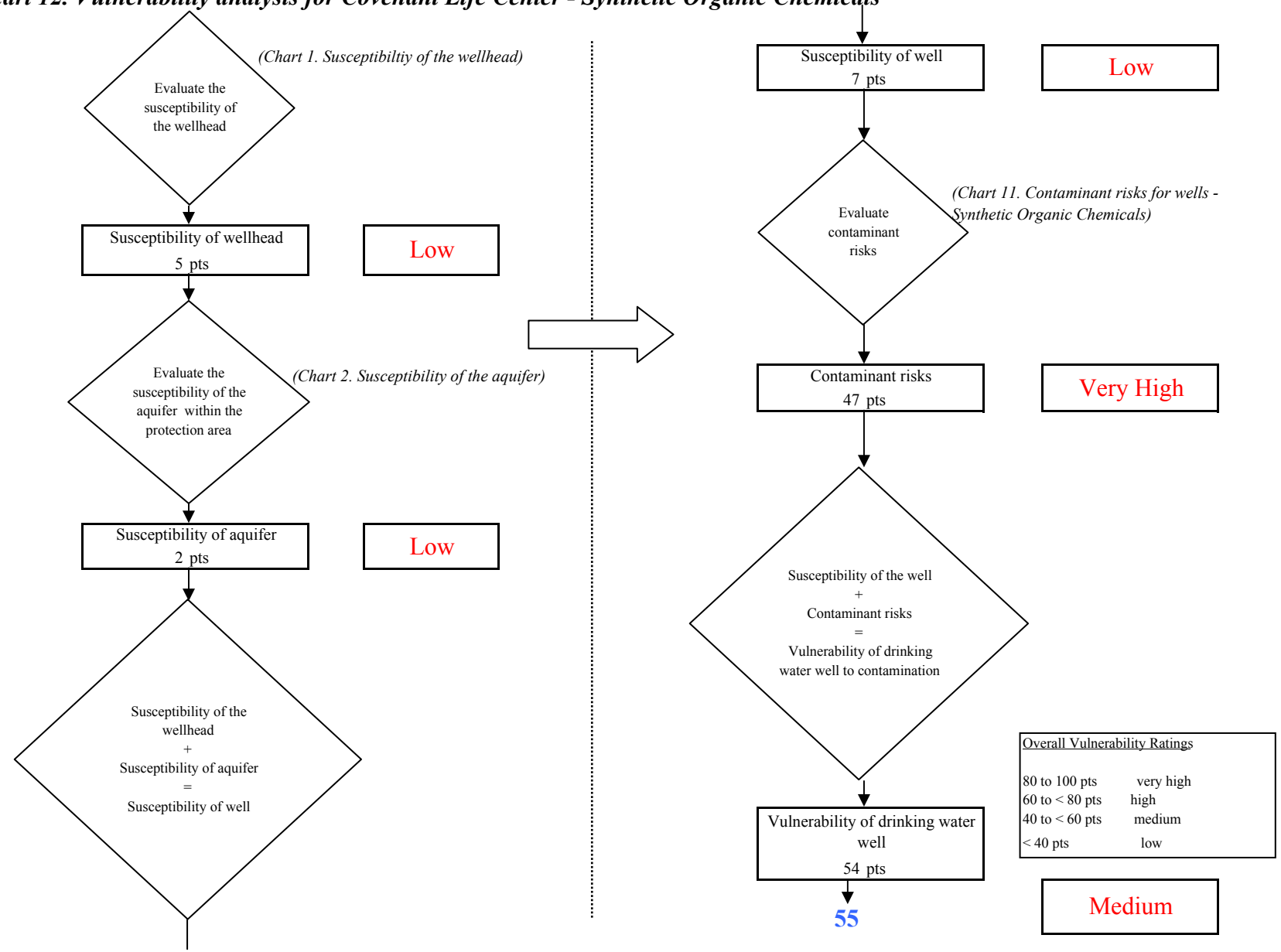


Chart 13. Contaminant risks for Covenant Life Center - Other Organic Chemicals

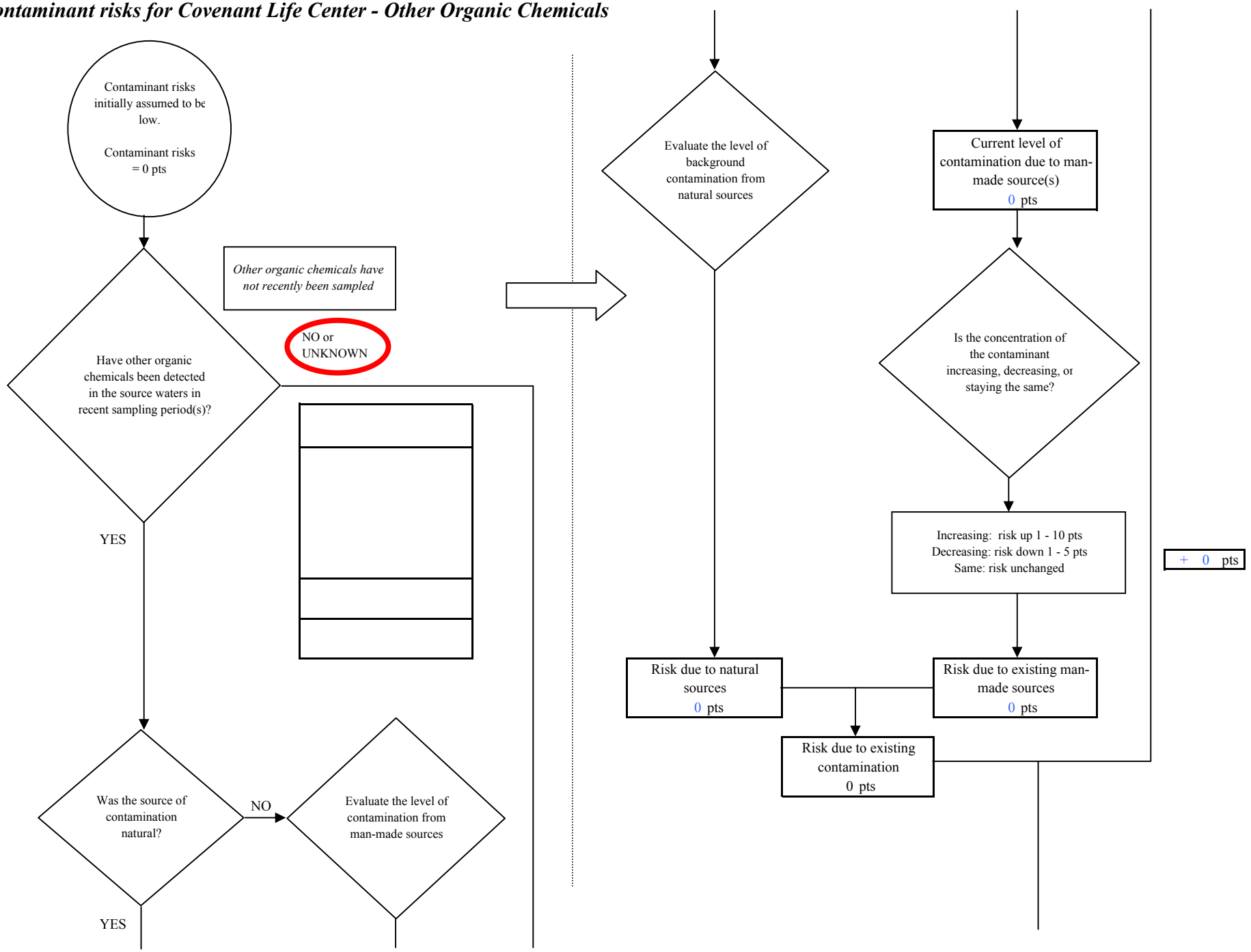


Chart 13. Contaminant risks for Covenant Life Center - Other Organic Chemicals

+ 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)	3	0	3

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

Matrix Score 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 Covenant Life Center - Other Organic Chemicals

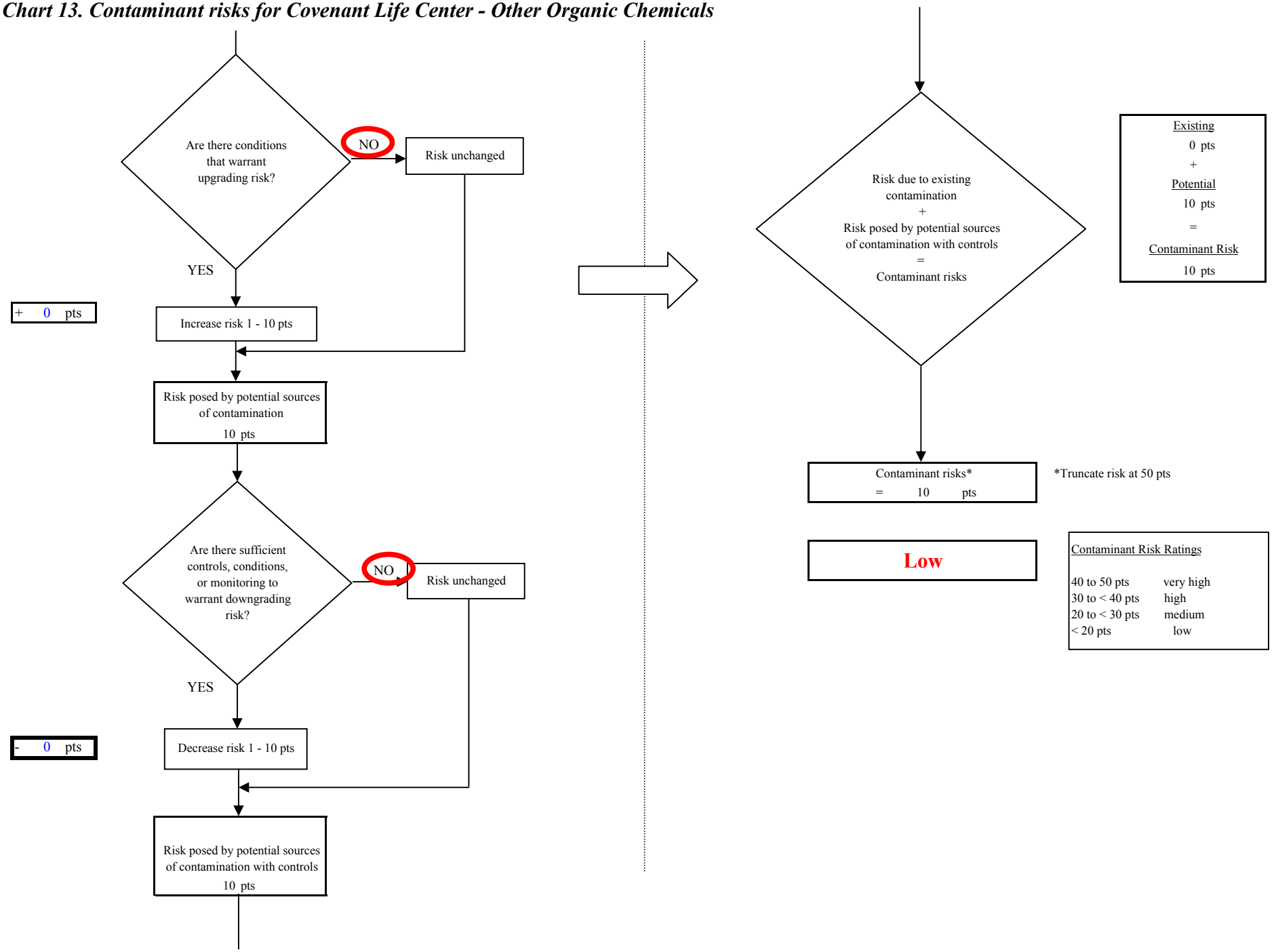


Chart 14. Vulnerability analysis for Covenant Life Center - Other Organic Chemicals