Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for the Tri Valley School Healy area, Alaska PWSID 390285

April 2004

DRINKING WATER PROTECTION PROGRAM REPORT Report 1503
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 Tri Valley School
Healy area, 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 Tri Valley School. This Class A (non-community non-transient) water system consists of one well on Coal Street northwest of Healy, 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 **High** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the Tri Valley School public water system include: a septic system, fuel storage tanks, a gasoline station, and raods. 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 Tri Valley School received an overall vulnerability rating of **High** for volatile organic chemicals, a **Medium** for bacteria and viruses, nitrates and/or nitrites, and heavy metals, cyanide, and other inorganic chemicals, and a **Low** for synthetic organic chemicals and other organic chemicals.

TRI VALLEY SCHOOL PUBLIC DRINKING WATER SYSTEM

The Tri Valley School public water system is a Class A (non-community non-transient) water system. The well is located on Coal Street north west of Healy, Alaska (T12S, R7W, Section 18) (See Map 1 of Appendix A). Healy is located 78 miles southwest of Fairbanks along the George Parks Highway.

Residents in the area of Healy primarily use individual water wells and septic systems (ADCED, 2002). Electricity is provided by Golden Valley Electric Association. Residents use heating oil (typically stored in both above and below ground 275 to 500-gallon tanks), wood, or the coal produced from the Usibelli Coal Mine to heat homes and buildings (ADCED, 2002). Refuse is hauled to the new Denali Borough regional landfill, located south of Anderson.

The Tri Valley School lies in the alluvial plain of the Nenana River at an elevation of approximately 1500 feet above sea level.

According to the 8/7/01 Sanitary Survey for this water system, the depth of the well is 240 feet below the ground surface. Most of the wells in this area are screened in sand and gravel, and it is assumed this one is also. For wells at this depth, static water level in this area is about 150 feet below ground surface. The coarse, alluvial, sandy gravel in the floodplains of the areas streams and rivers provides a large aquifer even in the winter when infiltration is low. Discontinuous permafrost (perennially frozen areas) may also be present in the alluvial plain. Areas with discontinuous permafrost may locally affect the ground water flow directions. Both the Nenana Rivers as well as surface infiltration contribute water to this alluvial aquifer.

The Tri Valley School public drinking water system serves approximately 250 residents through five service connections.

TRI VALLEY SCHOOL 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 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 Tri Valley School'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 Tri Valley School 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 Tri Valley School 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 TRI VALLEY SCHOOL 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 Tri Valley School received a Low Susceptibility rating. The 8/7/01 Sanitary Survey indicates the well is capped with a sanitary seal and the land surface is sloped away from each of the wells; however, and the well is not 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 the Tri Valley School well is completed in received a High Susceptibility rating. The highly transmissive aquifer material (sand and gravel) in the area allows contaminants to travel quickly through it. Private wells in the area can also provide a quick pathway for contaminants to travel down into the aquifer if the wells are not grouted correctly. The depth of the water table does create some protection from contaminants, however. The material above the aquifer creates natural filtering of potential contaminants before coming into contact with the water table where they can disperse quickly. Table 2 summarizes the Susceptibility scores and ratings for Tri Valley School.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	17	High
Natural Susceptibility	22	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	30	High
Nitrates and/or Nitrites	31	High
Volatile Organic Chemicals	40	Very High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	20	Medium
Synthetic Organic Chemicals	10	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	50	Medium
Nitrates and/or Nitrites	55	Medium
Volatile Organic Chemicals	60	High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	40	Medium
Synthetic Organic Chemicals	30	Low
Other Organic Chemicals	30	Low

Bacteria and Viruses

The Large Capacity Septic System (Class V Injection well) represents the greatest risk of Bacteria and Viruses to this water system. A Large Capacity Septic System Class V Injection well differs from a residential septic system when it receives sanitary waste from multiple family residences or a non-residential establishment and has the capacity to serve 20 or more persons per day.

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 medium.

Nitrates and Nitrites

The septic system also represents the greatest 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 been not detected in recent sampling history for the Tri Valley School well.

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

Volatile Organic Chemicals

The fuel storage tanks and the gas station represent the greatest risk of volatile organic chemical contamination to the well.

Both underground and above ground heating oil storage tanks are the standard 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 high.

Heavy Metals, Cyanide, and Other Inorganic Chemicals

The underground gasoline storage tanks represent the greatest risk to heavy metals for this source of public drinking water.

Barium and Beryllium were detected but in small concentrations with respect to their MCL. A MCL is the concentration of a contaminant allowed in the drinking water by the Environmental Protection Area (EPA). No other inorganics were detected.

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 medium.

Synthetic Organic Chemicals

The septic system represents the only identified risk of Synthetic Organic Chemical to this public water system.

Synthetic Organic Chemicals have not 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 low.

Other Organic Chemicals

The septic system also represents the greatest risk 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

Tri Valley School
Drinking Water Protection Area Location Map
(Map 1)

Denali Borough SD Tri Valley well

Map 1: DBSD Tri Valley Drinking Water Protection Area

PWSID: 390285.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 850 1,700 3,400 5,100 Feet

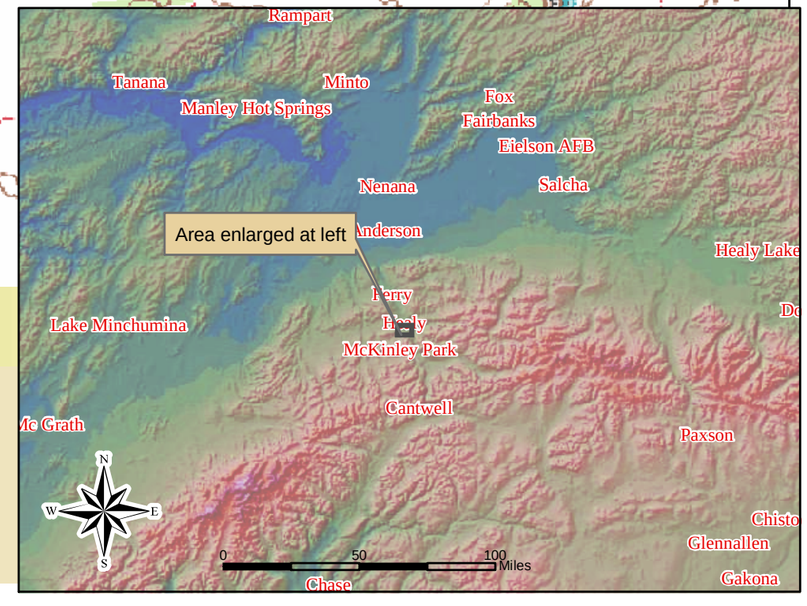
1:20,400

Data Sources:

Background image
- USGS 1:63,000 mapping

Legend

- Zone A
- Zone B
- Zone C
- Zone D
- Denali Borough SD Tri Valley well
- Roads



APPENDIX B

Contaminant Source Inventory and Risk Ranking for Tri Valley School (Tables 1-7)

Table 1

Contaminant Source Inventory for
Denali Borough SD Tri Valley

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	2	Septic system for Tri Valley School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	2	Fuel tank for Tri Valley School
Highways and roads, dirt/gravel	X24		A	2	Parks Highway, Coal Street
Gasoline stations (without repair shop)	C15	C15-1	B	2	
Tanks, diesel (underground)	T08	T08-1	B	2	on the Parks Highway
Tanks, gasoline (underground)	T12	T12-1	B	2	
Tanks, gasoline (underground)	T12	T12-1	B	2	on the Parks Highway

Table 2

Contaminant Source Inventory and Risk Ranking for Denali Borough SD Tri Valley Sources of Bacteria and Viruses

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	Parks Highway, Coal Street
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic system for Tri Valley School

Table 3

Contaminant Source Inventory and Risk Ranking for Denali Borough SD Tri Valley Sources of Nitrates/Nitrites

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	Parks Highway, Coal Street
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High	2	Septic system for Tri Valley School

Table 4

Contaminant Source Inventory and Risk Ranking for Denali Borough SD Tri Valley Sources of Volatile Organic Chemicals

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	Parks Highway, Coal Street
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic system for Tri Valley School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Fuel tank for Tri Valley School
Gasoline stations (without repair shop)	C15	C15-1	B	High	2	
Tanks, diesel (underground)	T08	T08-1	B	High	2	on the Parks Highway
Tanks, gasoline (underground)	T12	T12-1	B	High	2	
Tanks, gasoline (underground)	T12	T12-1	B	High	2	on the Parks Highway

Table 5

Contaminant Source Inventory and Risk Ranking for Denali Borough SD Tri Valley Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	Parks Highway, Coal Street
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic system for Tri Valley School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low	2	Fuel tank for Tri Valley School
Gasoline stations (without repair shop)	C15	C15-1	B	Low	2	
Tanks, gasoline (underground)	T12	T12-1	B	Medium	2	
Tanks, gasoline (underground)	T12	T12-1	B	Medium	2	on the Parks Highway

Table 6

Contaminant Source Inventory and Risk Ranking for Denali Borough SD Tri Valley Sources of Synthetic Organic Chemicals

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic system for Tri Valley School

Table 7

Contaminant Source Inventory and Risk Ranking for Denali Borough SD Tri Valley Sources of Other Organic Chemicals

PWSID 390285.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24		A	Low	2	Parks Highway, Coal Street
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low	2	Septic system for Tri Valley School
Gasoline stations (without repair shop)	C15	C15-1	B	Low	2	

APPENDIX C

Tri Valley School
Potential Contaminant Sources
(Map 2)

Tri Valley School well

T14-1

D10-1

C15-1
T12-2

T08-1
T12-1

GEORGE PARKS

COAL

CARSON

SULFIDE

HILLTOP

UNNAMED STREET

HEALY

Map 2: Denali Borough Tri Valley Potential Contaminant Sources

PWSID: 390285.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 250 500 1,000 1,500 Feet

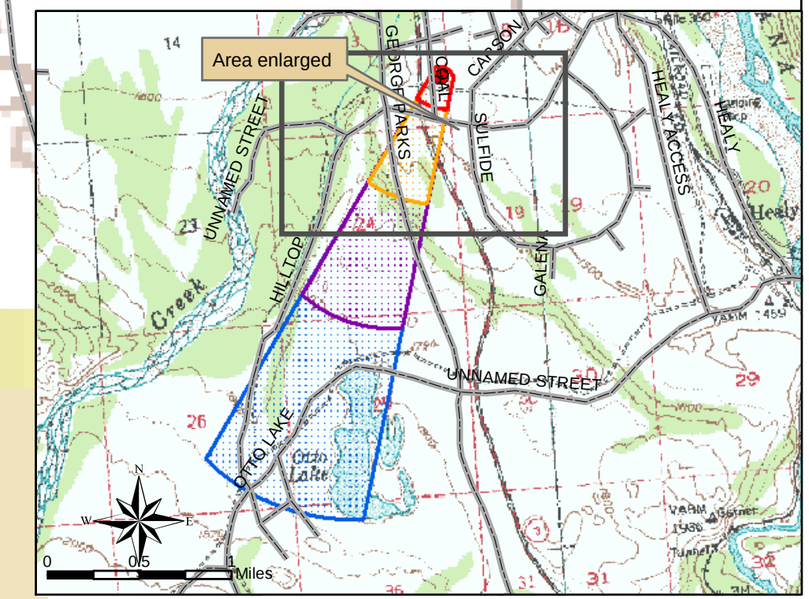
1:6,000

Data Sources:

Background image
- USGS 1:63,000 mapping
Roads
- Geographic Data Technologies

Legend

- Zone A
- Zone B
- Zone C
- Zone D
- Roads
- Denali Borough SD Tri Valley well
- C15, Gasoline station
- D10, Large capacity septic system
- T08, Underground diesel tank
- T12, Underground gasoline tank
- T14, Aboveground heating oil tank



APPENDIX D

Vulnerability Analysis for Tri Valley School Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Tri Valley School

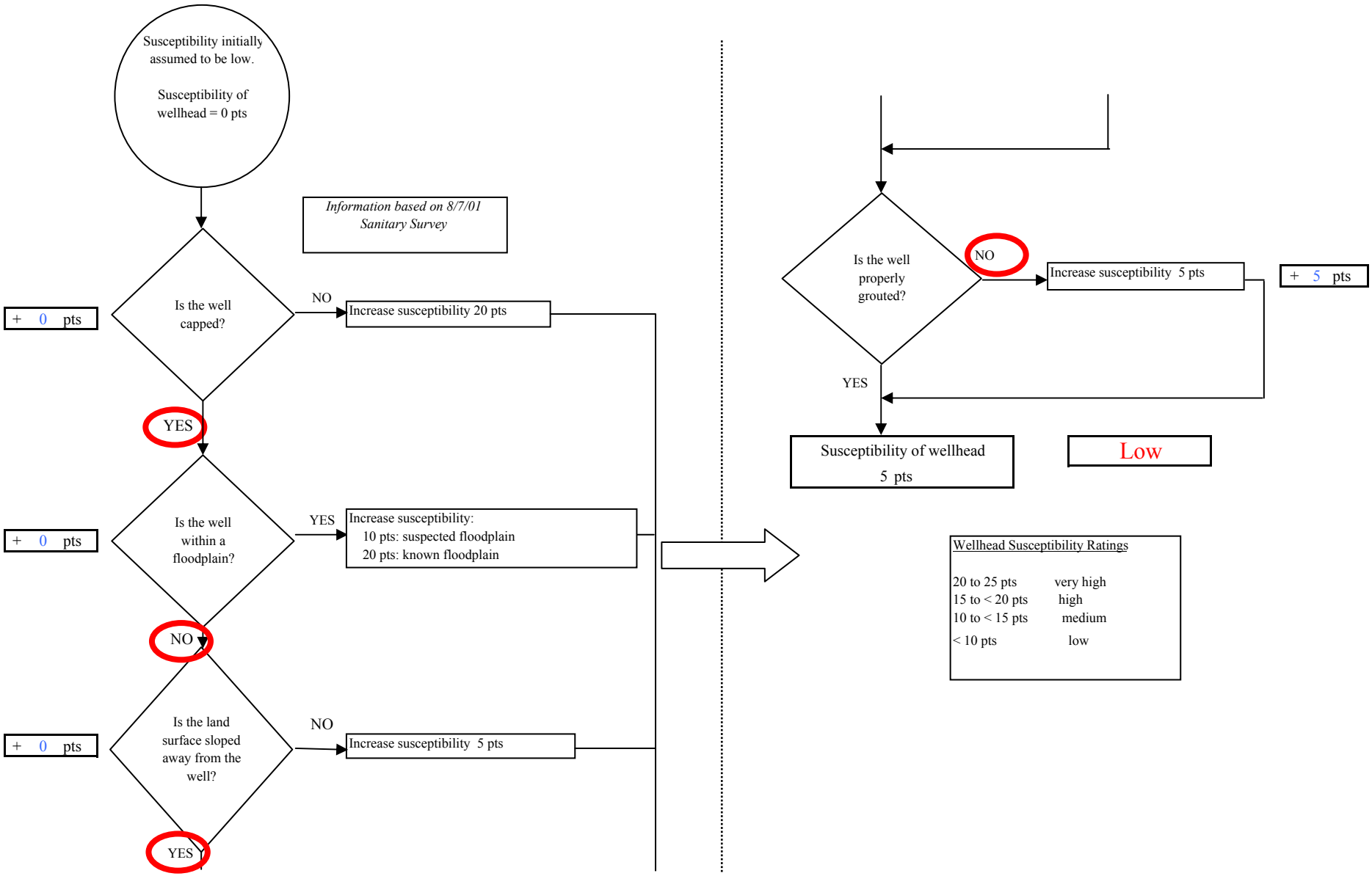


Chart 2. Susceptibility of the aquifer - Tri Valley School

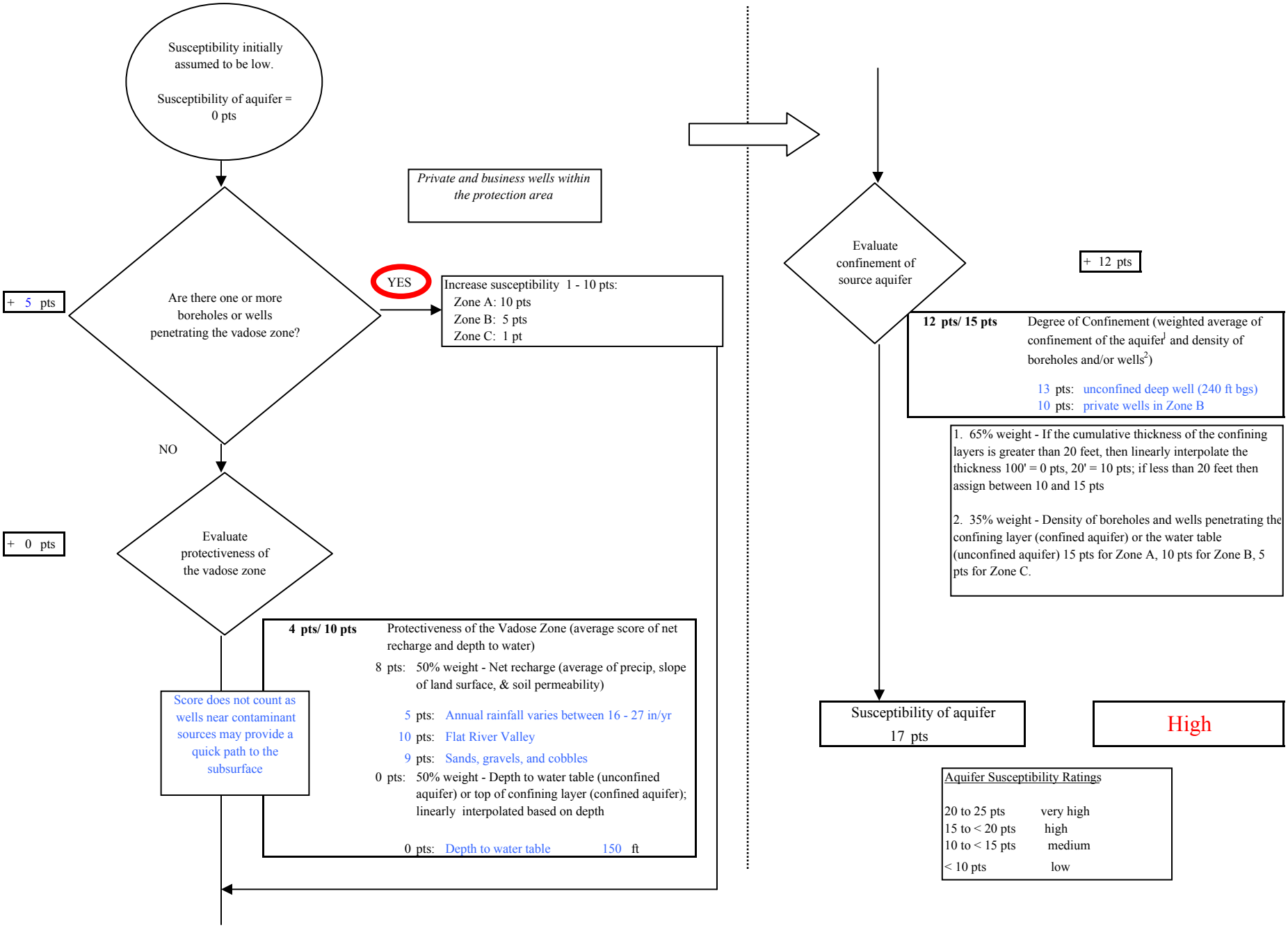
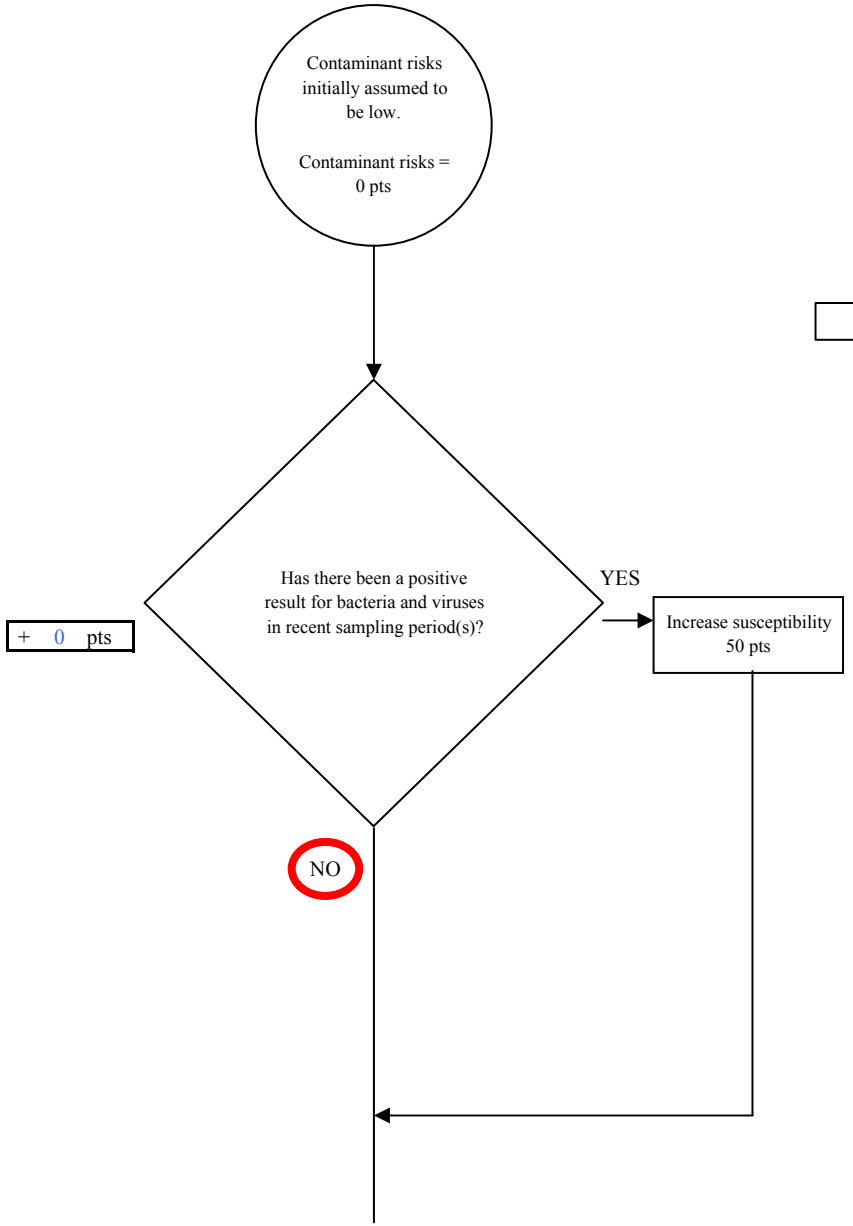
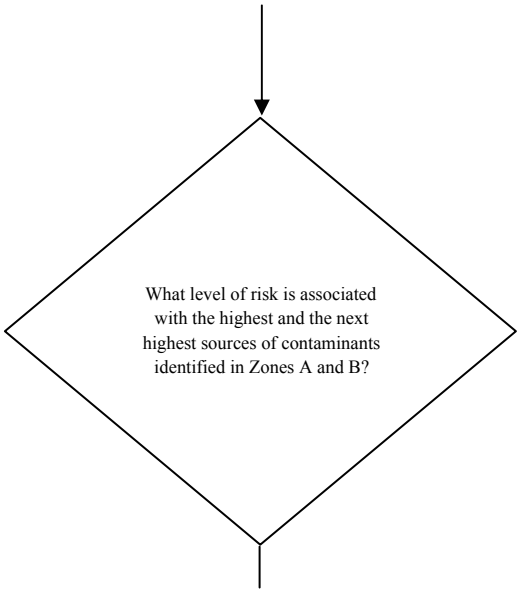


Chart 3. Contaminant risks for Tri Valley School - Bacteria & Viruses





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

	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.

Chart 3. Contaminant risks for Tri Valley School - Bacteria & Viruses

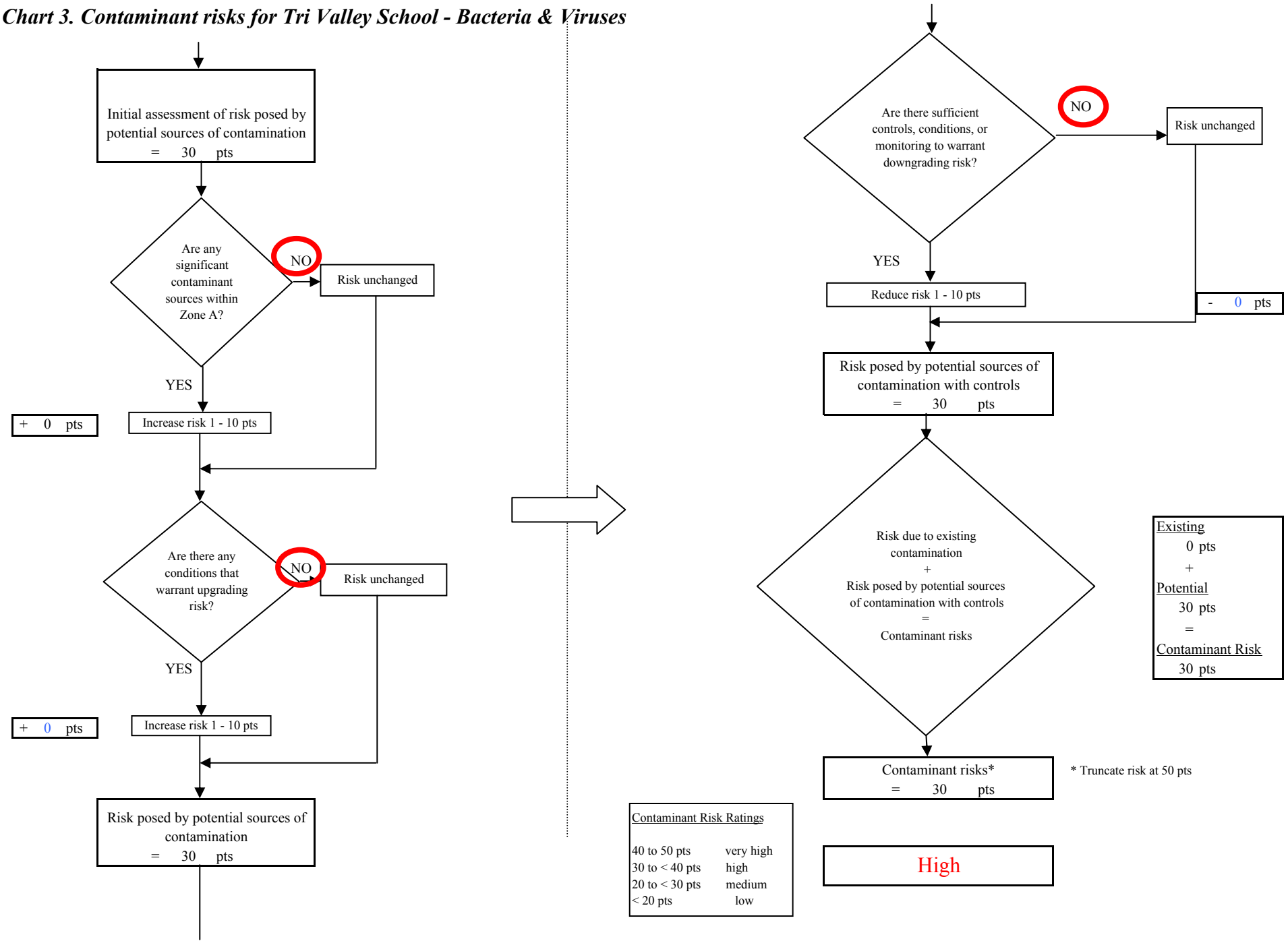


Chart 4. Vulnerability analysis for Tri Valley School - Bacteria & Viruses

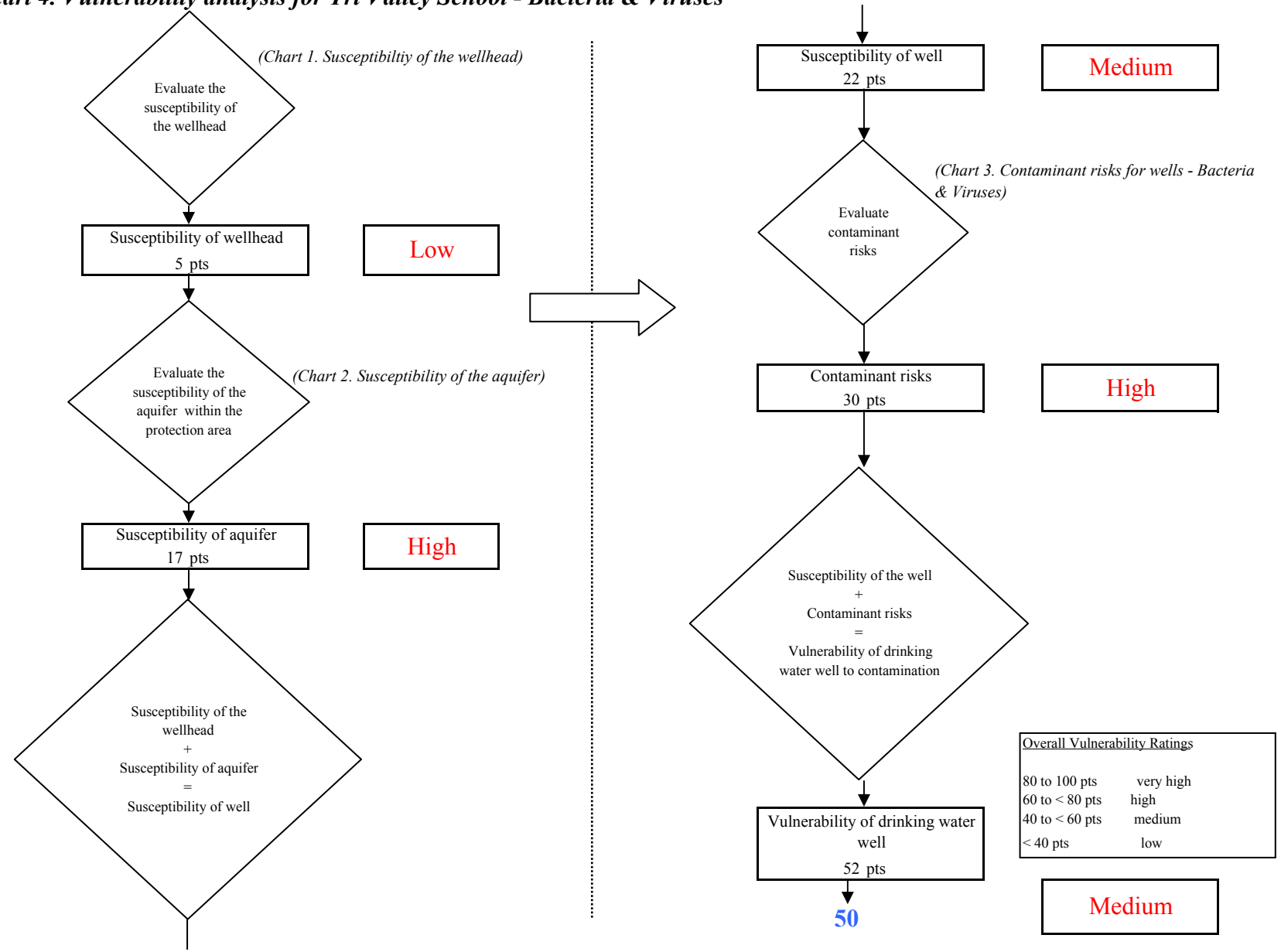


Chart 5. Contaminant risks for Tri Valley School - Nitrates and Nitrites

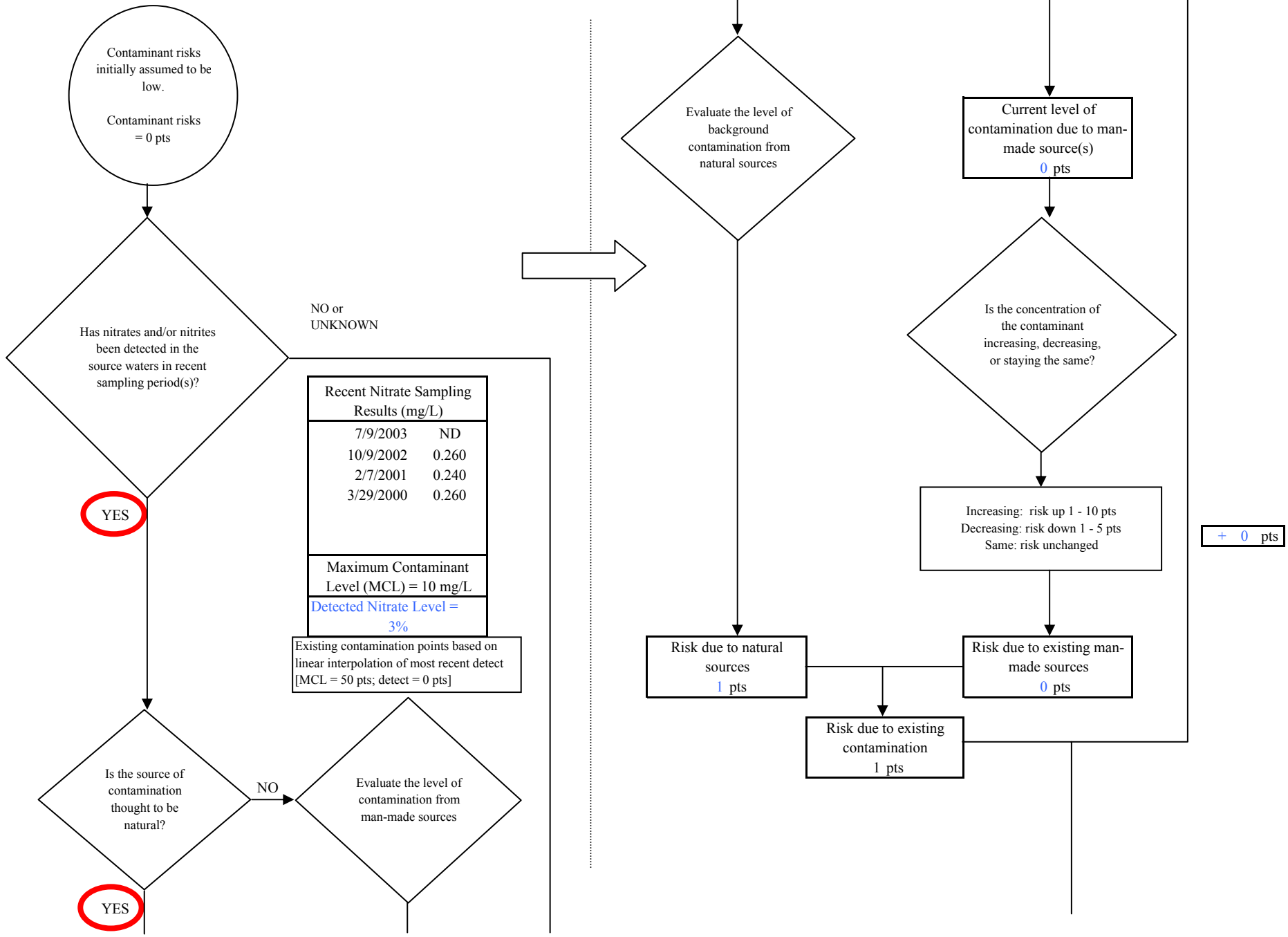


Chart 5. Contaminant risks for Tri Valley School - Nitrates and Nitrites

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

	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 Tri Valley School - Nitrates and Nitrites

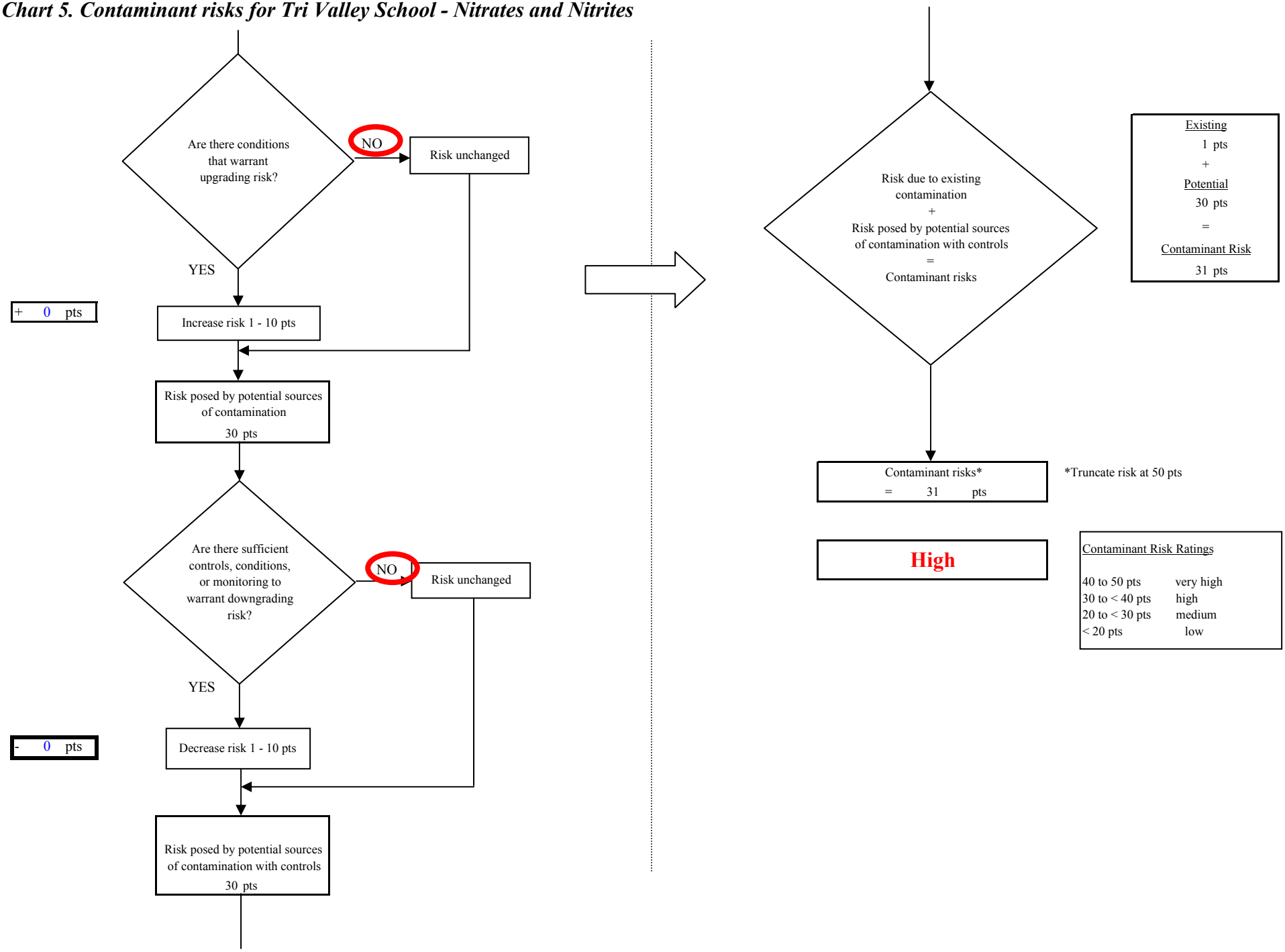


Chart 6. Vulnerability analysis for Tri Valley School - Nitrates and Nitrites

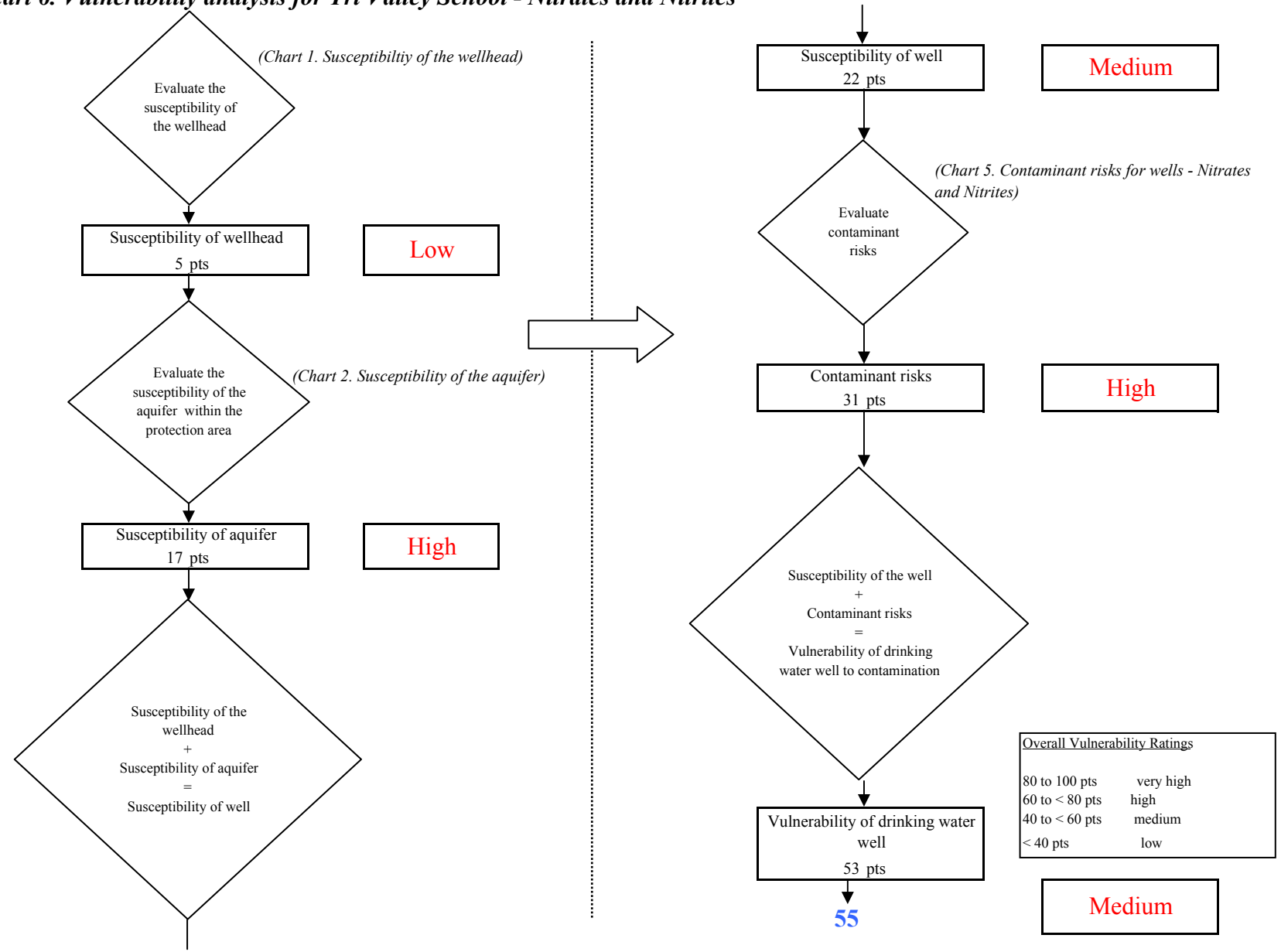


Chart 7. Contaminant risks for Tri Valley School - Volatile Organic Chemicals

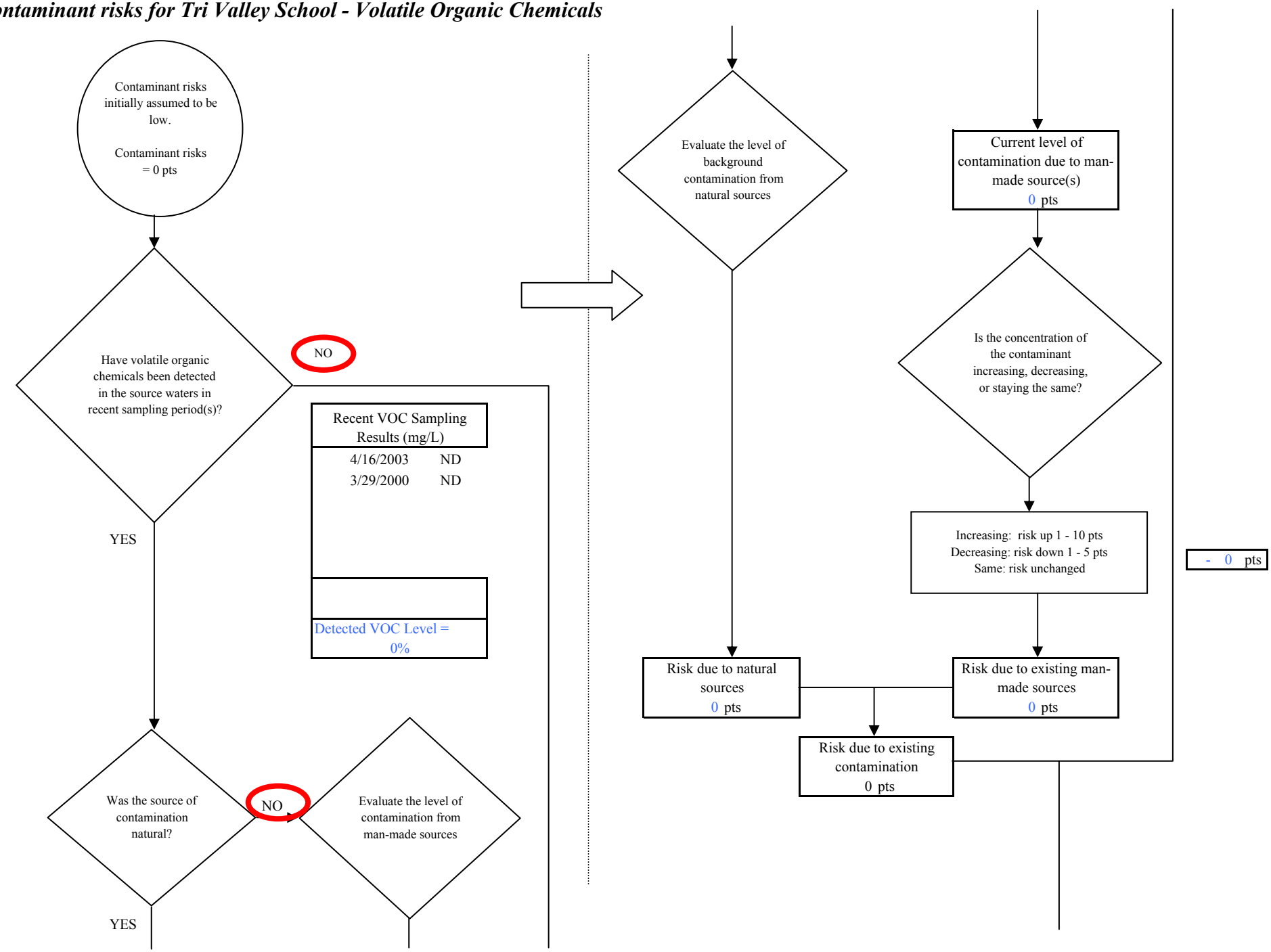


Chart 7. Contaminant risks for Tri Valley School - Volatile Organic Chemicals

+ 40 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	4	4
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 40

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

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

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

- 0 pts

Decrease risk 1 - 10 pts

Are any significant sources within Zone A?

NO

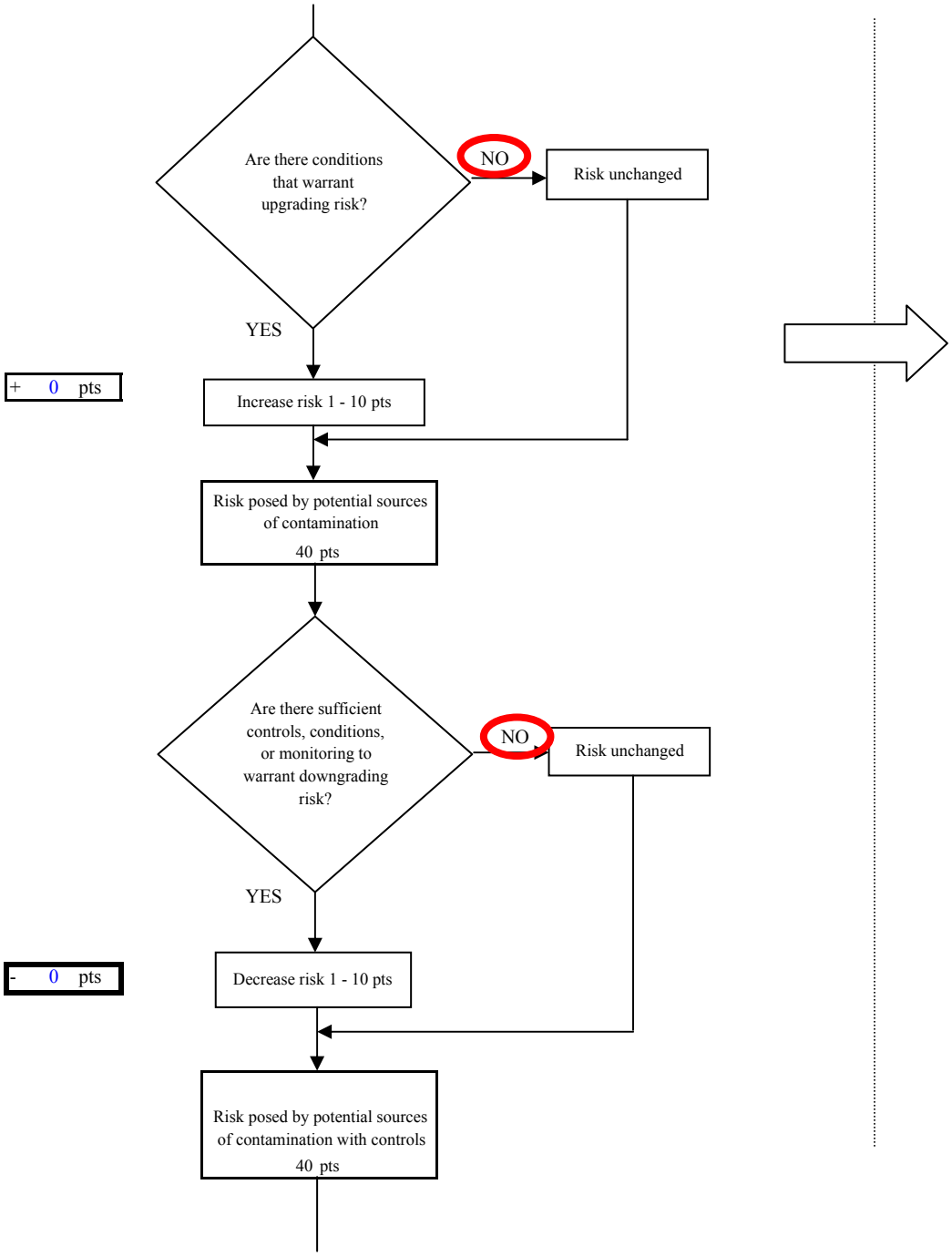
Risk unchanged

YES

+ 0 pts

Increase risk 1 - 10 pts

Chart 7. Contaminant risks for Tri Valley School - Volatile Organic Chemicals



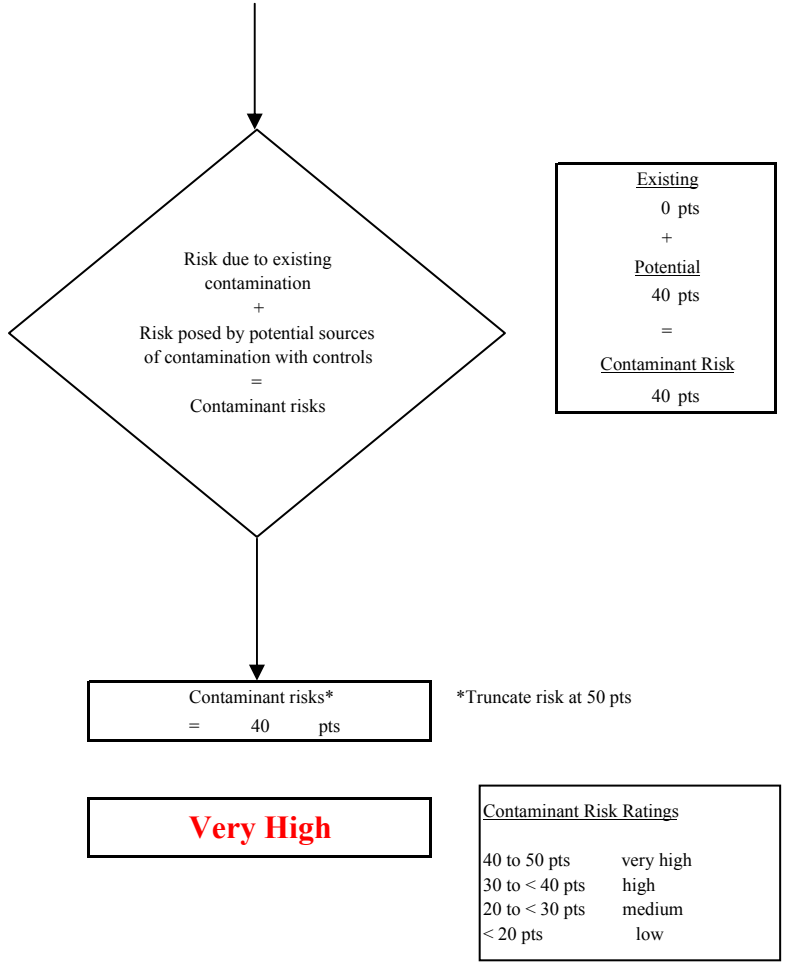


Chart 8. Vulnerability analysis for Tri Valley School - Volatile Organic Chemicals

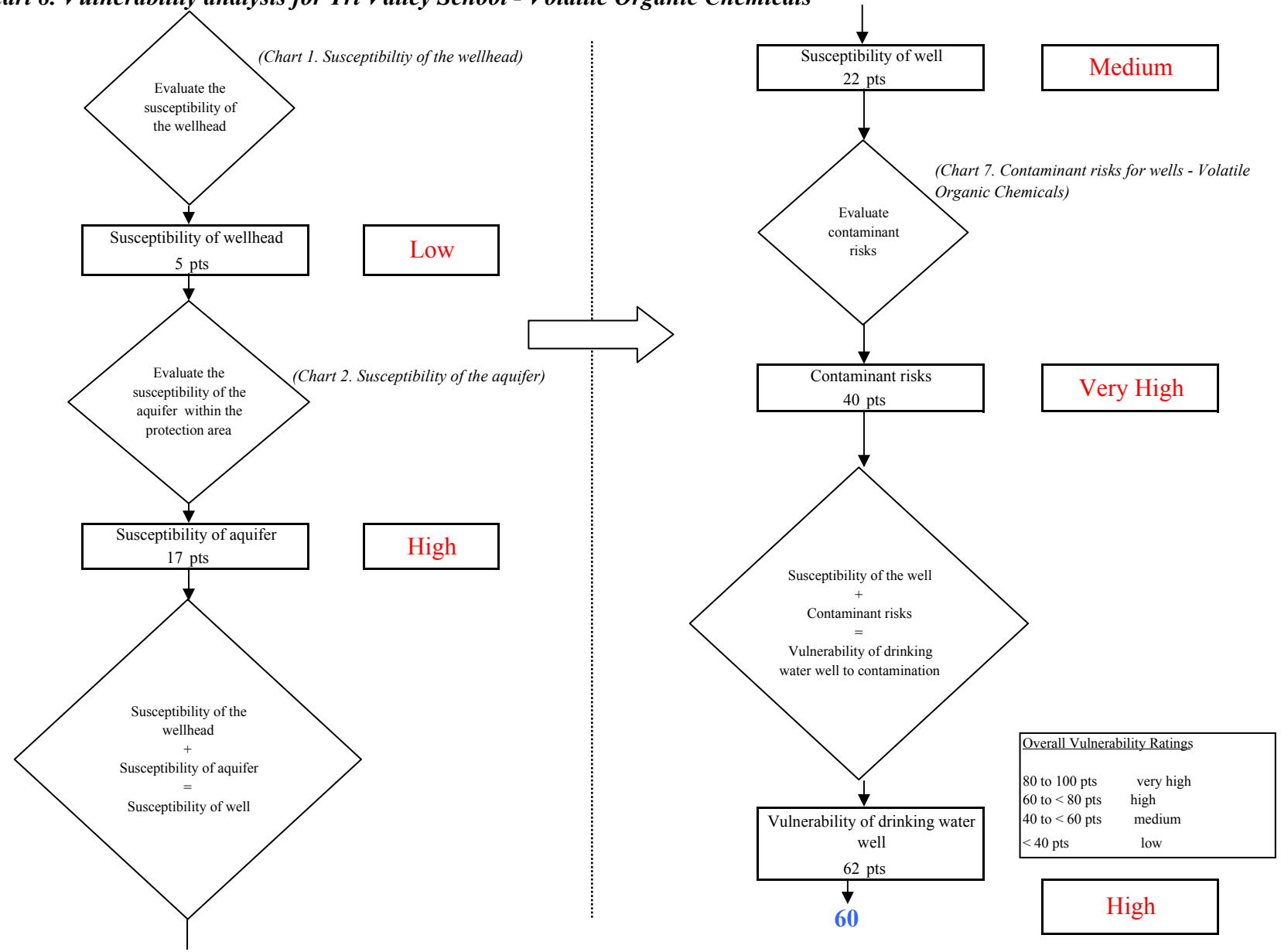


Chart 9. Contaminant risks for Tri Valley School - Heavy Metals, Cyanide and Other Inorganic Chemicals

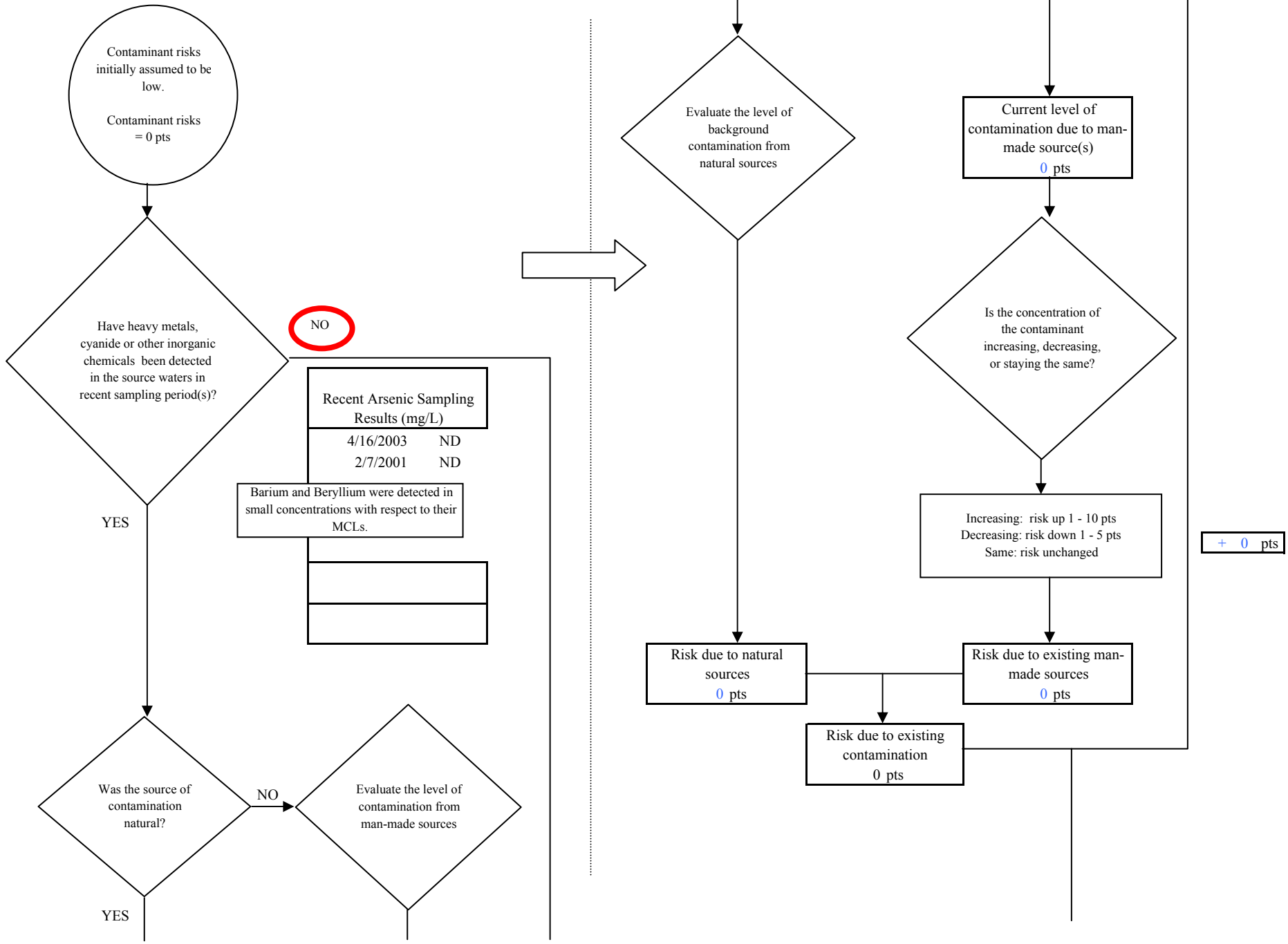
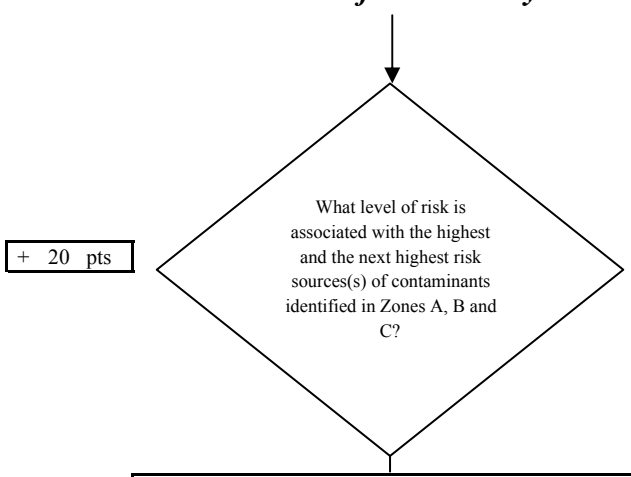


Chart 9. Contaminant risks for Tri Valley School - Heavy Metals, Cyanide and Other Inorganic Chemicals



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	2	2
Low(s)	3	1	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 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.

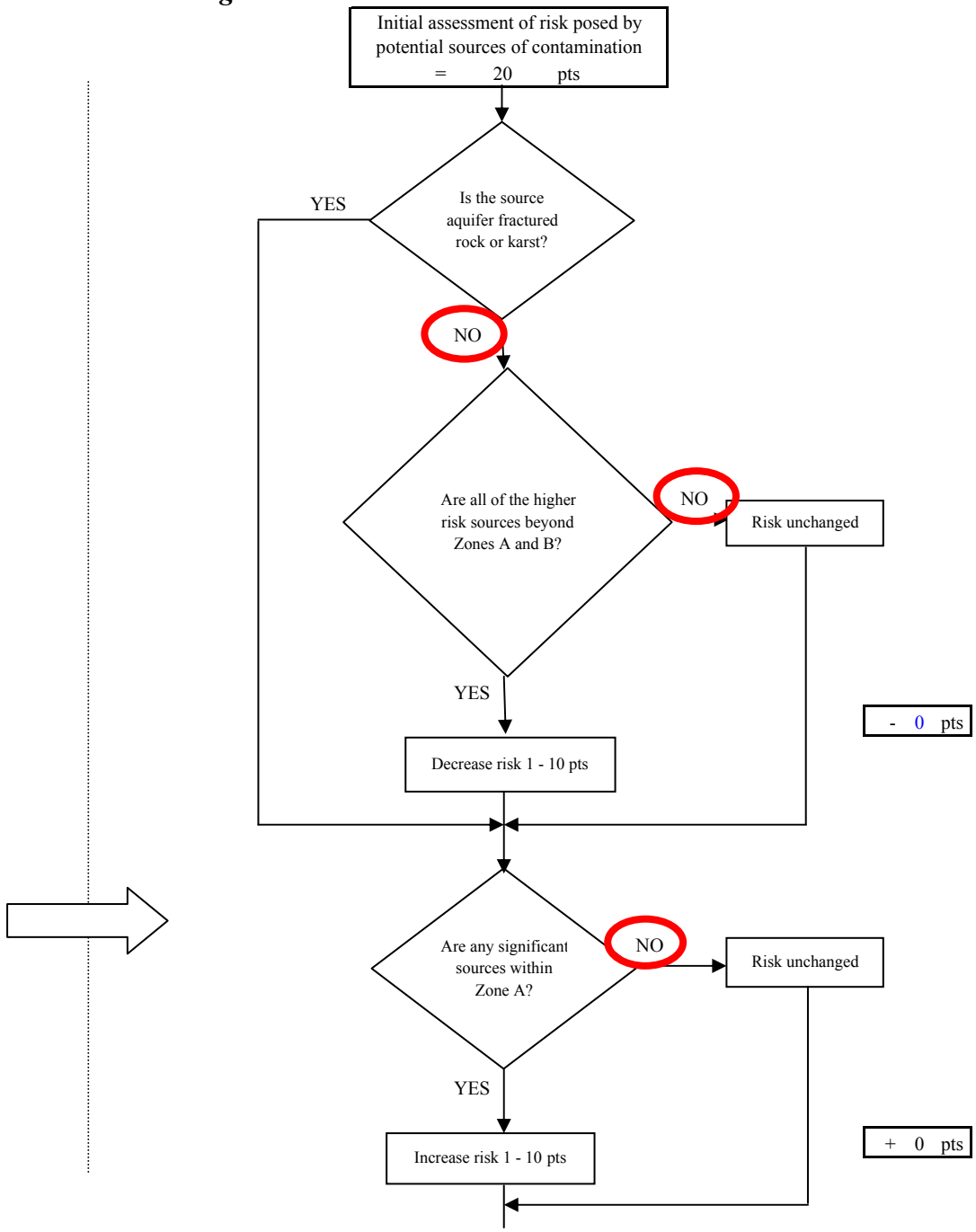


Chart 9. Contaminant risks for Tri Valley School - Heavy Metals, Cyanide and Other Inorganic Chemicals

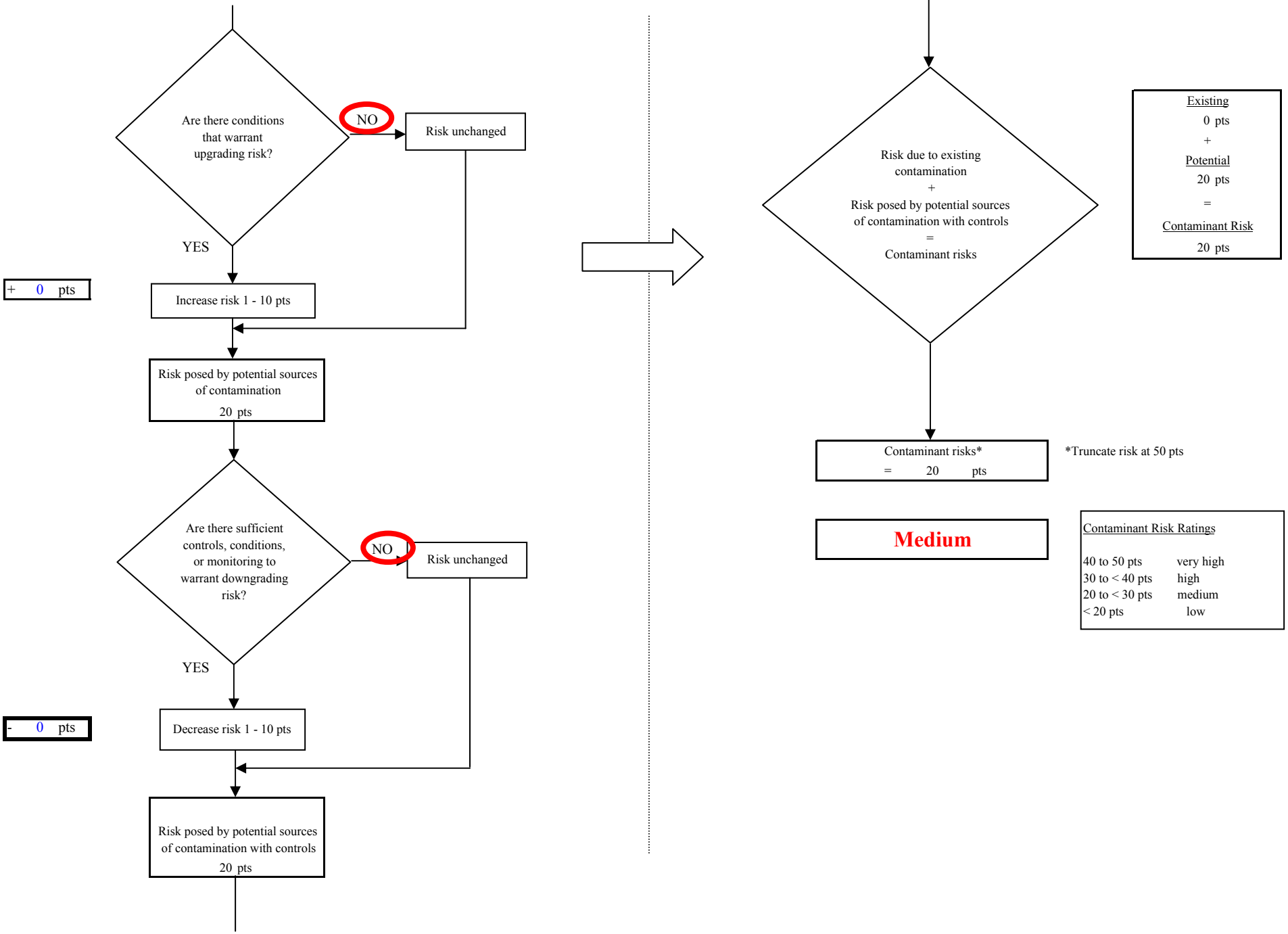


Chart 10. Vulnerability analysis for Tri Valley School - Heavy Metals, Cyanide and Other Inorganic Chemicals

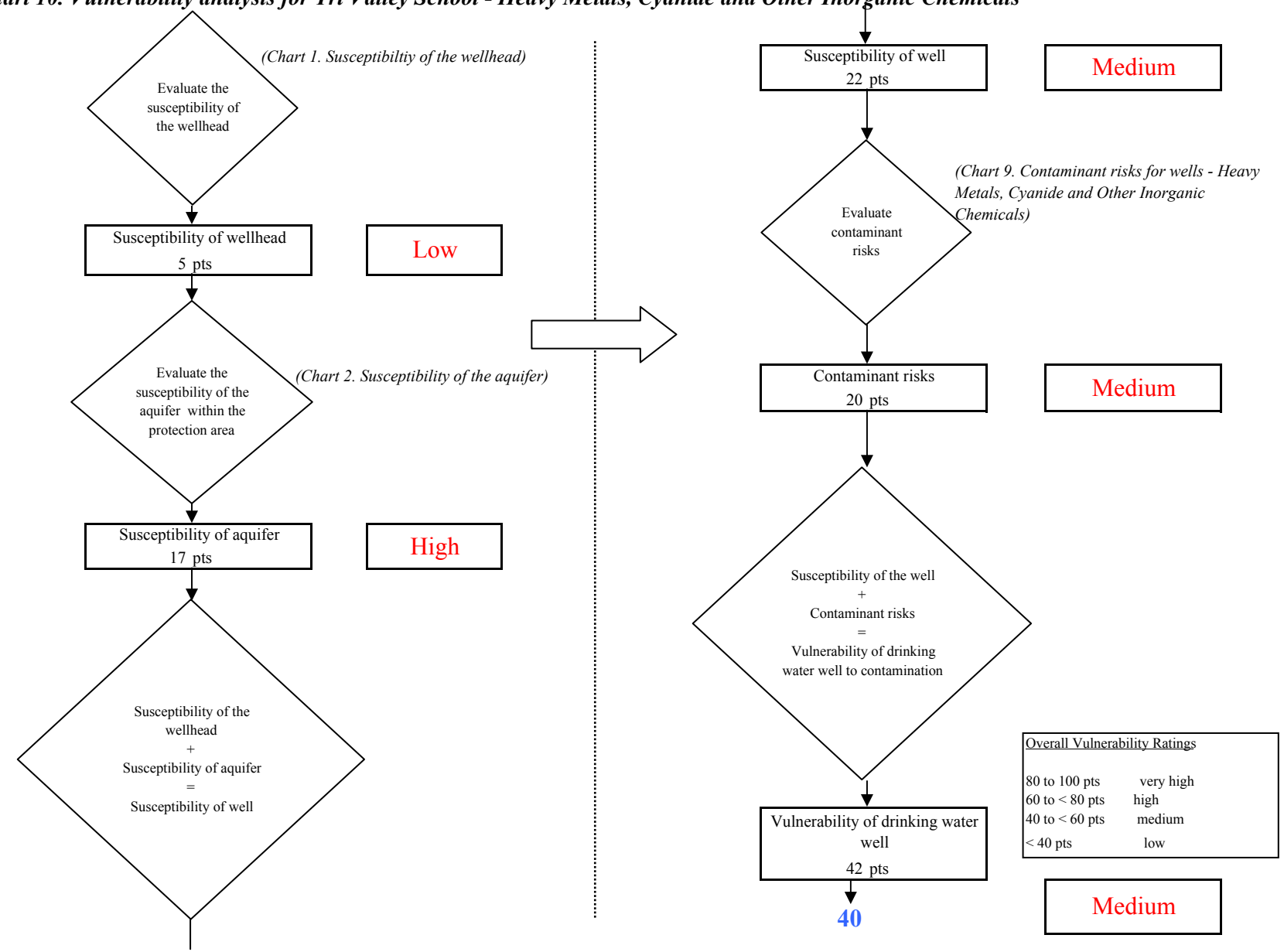


Chart 11. Contaminant risks for Tri Valley School - Synthetic Organic Chemicals

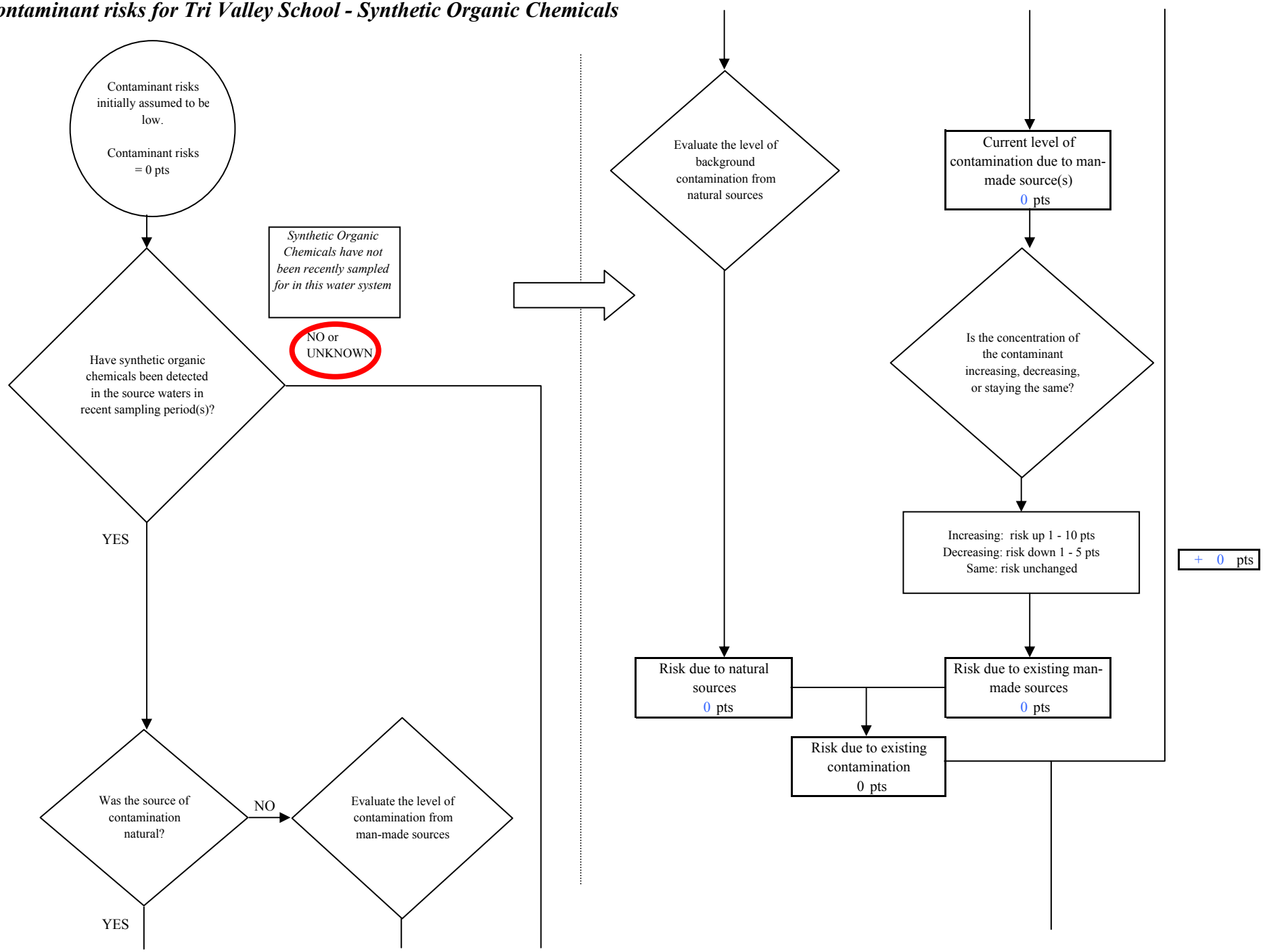
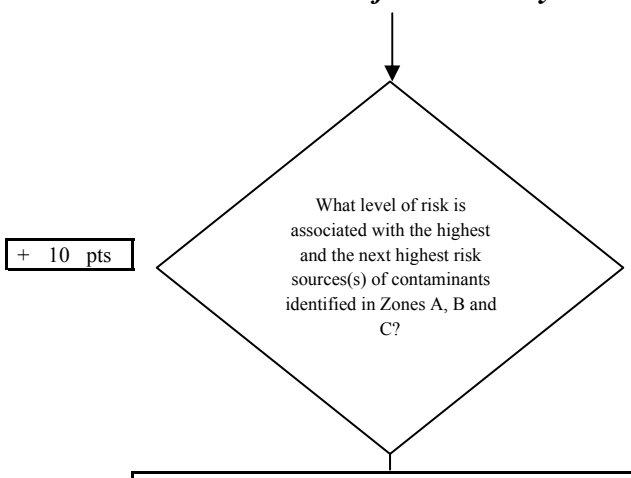


Chart 11. Contaminant risks for Tri Valley School - Synthetic Organic Chemicals



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	0	1

	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.

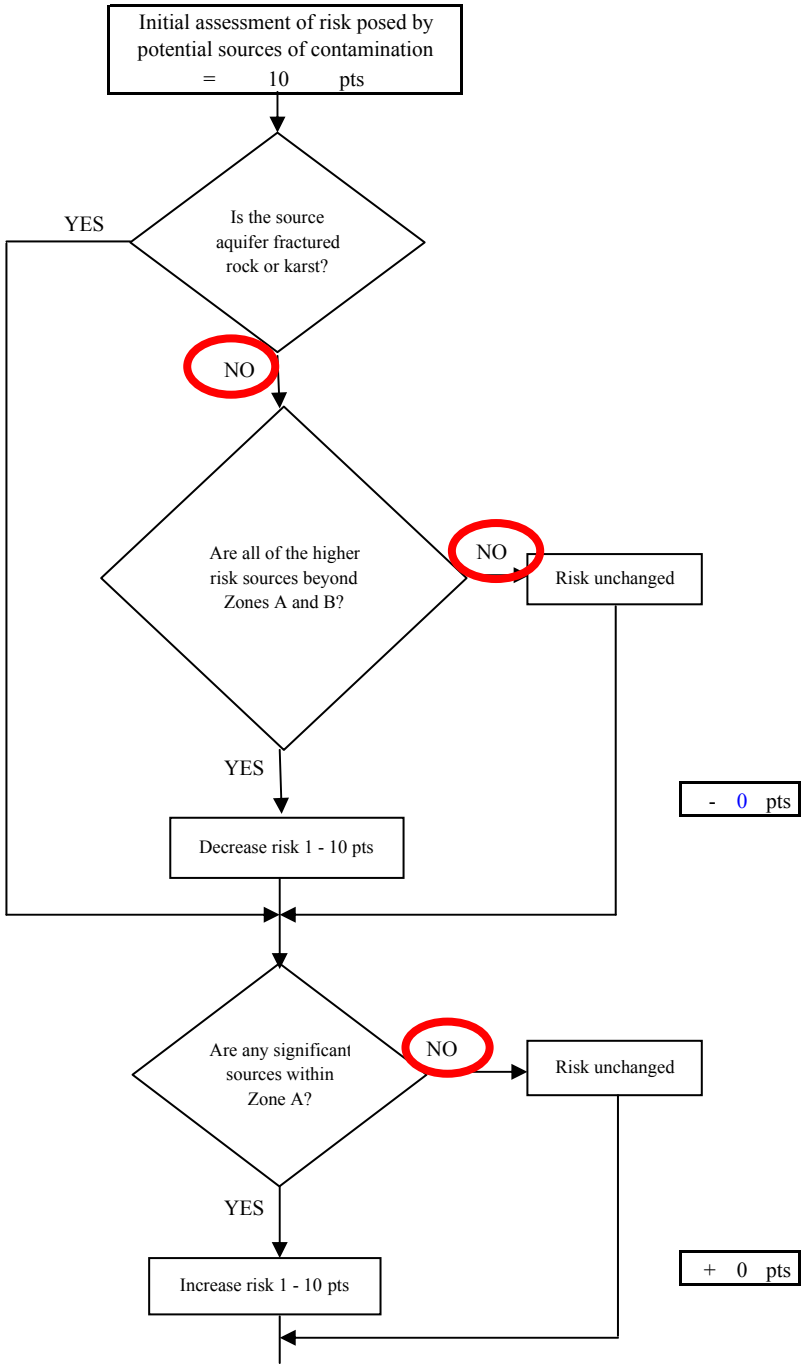
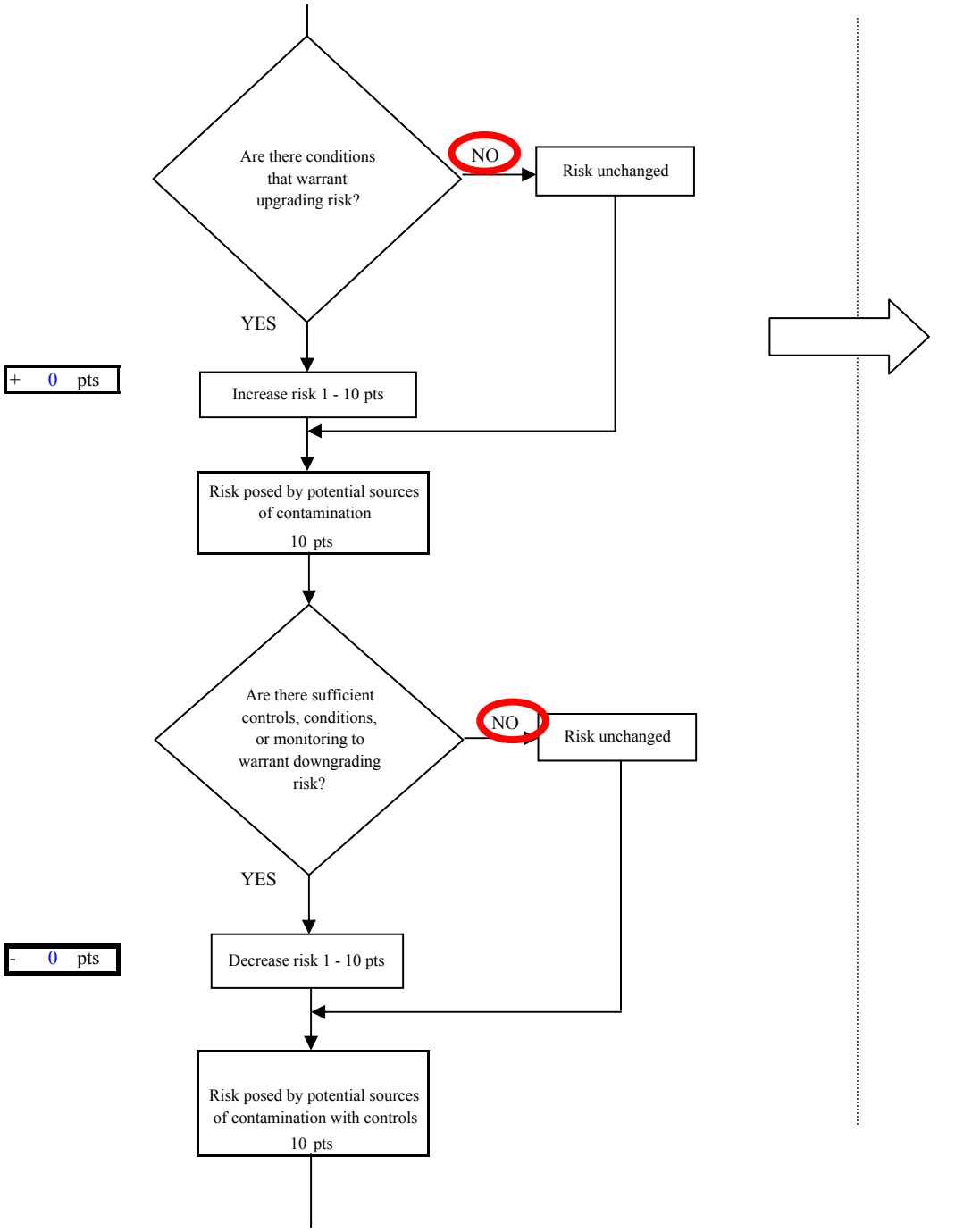


Chart 11. Contaminant risks for Tri Valley School - Synthetic Organic Chemicals



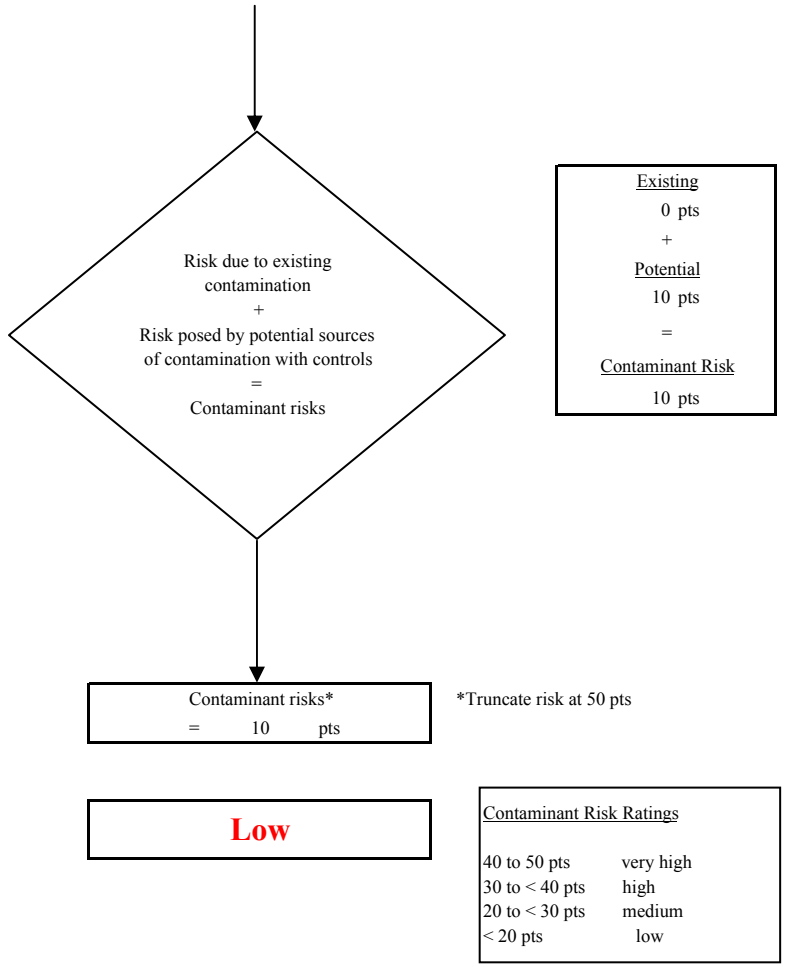


Chart 12. Vulnerability analysis for Tri Valley School - Synthetic Organic Chemicals

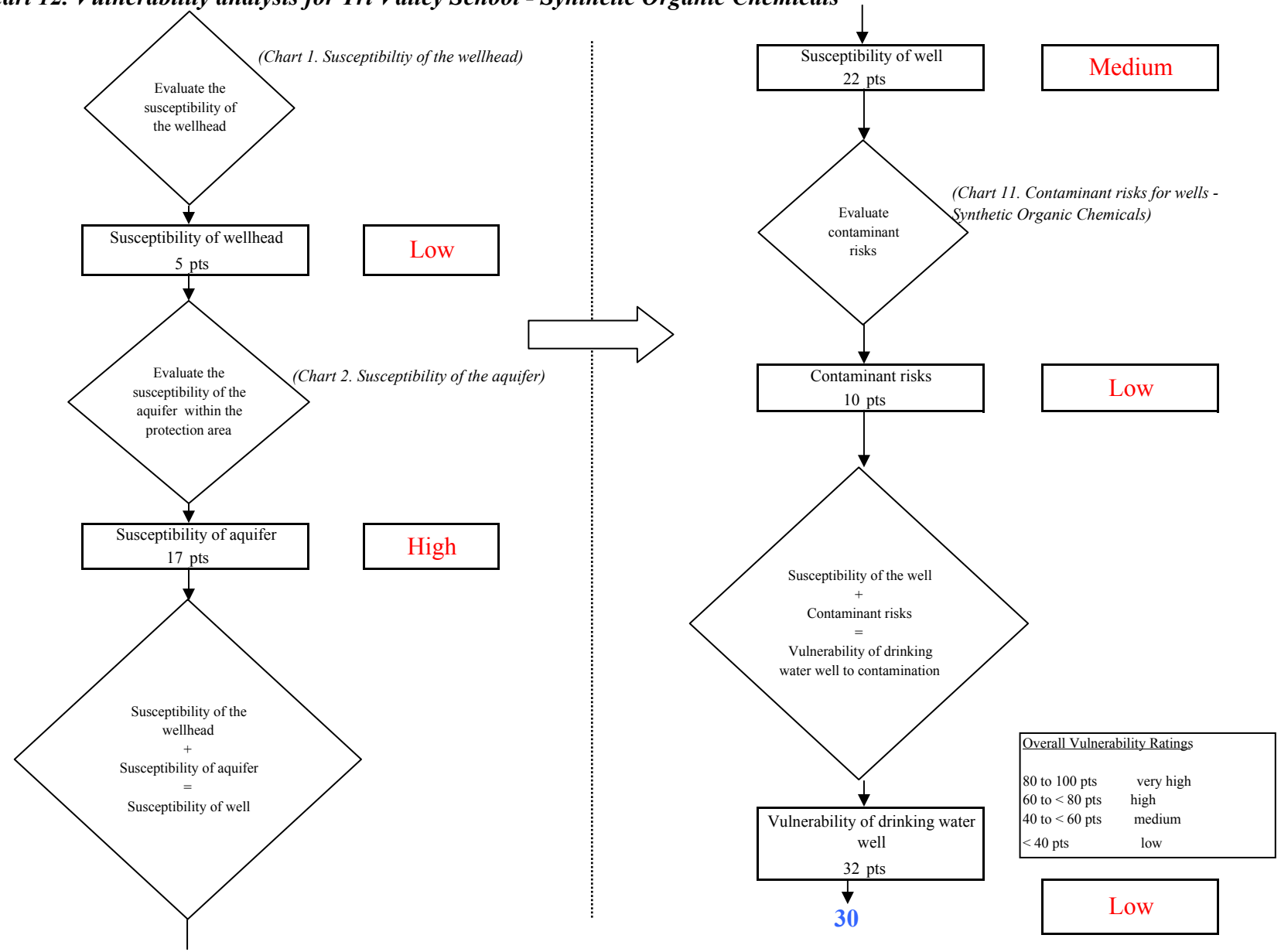


Chart 13. Contaminant risks for Tri Valley School - Other Organic Chemicals

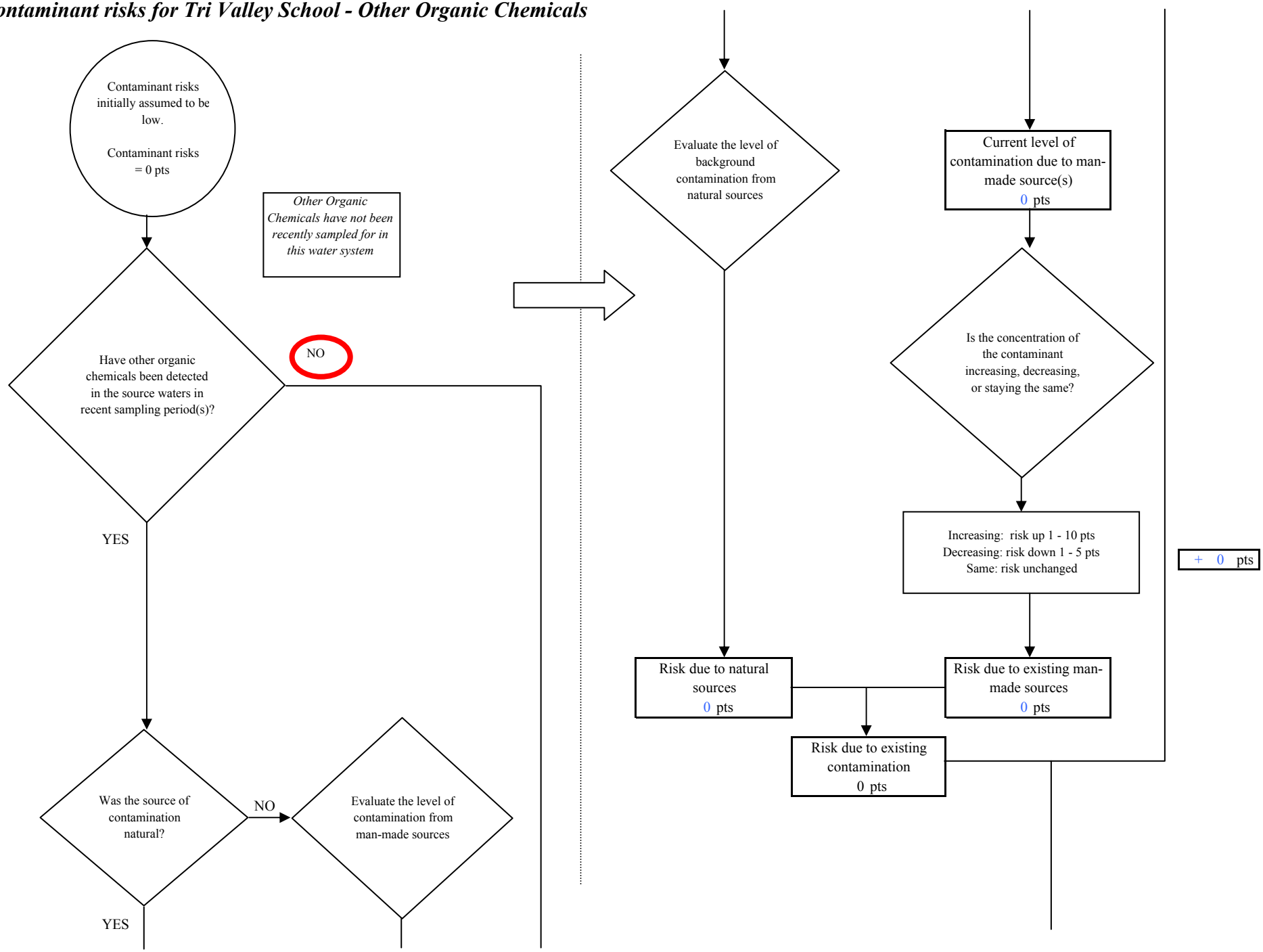


Chart 13. Contaminant risks for Tri Valley School - Other Organic Chemicals

+ 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)	2	1	3

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

Matrix Score 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

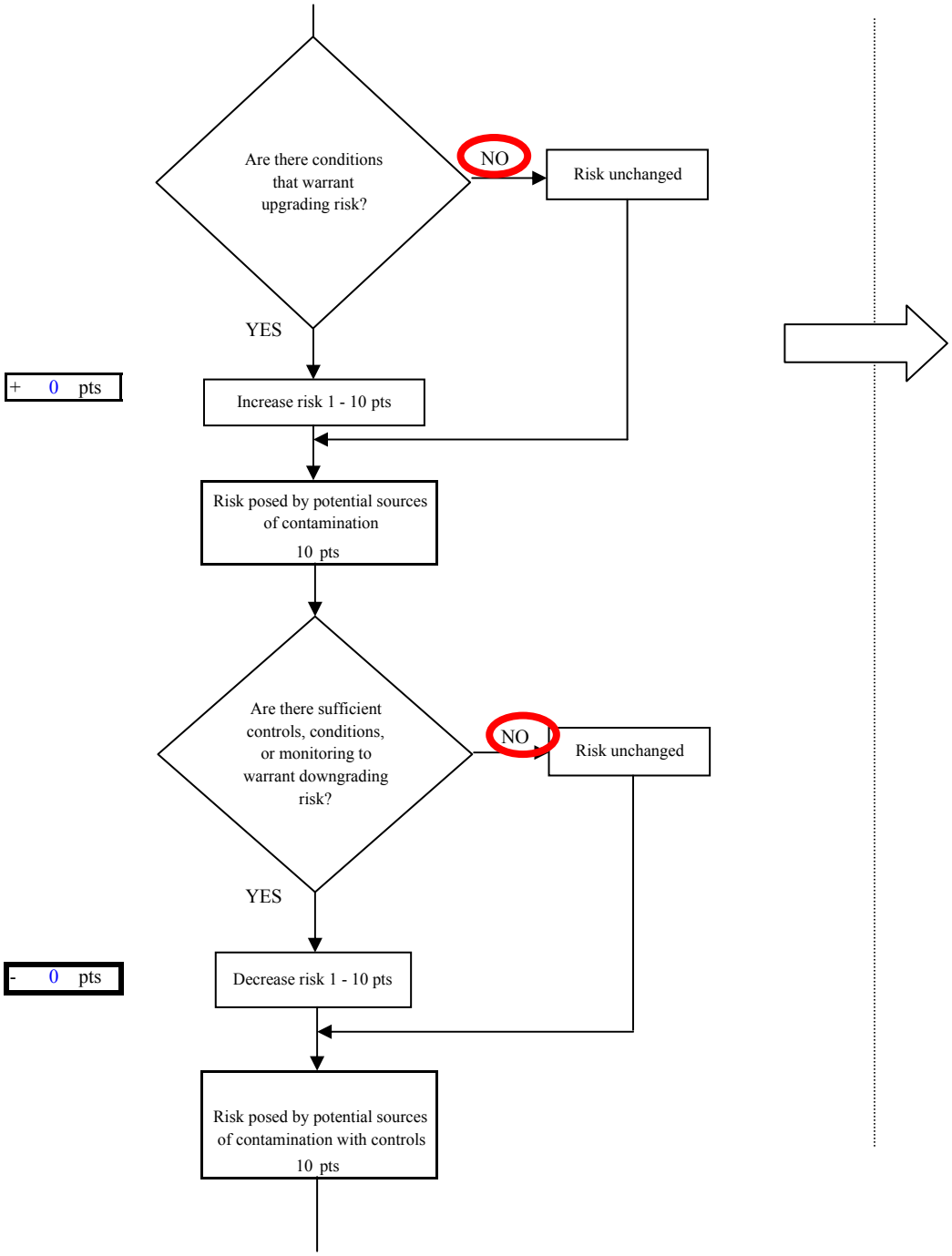
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 0 pts

Chart 13. Contaminant risks for Tri Valley School - Other Organic Chemicals



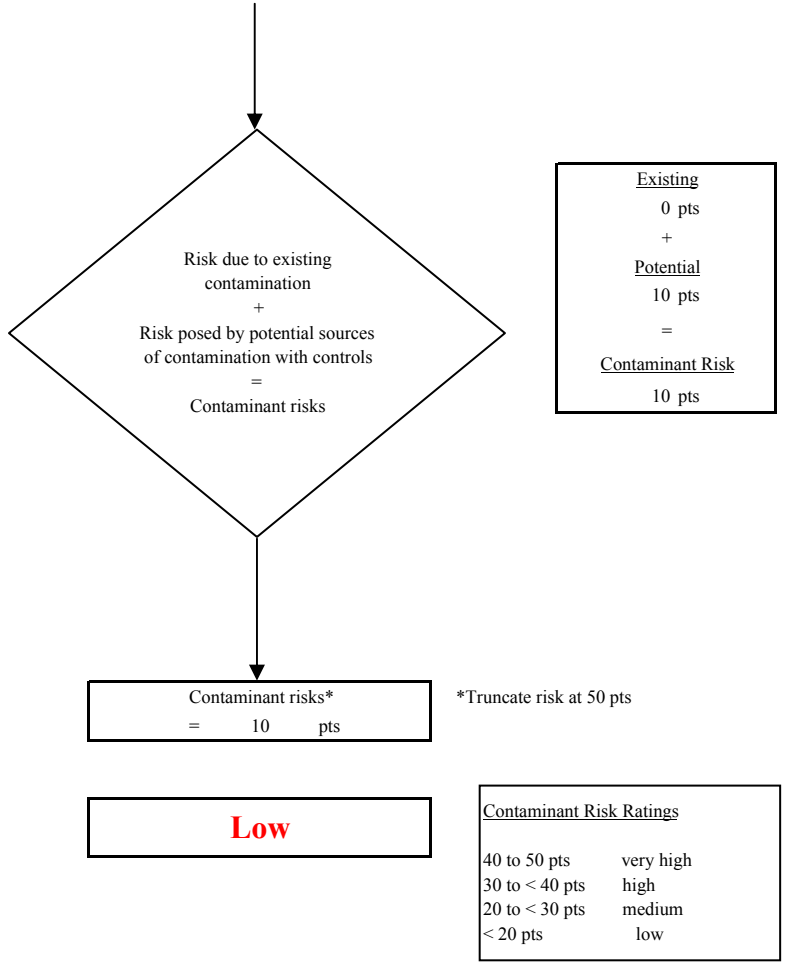


Chart 14. Vulnerability analysis for Tri Valley School - Other Organic Chemicals