Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Lockheed Martin/NOAA/AK Building Drinking Water System, Fox Area, Alaska

PWSID 310421

DRINKING WATER PROTECTION PROGRAM REPORT Report 466
Alaska Department of Environmental Conservation

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The Drinking Water Protection Program 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. 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 Lockheed Martin/NOAA/AK Building Source of Public Drinking Water,
Fox, Alaska

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The public water system for Lockheed Martin/NOAA/AK Building is a Class A (non-transient/community) water system consisting of one well on Eisele Road off of the Steese Highway southeast of Fox, Alaska. Identified potential and current sources of contaminants for Lockheed Martin/NOAA/AK Building public drinking water source include: domestic wastewater treatment plant effluent discharge, an underground mine, a mine tailings area, and an underground diesel storage tank. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals and other organic chemicals. Overall, the public water sources for Lockheed Martin/NOAA/AK Building received a vulnerability rating of **High** for volatile organic chemicals and heavy metals, **Medium** for bacteria and viruses and nitrates and nitrites, and **Low** for synthetic organic chemicals and other organic chemicals.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide public water system owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system.

This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

DESCRIPTION OF THE FAIRBANKS AREA, ALASKA

Fairbanks Area

The Fairbanks area is located in the Fairbanks North Star Borough which is near the center of Alaska (Please see the inset of Map 1 in Appendix A for location information). 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 Koyukon Athabascans are native to the Fairbanks area. Non-native population of the area began as a trading post on the Chena River. The discovery of gold in the early 1900s brought more than 6,000 prospectors during the Pedor Dome gold rush (ADCED, 2002). Construction of the Alcan Highway in the 1940s and the Trans-Alaska oil pipeline in the 1970s helped to continue the growth and development of the Fairbanks area.

Fox

Fox is located 10 miles northeast of Fairbanks at the junction of the Steese and Dalton Highways. Fox originally began as a mining camp established before 1905 and the Fox post office operated from 1908 through 1947 (ADCED, 2002).

The majority of Fox residents have individual water wells or use water delivery and have septic systems, and the remainder haul water from a central water point in Ester (ADCED, 2002). Heating oil (stored in both above and below ground 275 to 500-gallon tanks) is used for heating homes and buildings. Electricity is provided by Golden Valley Electric Association. Refuse is collected from dumpsters and transported to the Fairbanks North Star Borough landfill.

Climate

The Fairbanks area experiences extreme weather variations according to season. Temperatures in January vary from –22 to –2 degrees Farenheight and from 50 to 72 degrees in July (ADCED, 2002). Average annual precipitation in the area is 11.3 inches (ADCED, 2002). Ice fog is common during the winter.

Topography and Drainage

The Fairbanks area includes two distinct topographic areas: the floodplain of the Tanana River and the Chena River, and the uplands north of this floodplain. Ester is located in the uplands. Elevation in the uplands varies from about 500 feet to 2500 feet.

The uplands are drained by many small creeks that flow into the Chena, Tanana, and Chatanika Rivers. The hydrology of these streams is greatly affected by the distribution of permafrost. Streams in the upper areas are dry most of the summer with runoff occurring during spring snowmelt and after heavy summer rains.

Geology and Soils

Bedrock under the Fairbanks area is predominantly a metamorphosed marine mud deposit, called a pelitic schist. Calc-mica schist, marble, and quartzite are also found in the area. The schist is locally intruded by granitic rocks – granite and quartz diorite.

Permafrost is common on the lower part of the north-facing slopes and valley bottoms in the uplands area (Nelson, 1978).

Groundwater

Groundwater is principally contained in fractured bedrock of the Yukon-Tanana complex (King, 1969). Groundwater flows through bedrock primarily within the fractures. The capacity of the rocks to yield water to wells depends in part on their ability to hold fractures open against the pressure of overlying rocks. The water wells in the Ester area with the greatest well recharge appear to be in quartz veins, quartzite, and siliceous schist (Nelson, 1978).

Groundwater in the uplands is recharged by local precipitation. Outflow of ground water in the uplands primarily occurs two ways. In areas under artesian pressure (pressure caused by overlying permafrost), water can flow to the surface through thawed conduits within the permafrost. Otherwise groundwater will flow under the permafrost (if present) and out to the groundwater beneath the adjacent flood plain or creek valley (Nelson, 1978).

LOCKHEED MARTIN/NOAA/AK BUILDING PUBLIC DRINKING WATER SYSTEM

Lockheed Martin/NOAA/AK Building public water system is a Class A (non-transient/community) water system. The system consists of one well on Eisele Road off of the Steese Highway 10 miles southeast of Fox, Alaska (T2N, R1E, Section 27) (See Map 1 of Appendix A). This area is at an elevation of approximately 900 feet above sea level.

According to the water system operator, the depth of the well is 180 feet. Although a well log is not available for this well, other wells in the area are screened in bedrock and it is assumed that this well is also. The Sanitary Survey (8/10/98) indicates the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. The land surface is also appropriately sloped away from the well providing adequate surface water drainage. The well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants travelling along the well casing and into source waters.

This system operates year-round and 31 non-residents through one service connection.

LOCKHEED MARTIN/NOAA/AK BUILDING DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. Some areas are more likely to allow contamination to reach the well than others are. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and the well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the Drinking Water Protection Area (DWPA). Because releases of contaminants within the DWPA are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An outline of the immediate watershed was used to determine the size and shape of the DWPA for Lockheed Martin/NOAA/AK Building. Available bedrock geology was also considered to take into

account the trend of fractures and bedding planes water travels through to arrive at a meaningful DWPA (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The DWPAs established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources (*Jokela et. al., 1991*).

The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four DWPA zones and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. TOT
B	Less than the 2 year TOT
C	Less Than the 5 year TOT
D	Less than the 10 year TOT

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

The DWPA for Lockheed Martin/NOAA/AK Building is limited by its immediate watershed and includes only Zone A (See Map 1 of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Lockheed Martin/NOAA/AK Building DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. 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 organic chemicals.

The sources are displayed on Map 2 of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are 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 function of toxicity and volumes of specific contaminants associated with that source.

Tables 2 through 6 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, and other organic chemicals.

VULNERABILITY OF LOCKHEED MARTIN/NOAA/AK BUILDING DRINKING WATER SOURCE

Vulnerability of a drinking water source to contamination is a combination of two factors:

- Natural susceptibility; and
- Contaminant risks.

Each of the six categories of drinking water contaminants has been analyzed and an overall vulnerability score of 0 to 100 is ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

A score for the Natural Susceptibility is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)

+

Susceptibility of the Aquifer (0 – 25 Points)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

The well for Lockheed Martin/NOAA/AK Building is completed in an unconfined aquifer setting. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Susceptibility scores and ratings for Lockheed Martin/NOAA/AK Building.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	24	Very High
Natural Susceptibility	24	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	35	High
Nitrates and/or Nitrites	35	High
Volatile Organic Chemicals	40	Very High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	50	Very High
Synthetic Organic Chemicals	0	Low
Other Organic Chemicals	10	Low

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 naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. 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 contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains 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, synthetic organic chemicals, and other organic chemicals, respectively.

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	55	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	65	High
Heavy Metals, Cyanide and Other Inorganic Chemicals	75	High
Synthetic Organic Chemicals	25	Low
Other Organic Chemicals	35	Low

Bacteria and Viruses

The contaminant risk for bacteria and viruses is high with the domestic waste water treatment plant effluent creating the only risk to the drinking water well (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D).

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses have not been detected during recent water sampling of the system at Lockheed Martin/NOAA/AK Building. 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 contaminant risk for nitrates and nitrites is high with the domestic waste water treatment plant effluent creating the only risk to the drinking water well (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

Sampling history for Lockheed Martin/NOAA/AK Building well indicates that concentrations of nitrate were detected in 1999 in a very low concentration (0.1 mg/L). Nitrates have not been detected in previous or subsequent years. The Maximum Contaminant Level (MCL) for nitrates is 10 mg/L. The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects.

It is unknown how much of the existing nitrate concentration can be attributed to natural or human-made sources. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the decomposition of organic matter in soils [Wang, Strelakos, Jokela, 2000].

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 contaminant risk for volatile organic chemicals is very high with underground diesel tank creating the most significant risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D). Both underground and above ground heating oil storage tanks are the standard way of heating homes and businesses in the Fox 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 recent sampling of Lockheed Martin/NOAA/AK Building's well. 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 contaminant risk for heavy metals is very high with the mining activities in the DWPA creating the most significant risk (See Chart 9 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D). Water flowing over and through the metal-rich rock exposed by mining activities can contaminate the surface and ground waters. This occurrence is called acid mine drainage, and is often generated from waste rock piles or other mining wastes. Acid mine drainage can occur at an active or inactive mine or tailing and continue long after mining ends.

Review of the historical sampling data indicates that copper has recently been detected above the MCL in Lockheed Martin/NOAA/AK Building's drinking water (3.54 in 2000). High levels of copper are usually caused by corrosion of the water system's plumbing, but can also come from the erosion of natural deposits such as caused by mining activities (EPA, 2000). No other contaminants of this category were detected in significant levels. After combining the contaminant risk for heavy metals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is high.

Synthetic Organic Chemicals

No sources of synthetic organic chemicals were inventoried in the DWPA. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability to synthetic organic chemicals of the well is low.

Other Organic Chemicals

The contaminant risk for other organic chemicals is low with the domestic wastewater treatment plant effluent creating the only risk. After combining the contaminant risk with the natural susceptibility of the well, the overall vulnerability to other organic chemicals of the well is low.

Review of the historical sampling data indicates that no synthetic organic chemicals or other organic chemicals have been sampled for in Lockheed Martin/NOAA/AK Building's drinking water within the past 5 years (See Charts 11 and 13 – Contaminant Risks for Synthetic

Organic Chemicals and Other Organic Chemicals in Appendix D, respectively).

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Lockheed Martin/NOAA/AK Building. The overall vulnerability of this source to contamination is **High** for volatile organic chemicals and heavy metals, **Medium** for bacteria and viruses and nitrates and nitrites, and **Low** for synthetic organic chemicals and other organic chemicals. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of Lockheed Martin/NOAA/AK Building to protect public health. It is anticipated that *Source Water Assessments* will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of Lockheed Martin/NOAA/AK Building public drinking water source.

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APPENDIX A

Lockheed Martin/NOAA/AK Building
Drinking Water Protection Area Location Map
(Map 1)

Lockheed Martin/NOAA/AK Bldg Drinking Water Protection Area

OLD STEESE HIGHWAY

STEESE HIGHWAY

EISELE ROAD

Zone A

Lockheed Martin/NOAA/AK Bldg Well

GILMORE TRAIL

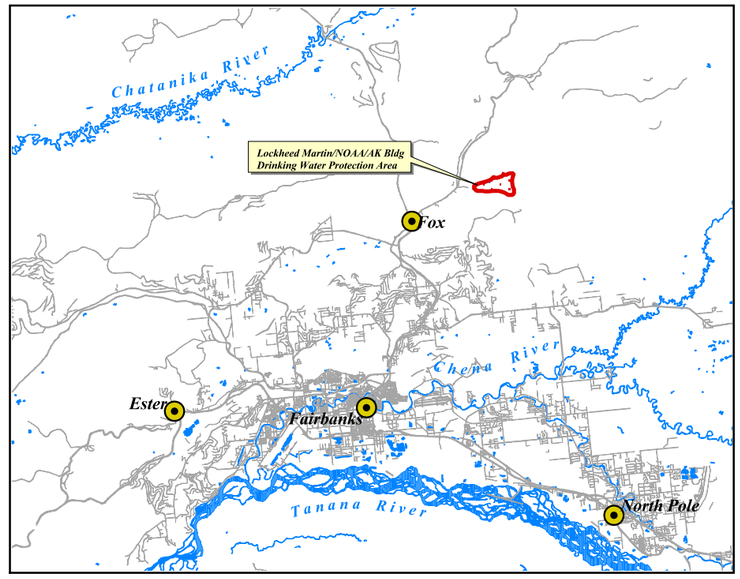
TUNGSTEN TRAIL

1 0 1 2 3 Miles

PWSID 310421.001

Legend

- Lockheed Martin/NOAA/AK Bldg well
- Zone A Protection Area
- Several Months Travel Time
- Parcels
- Roads



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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Lockheed Martin/NOAA/AK Building (Tables 1-6)

Table 1 *Contaminant Source Inventory for* ***PWSID 310421.001***

Lockheed Martin /NOAA/Ak Bldg

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater treatment plant effluent discharge	D03	D03-1	A	2	North-northwest of GCGO Building
Metals mining, underground (active or inactive?)	E05	E05-1	A	2	
Mine tailings (active piles or ponds)	E07	E07-1	A	2	Gilmore Creek is mine tailings of both active and inactive mines
Tanks, diesel (underground)	T08	T08-1	A	2	Heating and Equipment fuel

Table 2

Contaminant Source Inventory and Risk Ranking for Lockheed Martin /NOAA/Ak Bldg Sources of Bacteria and Viruses

PWSID 310421.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Domestic wastewater treatment plant effluent discharge	D03	D03-1	A	High	2	North-northwest of GCGO Building

Table 3

Contaminant Source Inventory and Risk Ranking for Lockheed Martin /NOAA/Ak Bldg Sources of Nitrates/Nitrites

PWSID 310421.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Domestic wastewater treatment plant effluent discharge	D03	D03-1	A	High	2	North-northwest of GCGO Building

Table 4

Contaminant Source Inventory and Risk Ranking for Lockheed Martin /NOAA/Ak Bldg Sources of Volatile Organic Chemicals

PWSID 310421.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Domestic wastewater treatment plant effluent discharge	D03	D03-1	A	Low	2	North-northwest of GCGO Building
Metals mining, underground (active or inactive?)	E05	E05-1	A	Medium	2	
Tanks, diesel (underground)	T08	T08-1	A	High	2	Heating and Equipment fuel

Table 5

Contaminant Source Inventory and Risk Ranking for Lockheed Martin /NOAA/Ak Bldg Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 310421.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant effluent discharge	D03	D03-1	A	Low	2	North-northwest of GCGO Building
Metals mining, underground (active or inactive?)	E05	E05-1	A	Very High	2	
Mine tailings (active piles or ponds)	E07	E07-1	A	Very High	2	Gilmore Creek is mine tailings of both active and inactive mines

Table 6

Contaminant Source Inventory and Risk Ranking for Lockheed Martin /NOAA/Ak Bldg Sources of Other Organic Chemicals

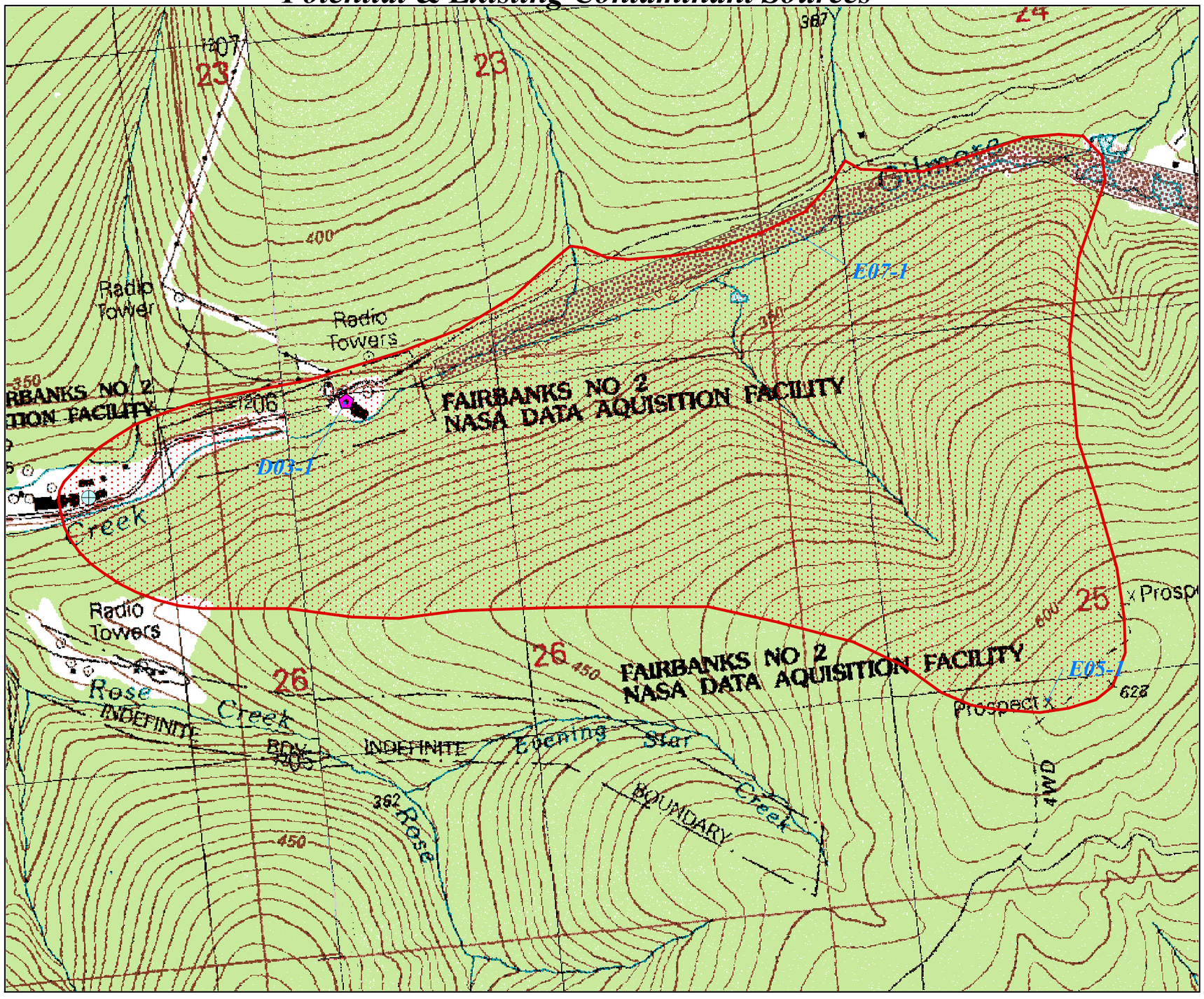
PWSID 310421.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater treatment plant effluent discharge	D03	D03-1	A	Low	2	North-northwest of GCGO Building

APPENDIX C

Lockheed Martin/NOAA/AK Building
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Lockheed Martin/NOAA/Ak Bldg Drinking Water Protection Area with Potential & Existing Contaminant Sources



Legend

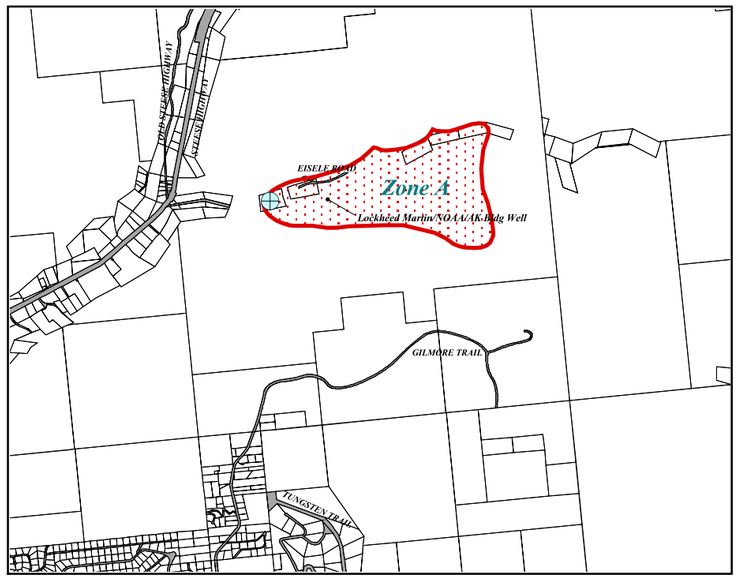
- *Lockheed Martin/NOAA/AK Bldg Well*

Zone A Drinking Water Protection Area

- *Several Months Travel Time*

Contaminant Sources

- *Quarry - gravel (E10)*
- *Underground metals mine (E5)*
- *Domestic wastewater treatment plant effluent discharge (D03)*
- *Mine tailings piles/ponds (U1)*



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Map 2

APPENDIX D

Vulnerability Analysis for Lockheed Martin/NOAA/AK Building Public Drinking Water Source

(Charts 1-14)

Chart 1. Susceptibility of the wellhead - Lockheed Martin/NOAA/AK Building

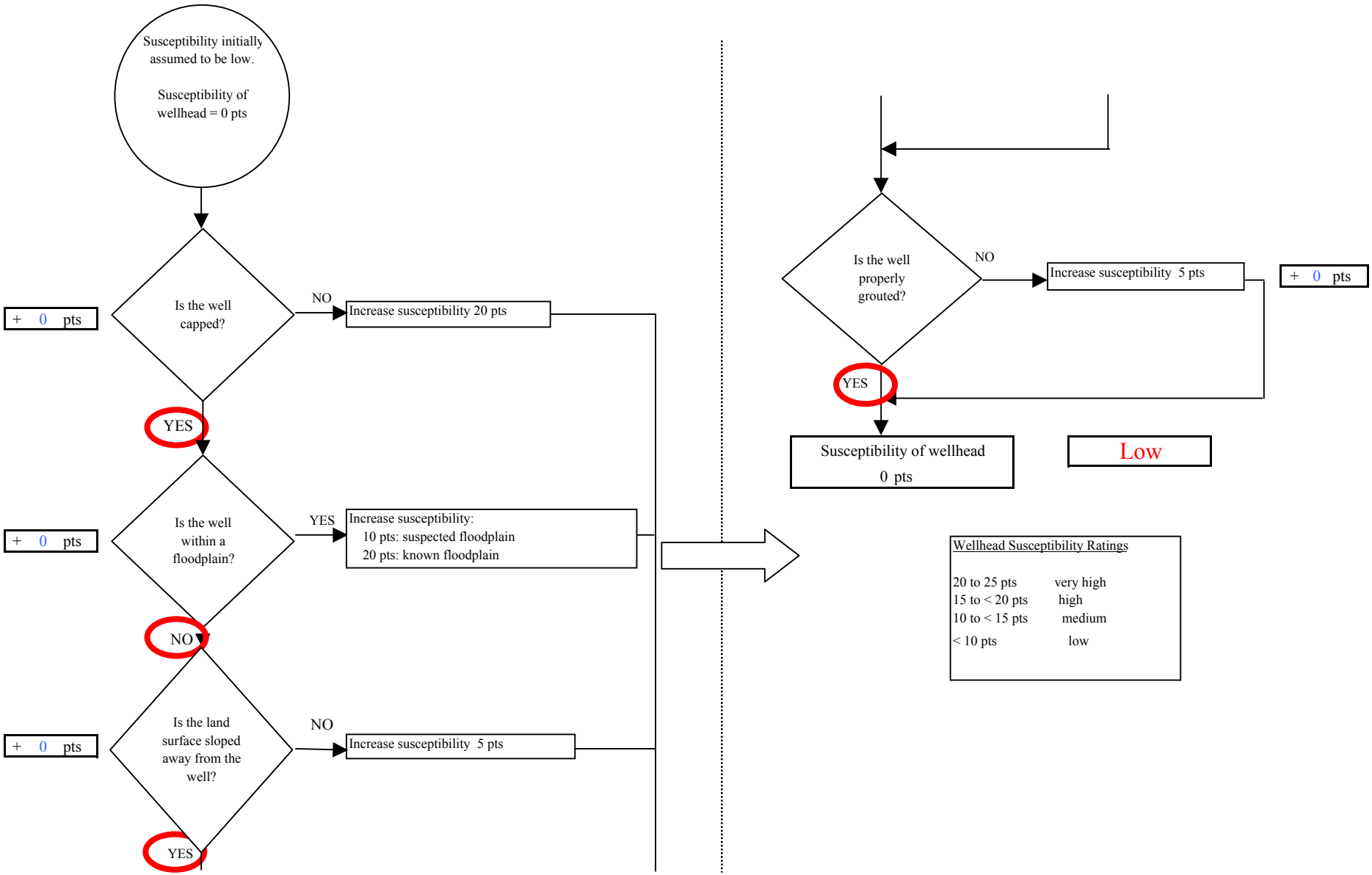


Chart 2. Susceptibility of the aquifer - Lockheed Martin/NOAA/AK Building

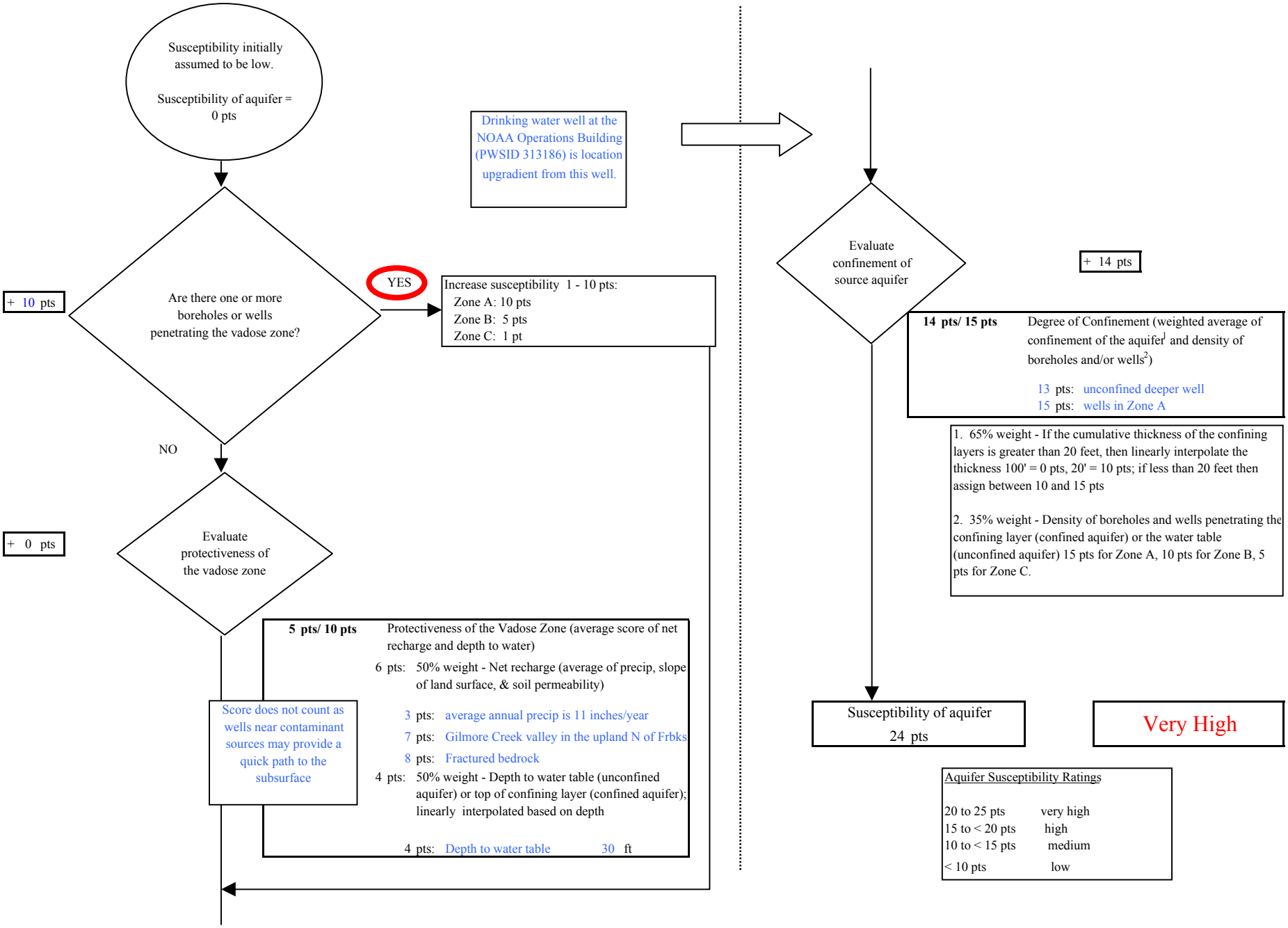
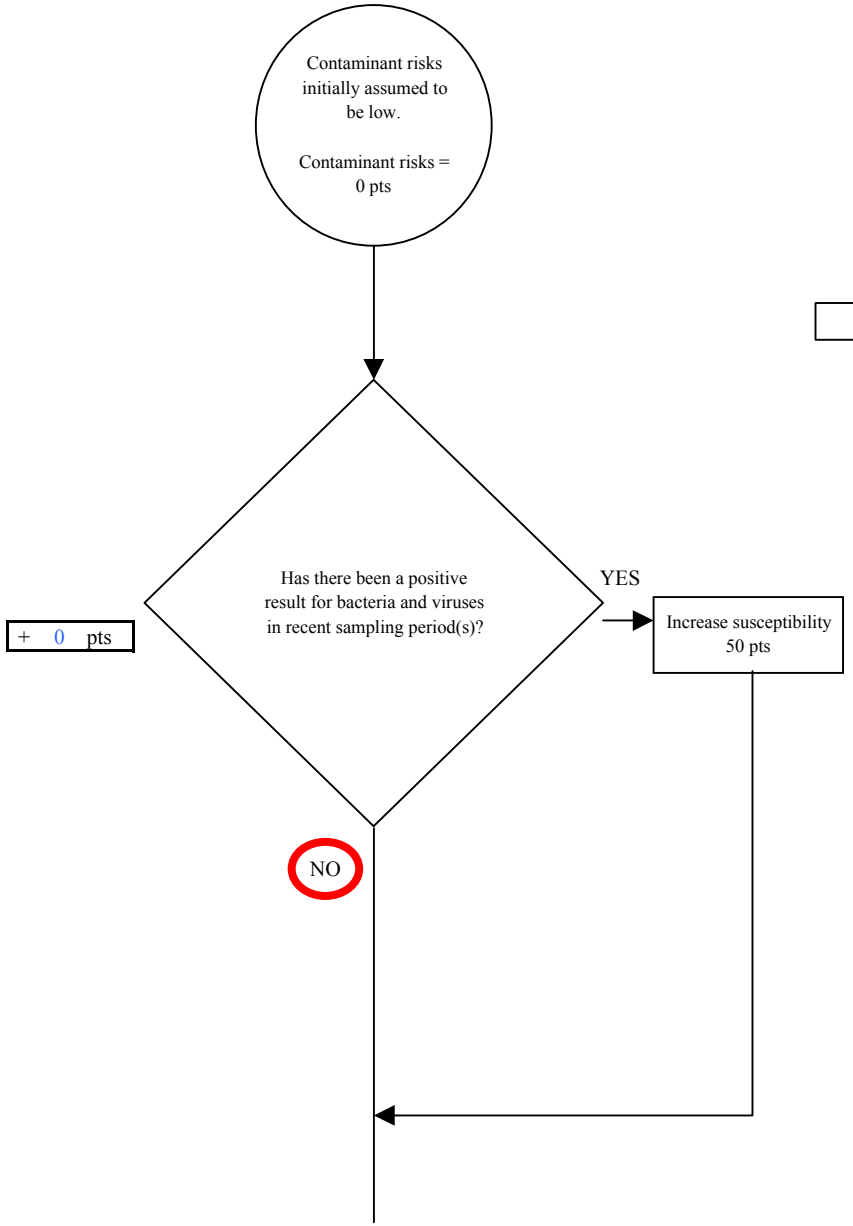
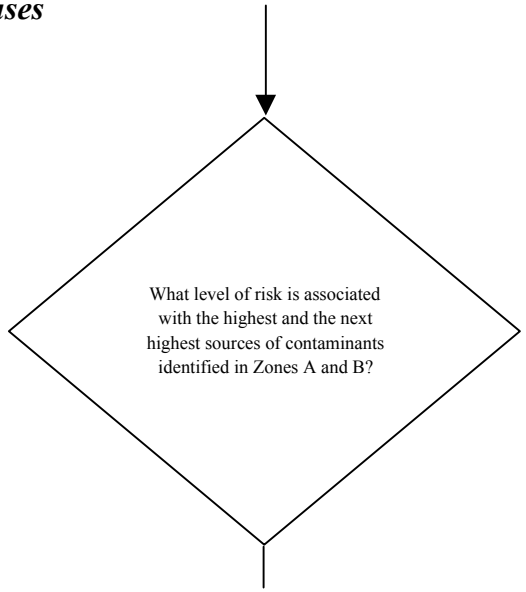


Chart 3. Contaminant risks for Lockheed Martin/NOAA/AK Building - Bacteria & Viruses





+ 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)	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 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 Lockheed Martin/NOAA/AK Building - Bacteria & Viruses

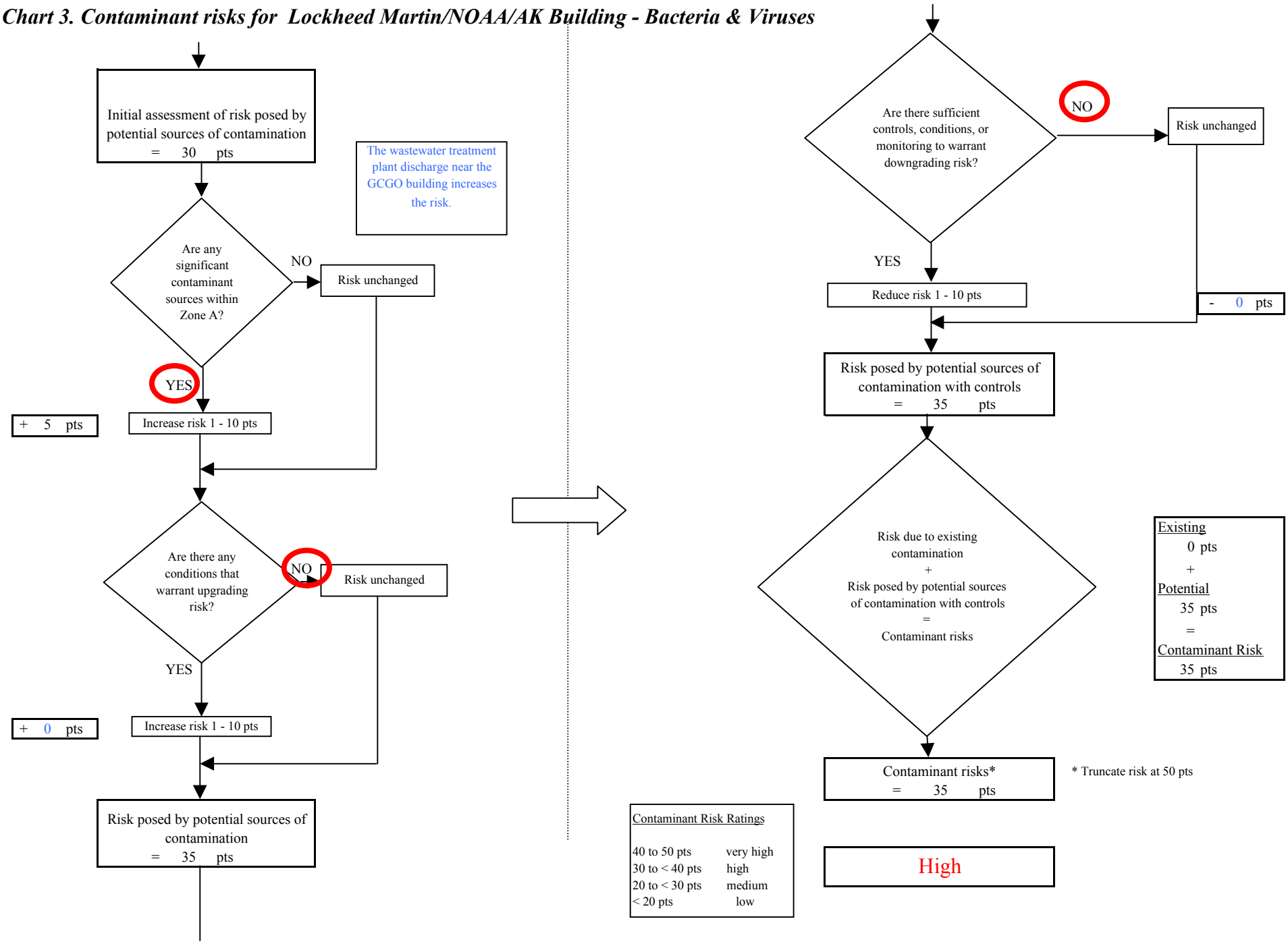


Chart 4. Vulnerability analysis for Lockheed Martin/NOAA/AK Building - Bacteria & Viruses

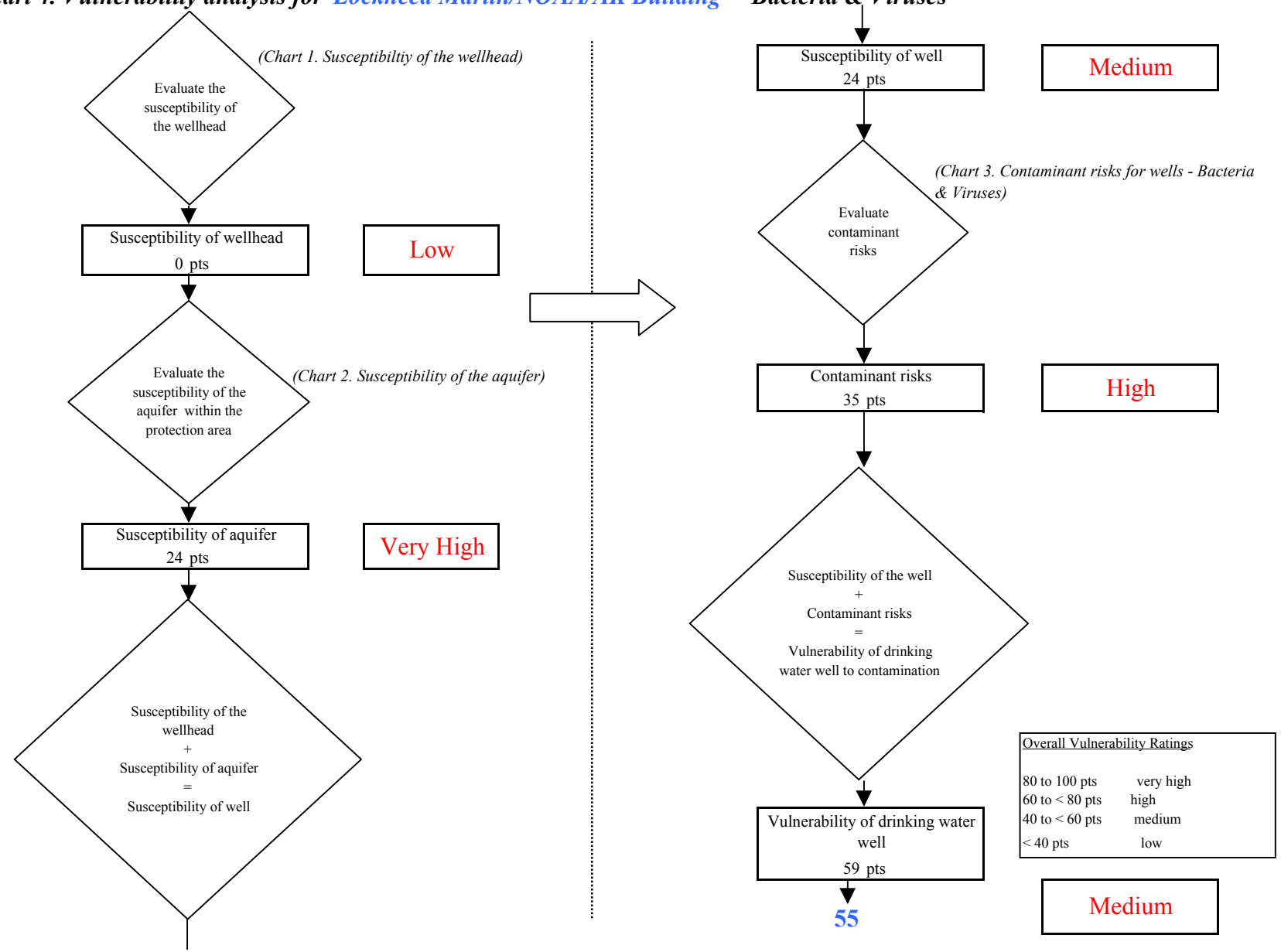


Chart 5. Contaminant risks for Lockheed Martin/NOAA/AK Building - Nitrates and Nitrites

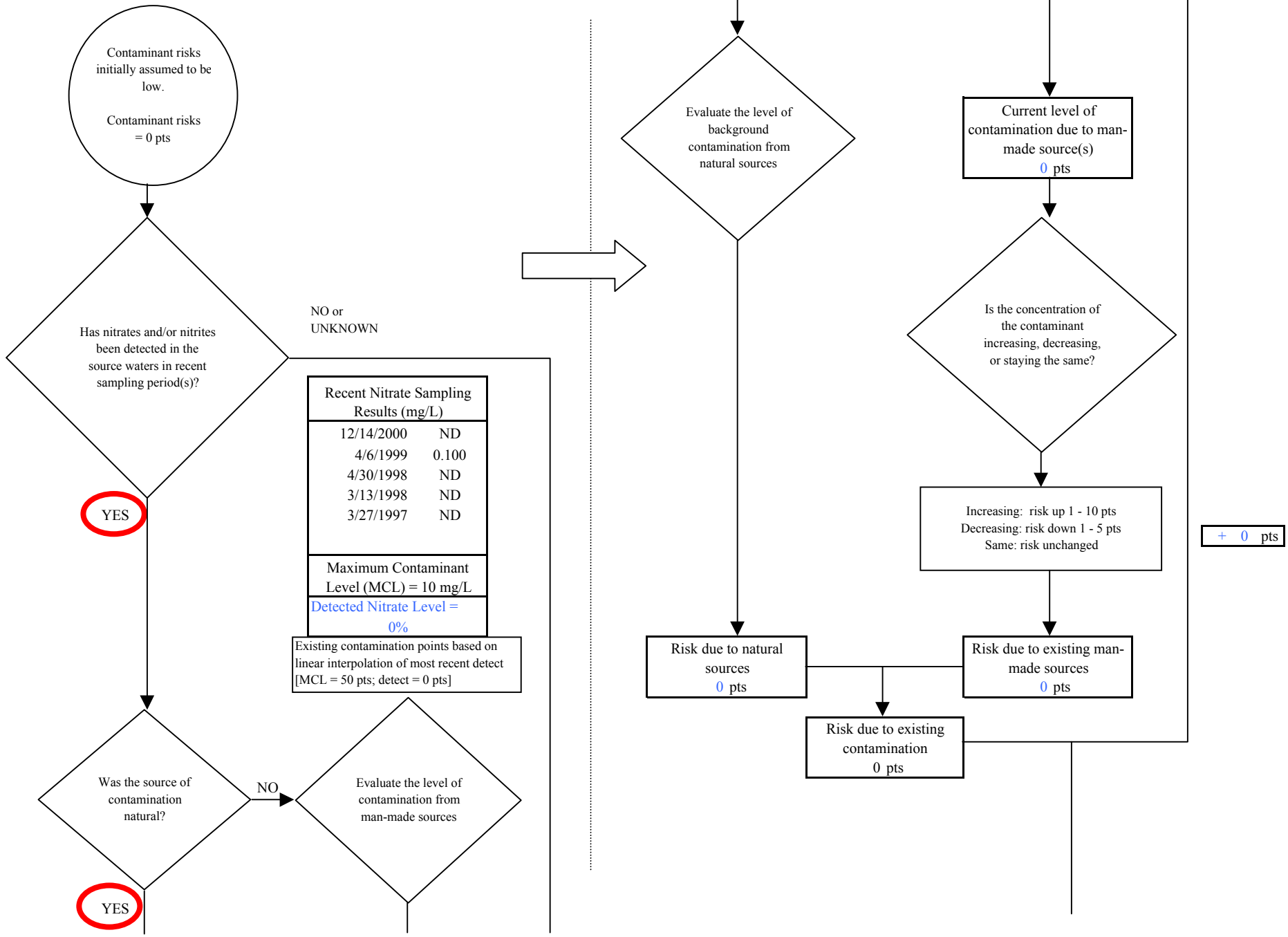
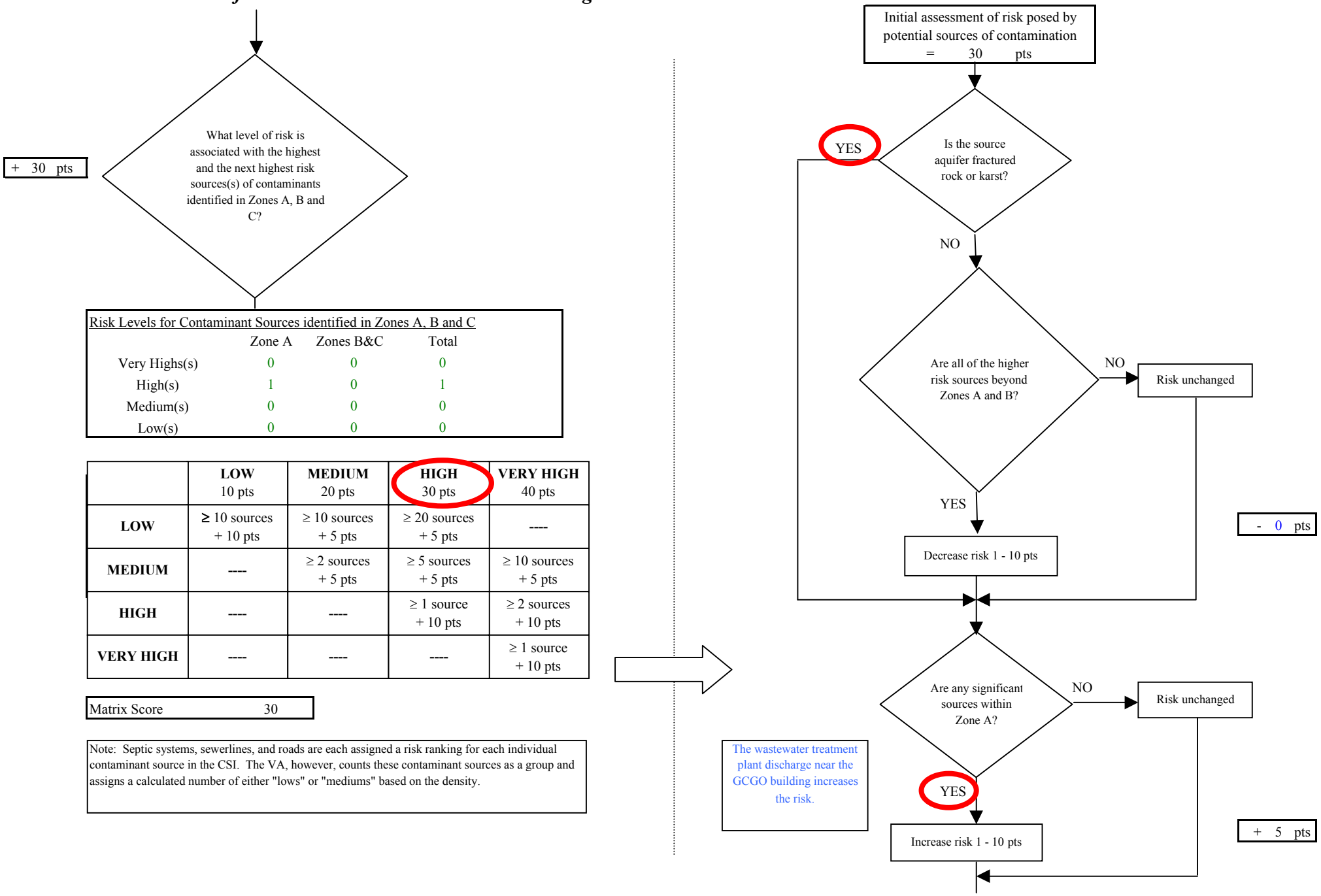


Chart 5. Contaminant risks for Lockheed Martin/NOAA/AK Building - Nitrates and Nitrites



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)	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 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 5. Contaminant risks for Lockheed Martin/NOAA/AK Building - Nitrates and Nitrites

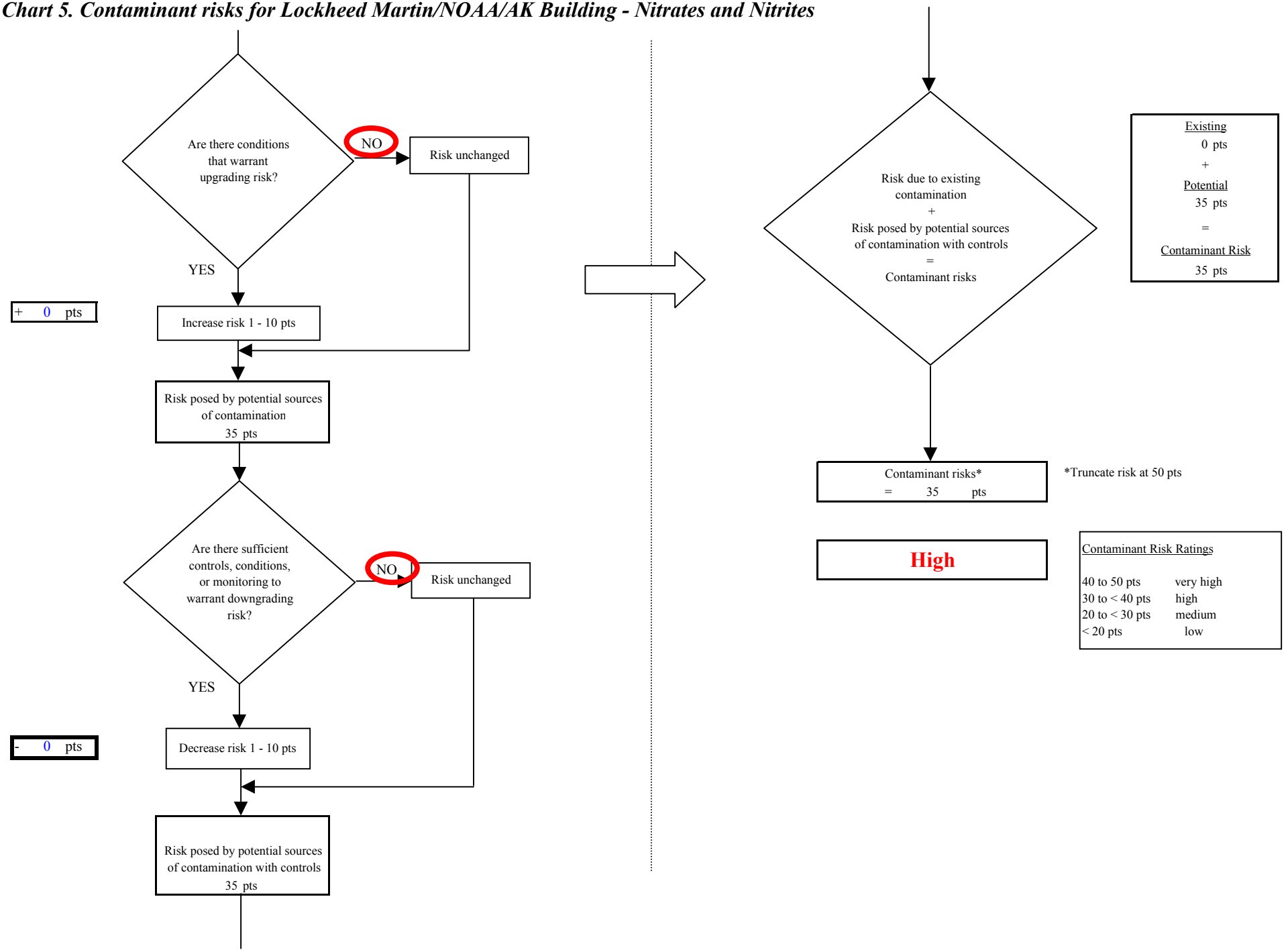


Chart 6. Vulnerability analysis for Lockheed Martin/NOAA/AK Building - Nitrates and Nitrites

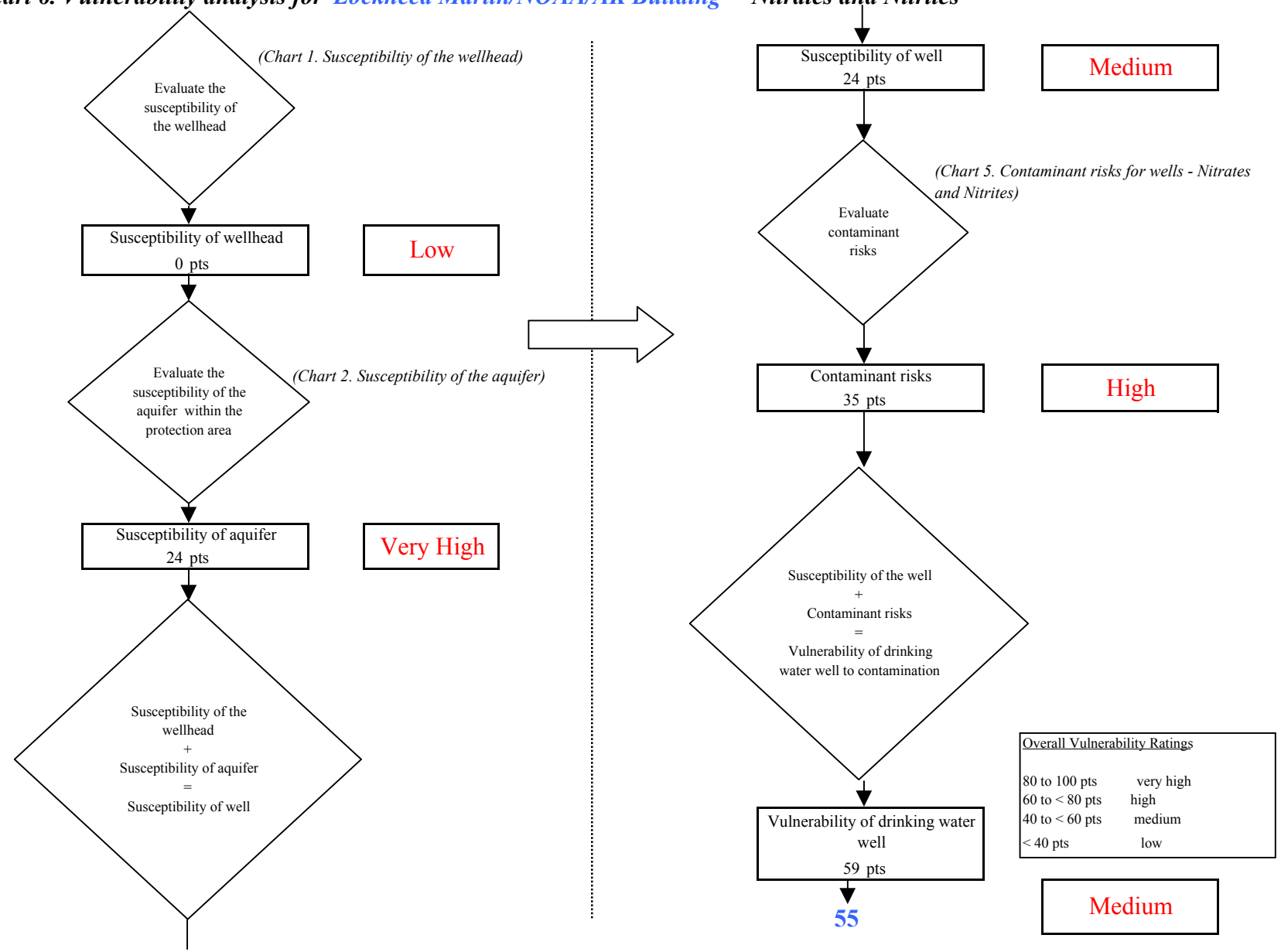


Chart 7. Contaminant risks for Lockheed Martin/NOAA/AK Building - Volatile Organic Chemicals

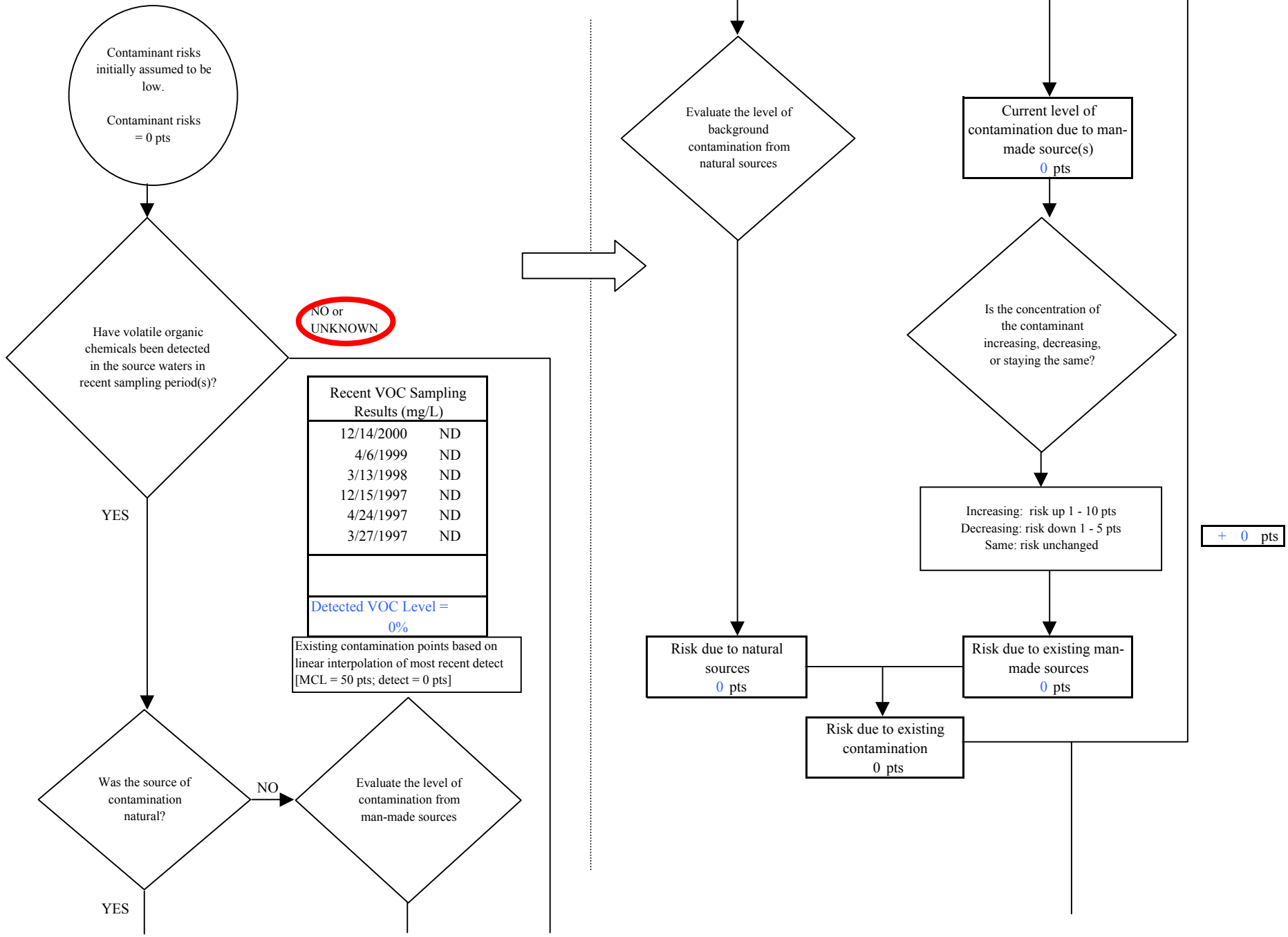
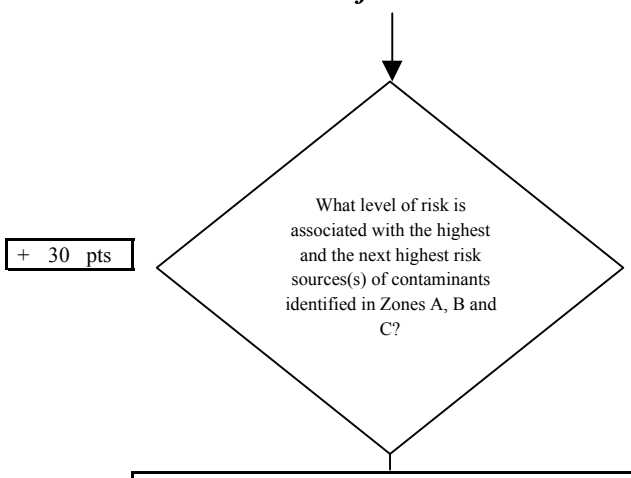


Chart 7. Contaminant risks for Lockheed Martin/NOAA/AK Building - Volatile Organic Chemicals



+ 30 pts

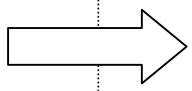
Risk Levels for Contaminant Sources identified in Zones A, B and C

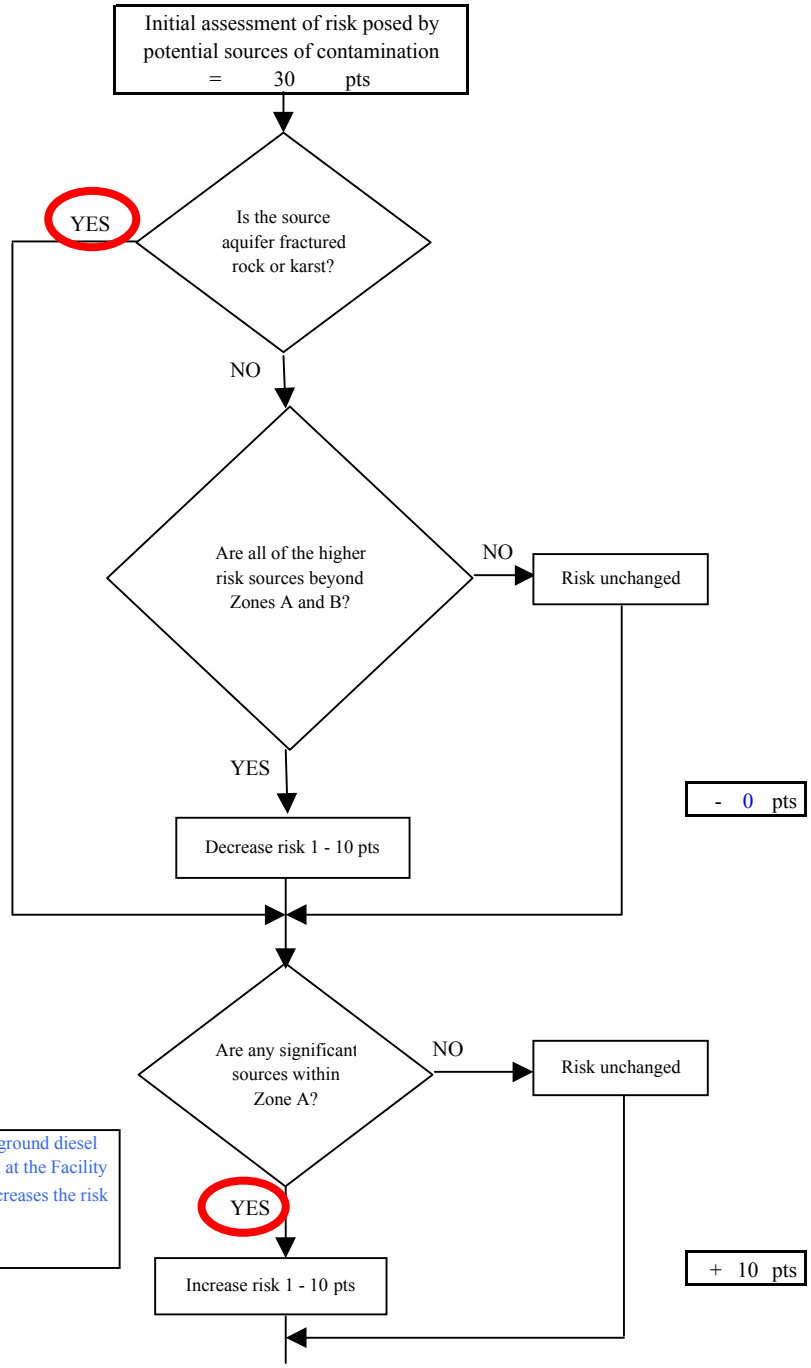
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	1	0	1
Low(s)	1	0	1

	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.





The underground diesel storage tank at the Facility Building increases the risk

Chart 7. Contaminant risks for Lockheed Martin/NOAA/AK Building - Volatile Organic Chemicals

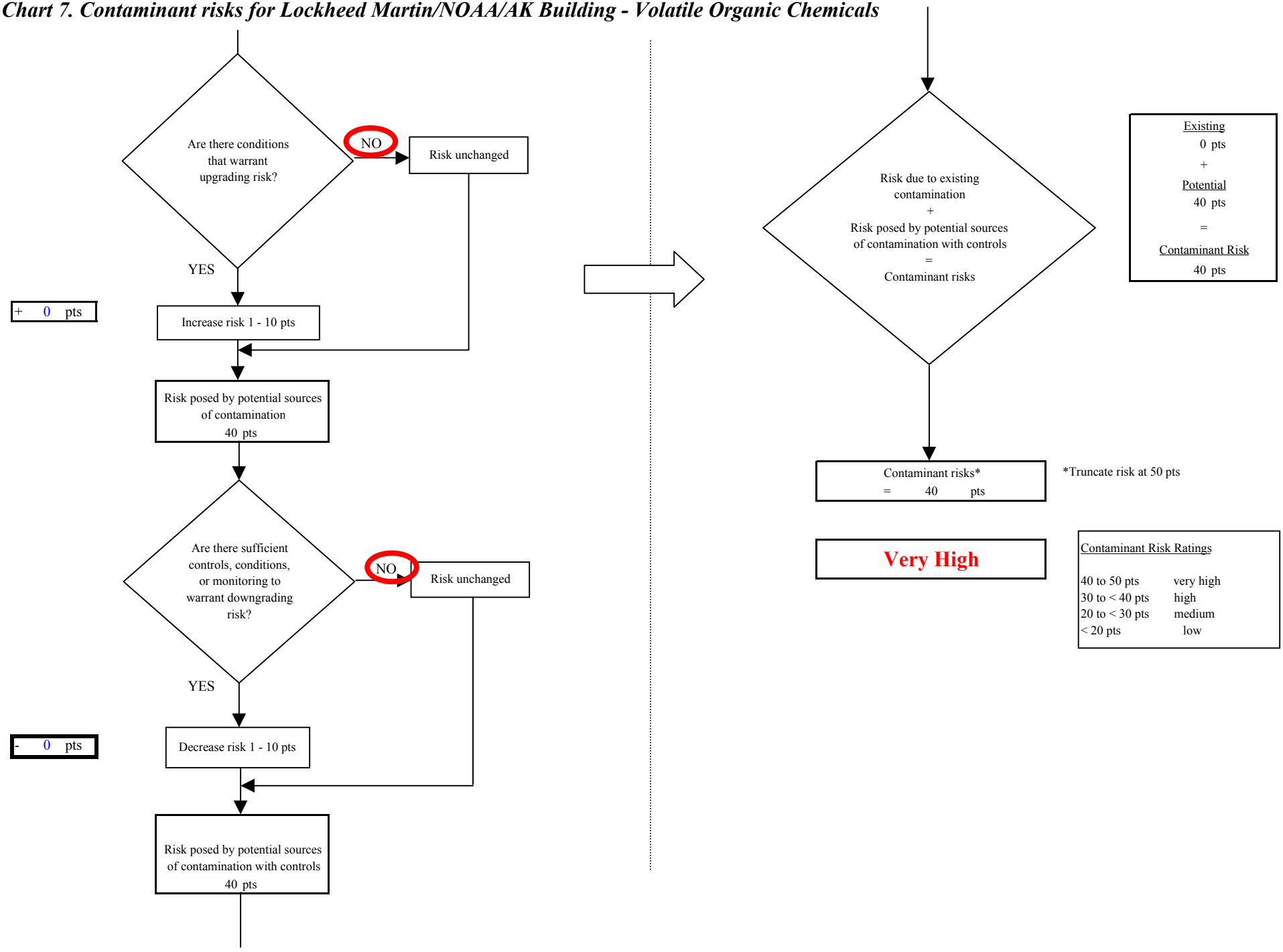


Chart 8. Vulnerability analysis for Lockheed Martin/NOAA/AK Building - Volatile Organic Chemicals

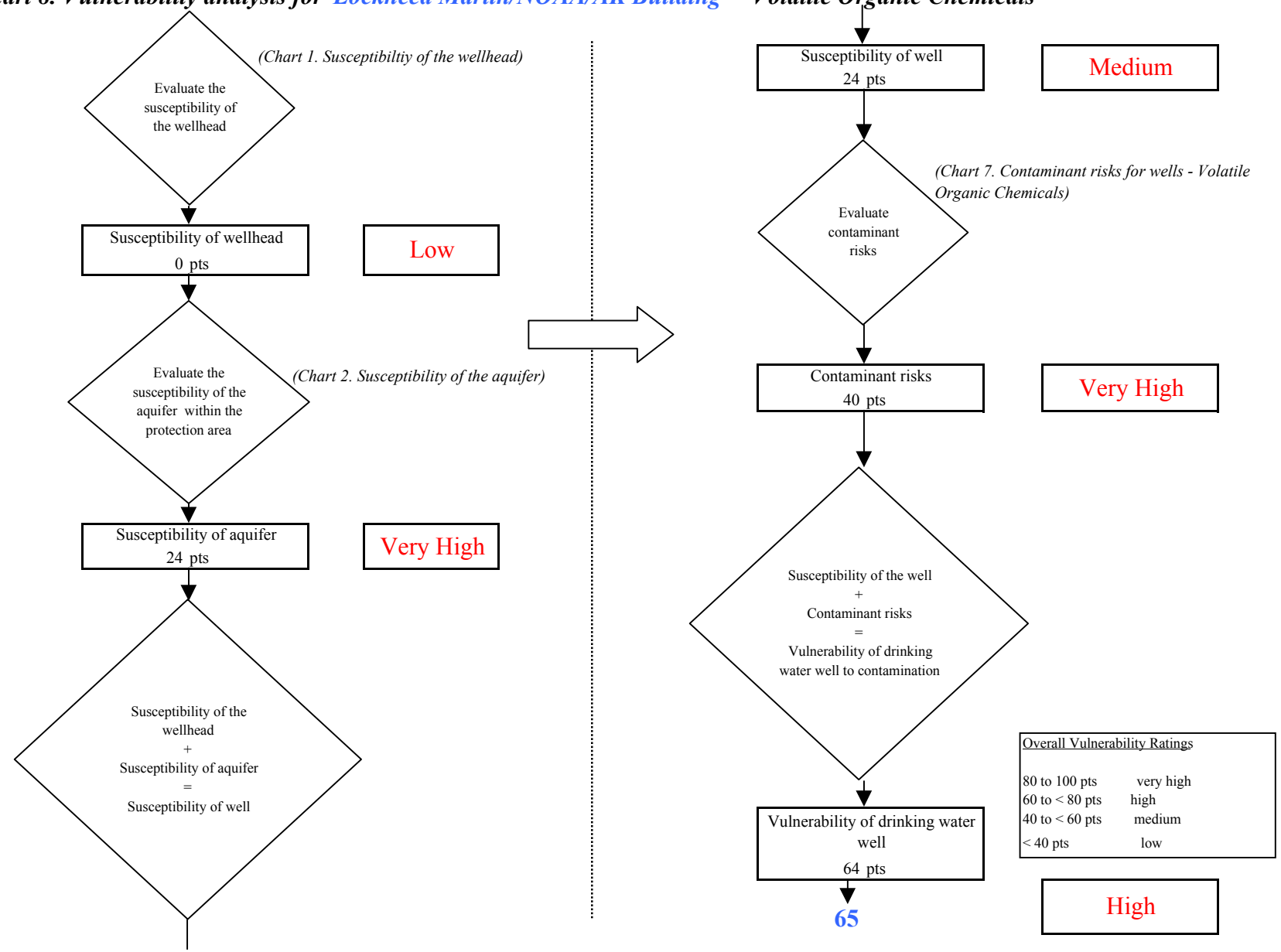


Chart 9. Contaminant risks for Lockheed Martin/NOAA/AK Building - Heavy Metals, Cyanide and Other Inorganic Chemicals

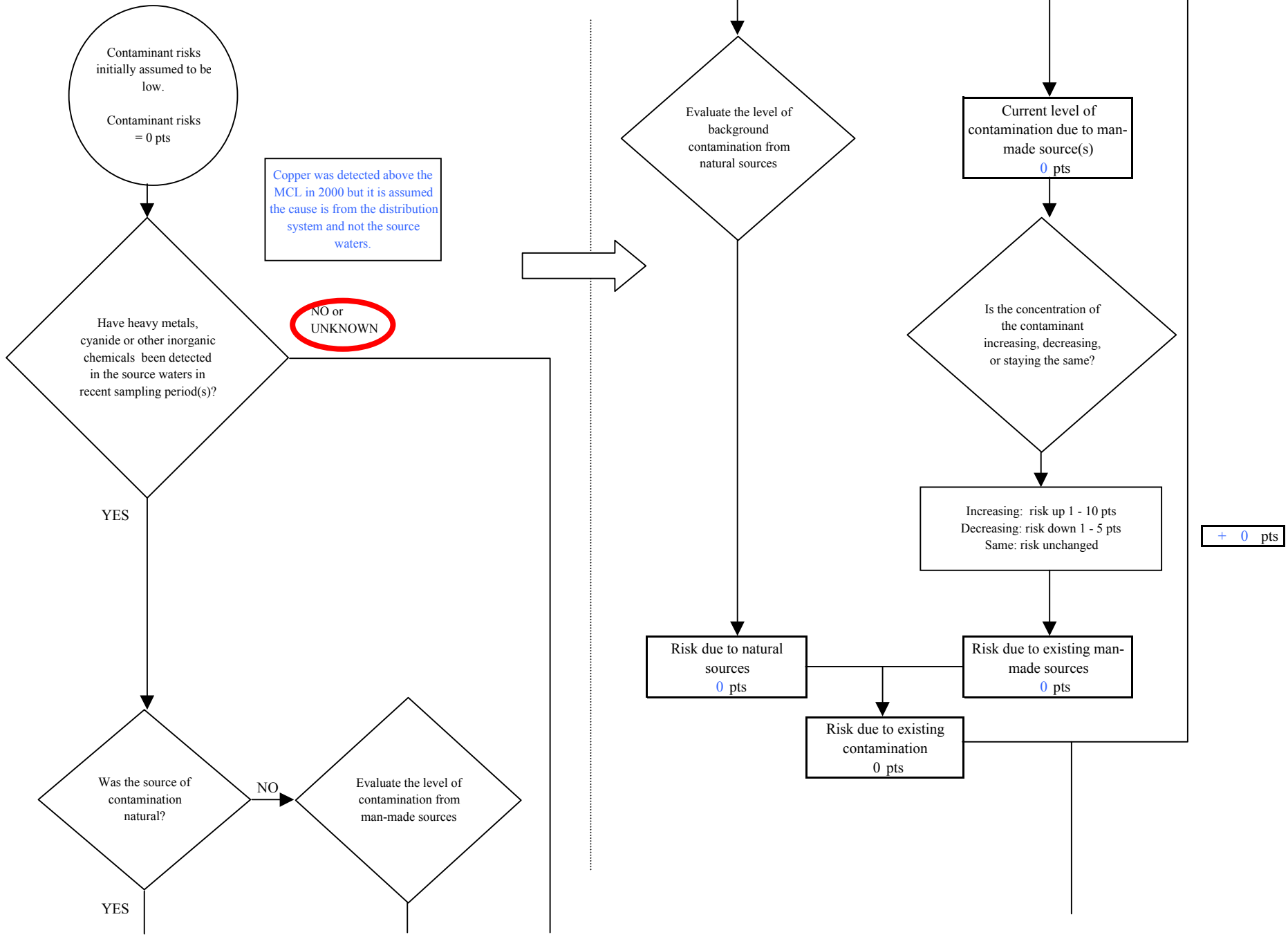
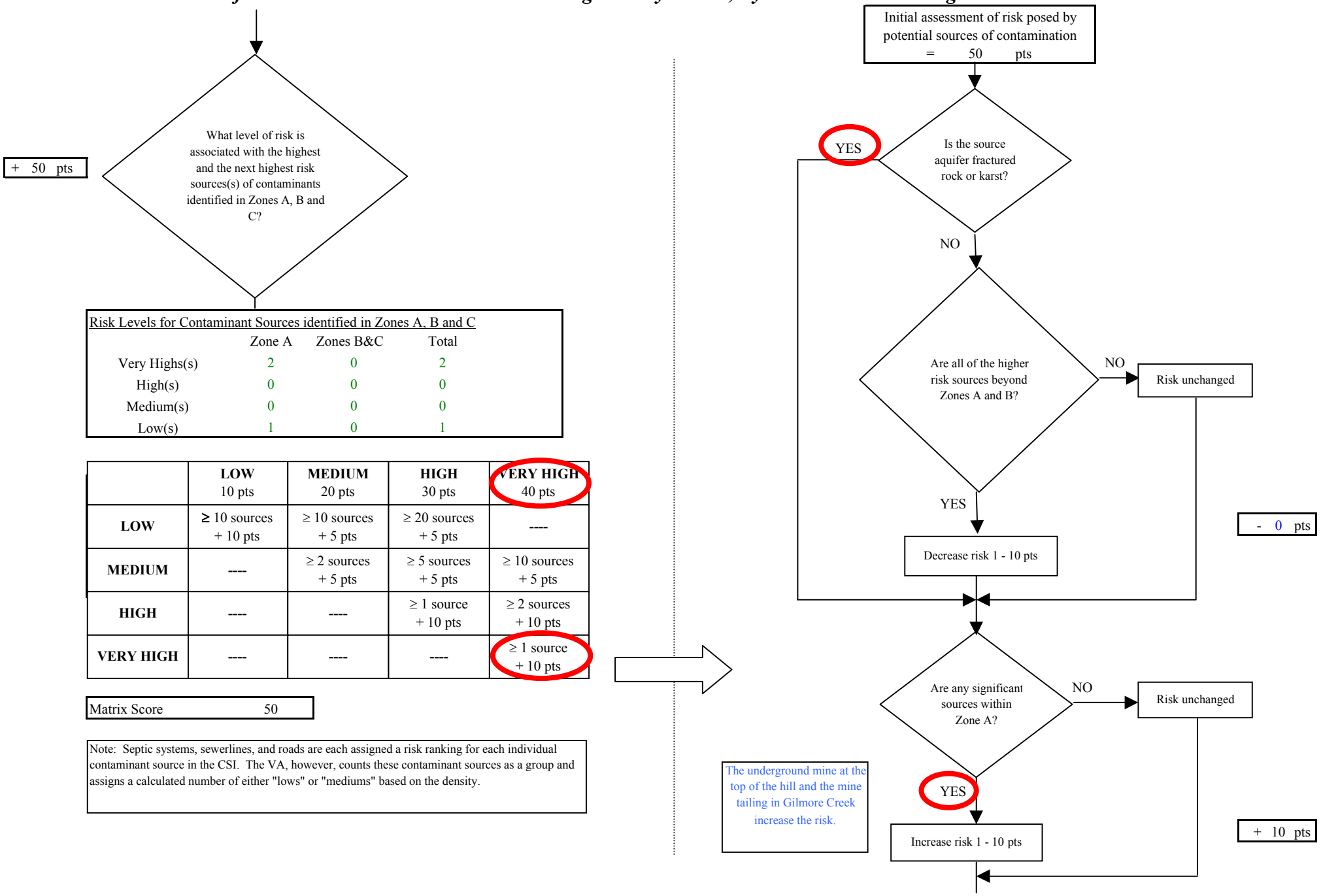


Chart 9. Contaminant risks for Lockheed Martin/NOAA/AK Building - Heavy Metals, Cyanide and Other Inorganic Chemicals



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

	Zone A	Zones B&C	Total
Very Highs(s)	2	0	2
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 50

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 Lockheed Martin/NOAA/AK Building - Heavy Metals, Cyanide and Other Inorganic Chemicals

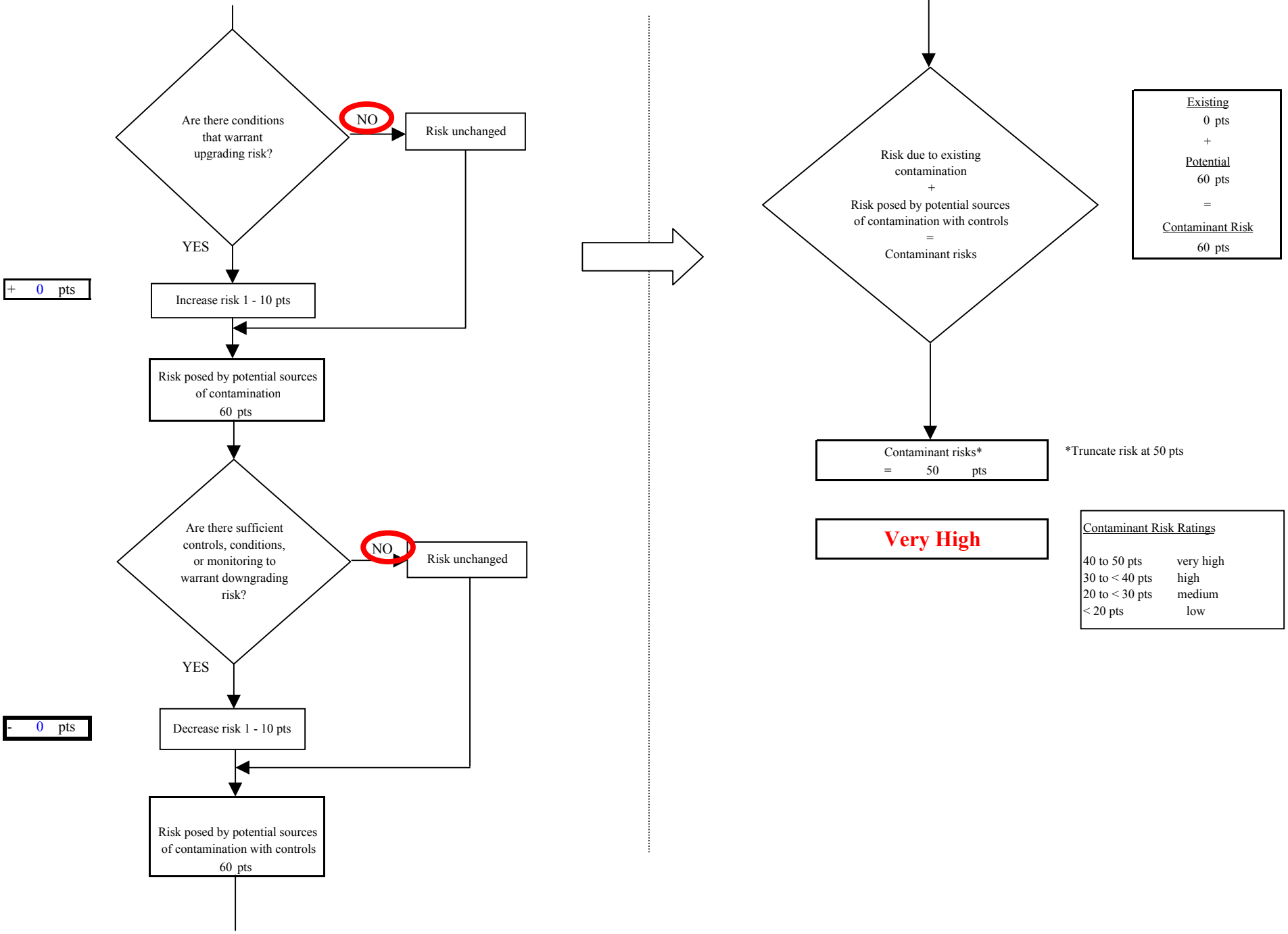


Chart 10. Vulnerability analysis for Lockheed Martin/NOAA/AK Building - Heavy Metals, Cyanide and Other Inorganic Chemicals

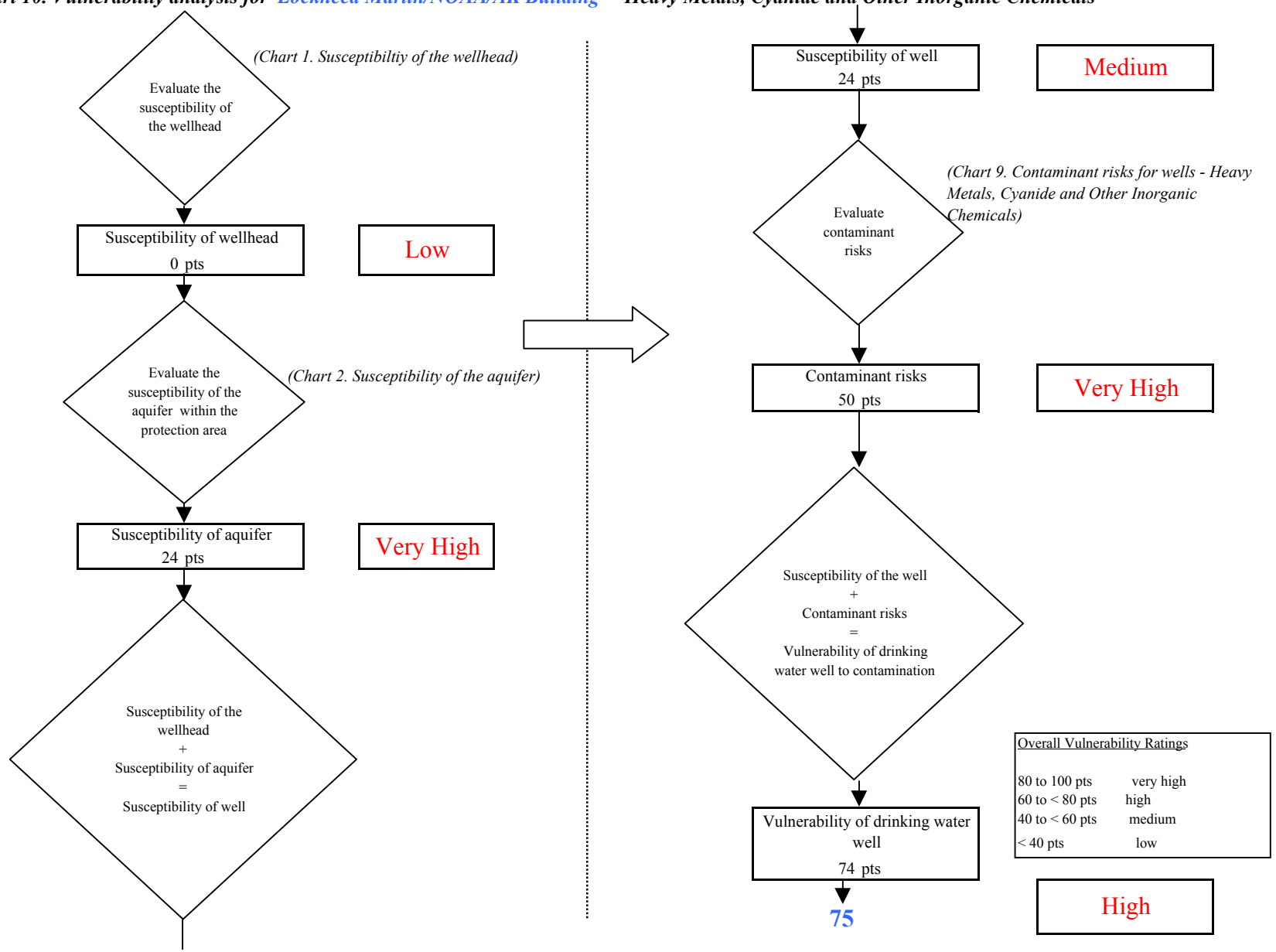


Chart 11. Contaminant risks for Lockheed Martin/NOAA/AK Building - Synthetic Organic Chemicals

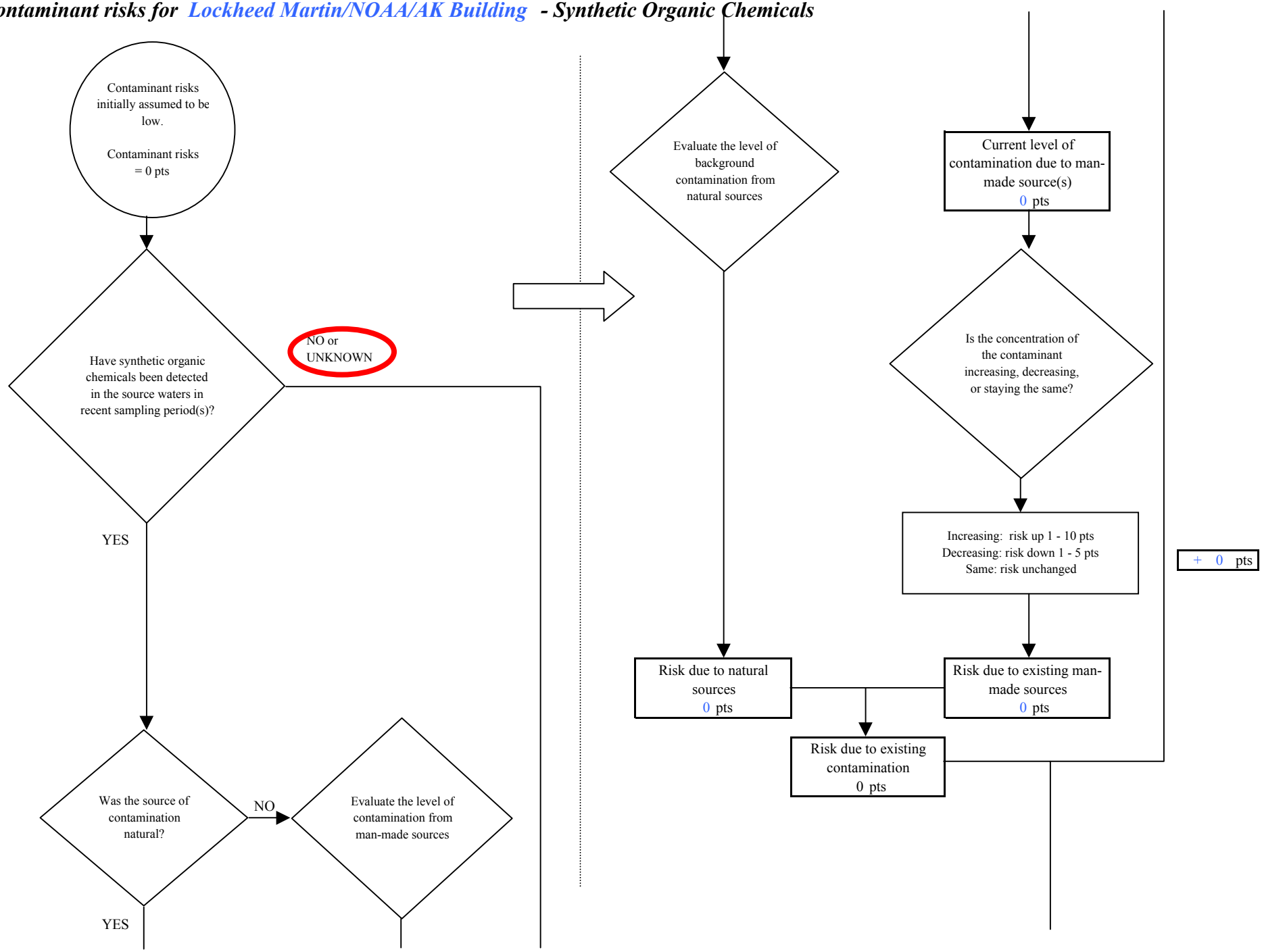
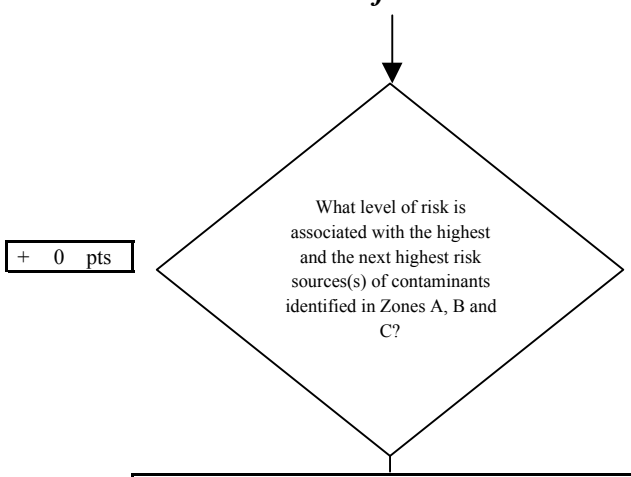


Chart 11. Contaminant risks for Lockheed Martin/NOAA/AK Building - Synthetic Organic Chemicals



+ 0 pts

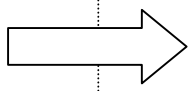
Risk Levels for Contaminant Sources identified in Zones A, B and C

	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.



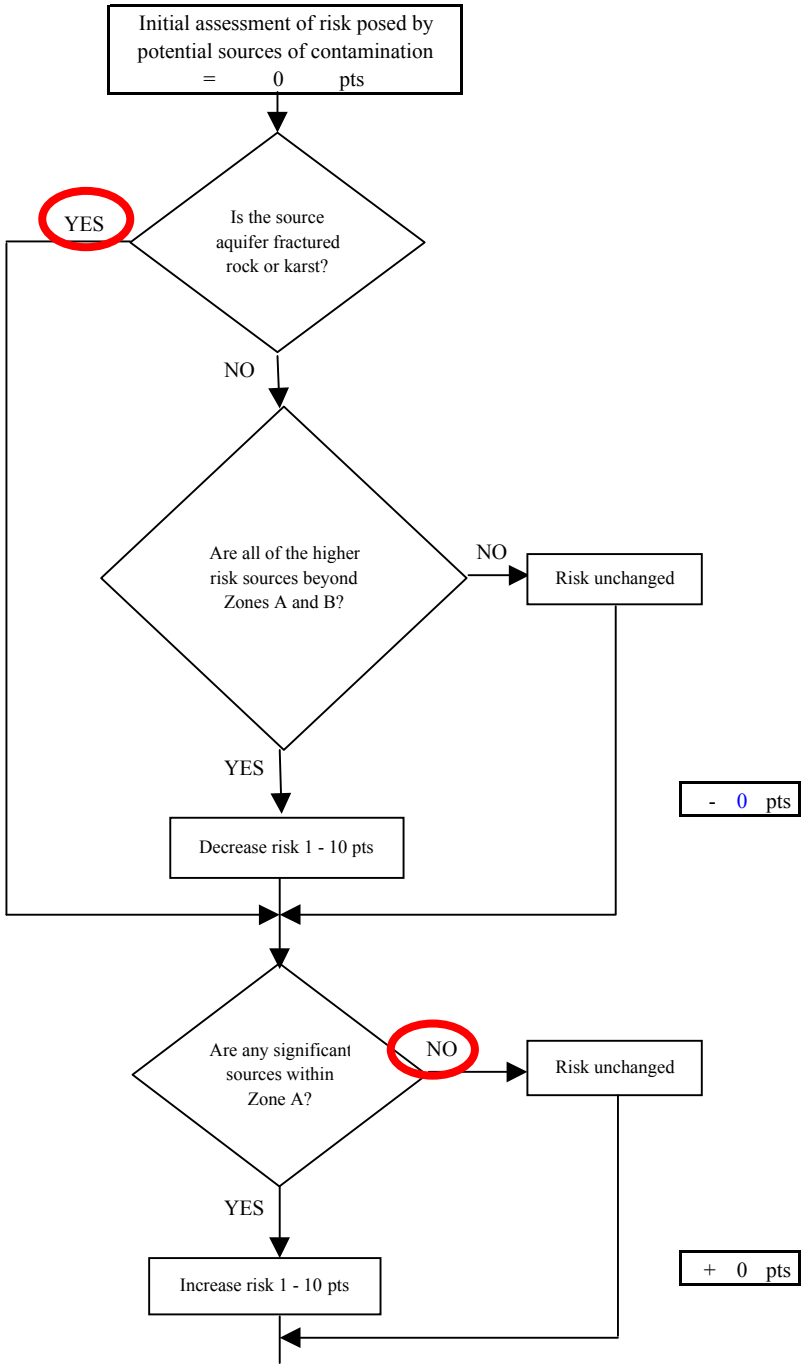


Chart 11. Contaminant risks for Lockheed Martin/NOAA/AK Building - Synthetic Organic Chemicals

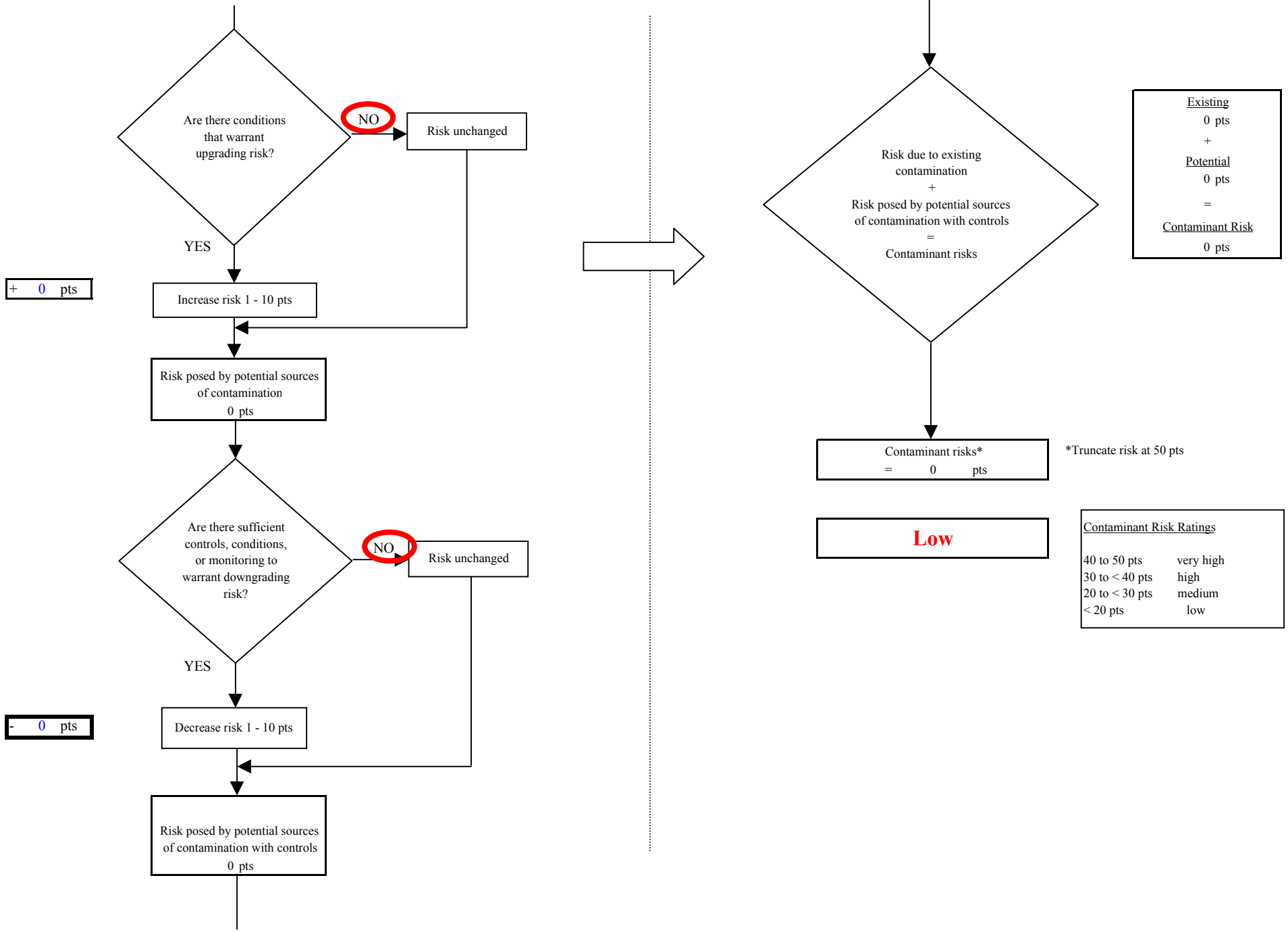


Chart 12. Vulnerability analysis for Lockheed Martin/NOAA/AK Building - Synthetic Organic Chemicals

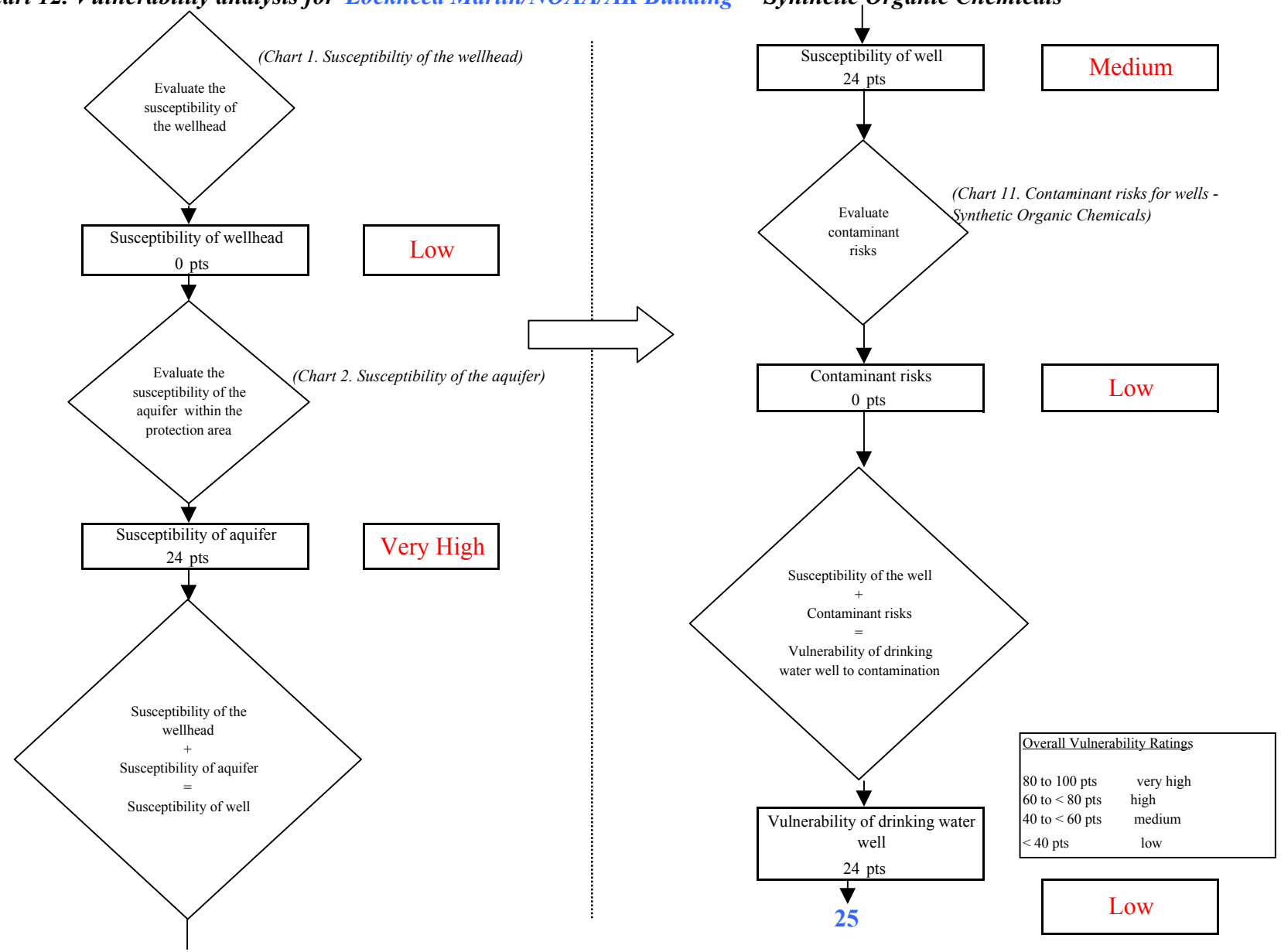


Chart 13. Contaminant risks for Lockheed Martin/NOAA/AK Building - Other Organic Chemicals

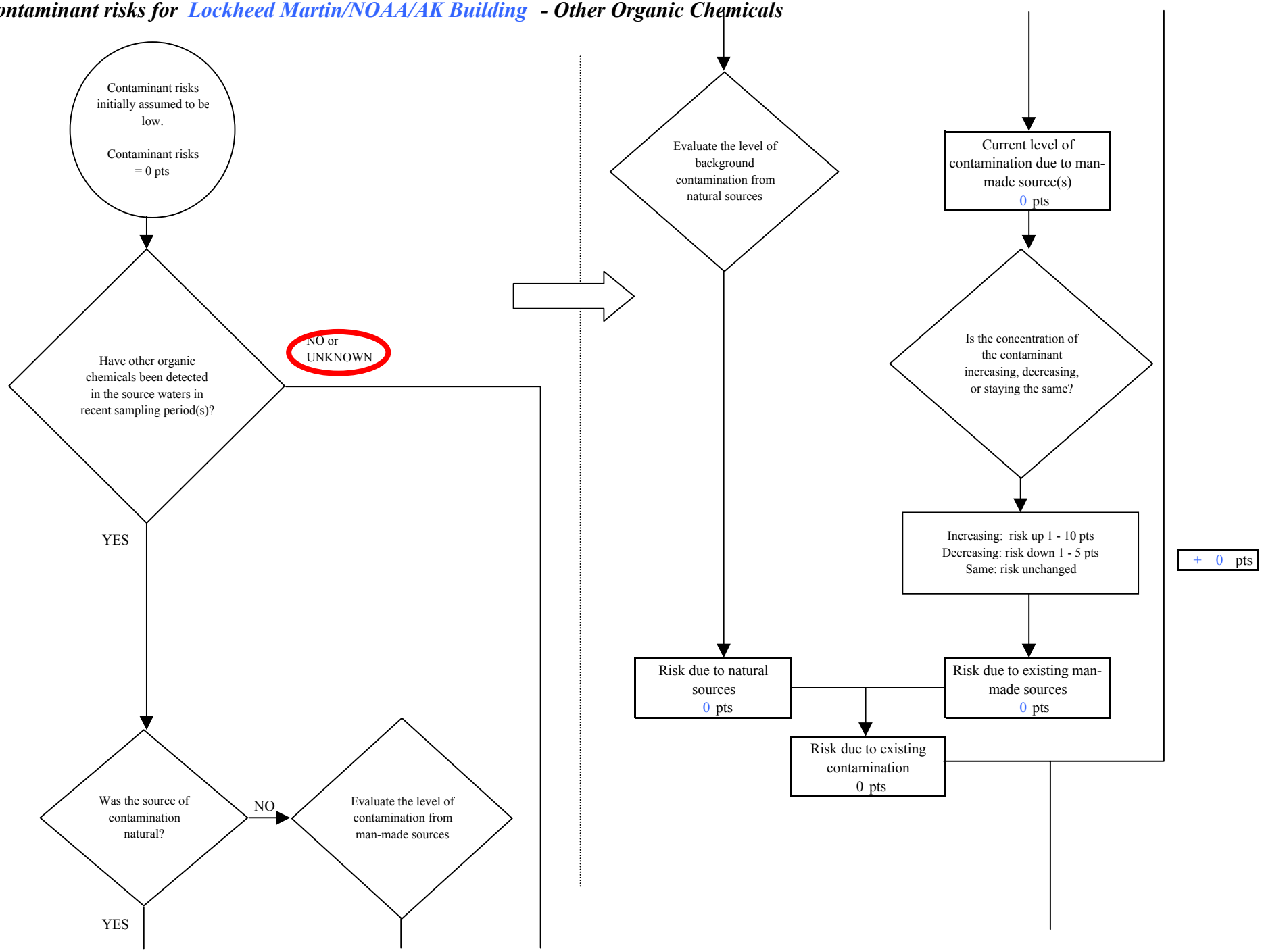
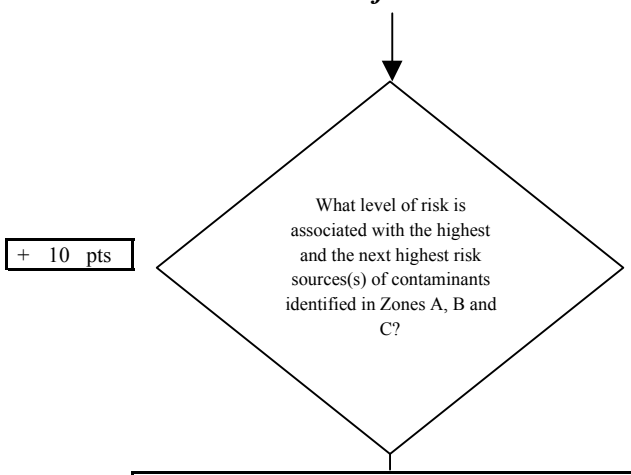


Chart 13. Contaminant risks for Lockheed Martin/NOAA/AK Building - Other Organic Chemicals



+ 10 pts

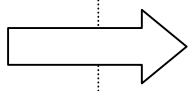
Risk Levels for Contaminant Sources identified in Zones A, B and C

	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	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.



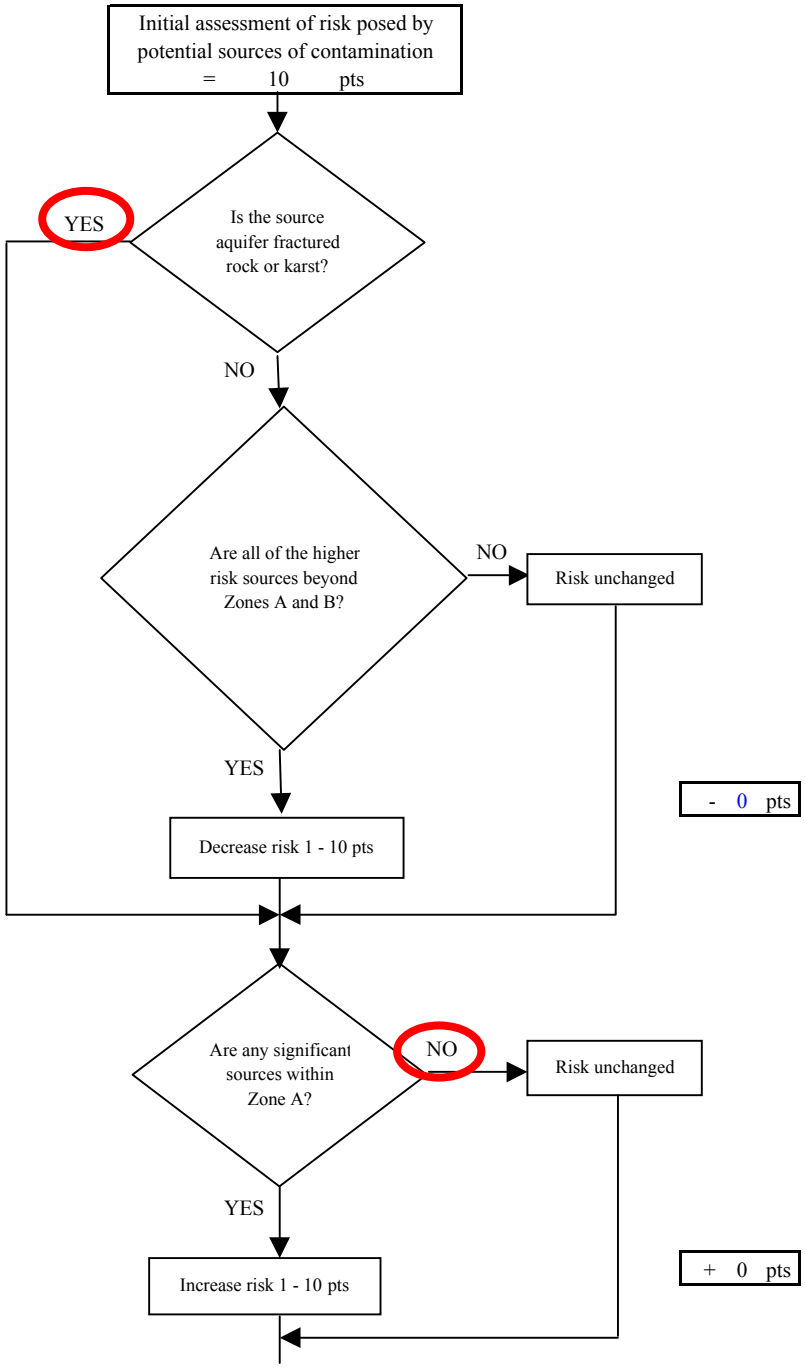


Chart 13. Contaminant risks for Lockheed Martin/NOAA/AK Building - Other Organic Chemicals

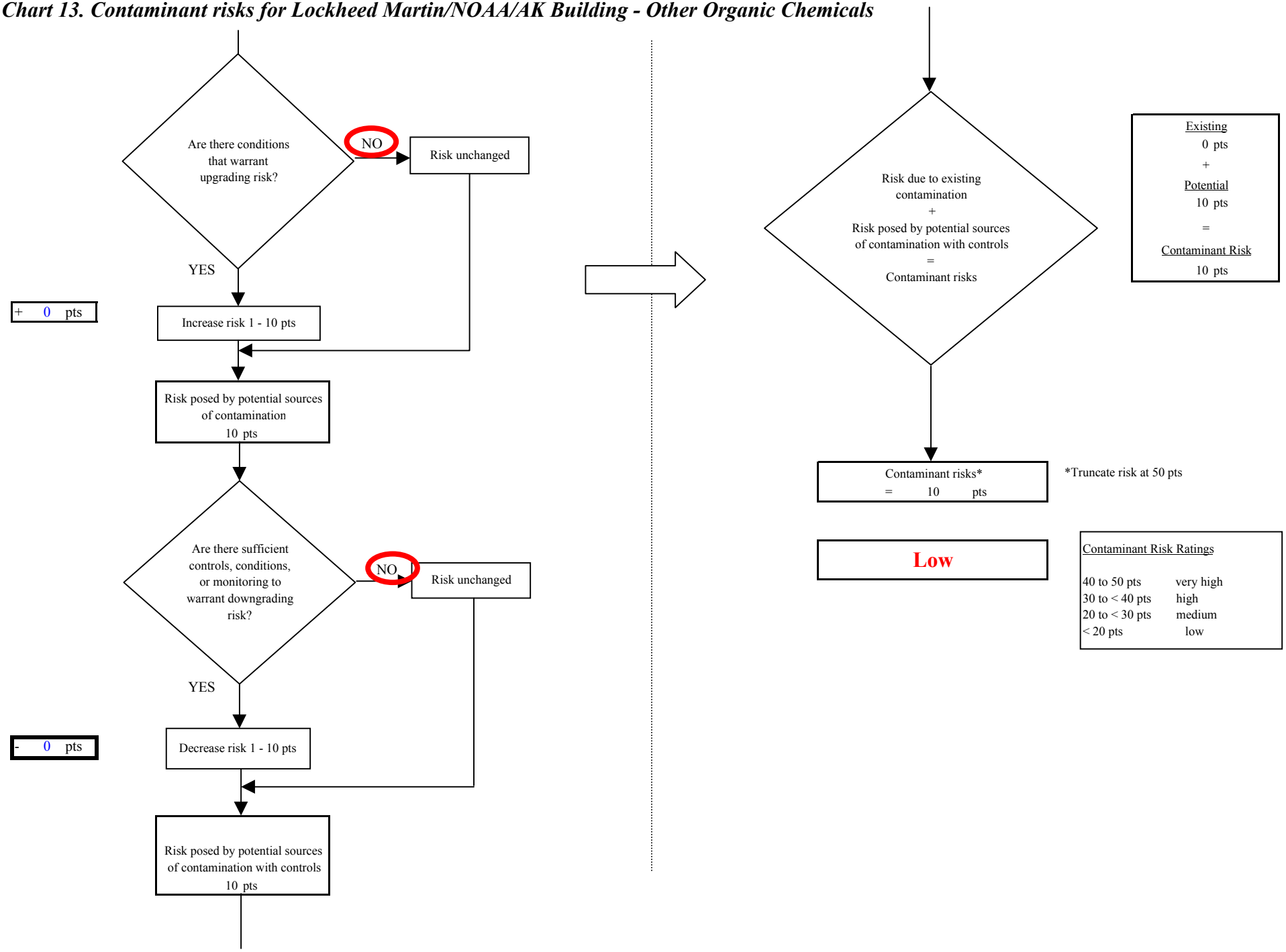


Chart 14. Vulnerability analysis for Lockheed Martin/NOAA/AK Building - Other Organic Chemicals