# *Source Water Assessment* for City of Palmer Well No. 4

A Hydrogeologic Susceptibility and Vulnerability Assessment

DRINKING WATER PROTECTION PROGRAM REPORT 427
PWSID 226020.002

April 2002

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Alaska Department of Environmental Conservation

DRINKING WATER PROTECTION PROGRAM REPORT 427

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.

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION: 2002

# CONTENTS



# TABLES



# ILLUSTRATIONS



# APPENDICES

# Hydrogeologic Susceptibility and Vulnerability Assessment for City of Palmer Well No. 4 Public Drinking Water Source, Palmer, Alaska

By Alaska Department of Environmental Conservation

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**Drinking Water Protection Program**
**Alaska Department of Environmental Conservation**

## EXECUTIVE SUMMARY

The City of Palmer Well No. 4 is a Class A (community) drinking water source consisting of one well. Identified potential and current sources of contaminants for City of Palmer Well No. 4 include: residential area, sewer lines, residential septic systems, gasoline stations, airports, paved roads, railroad corridor, golf courses, large capacity septic systems, underground fuel tanks, Leaking Underground Storage Tank sites (LUST's), recognized contaminated sites, various mining activities and landfills. These existing and potential sources of contamination are considered a source of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals. Overall, City of Palmer Well No. 4 public water source received vulnerability rating of **High** for bacteria and viruses; **Medium** for nitrates/nitrites, and **Very High** for volatile organic chemicals, inorganic chemicals, synthetic organic chemicals and other organic chemicals.

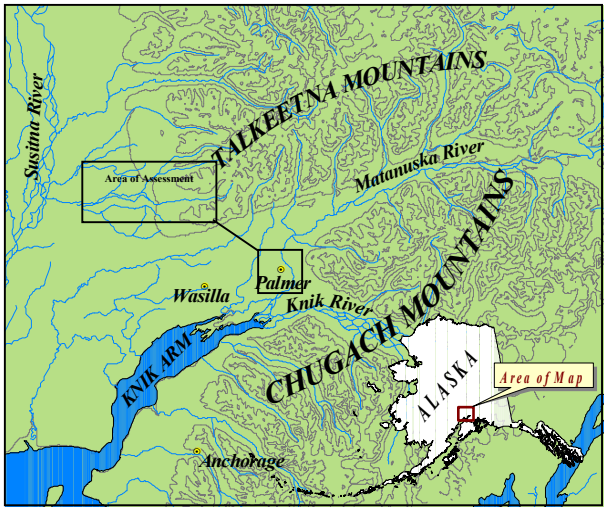


**Figure 1. Index Map showing the location of the Matanuska-Susitna Valley and area of assessment.**

## INTRODUCTION

The purpose of this environmental assessment is to provide public water system owners/operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. This assessment was completed for the City of Palmer Well No. 4 source of public drinking water. This source consists of one well in the Palmer area (Figure 1). This assessment, known under the Alaska Drinking Water Protection Program as the *Source Water Assessment*, has combined a review of the natural hydrogeologic sensitivity with potential and existing contaminant risks to arrive at an overall vulnerability of the drinking water source to contamination. This assessment has been completed as a basis for local voluntary protection efforts and to assist agencies in their efforts to reduce risk to this public drinking water supply.

## DESCRIPTION OF THE MATANUSKA-SUSITNA VALLEY-AREA, ALASKA

### Location

The Matanuska-Susitna Valley is part of the lowland lying about 50 miles north of Anchorage in south-central Alaska. The well described in this report is part of the Matanuska River Watershed. This study area is roughly bounded on the north by the Talkeetna Mountains; on the west by Wasilla Creek; on the south by the Knik River; and on the east by the Chugach Mountains. The area covers approximately 150 square miles.

### Climate

The climate of the Matanuska-Susitna Valley is the result of a combination of marine and continental influences. The climate is somewhat transitional in that it does not experience large daily and annual temperature fluctuations like those experienced in the

interior of Alaska nor does it experience high amounts of precipitation typified by gulf coast regions. Mean annual precipitation is approximately 15 inches per year. On the average, the Valley receives a total snow accumulation of 58 inches per year. Precipitation generally increased inland toward the Talkeetna Mountains where annual precipitation may exceed 60 inches. Mean daily temperature ranges from 67° F during July to 5° F in January (Western Regional Climate Center, 2000).

**Physiography and Groundwater Conditions**

The Matanuska-Susitna Valley is surrounded by rugged mountains that rise abruptly above the valley floor. The Chugach Mountains at the southern edge of the valley reach altitudes greater than 6300 feet. These mountains are composed primarily of metamorphosed sedimentary marine and volcanic rocks. Along the northern edge of the valley, peaks in the Talkeetna Mountains reach altitudes of 3000 to 5000 feet. The Talkeetna Mountains are composed mainly of igneous rocks, chiefly granite intrusives and subordinate lavas; Cretaceous and Tertiary sedimentary rocks form the south flank of the mountains. Although the altitude of the valley floor ranges from sea level at Knik Arm to 1000 feet at the base of Wishbone Hill, the local relief is commonly not more than 100 to 200 feet.

The Matanuska and Knik River's drain the area. These rivers are braided glacial outwash streams having wide floodplains. Drainage is poor in many interstream tracts resulting in large areas of swampy ground with shallow lakes occupying depressions.

The Matanuska-Susitna Valley is floored with unconsolidated deposits, chiefly glacial drift that represents several episodes of glacial advances and retreats. The drift includes till, outwash stream deposits, and estuarine and lake deposits. Physiographic features formed by these deposits in or adjacent to the study area include end moraine, lateral moraines, eskers, crevasse fillings, and other pitted

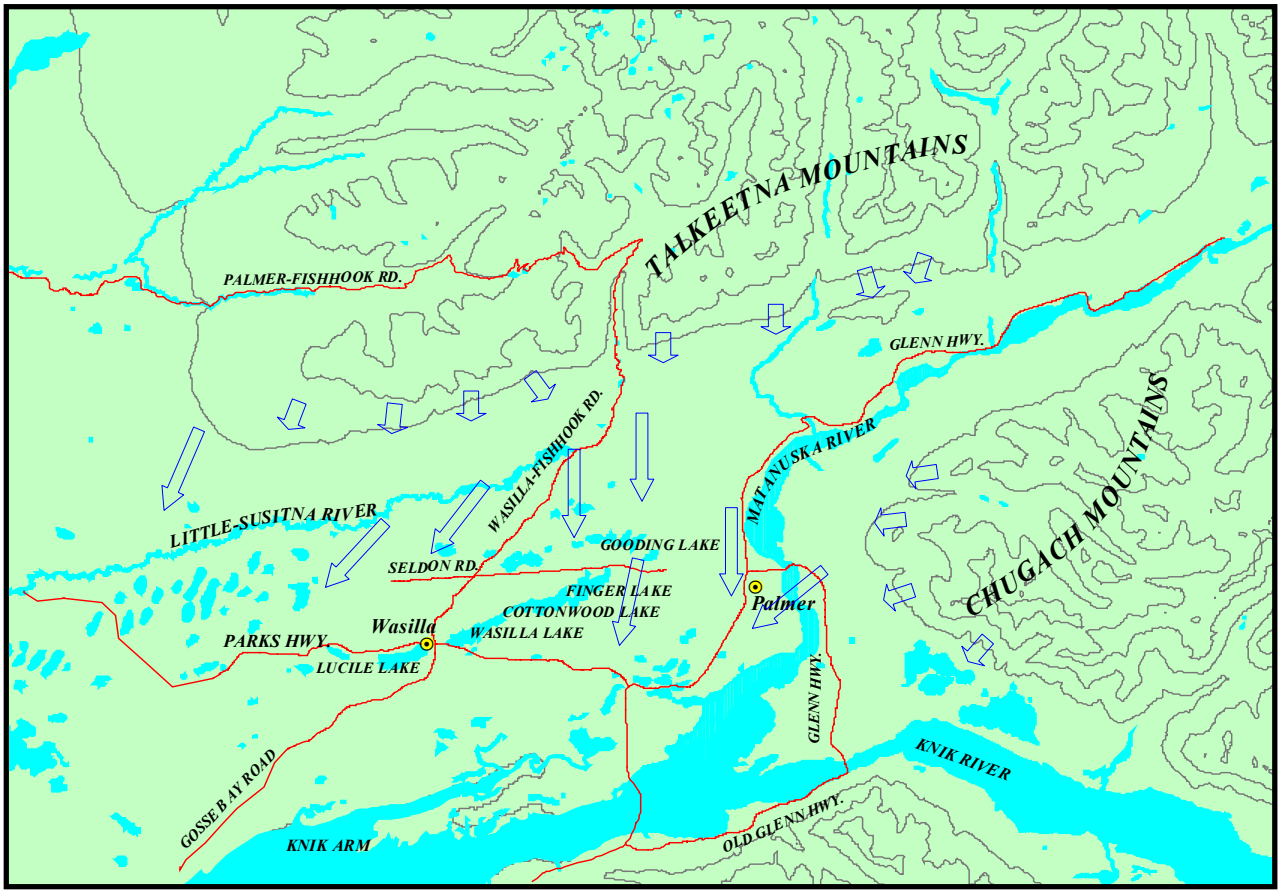


**Figure 2. Map showing groundwater flow in the Matanuska-Susitna Valley (Jokela, Munter and Evans, 1991).**

features, river terraces, outwash floodplains and an extensive estuarine flat (Trainer, 1960).

The glacial till and bedrock form aquifers of minor importance. The chief hydrologic significance of the till is in confining the artesian aquifer. Generally, the till is poorly permeable, although locally thin layers of sand may yield small quantities of water. Till that is present at or near the land surface in much of the area makes the acquisition of shallow groundwater difficult. The bedrock is poorly permeable. It yields water only from fractures, whose location and frequency cannot be easily predicted.

The chief aquifers are composed of outwash sand and gravel laid down by melt-water streams or in lakes. The outwash deposits are of two chief forms. The first consists of sheet-like deposits that lie just beneath the ground surface. These deposits range in thickness from a few feet to more than 100 feet. They typically rest on till or bedrock. The water in these deposits is unconfined. The other outwash deposits are buried beneath till. They are known to be as much as 50 to 60 feet thick, and probably are considerably thicker in some places. They commonly contain confined, or artesian, groundwater. Well logs and data from pumping tests suggest that outwash sand and gravel form a continuous or nearly continuous sheet in an area of more than 10 square miles north and west of Palmer (Jakola et al, 1991).

In the Mat-Su Valley, groundwater is primarily recharged by snowmelt and precipitation infiltrating both directly and also from the infiltration into the foothill slopes of the Talkeetna and Chugach Mountains. In addition,, aquifers may be recharged by streams where surface water percolates into surrounding permeable sediments (losing reaches of streams). This is the case for the water-table aquifers in the terrace south of Palmer and in the Bodenburg Butte area, which receive underground flow from the Matanuska River. Groundwater flow in the confined aquifers is generally from the north and north-northwest. The direction of groundwater flow in the upper unconfined aquifer is more variable due to the influence from surficial topography as well as its close connection with surface water bodies (Trainer,1960).

## CITY OF PALMER WELL NO. 4 PUBLIC WATER SOURCE

The City of Palmer public water system consists of three Class A wells, which are owned and operated by the City of Palmer. This report assesses Well No. 4, which is located approximately 1 mile west of the Glenn Highway off of Outer Springer Avenue and Cope Industrial Way. The well is at an approximate elevation of 215 feet above seal level. The depth of well is 186 feet below the surface. The static water level at the time of drilling (1/30/87) was 103 feet below the surface. The well is screened for 20 feet from 151 to 171 feet below the surface. The well is grouted. Grouting is a seal surrounding the well casing. The seal helps protect ground water resource from surface and/or subsurface contamination (NGWA, 2001).

The Palmer water system operates 365 days per year. According to the 1999 Sanitary Survey, the system provides water to 4000 + residents, via 1400+ service connections. The total number of residents served is expected to increase significantly over the next few years. As a result, The City of Palmer is planning to add another well to their system. It is expected that the new well will be located in the vicinity of Well No.4. The exact location has yet to be determined. The current production rate for Well No. 4 is 1200 gallons/minute. Well No. 4 produces 90% of the total water supply for the City of Palmer. Well No.1 and Well No.3 produce the remaining 10%. Well No. 2 is inactive due to high silt content. If Well No. 4 should go down, Well No. 1 would be the primary pump for the city.

## ASSESSMENT AND PROTECTION AREA FOR CITY OF PALMER WELL NO. 4 DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for City of Palmer Well No. 4 is the area that is most sensitive to contamination. This area has served as a basis for assessing the risk of the drinking water source to contamination. This zone around the drinking water source is the most critical area for the preservation of the quality of the drinking water for this source. For simplicity, this area will be known as your Drinking Water Protection Area and will serve as the area of focus for voluntary protection efforts.

Conceptually, groundwater enters the aquifer systems along the front range of the Talkeetna Mountains and flows toward Cook Inlet. An analytical calculation was used to calculate the size and shape of the area that contributes water to the well. The input parameters describing the attributes of the aquifer in this calculation were adopted from the well log and the recent Sanitary Survey. This analytical calculation was used as a guide in establishing the protection area for City of Palmer Well No. 4. Additional methods were further employed to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful and conservative protection area with respect to public health (Please refer to the

Guidance Manual for Class A Public Water Systems for additional information).

The Drinking Water Protection Areas established for wells by the Alaska Department of Environmental Conservation (ADEC) are separated into zones. These zones correspond to a time-of-travel. Time-of-travel is the time required for water to move in the saturated zone of the ground from a specific point to the well. The Drinking Water Protection Areas for City of Palmer Well No. 4 contains four zones, Zone A, Zone B, Zone C and Zone D (Map 1, Appendix A). Zone A corresponds to the area between the well and the distance equal to ¼ of the distance of the 2-year time-of-travel. Depending on where a contaminant source is located within Zone A, travel time for a contaminant to the well may be on the order of several days to several hours. Zone A also extends down gradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. The Zone B protection area for City of Palmer Well No. 4 corresponds to a time-of-travel of less than two years and extends toward base of the Talkeetna Mountains. Zone C protection area corresponds to a time-of-travel of greater than 2 years and less than 5 years. Zone D corresponds to a time-of-travel of greater than 5 years and less than 10 years.

## INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within City of Palmer Well No. 4 Drinking Water Protection Area. This survey was completed through a search of agency records and other publicly available information.

Potential sources of contamination to drinking water supplies cover 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 this assessment and 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
- Other organic chemicals

Table 1 in Appendix C lists the Contaminant Source Inventory for City of Palmer Well No. 4. Below is a summary of the categories of the contaminant sources inventoried within the City of Palmer Well No. 4 protection area Zone A though D:

- Residential septic systems
- Sewer lines
- Paved roads
- Large capacity septic systems (Class V Injection Wells)
- Residential areas
- Airports
- Railroad corridors
- Leaking Underground Storage Tank sites (LUST's)
- ADEC recognized contaminated sites.
- Underground fuel tanks.
- Various mining activities.
- Golf courses

These potential contaminant sources present risks for all six categories of drinking water contaminants for City of Palmer Well No. 4 drinking water source.

## RANKING OF CONTAMINANT RISKS

Potential and existing sources of contamination have been identified, sorted, and ranked 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. Contaminant risks are further a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the well (Appendices B & C).

## VULNERABILITY OF CITY OF PALMER WELL NO. 4 DRINKING WATER SOURCES

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

- Natural susceptibility; and
- Contaminant risks.

Each of the three 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 City of Palmer Well No. 4 well is completed in an unconfined-aquifer setting. The well log indicates that loose sand and gravel exist from near the surface to the bottom of the well. These deposits are coarse and highly transmissive, allowing water to flow rapidly through the aquifer material. The lack of a confining layer and the highly transmissive deposits may allow contaminants to enter the subsurface aquifer uninhibited. Once contaminants have entered the aquifer, the have the potential to travel down gradient.

Combining the susceptibilities of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility (Appendix D). Table 1 shows the overall Susceptibility score and rating for City of Palmer Well No. 4.

**Table 1. Natural Susceptibility - Susceptibility of the Wellheads and Aquifer to Contamination**

| | Score | Rating |
|---|---|---|
| Susceptibility of the Wellheads | 0 | Low |
| Susceptibility of the Aquifer | 25 | Very High |
| Natural Susceptibility | 25 | Medium |

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. A score (0 – 50 points) and rating of Contaminant Risks (See Appendix D) is assigned based on the findings of the Contaminant Source Inventory (See Appendix B - Table 1 – Table 7). This portion of the analysis examines recent existing or historical contamination that has been detected at the drinking water sources through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the either well.

Table 2 summarizes the Contaminant Risks for each category of drinking water contaminants.

**Table 2. Contaminant Risks**

| Contaminant Risks | Score | Rating |
|---|---|---|
| Bacteria and Viruses | 30 | High |
| Nitrates and/or Nitrites | 40 | High |
| Volatile Organic Chemicals | 50 | Very High |
| Heavy Metals, Cyanide, And Other Inorganic Chemicals | 50 | Very High |
| Synthetic Organic Chemicals | 50 | Very High |
| Other Organic Chemicals | 42 | Very Hig |

Appendix D contains fourteen charts, which together form the 'Vulnerability Analysis' for a Class A public drinking water system. 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 Analysis for nitrates and nitrites, volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

Vulnerability of drinking water sources to contamination is the combination of susceptibility of the aquifer and the well with contaminant risks. Table 3 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants (See Appendix D). Note: scores are rounded off to the nearest five.

Table 3. Overall Vulnerability of City of Palmer Well No. 4 Public Drinking Water Source to Contamination by Category

| Category | Score | Rating |
|---|---|---|
| Bacteria and Viruses | 60 | High |
| Nitrates and Nitrites | 55 | Medium |
| Volatile Organic Chemicals | 75 | Very High |
| Heavy Metals, Cyanide, and Other Inorganic Chemicals | 75 | Very High |
| Synthetic Organic Chemicals | 75 | Very High |
| Other Organic Chemicals | 65 | Very High |

Tables 2 through 7 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, heavy metals, synthetic organic chemicals, and other organic chemicals, respectively.

The contamination risk for the bacteria/viruses is driven by the potential risk associated with sewer lines, , storm water drains, septic systems, large capacity septic systems, residential septic systems, residential area and roads. No detection of bacteria and viruses has occurred in recent sampling history. Combining the contamination risk with the natural susceptibility of the well leads to an overall vulnerability to bacteria and virus contamination of high.

The contamination risk for nitrate/nitrites is driven by the potential risk associated with sewer lines, landfills, residential septic systems, residential area, large capacity septic systems, roads, airports, and golf courses.

Exisitng risk was determined by reviewing recent historical sampling data. The most recent detection indicates that nitrates were detected at 6% of the maximum contaminant level (MCL) of 10 mg/l on 4/9/01. (See Chart 5 – Contaminant Risks for nitrates and/or nitrites in Appendix D.) The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful effects. Combining the contamination risk with the natural susceptibility of the well leads to an overall vulnerability to nitrate/nitrite contamination of medium.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere in Alaska. Other sources of nitrate and/or nitrites are human sewage, livestock manure, especially from feedlots and fertilizers. Due to high solubility and weak retention by soil, nitrates are very mobile often moving at approximately the same rate as water. According to the USEPA, short-term exposure to levels excessively above the MCL has caused serious illness and sometimes death. Serious illness in infants can occur due to the conversion of nitrate to nitrite by the body, which can interfere with the oxygen-carrying capacity of the childs blood. This can be an acute condition in which health deteriorates rapidly over a period of days. Symptoms include shortness of breath and blueness of the skin. Long term exposure to nitrates and nitrites at levels above the MCL can lead to diuresis, increased starchy deposits and hemorrhaging of the spleen (USEPA, 2001).

Because naturally less than 2 mg/l (or 20% the MCL), it is suspected that the nitrate levels detected are not being influenced by man made sources. (Wang, Strelakos, Jokela, 2000). The level of nitrate/nitrite detected at City of Palmer Well No. 4 remains at very safe levels with respect to human health.

The contaminant risks for volatile organic chemicals are driven by the potential risk associated with gasoline stations, sewer lines, storm water basins, landfills, residential area, underground fuel tanks, LUST sites, airports, recognized contaminated sites, large capacity septic systems, various mining activities and railroad corridors.

Recent historical sampling indicates no detection of volatile organic chemicals. Combining the potential and existing contaminant risk with the natural susceptibility of the wells leads to an overall vulnerability to volatile organic chemical contamination of high.

The contaminant risks for heavy metals and inorganics are driven by the potential risks associated with gasoline stations, sewer lines, landfills, mining activities, underground fuel tanks, LUST sites, recognized contaminated sites, railroad corridors, golf courses, airports, residential septic systems, residential area, large capacity septic systems and roads.

Exisitng risk was determined by reviewing recent historical sampling data. The most recent detection indicates that barium was detected at 37% of the maximum contaminant level (MCL) of 0.05 mg/l on 1/5/1998.. (See Chart 9 – Contaminant Risks for Heavy Metals, Cyanide and Other Inorganic Chemicals) in Appendix D)..

Combining the potential contaminant risk and existing contaminant risk with the natural susceptibility of the

well leads to an overall vulnerability to heavy metals and inorganic chemical contamination of high. Barium is a lustrous, machinable metal, which exists in nature in ores containing mixtures of elements. It is used in making a wide variety of electronic components, in metal alloys, bleaches, dyes, fireworks, ceramics and glass. In particular, it is used in well drilling operations where it is directly released into the ground (USEPA, 2002).

Barium has potential to cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the MCL for relatively short periods of time. Lifetime exposure at levels above the MCL may lead to high blood pressure (USEPA, 2001). The source of the barium is unknown, however it is likely to from naturally occurring geologic deposits. The levels of barium detected at Palmer Well No. 4 remains at very safe levels with respect to human health.

The contaminant risk for synthetic organic chemicals is driven by the potential risk associated with sewer lines, landfills, railroad corridors, golf courses, airports, residential septic systems, residential area, and large capacity septic systems.

Recent historical sampling indicates no detection of regulated synthetic organic chemicals. Combining the potential and existing contaminant risk with the natural susceptibility of the wells leads to an overall vulnerability to volatile organic chemical contamination of high.

The contaminant risk for other organic chemicals is driven by the potential risk associated with sewer lines, storm sewer lines, landfills, railroad corridors, airports, residential septic systems, residential area, roads and large capacity septic systems.

Recent historical sampling indicates no detection of other organic chemicals. Combining the potential and existing contaminant risk with the natural susceptibility of the wells leads to an overall vulnerability to volatile organic chemical contamination of high.

**SUMMARY**

A *Source Water Assessment* has been completed for the source of public drinking water serving City of Palmer Well No. 4. The overall vulnerability of this source to contamination is **High** for bacteria and viruses; **Medium** for nitrates/nitrites, and **Very High** for volatile organic chemicals, inorganic chemicals, 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 City of Palmer Well No. 4 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 City of Palmer Well No. 4' public drinking water source.

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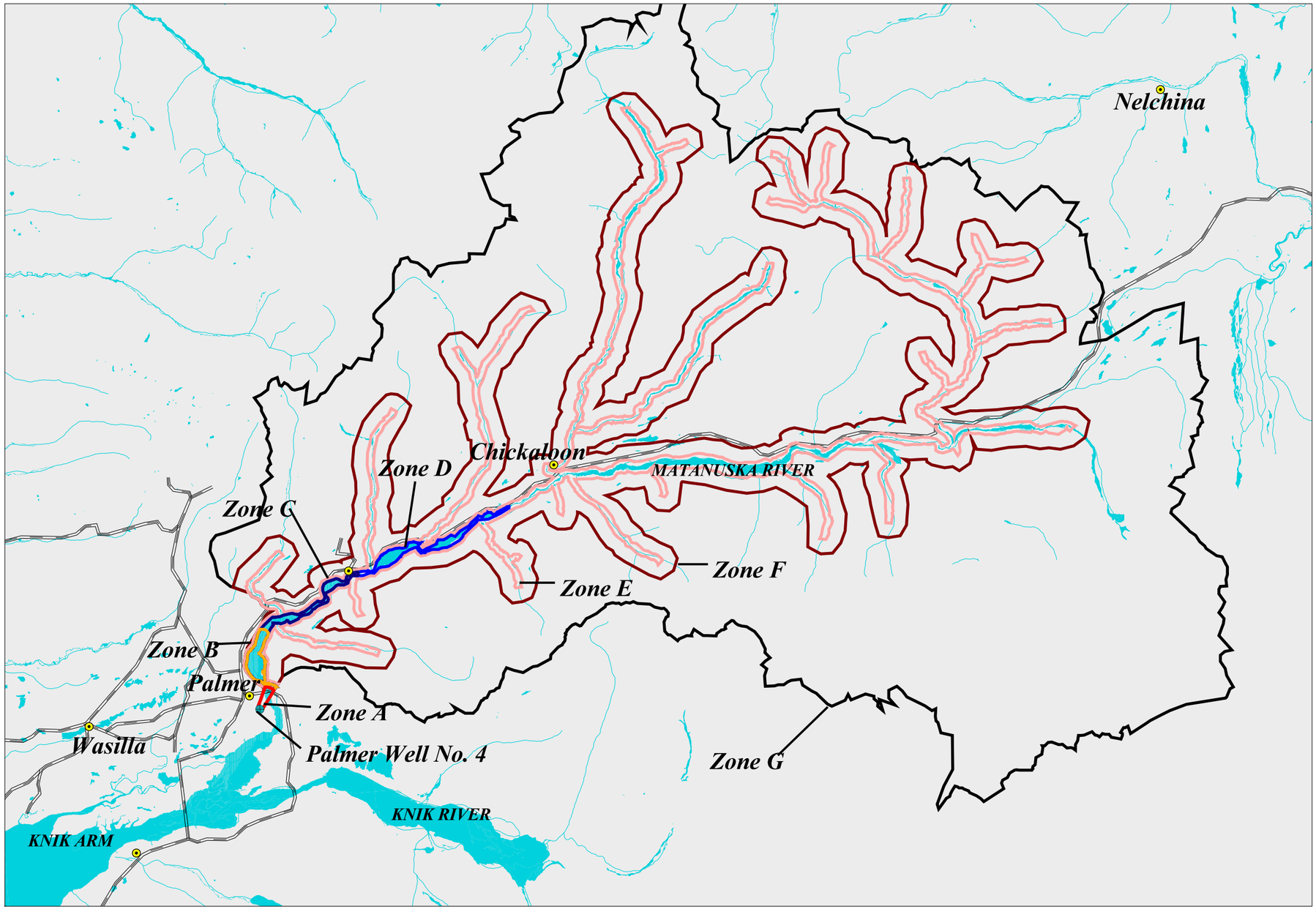
# APPENDIX A

## City of Palmer Well No. 4
## Drinking Water Protection Area

# Drinking Water Protection Area for the City of Palmer Well No. 4




20 0 20 40 Miles

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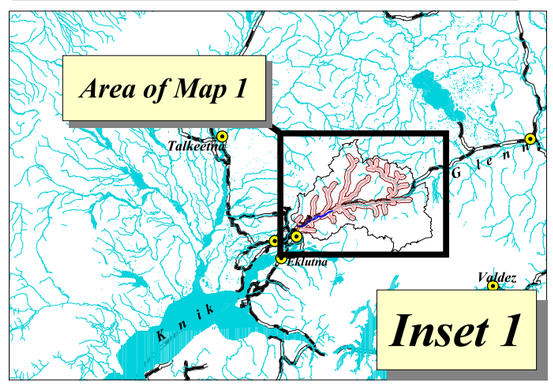
## *Legend*

- Towns
- Palmer Well No. 4
- Zone A Protection Area — Several Months Travel Time
- Zone B Proteciton Area — Less than 2 Years Travel Time
- Zone C Protection Area — Less than 5 Years Travel Time
- Zone D Protection Area — Less than 10 Years Travel Time
- Zone E Protection Area — 1000 feet Buffer
- Zone F Protection Area — 1 Mile Buffer
- Zone G Protection Area — Watershed Boundaries
- Roads
- River Lakes and Oceans
- Rivers

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# Map 1

# APPENDIX B

## Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4

***Table 1*** *Contaminant Source Inventory for* ***PWSID 226020.002***

## *City of Palmer Well No. 4*

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Gasoline stations (without repair shop) | C15 | C15-01 | A | Cope Industrial Way | 2 | |
| Gasoline stations (without repair shop) | C15 | C15-02 | A | Cope Industrial Way | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Along Cope Industrial Way | 2 | |
| Storm water basins and overflows | D19 | D19-01 | A | | 2 | |
| Storm water basins and overflows | D19 | D19-02 | A | | 2 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Quarries (gravel) | E10 | E10-01 | A | Near Evergreen Avenue | 2 | Non Active |
| Residential Areas | R01 | R01-01 | A | Residential area in Zone A | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Thuma Street | 2 | |
| Tanks, diesel (underground) | T08 | T08-01 | A | Hichinbrook Cheveron | 2 | Cheveron |
| Tanks, diesel (underground) | T08 | T08-02 | A | Cope Industrial Way | 2 | 15000 gallon diesel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-01 | A | Cheveron- Cope Industrial Way | 2 | Tank No. 2: 12000 gallon underground gasoline tank. 11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Tanks, gasoline (underground) | T12 | T12-02 | A | Cheveron-Cope Industrial Way | 2 | Tank No. 3: 12000 gallon underground gasoline tank. 11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Tanks, gasoline (underground) | T12 | T12-03 | A | Woods Air | 2 | 10000 gallon diesel. Permanently out of use. |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Tanks, gasoline (underground) | T12 | T12-04 | A | Cope Industrial Way | 2 | 10000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-05 | A | Cope Industrial Way | 2 | 10000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-06 | A | Cope Industrial Way | 2 | 5000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-07 | A | Cope Industrial Way | 2 | 5000 gallon aviation fuel. Permanently out of use. |
| Tanks, heating oil, nonresidential (underground) | T16 | T16-01 | A | Cheveron-Cope Industrial Way | 2 | Tank No. 1: 12000 gallon underground kerosene tank.11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-03 | A | Mile 17 Old Glenn Highway | 2 | Inactive: chlorinated hydrocarbon tetrachloroethane (PCE) have been detected at 0.030-0.040 mg/l in shallow groundwater and surface water at this site. The extent of PCE and source of contamination is not known. |
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-01 | A | Cope Industrial Way | 2 | Facility ID: 1571, Event ID: 2313, Status: Open. Diesel contamination found at 10 and 30 ft below ground surface. |
| Closed Leaking Underground Fuel Storage Tank (LUST) Sites | U08 | U08-01 | A | Cope Industrial Way | 2 | Facility ID: 1571, Event ID: 685, Status: Closed. 3,000 gallons aviation gas spilled to ground surface on March 10, 1993. Suspected vandalizm during the night, hose left on the ground and pump left running. |
| Golf courses | X02 | X02-01 | A | | 2 | |
| Airports | X14 | X14-01 | A | Palmer Runway | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-01 | A | Outer Springer Avenue | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-02 | A | Thuma Road | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-03 | A | Cope Industrial Way | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-04 | A | Lynn Martin Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-05 | A | Old Glenn Highway | 2 | |
| Rail corridors | X30 | X30-01 | A | Alaska Railroad Spur | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | West bank of Matanuska River | 3 | |
| Residential Areas | R01 | R01-02 | B | Residential Area in Zone B | 3 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R02-03 | B | | 3 | |
| Open dumps | U09 | U09-01 | B | Near bluff on Matanuska River | 3 | Unpermitted landfill. Appears that people have been dumping vehicles,scrap metal, batteries and appliances. |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | Old Glenn Highway | 2 | Camper Park |
| Solid Waste Transfer Facility | D61 | D61-01 | E | Sutton | 4 | Sutton Transfer Facility |
| Metals mining, open pit-Active | E03 | E03-03 | E | Wishbone Hill | 4 | |
| Metals mining, open pit Inactive | E03 | E03-04 | E | Howard-Jessen | 4 | |
| Metals mining, open pit- Inactive | E03 | E03-05 | E | Evan Jones | 4 | |
| Metals mining, open pit- Inactive | E03 | E03-06 | E | Coal Creek | 5 | |
| Metals mining, open pit (active or inactive?) | E03 | E03-07 | E | Jack | 5 | |
| Metals mining, placer - Active | E04 | E04-01 | E | Moose Creek | 4 | Expected Prosepect |
| Metals mining, placer- Active | E04 | E04-02 | E | Mag 1-2 | 4 | Expected Prosepect |
| Metals mining, placer- Active | E04 | E04-05 | E | Glacier Creek | 5 | |
| Metals mining, placer-Inactive | E04 | E04-06 | E | Matanuska River | 5 | |
| Metals mining, placer -Inactive | E04 | E04-07 | E | Caribou Creek | 5 | |
| Metals mining, placer-Inactive | E04 | E04-09 | E | Anges No. 1 | 5 | |
| Metals mining, placer -Inactive | E04 | E04-10 | E | Mazuma Creek | 5 | |
| Metals mining, placer - Inactive | E04 | E04-12 | E | Alfred Creek | 5 | |
| Metals mining, placer Inactive | E04 | E04-13 | E | LynDee 1-3 | 5 | |
| Metals mining, placer Inactive | E04 | E04-14 | E | Chickaloon River | 5 | |
| Metals mining, placer Inactive | E04 | E04-15 | E | Boulder Creek | 5 | |
| Metals mining, placer -Active | E04 | E04-16 | E | Al's Discovery | 5 | |
| Metals mining, placer-Active | E04 | E04-17 | E | California Creek | 5 | |
| Metals mining, underground- Inactive | E05 | E05-01 | E | Premier Mine near Moose Creek | 4 | |
| Metals mining, underground-Inactive | E05 | E05-02 | E | Baxter Mine | 4 | |
| Metals mining, underground Inactive | E05 | E05-03 | E | Buffalo Mine | 4 | |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Metals mining, underground- Inactive | E05 | E05-04 | E | Rawson Mine | 4 | |
| Quarries (gravel) | E10 | E10-02 | E | Near Old Glenn Highway | 2 | Associated Aggregate Pit and Plant--Non Active |
| Orchards or nurseries | A10 | A10-01 | F | Bushes and Bunches Greenhouses | 3 | |
| Gasoline stations (with repair shop) | C16 | C16-01 | F | Mile 59.5 Glenn Hwy | 4 | Hilltop Tesoro |
| Metals mining, placer- Active | E04 | E04-08 | F | Rock Glacier Creek | 5 | |
| Tanks, diesel (underground) | T08 | T08-04 | F | Palmer Correctional Center | 4 | |
| Tanks, diesel (underground) | T08 | T08-05 | F | Palmer Correctional Center | 4 | |
| Tanks, gasoline (underground) | T12 | T12-09 | F | Palmer Correctional Center | 4 | |
| Abandoned mine spoils or mine tailings piles/ ponds | U01 | U01-01 | F | Knob Creek - Division of Mining, Site #1 | 4 | |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-01 | F | Near Medium Security Facility | 4 | Active: 165 gallons Diesel No. 1 spilled in 1995. Site assessed by Shannon and Wilson. Priority: Low |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-02 | F | Near maximum Facility | 4 | Status:Active. Estmated 20,000 gallons of Diesel No. 1spill occurred in 1989. Clean was unfeasible due to the location of the spill. Extensive monitoring wells are in place. Priority: High |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-04 | F | Near Medium Security Facility | 4 | Active: During the removal of one 500 gallon diesel Underground storage tank and one 1500 gallon buried heating oil tank, petroleum contamination encountered at both excavations. Priority: Medium |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-05 | F | Palmer Correctional Center | 4 | Release of <480 gallons #1 diesel from a 500 gallon above ground storage tank connection in 12/93. |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-06 | F | Near maximum Facility | 4 | Status Active. Estimated 10,000 gallons of Diesel No. 1 spill occurred in 1998. Cotamination levels noted to 82 feet below the surface. Excavation deemed not feasible. Monitoring wells in place. Status: High. Site is being monitorred. |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-07 | F | Near runway | 4 | Active: Release of less then 480 gallons diesel No. 1 from a 500 gallon above ground storage tank in 1993. Priority: Low |
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-02 | F | Near Maximum Facility | 4 | Status: Active. Tank No. 4 pulled. Stored 300 gallons of diesel. Contamiantion was present. Priority: Low |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-03 | F | Near Maximum facility | 4 | Active: Soil contamination encountered during tank closure. Levels of contamination above cleanup action levels remain at the site. Priority: Medium |
| Closed Leaking Underground Fuel Storage Tank (LUST) Sites | U08 | U07-04 | F | Near Medium Security Facility | 4 | Inactive:A 300 gallon diesel tank #2 was pulled. Soil contaminated above 200 kg.mg level for diesel. Soil excavated from the site. Soil presently stored on site must be treated. Priority: Low |
| Mineral extraction wells- Active | W05 | W05-01 | F | Drill Lake | 5 | |
| Landfills (municipal; Class III) | D51 | D51-02 | G | Chickaloon | 4/5 | Chickaloon Landfill |
| Metals mining, open pit (active or inactive?) | E03 | E03-08 | G | Gypsum Creek | 5 | |
| Metals mining, placer- Active | E04 | E04-03 | G | Cascade Creek | 5 | |
| Metals mining, placer- Active | E04 | E04-04 | G | Hicks Creek | 5 | |

**Table 2**

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Bacteria and Viruses*

**PWSID 226020.002**

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Low | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Low | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Low | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Low | Thuma Street | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | Low | West bank of Matanuska River | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | Medium | | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Medium | Along Cope Industrial Way | 2 | |
| Storm water basins and overflows | D19 | D19-01 | A | Medium | | 2 | |
| Storm water basins and overflows | D19 | D19-02 | A | Medium | | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-02 | A | Low | Thuma Road | 1 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | Low | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Residential Areas | R01 | R01-01 | A | Low | Residential area in Zone A | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-01 | A | Low | Outer Springer Avenue | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-03 | A | Low | Cope Industrial Way | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-04 | A | Low | Lynn Martin Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-05 | A | Low | Old Glenn Highway | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | Residential Area in Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R02-03 | B | Low | | 3 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | High | Old Glenn Highway | 2 | Camper Park |

**Table 3**

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Nitrates/Nitrites*

**PWSID 226020.002**

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Low | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Low | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Low | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Low | Thuma Street | 2 | |
| Golf courses | X02 | X02-01 | A | Medium | | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | Low | West bank of Matanuska River | 3 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | Medium | | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Medium | Along Cope Industrial Way | 2 | |
| Storm water basins and overflows | D19 | D19-01 | A | Low | | 2 | |
| Storm water basins and overflows | D19 | D19-02 | A | Low | | 2 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | Low | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Quarries (gravel) | E10 | E10-01 | A | Low | Near Evergreen Avenue | 2 | Non Active |
| Residential Areas | R01 | R01-01 | A | Low | Residential area in Zone A | 2 | |
| Airports | X14 | X14-01 | A | Low | Palmer Runway | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-01 | A | Low | Outer Springer Avenue | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-02 | A | Low | Thuma Road | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-03 | A | Low | Cope Industrial Way | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-04 | A | Low | Lynn Martin Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-05 | A | Low | Old Glenn Highway | 2 | |
| Residential Areas | R01 | R01-02 | B | Low | Residential Area in Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R02-03 | B | Low | | 3 | |

***Table 3 (continued)***

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Nitrates/Nitrites*

***PWSID 226020.002***

| ***Contaminant Source Type*** | ***Contaminant Source ID*** | ***CS ID tag*** | ***Zone*** | ***Risk Ranking for Analysis*** | ***Location*** | ***Map Number*** | ***Comments*** |
|---|---|---|---|---|---|---|---|
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | High | Old Glenn Highway | 2 | Camper Park |
| Quarries (gravel) | E10 | E10-02 | E | Low | Near Old Glenn Highway | 2 | Associated Aggregate Pit and Plant--Non Active |
| Orchards or nurseries | A10 | A10-01 | F | Medium | Bushes and Bunches Greenhouses | 3 | |

**Table 4**

# Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Volatile Organic Chemicals

**PWSID 226020.002**

| Contaminant Source Type | Contaminant Source ID | CS ID tag | Zone | Risk Ranking for Analysis | Location | Map Number | Comments |
|---|---|---|---|---|---|---|---|
| Airports | X14 | X14-01 | A | High | Palmer Runway | 2 | |
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-01 | A | Medium | Cope Industrial Way | 2 | Facility ID: 1571, Event ID: 2313, Status: Open. Diesel contamination found at 10 and 30 ft below ground surface. |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-03 | A | High | Mile 17 Old Glenn Highway | 2 | Inactive: chlorinated hydrocarbon tetrachloroethane (PCE) have been detected at 0.030-0.040 mg/l in shallow groundwater and surface water at this site. The extent of PCE and source of contamination is not known. |
| Highways and roads, paved (cement or asphalt) | X20 | X20-02 | A | Low | Thuma Road | 1 | |
| Rail corridors | X30 | X30-01 | A | Medium | Alaska Railroad Spur | 2 | |
| Tanks, gasoline (underground) | T12 | T12-01 | A | High | Cheveron- Cope Industrial Way | 2 | Tank No. 2: 12000 gallon underground gasoline tank. 11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Tanks, gasoline (underground) | T12 | T12-02 | A | High | Cheveron-Cope Industrial Way | 2 | Tank No. 3: 12000 gallon underground gasoline tank. 11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Gasoline stations (without repair shop) | C15 | C15-01 | A | High | Cope Industrial Way | 2 | |
| Gasoline stations (without repair shop) | C15 | C15-02 | A | High | Cope Industrial Way | 2 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | High | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Tanks, heating oil, nonresidential (underground) | T16 | T16-01 | A | Low | Cheveron-Cope Industrial Way | 2 | Tank No. 1: 12000 gallon underground kerosene tank.11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | Low | | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Low | Along Cope Industrial Way | 2 | |
| Storm water basins and overflows | D19 | D19-01 | A | Medium | | 2 | |
| Storm water basins and overflows | D19 | D19-02 | A | Medium | | 2 | |
| Quarries (gravel) | E10 | E10-01 | A | Low | Near Evergreen Avenue | 2 | Non Active |

***Table 4 (continued)***

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Volatile Organic Chemicals*

***PWSID 226020.002***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Residential Areas | R01 | R01-01 | A | Low | Residential area in Zone A | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Low | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Low | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Low | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Low | Thuma Street | 2 | |
| Tanks, diesel (underground) | T08 | T08-01 | A | High | Hichinbrook Cheveron | 2 | Cheveron |
| Tanks, diesel (underground) | T08 | T08-02 | A | High | Cope Industrial Way | 2 | 15000 gallon diesel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-03 | A | High | Woods Air | 2 | 10000 gallon diesel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-04 | A | High | Cope Industrial Way | 2 | 10000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-05 | A | High | Cope Industrial Way | 2 | 10000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-06 | A | High | Cope Industrial Way | 2 | 5000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-07 | A | High | Cope Industrial Way | 2 | 5000 gallon aviation fuel. Permanently out of use. |
| Closed Leaking Underground Fuel Storage Tank (LUST) Sites | U08 | U08-01 | A | Low | Cope Industrial Way | 2 | Facility ID: 1571, Event ID: 685, Status: Closed. 3,000 gallons aviation gas spilled to ground surface on March 10, 1993. Suspected vandalizm during the night, hose left on the ground and pump left running. |
| Highways and roads, paved (cement or asphalt) | X20 | X20-01 | A | Low | Outer Springer Avenue | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-03 | A | Low | Cope Industrial Way | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-04 | A | Low | Lynn Martin Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-05 | A | Low | Old Glenn Highway | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | Low | West bank of Matanuska River | 3 | |
| Residential Areas | R01 | R01-02 | B | Low | Residential Area in Zone B | 3 | |

*Table 4 (continued)*

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Volatile Organic Chemicals*

***PWSID 226020.002***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Septic systems (serves one single-family home) | R02 | R02-03 | B | Low | | 3 | |
| Open dumps | U09 | U09-01 | B | Medium | Near bluff on Matanuska River | 3 | Unpermitted landfill. Appears that people have been dumping vehicles,scrap metal, batteries and appliances. |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | Low | Old Glenn Highway | 2 | Camper Park |
| Solid Waste Transfer Facility | D61 | D61-01 | E | Low | Sutton | 4 | Sutton Transfer Facility |
| Metals mining, underground- Inactive | E05 | E05-01 | E | Medium | Premier Mine near Moose Creek | 4 | |
| Quarries (gravel) | E10 | E10-02 | E | Low | Near Old Glenn Highway | 2 | Associated Aggregate Pit and Plant--Non Active |
| Gasoline stations (with repair shop) | C16 | C16-01 | F | High | Mile 59.5 Glenn Hwy | 4 | Hilltop Tesoro |
| Tanks, diesel (underground) | T08 | T08-04 | F | High | Palmer Correctional Center | 4 | |
| Tanks, diesel (underground) | T08 | T08-05 | F | High | Palmer Correctional Center | 4 | |
| Tanks, diesel (underground) | T08 | T08-05 | F | High | Palmer Correctional Center | 4 | |
| Tanks, gasoline (underground) | T12 | T12-09 | F | High | Palmer Correctional Center | 4 | |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-01 | F | Medium | Near Medium Security Facility | 4 | Active: 165 gallons Diesel No. 1 spilled in 1995. Site assessed by Shannon and Wilson. Priority: Low |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-02 | F | High | Near maximum Facility | 4 | Status:Active. Estmated 20,000 gallons of Diesel No. 1spill occurred in 1989. Clean was unfeasible due to the location of the spill. Extensive monitoring wells are in place. Priority: High |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-04 | F | Medium | Near Medium Security Facility | 4 | Active: During the removal of one 500 gallon diesel Underground storage tank and one 1500 gallon buried heating oil tank, petroleum contamination encountered at both excavations. Priority: Medium |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-05 | F | High | Palmer Correctional Center | 4 | Release of <480 gallons #1 diesel from a 500 gallon above ground storage tank connection in 12/93. |

*Table 4 (continued)*

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Volatile Organic Chemicals*

***PWSID 226020.002***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-06 | F | High | Near maximum Facility | 4 | Status Active. Estimated 10,000 gallons of Diesel No. 1 spill occurred in 1998. Cotamination levels noted to 82 feet below the surface. Excavation deemed not feasible. Monitoring wells in place. Status: High. Site is being monitorred. |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-07 | F | Medium | Near runway | 4 | Active: Release of less then 480 gallons diesel No. 1 from a 500 gallon above ground storage tank in 1993. Priority: Low |
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-02 | F | Low | Near Maximum Facility | 4 | Status: Active. Tank No. 4 pulled. Stored 300 gallons of diesel. Contamiantion was present. Priority: Low |
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-03 | F | Medium | Near Maximum facility | 4 | Active: Soil contamination encountered during tank closure. Levels of contamination above cleanup action levels remain at the site. Priority: Medium |
| Closed Leaking Underground Fuel Storage Tank (LUST) Sites | U08 | U07-04 | F | Low | Near Medium Security Facility | 4 | Inactive:A 300 gallon diesel tank #2 was pulled. Soil contaminated above 200 kg.mg level for diesel. Soil excavated from the site. Soil presently stored on site must be treated. Priority: Low |
| Landfills (municipal; Class III) | D51 | D51-02 | G | High | Chickaloon | 4/5 | Chickaloon Landfill |

**Table 5**

# Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4
## Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

**PWSID 226020.002**

| Contaminant Source Type | Contaminant Source ID | CS ID tag | Zone | Risk Ranking for Analysis | Location | Map Number | Comments |
|---|---|---|---|---|---|---|---|
| Airports | X14 | X14-01 | A | Low | Palmer Runway | 2 | |
| Open Leaking Underground Fuel Storage Tank (LUST) Sites | U07 | U07-01 | A | Medium | Cope Industrial Way | 2 | Facility ID: 1571, Event ID: 2313, Status: Open. Diesel contamination found at 10 and 30 ft below ground surface. |
| Highways and roads, paved (cement or asphalt) | X20 | X20-02 | A | Low | Thuma Road | 1 | |
| Rail corridors | X30 | X30-01 | A | Low | Alaska Railroad Spur | 2 | |
| Tanks, gasoline (underground) | T12 | T12-01 | A | Medium | Cheveron- Cope Industrial Way | 2 | Tank No. 2: 12000 gallon underground gasoline tank. 11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Tanks, gasoline (underground) | T12 | T12-02 | A | Medium | Cheveron-Cope Industrial Way | 2 | Tank No. 3: 12000 gallon underground gasoline tank. 11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Gasoline stations (without repair shop) | C15 | C15-01 | A | Low | Cope Industrial Way | 2 | |
| Gasoline stations (without repair shop) | C15 | C15-02 | A | Low | Cope Industrial Way | 2 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | High | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Tanks, heating oil, nonresidential (underground) | T16 | T16-01 | A | Low | Cheveron-Cope Industrial Way | 2 | Tank No. 1: 12000 gallon underground kerosene tank.11 years old double walled with tank detection. Next inspection due 10/31/03. |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | Low | | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Low | Along Cope Industrial Way | 2 | |
| Residential Areas | R01 | R01-01 | A | Low | Residential area in Zone A | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Low | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Low | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Low | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Low | Thuma Street | 2 | |
| Tanks, gasoline (underground) | T12 | T12-03 | A | Medium | Woods Air | 2 | 10000 gallon diesel. Permanently out of use. |

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Tanks, gasoline (underground) | T12 | T12-04 | A | Medium | Cope Industrial Way | 2 | 10000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-05 | A | Medium | Cope Industrial Way | 2 | 10000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-06 | A | Medium | Cope Industrial Way | 2 | 5000 gallon aviation fuel. Permanently out of use. |
| Tanks, gasoline (underground) | T12 | T12-07 | A | Medium | Cope Industrial Way | 2 | 5000 gallon aviation fuel. Permanently out of use. |
| Closed Leaking Underground Fuel Storage Tank (LUST) Sites | U08 | U08-01 | A | Low | Cope Industrial Way | 2 | Facility ID: 1571, Event ID: 685, Status: Closed. 3,000 gallons aviation gas spilled to ground surface on March 10, 1993. Suspected vandalizm during the night, hose left on the ground and pump left running. |
| Golf courses | X02 | X02-01 | A | Low | | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-01 | A | Low | Outer Springer Avenue | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-03 | A | Low | Cope Industrial Way | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-04 | A | Low | Lynn Martin Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-05 | A | Low | Old Glenn Highway | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | Low | West bank of Matanuska River | 3 | |
| Residential Areas | R01 | R01-02 | B | Low | Residential Area in Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R02-03 | B | Low | | 3 | |
| Open dumps | U09 | U09-01 | B | Medium | Near bluff on Matanuska River | 3 | Unpermitted landfill. Appears that people have been dumping vehicles,scrap metal, batteries and appliances. |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | Low | Old Glenn Highway | 2 | Camper Park |
| Solid Waste Transfer Facility | D61 | D61-01 | E | Low | Sutton | 4 | Sutton Transfer Facility |
| Metals mining, open pit-Active | E03 | E03-03 | E | Very High | Wishbone Hill | 4 | |
| Metals mining, open pit Inactive | E03 | E03-04 | E | Very High | Howard-Jessen | 4 | |

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4*

## *Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Metals mining, open pit- Inactive | E03 | E03-05 | E | Very High | Evan Jones | 4 | |
| Metals mining, open pit- Inactive | E03 | E03-06 | E | Very High | Coal Creek | 5 | |
| Metals mining, open pit (active or inactive?) | E03 | E03-07 | E | Very High | Jack | 5 | |
| Metals mining, placer - Active | E04 | E04-01 | E | Low | Moose Creek | 4 | Expected Prosepect |
| Metals mining, placer- Active | E04 | E04-02 | E | Low | Mag 1-2 | 4 | Expected Prosepect |
| Metals mining, placer- Active | E04 | E04-05 | E | Low | Glacier Creek | 5 | |
| Metals mining, placer-Inactive | E04 | E04-06 | E | Low | Matanuska River | 5 | |
| Metals mining, placer -Inactive | E04 | E04-07 | E | Low | Caribou Creek | 5 | |
| Metals mining, placer-Inactive | E04 | E04-09 | E | Low | Anges No. 1 | 5 | |
| Metals mining, placer -Inactive | E04 | E04-10 | E | Low | Mazuma Creek | 5 | |
| Metals mining, placer - Inactive | E04 | E04-12 | E | Low | Alfred Creek | 5 | |
| Metals mining, placer Inactive | E04 | E04-13 | E | Low | LynDee 1-3 | 5 | |
| Metals mining, placer Inactive | E04 | E04-14 | E | Low | Chickaloon River | 5 | |
| Metals mining, placer Inactive | E04 | E04-15 | E | Low | Boulder Creek | 5 | |
| Metals mining, placer -Active | E04 | E04-16 | E | Low | Al's Discovery | 5 | |
| Metals mining, placer-Active | E04 | E04-17 | E | Low | California Creek | 5 | |
| Metals mining, underground- Inactive | E05 | E05-01 | E | Very High | Premier Mine near Moose Creek | 4 | |
| Metals mining, underground-Inactive | E05 | E05-02 | E | Very High | Baxter Mine | 4 | |
| Metals mining, underground Inactive | E05 | E05-03 | E | Very High | Buffalo Mine | 4 | |
| Metals mining, underground- Inactive | E05 | E05-04 | E | Very High | Rawson Mine | 4 | |
| Orchards or nurseries | A10 | A10-01 | F | Low | Bushes and Bunches Greenhouses | 3 | |
| Gasoline stations (with repair shop) | C16 | C16-01 | F | Low | Mile 59.5 Glenn Hwy | 4 | Hilltop Tesoro |
| Metals mining, placer- Active | E04 | E04-08 | F | Low | Rock Glacier Creek | 5 | |

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4*

## *Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals*

| ***Contaminant Source Type*** | ***Contaminant Source ID*** | ***CS ID tag*** | ***Zone*** | ***Risk Ranking for Analysis*** | ***Location*** | ***Map Number*** | ***Comments*** |
|---|---|---|---|---|---|---|---|
| Abandoned mine spoils or mine tailings piles/ ponds | U01 | U01-01 | F | Very High | Knob Creek - Division of Mining, Site #1 | 4 | |
| Contaminated sites, DEC recognized, non-Superfund, non-RCRA | U04 | U04-04 | F | Medium | Near Medium Security Facility | 4 | Active: During the removal of one 500 gallon diesel Underground storage tank and one 1500 gallon buried heating oil tank, petroleum contamination encountered at both excavations. Priority: Medium |
| Mineral extraction wells- Active | W05 | W05-01 | F | High | Drill Lake | 5 | |
| Landfills (municipal; Class III) | D51 | D51-02 | G | High | Chickaloon | 4/5 | Chickaloon Landfill |
| Metals mining, open pit (active or inactive?) | E03 | E03-08 | G | Very High | Gypsum Creek | 5 | |
| Metals mining, placer- Active | E04 | E04-03 | G | Low | Cascade Creek | 5 | |
| Metals mining, placer- Active | E04 | E04-04 | G | Low | Hicks Creek | 5 | |

**Table 6**

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Synthetic Organic Chemicals*

**PWSID 226020.002**

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Airports | X14 | X14-01 | A | Medium | Palmer Runway | 2 | |
| Golf courses | X02 | X02-01 | A | High | | 2 | |
| Rail corridors | X30 | X30-01 | A | Medium | Alaska Railroad Spur | 2 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | High | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Residential Areas | R01 | R01-01 | A | Low | Residential area in Zone A | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Low | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Low | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Low | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Low | Thuma Street | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Low | Along Cope Industrial Way | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | Low | | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | Low | West bank of Matanuska River | 3 | |
| Residential Areas | R01 | R01-02 | B | Low | Residential Area in Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R02-03 | B | Low | | 3 | |
| Open dumps | U09 | U09-01 | B | Medium | Near bluff on Matanuska River | 3 | Unpermitted landfill. Appears that people have been dumping vehicles,scrap metal, batteries and appliances. |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | Low | Old Glenn Highway | 2 | Camper Park |
| Solid Waste Transfer Facility | D61 | D61-01 | E | Low | Sutton | 4 | Sutton Transfer Facility |
| Orchards or nurseries | A10 | A10-01 | F | High | Bushes and Bunches Greenhouses | 3 | |
| Landfills (municipal; Class III) | D51 | D51-02 | G | Very High | Chickaloon | 4/5 | Chickaloon Landfill |

**Table 7**

# Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4 Sources of Other Organic Chemicals

**PWSID 226020.002**

| Contaminant Source Type | Contaminant Source ID | CS ID tag | Zone | Risk Ranking for Analysis | Location | Map Number | Comments |
|---|---|---|---|---|---|---|---|
| Airports | X14 | X14-01 | A | Medium | Palmer Runway | 2 | |
| Rail corridors | X30 | X30-01 | A | Low | Alaska Railroad Spur | 2 | |
| Gasoline stations (without repair shop) | C15 | C15-01 | A | Low | Cope Industrial Way | 2 | |
| Gasoline stations (without repair shop) | C15 | C15-02 | A | Low | Cope Industrial Way | 2 | |
| Landfills (municipal; Class III) | D51 | D51-01 | A | High | Palmer Airport Landfill | 2 | Unpermitted landfill. Clean up occurred and solid waste was moved the MSB Central landfill. Site has been inactive for years. |
| Residential Areas | R01 | R01-01 | A | Low | Residential area in Zone A | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-01 | A | Low | Near Old Glenn Highway and Matanuska River | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-02 | A | Low | Near Old Glenn Bridge | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-04 | A | Low | Thuma Street | 2 | |
| Septic systems (serves one single-family home) | R02 | R02-05 | A | Low | Thuma Street | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-01 | A | Low | | 2 | |
| Domestic wastewater collection systems (sewer lines or lift stations) | D01 | D01-02 | A | Low | Along Cope Industrial Way | 2 | |
| Storm water basins and overflows | D19 | D19-01 | A | Medium | | 2 | |
| Storm water basins and overflows | D19 | D19-02 | A | Medium | | 2 | |
| Quarries (gravel) | E10 | E10-01 | A | Low | Near Evergreen Avenue | 2 | Non Active |
| Highways and roads, paved (cement or asphalt) | X20 | X20-01 | A | Low | Outer Springer Avenue | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-02 | A | Low | Thuma Road | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-03 | A | Low | Cope Industrial Way | 1 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-04 | A | Low | Lynn Martin Drive | 2 | |
| Highways and roads, paved (cement or asphalt) | X20 | X20-05 | A | Low | Old Glenn Highway | 2 | |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-04 | B | Low | West bank of Matanuska River | 3 | |

***Table 7 (continued)***

# *Contaminant Source Inventory and Risk Ranking for City of Palmer Well No. 4*
## *Sources of Other Organic Chemicals*

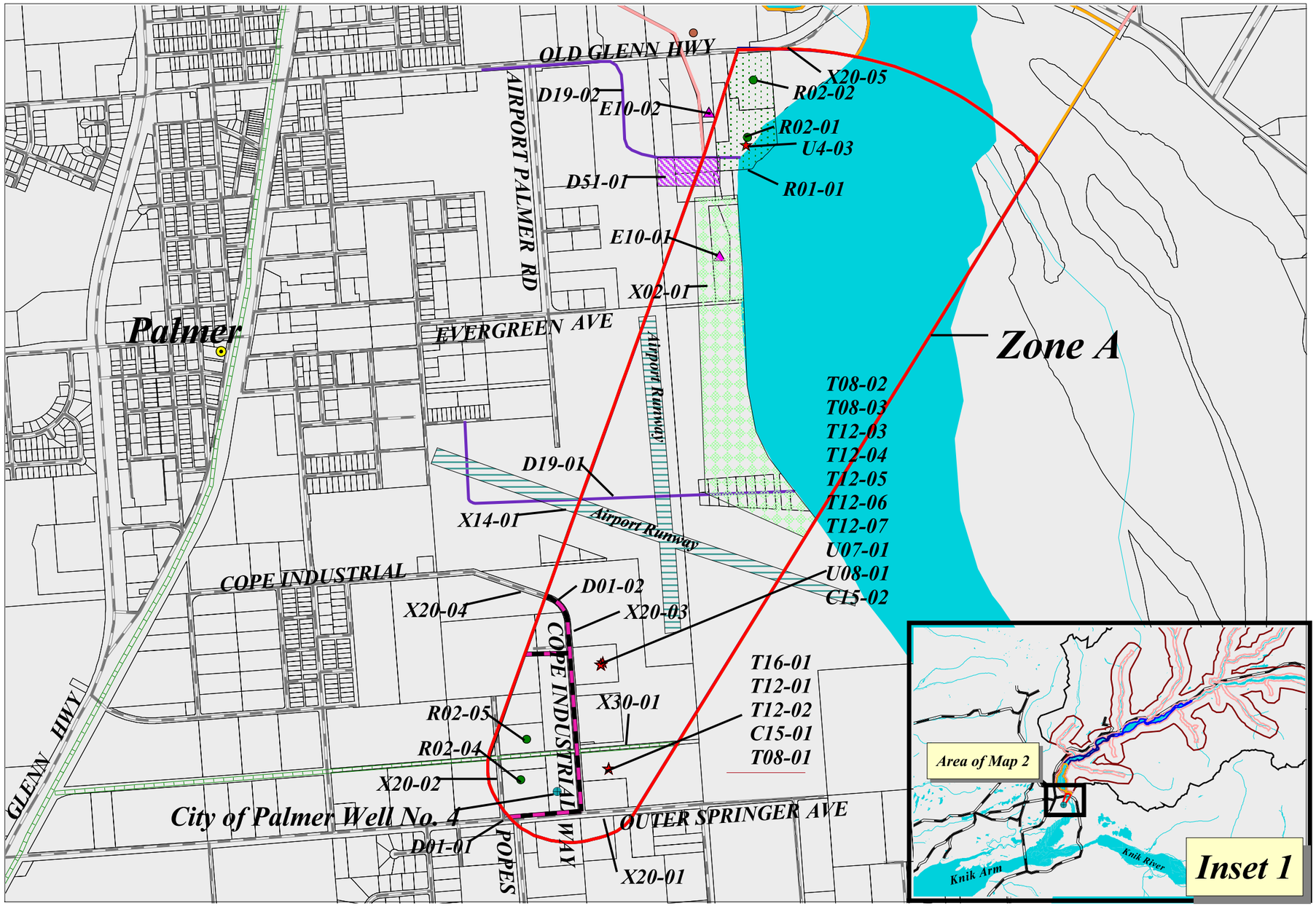
***PWSID 226020.002***

| *Contaminant Source Type* | *Contaminant Source ID* | *CS ID tag* | *Zone* | *Risk Ranking for Analysis* | *Location* | *Map Number* | *Comments* |
|---|---|---|---|---|---|---|---|
| Residential Areas | R01 | R01-02 | B | Low | Residential Area in Zone B | 3 | |
| Septic systems (serves one single-family home) | R02 | R02-03 | B | Low | | 3 | |
| Open dumps | U09 | U09-01 | B | Medium | Near bluff on Matanuska River | 3 | Unpermitted landfill. Appears that people have been dumping vehicles,scrap metal, batteries and appliances. |
| Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method) | D10 | D10-02 | E | Low | Old Glenn Highway | 2 | Camper Park |
| Solid Waste Transfer Facility | D61 | D61-01 | E | Low | Sutton | 4 | Sutton Transfer Facility |
| Quarries (gravel) | E10 | E10-02 | E | Low | Near Old Glenn Highway | 2 | Associated Aggregate Pit and Plant--Non Active |
| Orchards or nurseries | A10 | A10-01 | F | Low | Bushes and Bunches Greenhouses | 3 | |
| Gasoline stations (with repair shop) | C16 | C16-01 | F | Medium | Mile 59.5 Glenn Hwy | 4 | Hilltop Tesoro |
| Landfills (municipal; Class III) | D51 | D51-02 | G | Very High | Chickaloon | 4/5 | Chickaloon Landfill |

# APPENDIX C

## City of Palmer Well No. 4
## Drinking Water Protection Area
## And Potential & Existing Contaminant Sources

# Drinking Water Protection Area and Potential and Existing Sources of Contamination for the City of Palmer Well No. 4




0 4000 Feet

PWSID 226020.002

## Legend

- Cities
- Palmer Well No. 4

Zone A Protection Area
- Several Months Travel Time

Zone B Proteciton Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 5 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time

Zone E Protection Area
- 1000 feet Buffer

Zone F Protection Area
- 1 Mile Buffer

Zone G Protection Area
- Watershed Boundaries
- Residential Areas (R01)
- Golf Course (X02)
- Airport Runways (X14-01)
- Solid Waste Facility (D51)
- Sewer lines (D01)
- Storm Water Sewers (D19)

Septics
- Class V Injection Wells -Drainfield (D10)
- Residential Septic Systems (R02)
- Potential and Existing Sources of Contamination

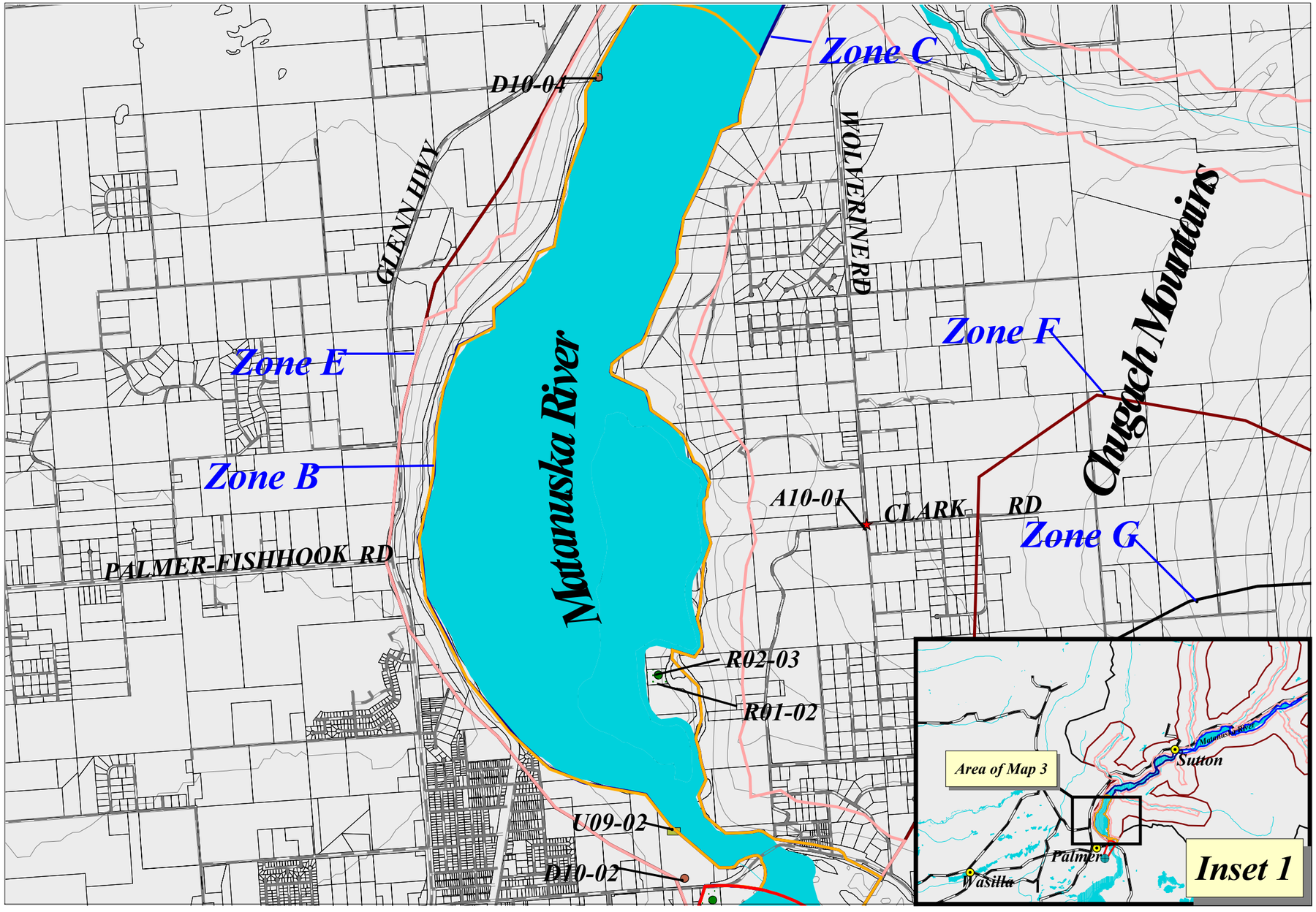
Mines
- Surface-Underground
- Surface
- Underground
- Well

- Railroad Corridor
- Roads
- River Lakes and Oceans
- Rivers
- Parcels

N
W E
S

# Map 2

# Drinking Water Protection Area and Potential and Existing Sources of Contamination for the City of Palmer Well No. 4




20 0 20 40 Miles

**PWSID 226020.002**

## *Legend*

- Towns
- Palmer Well No. 4

Zone A Protection Area
- Several Months Travel Time

Zone B Proteciton Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 5 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time

Zone E Protection Area
- 1000 feet Buffer

Zone F Protection Area
- 1 Mile Buffer

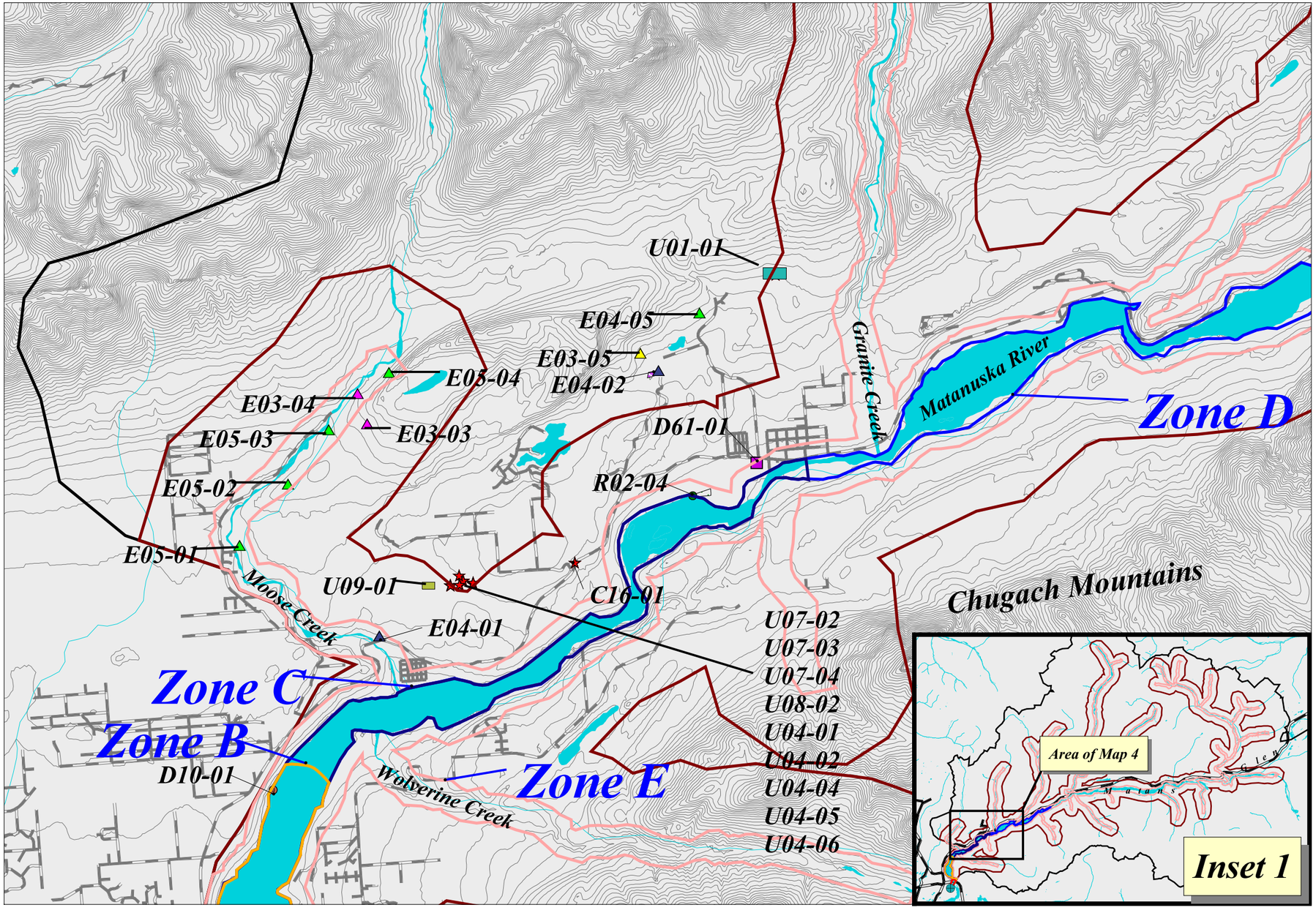
Zone G Protection Area
- Watershed Boundaries
- Residential Areas (R01)

Septics
- Class V Injection Wells -Drainfield (D10)
- Residential Septic Systems (R02)
- Potential and Existing Sources of Contamination
- Roads
- River Lakes and Oceans
- Rivers
- Parcels

N W E S

# Map 3

# Drinking Water Protection Area and Potential and Exisiting Sources of Contamination for the City of Palmer Well No. 4




20 0 20 40 Miles

**PWSID 226020.002**

## *Legend*

- Palmer Well No. 4

Zone A Protection Area
- Several Months Travel Time

Zone B Proteciton Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 5 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time

Zone E Protection Area
- 1000 feet Buffer

Zone F Protection Area
- 1 Mile Buffer

Zone G Protection Area
- Watershed Boundaries
- Residential Areas (R01)
- Mine Tailings (U01)

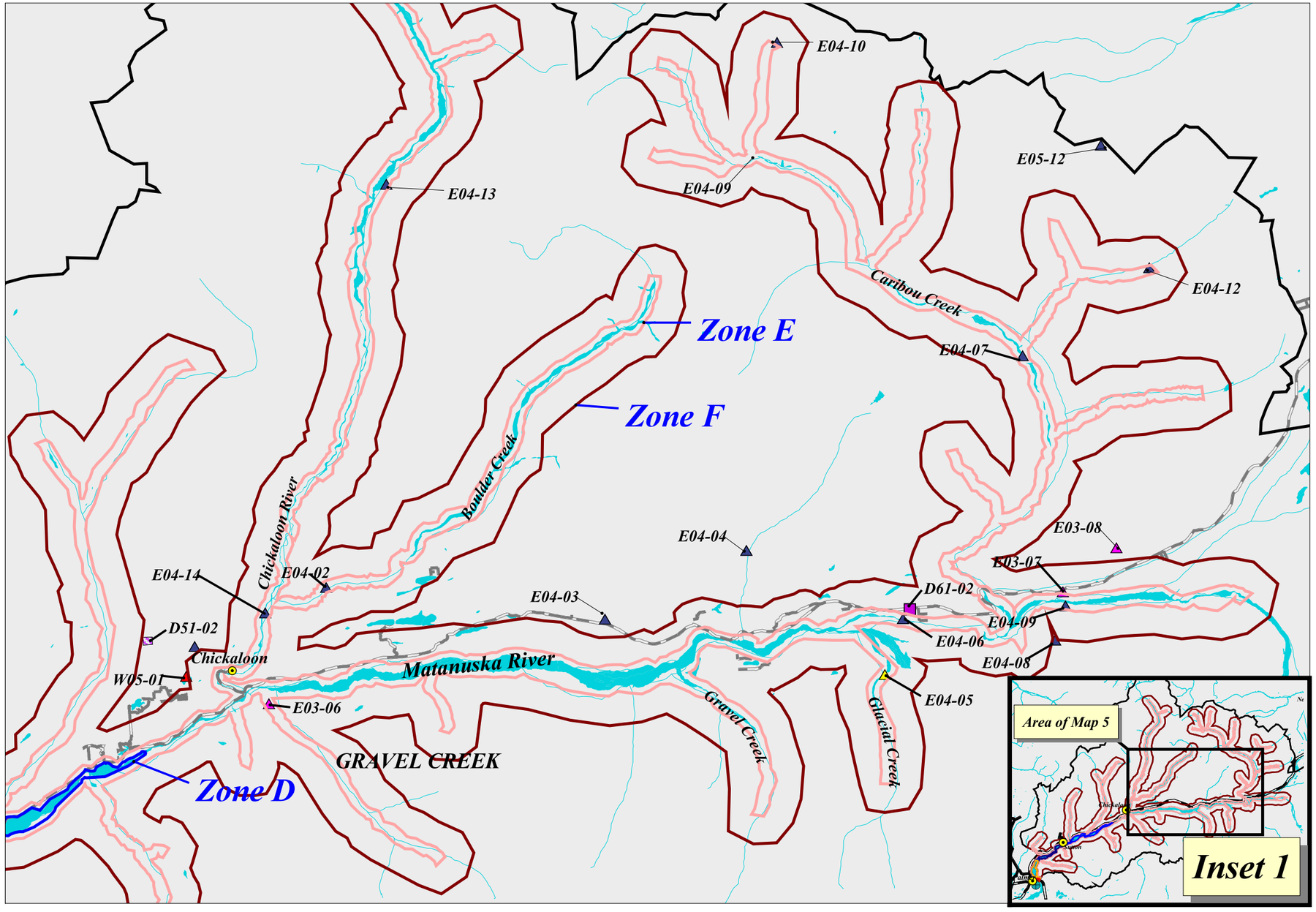
Septics
- Class V Injection Wells -Drainfield (D10)
- Residential Septic Systems (R02)

Mines
- Surface (E03)
- Underground (E05)
- Mineral Extraction Well (W05)
- Placer Mine (E04)
- Transfer Stations (D61)
- Potential and Existing Sources of Contamination
- Open Dumps (U09)
- Roads
- River Lakes and Oceans
- Rivers
- Elevation Contours
- Parcels

N W E S

# Map 4

# Drinking Water Protection Area and Potential and Existing Sources of Contamination for the City of Palmer Well No. 4




20 0 20 40 Miles

**PWSID 226020.002**

## *Legend*

- Towns
- Palmer Well No. 4

Zone A Protection Area
- Several Months Travel Time

Zone B Proteciton Area
- Less than 2 Years Travel Time

Zone C Protection Area
- Less than 5 Years Travel Time

Zone D Protection Area
- Less than 10 Years Travel Time

Zone E Protection Area
- 1000 feet Buffer

Zone F Protection Area
- 1 Mile Buffer

Zone G Protection Area
- Watershed Boundaries
- Solid Waste Facility (D51)
- Potential and Existing Sources of Contamination
- Transfer Stations (D61)
- Placer Mines (E04)

Mines
- Surface (E03)
- Underground (E05)
- Mineral Extraction Well (W05)
- Roads
- River Lakes and Oceans
- Rivers
- Elevation Contours

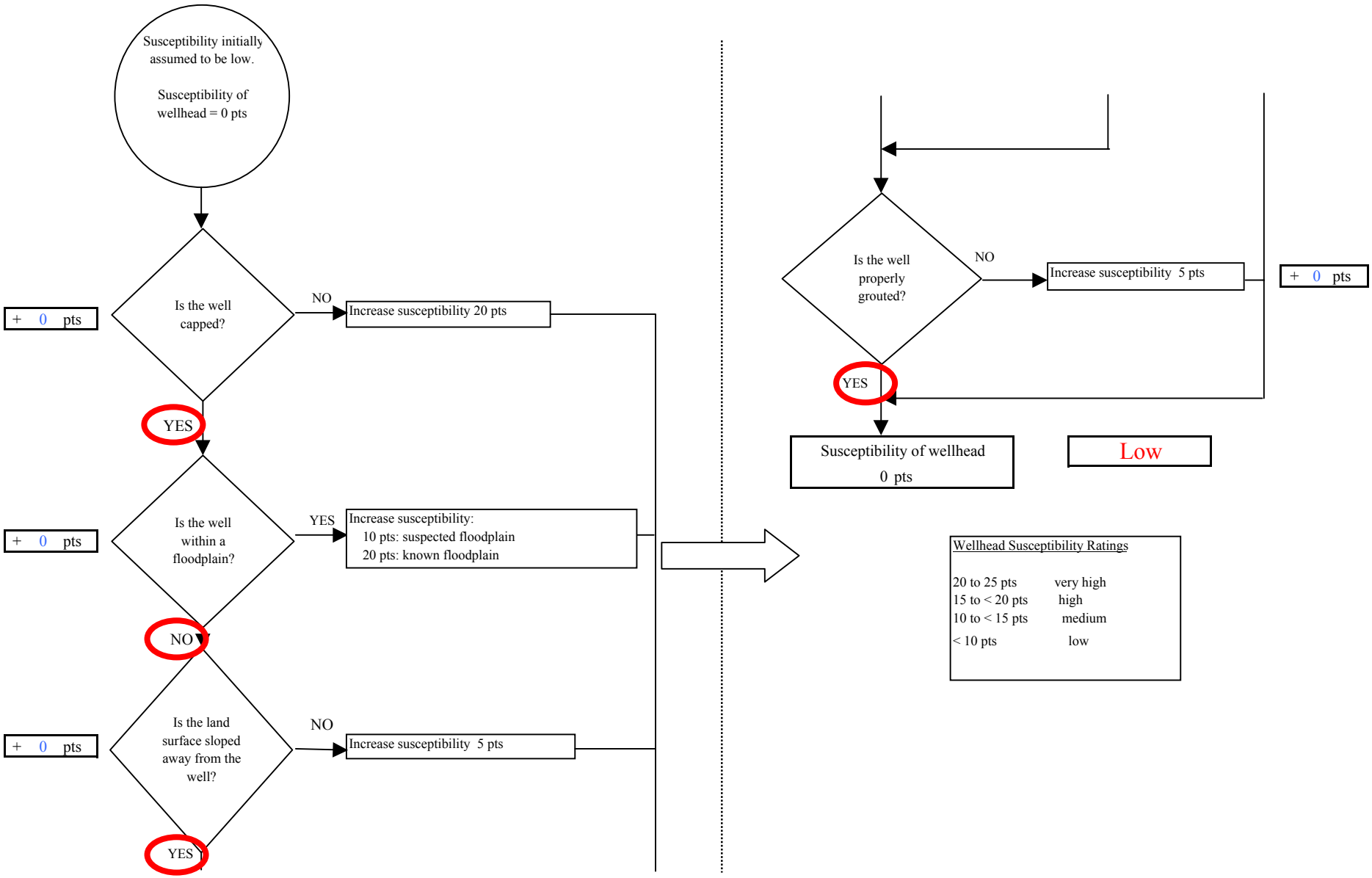
N W E S

# Map 5

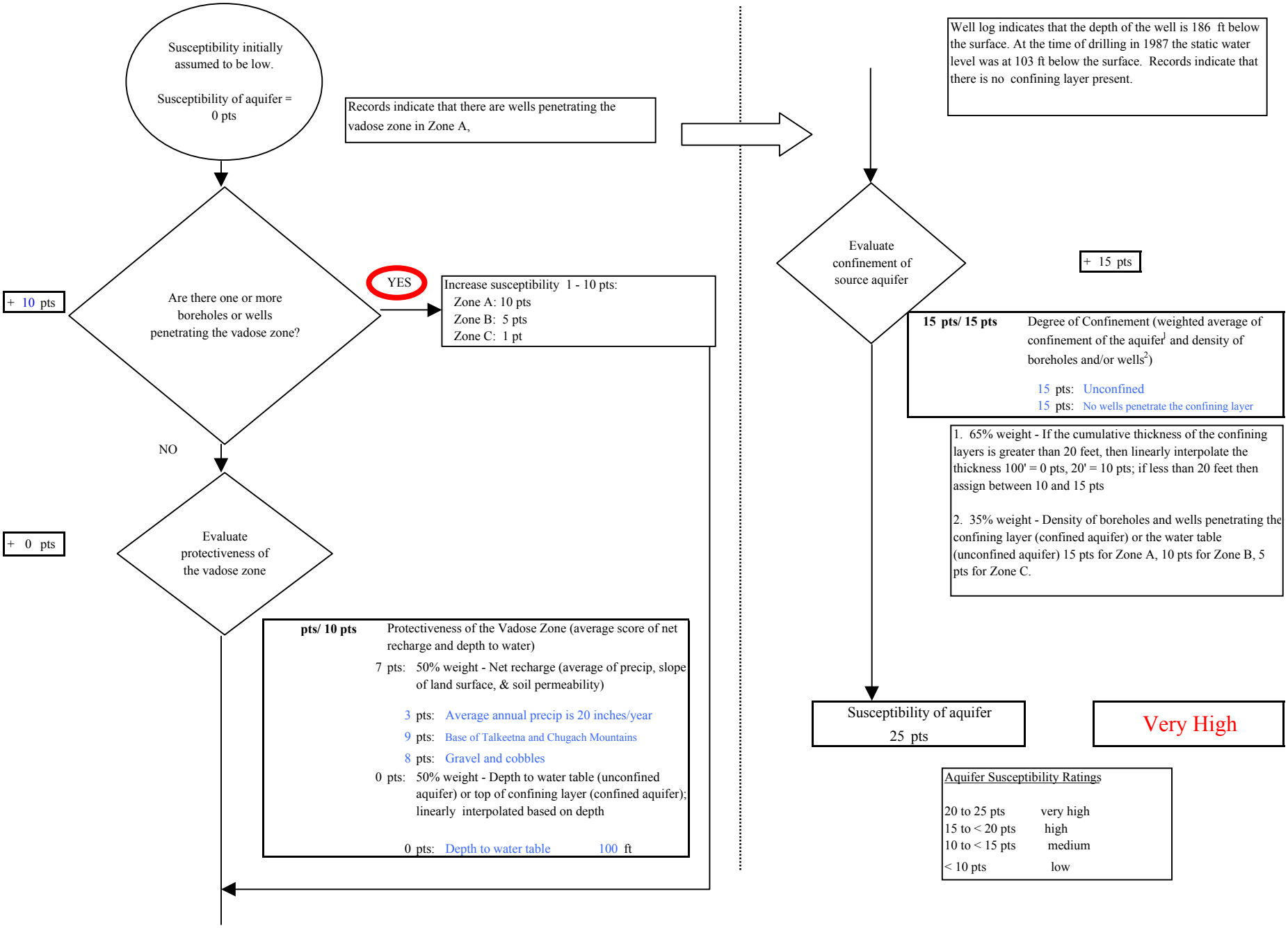
# APPENDIX D

## Vulnerability Analysis for City of Palmer Well No. 4
## Public Drinking Water Source

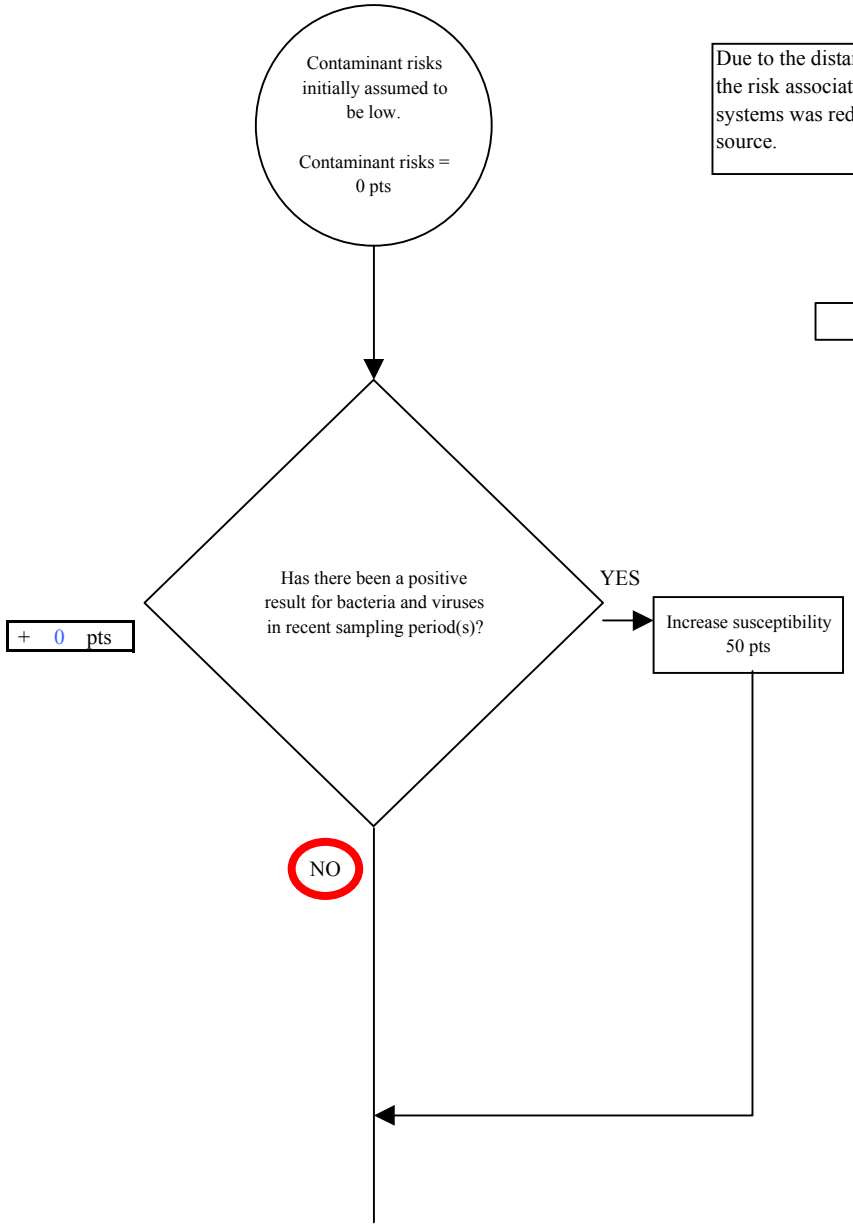
***Chart 1. Susceptibility of the wellhead - City of Palmer Well No. 4***



## *Chart 2. Susceptibility of the aquifer - City of Palmer Well No. 4*



## *Chart 3. Contaminant risks for City of Palmer Well No. 4 - Bacteria & Viruses*




Due to the distance between D10-04 and the well, the risk associated with large capacity septic systems was reduced to low for this potential source.

What level of risk is associated with the highest and the next highest sources of contaminants identified in Zones A and B?

+ 25 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

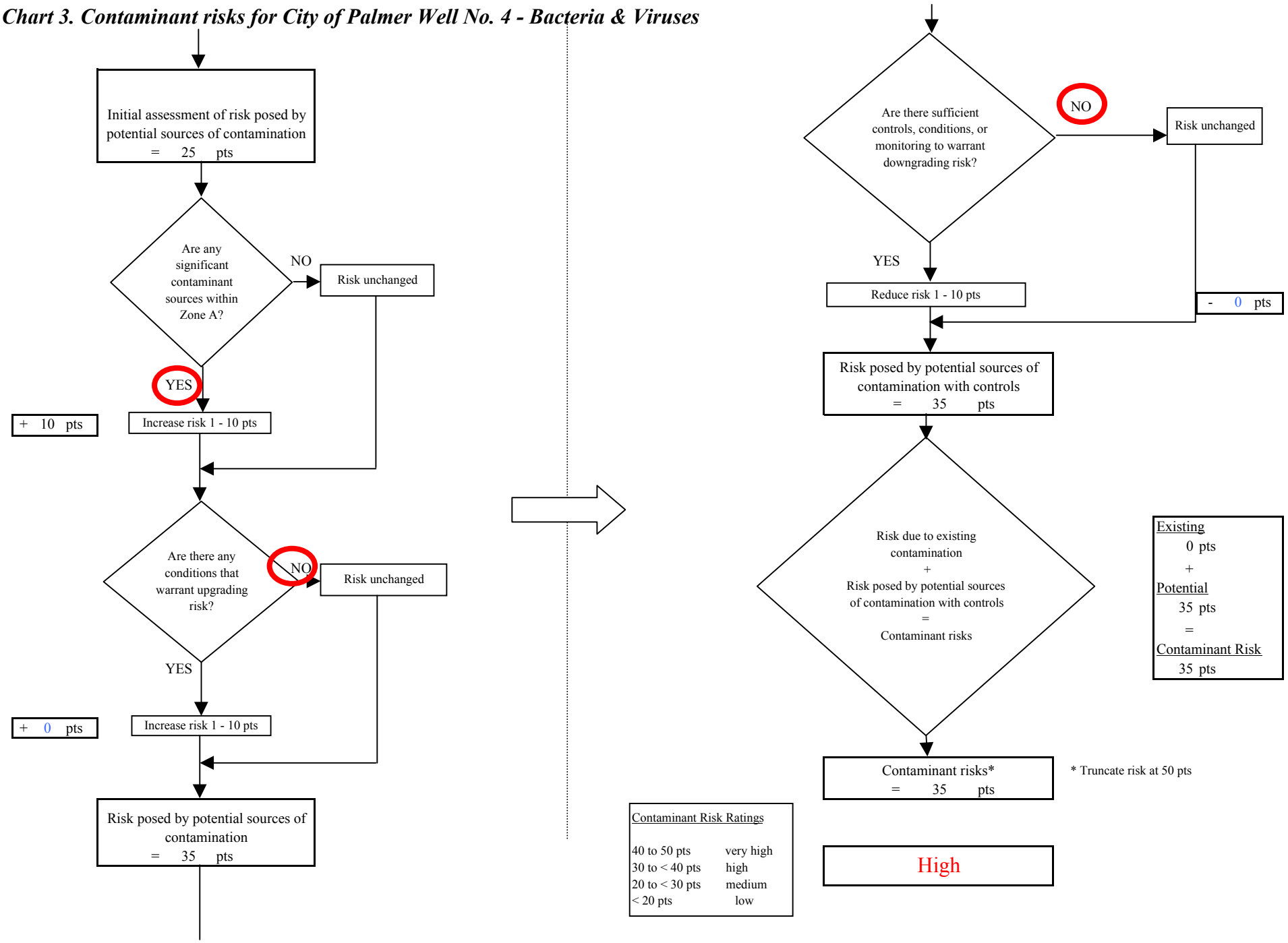
| | Zone A | Zone B | Total |
|---|---|---|---|
| Very Highs(s) | 0 | 0 | 0 |
| High(s) | 0 | 0 | 0 |
| Medium(s) | 3 | 0 | 3 |
| Low(s) | 7 | 3 | 10 |

| | **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 |

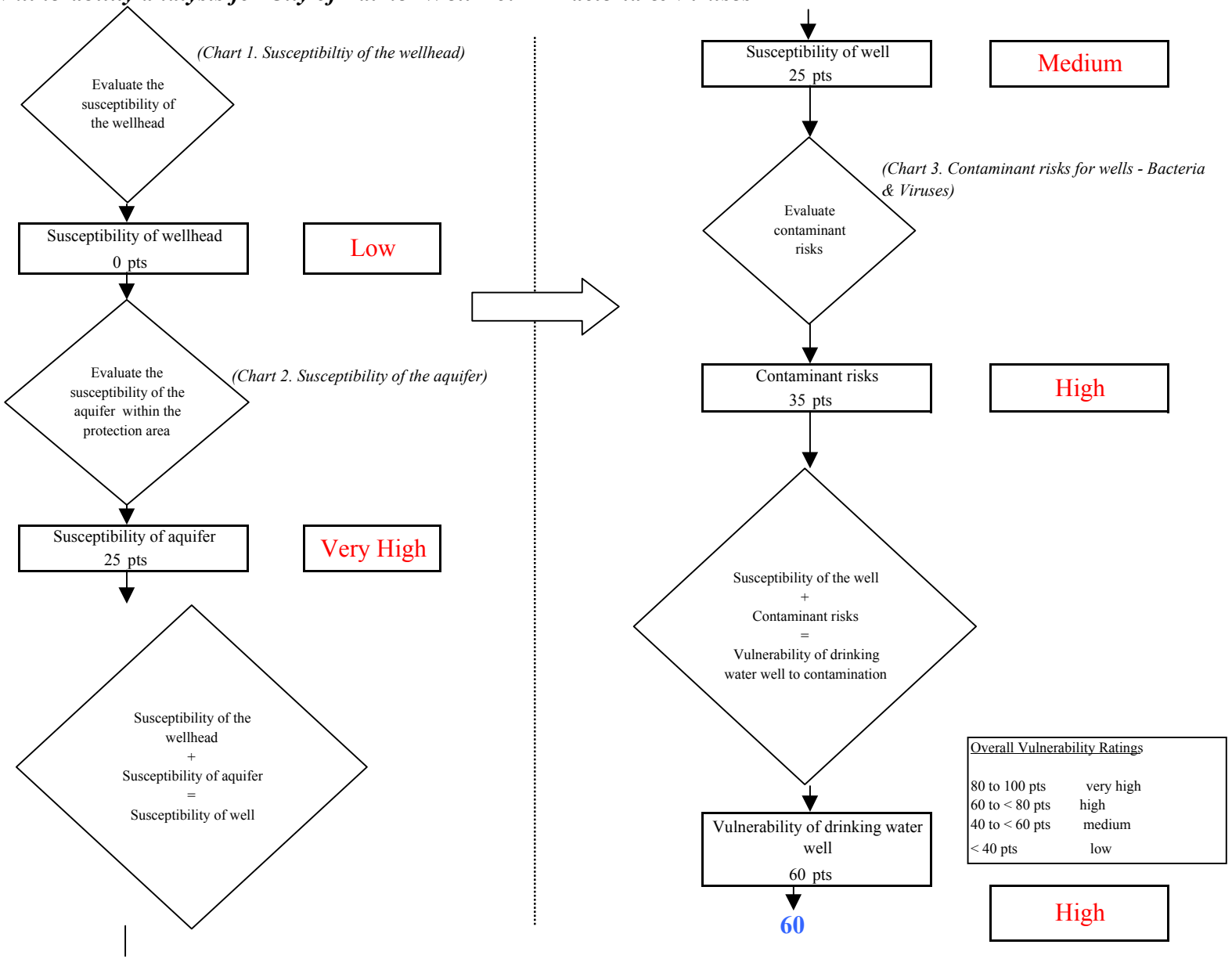
Matrix Score 25

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.

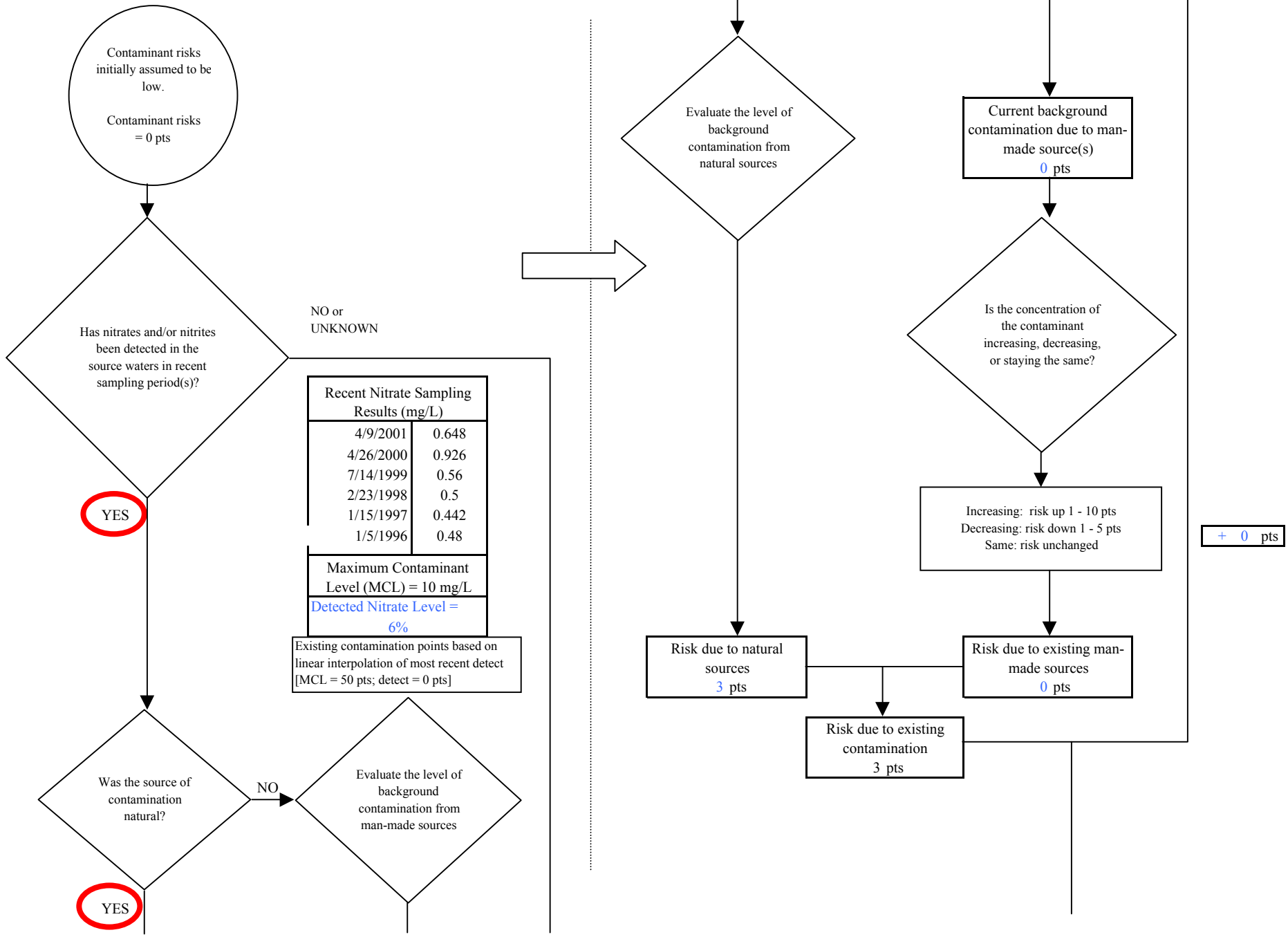
## *Chart 3. Contaminant risks for City of Palmer Well No. 4 - Bacteria & Viruses*



## *Chart 4. Vulnerability analysis for City of Palmer Well No. 4 - Bacteria & Viruses*



## *Chart 5. Contaminant risks for City of Palmer Well No. 4 - Nitrates and Nitrites*



## *Chart 5. Contaminant risks for City of Palmer Well No. 4 - Nitrates and Nitrites*

+ 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) | 2 | 0 | 2 |
| Low(s) | 11 | 3 | 14 |

| | **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.

Initial assessment of risk posed by potential sources of contamination = 20 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

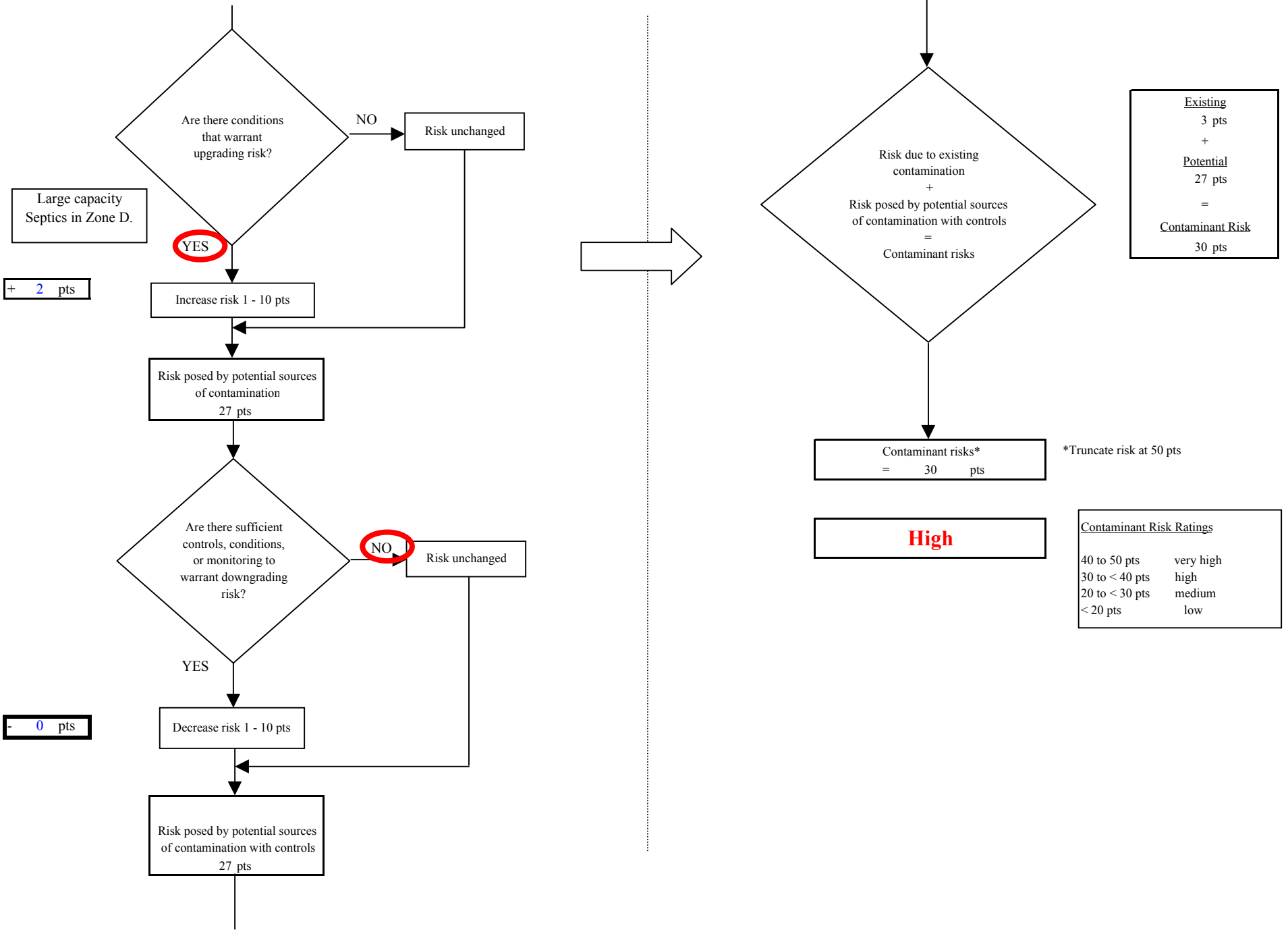
Risk unchanged

YES

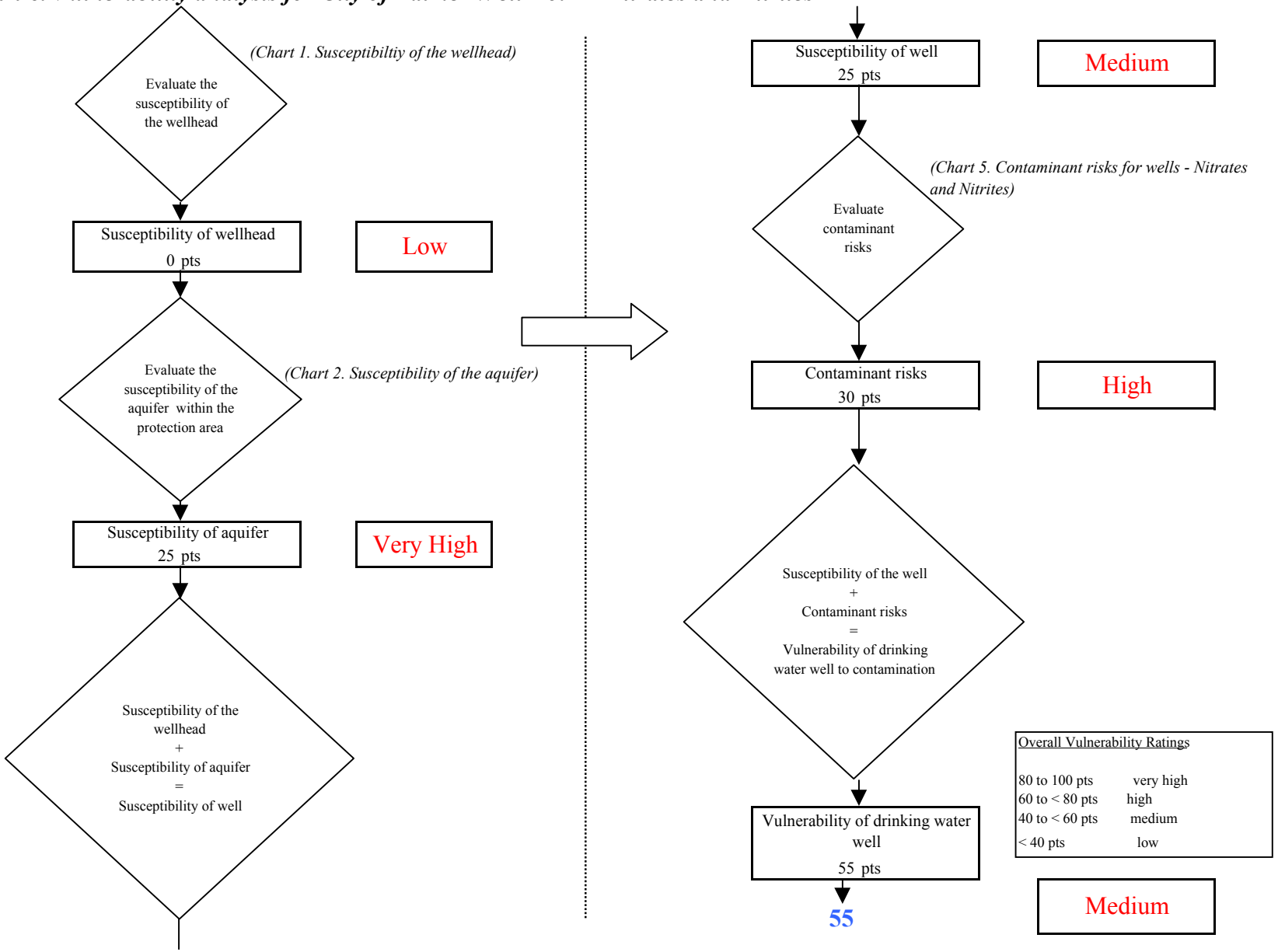
Increase risk 1 - 10 pts

+ 5 pts

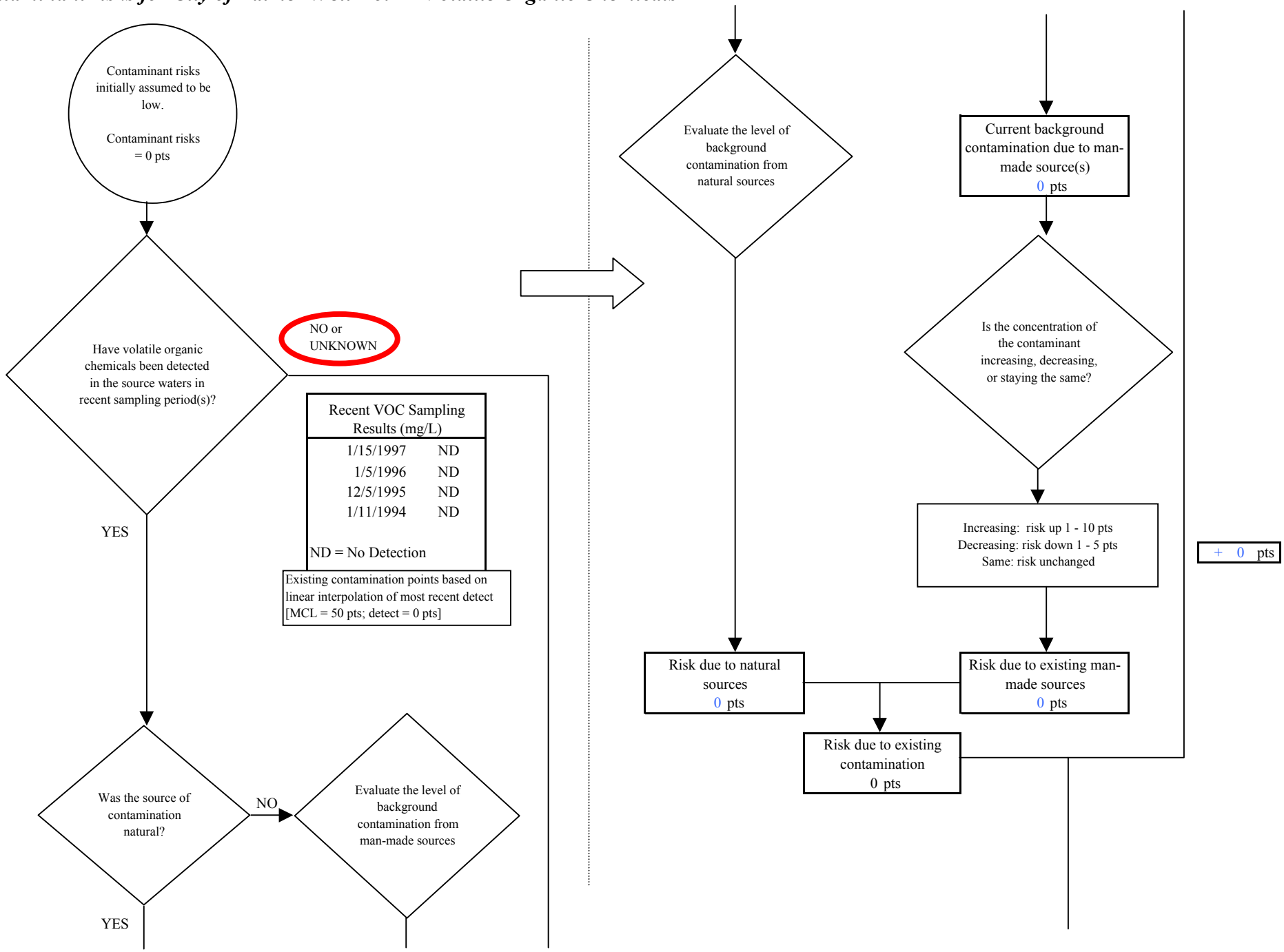
## *Chart 5. Contaminant risks for City of Palmer Well No. 4 - Nitrates and Nitrites*



## *Chart 6. Vulnerability analysis for City of Palmer Well No. 4 - Nitrates and Nitrites*



## *Chart 7. Contaminant risks for City of Palmer Well No. 4 - Volatile Organic Chemicals*



## *Chart 7. Contaminant risks for City of Palmer Well No. 4 - 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) | 14 | 0 | 14 |
| Medium(s) | 4 | 0 | 4 |
| Low(s) | 7 | 3 | 10 |

| | **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

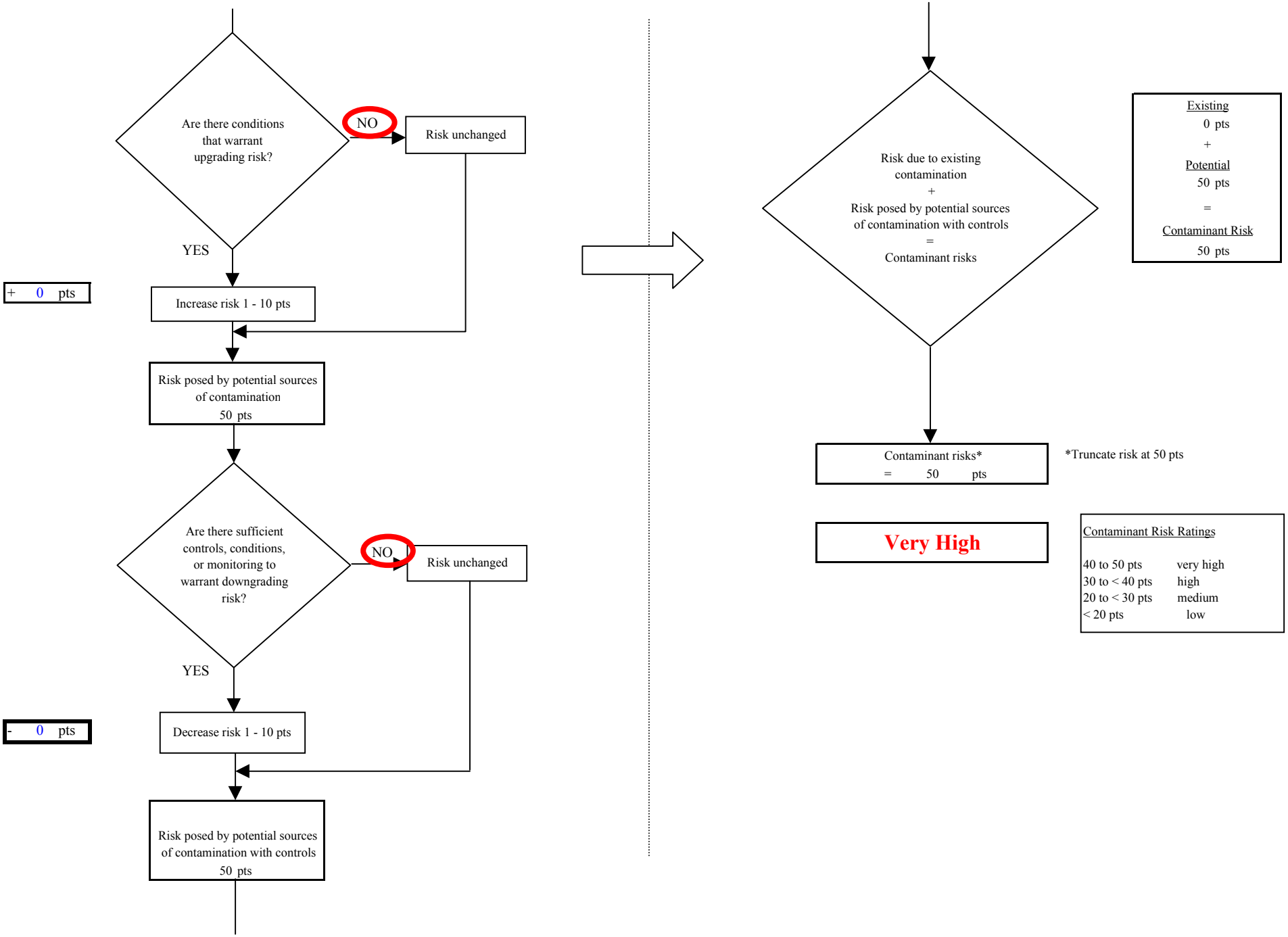
Risk unchanged

YES

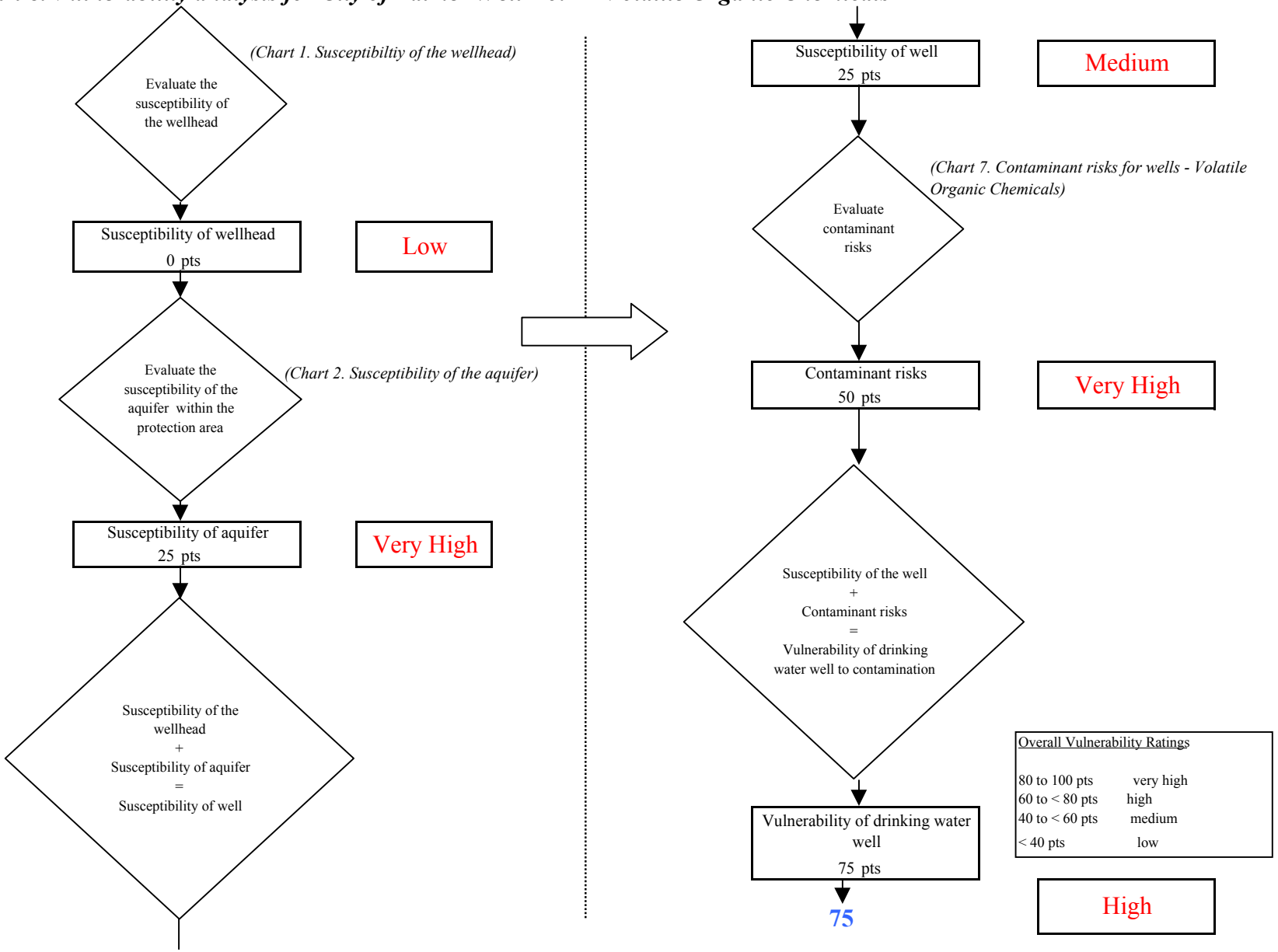
+ 10 pts

Increase risk 1 - 10 pts

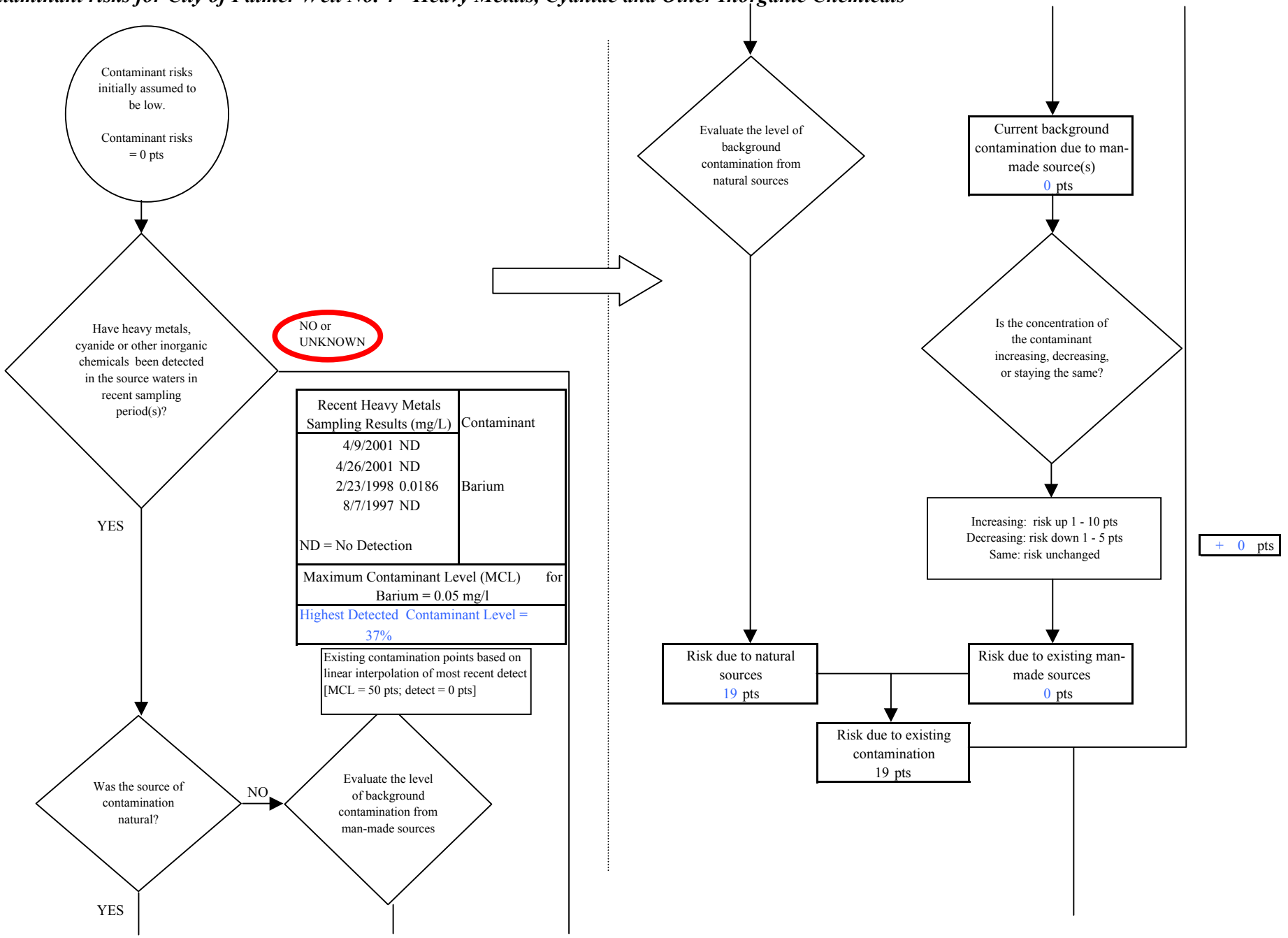
## *Chart 7. Contaminant risks for City of Palmer Well No. 4 - Volatile Organic Chemicals*



## *Chart 8. Vulnerability analysis for City of Palmer Well No. 4 - Volatile Organic Chemicals*



## *Chart 9. Contaminant risks for City of Palmer Well No. 4 - Heavy Metals, Cyanide and Other Inorganic Chemicals*



## *Chart 9. Contaminant risks for City of Palmer Well No. 4 - Heavy Metals, Cyanide and Other Inorganic Chemicals*

+ 35 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) | 8 | 0 | 8 |
| Low(s) | 11 | 3 | 14 |

| | **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 35

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 = 35 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

+ 10 pts

## *Chart 9. Contaminant risks for City of Palmer Well No. 4 - Heavy Metals, Cyanide and Other Inorganic Chemicals*

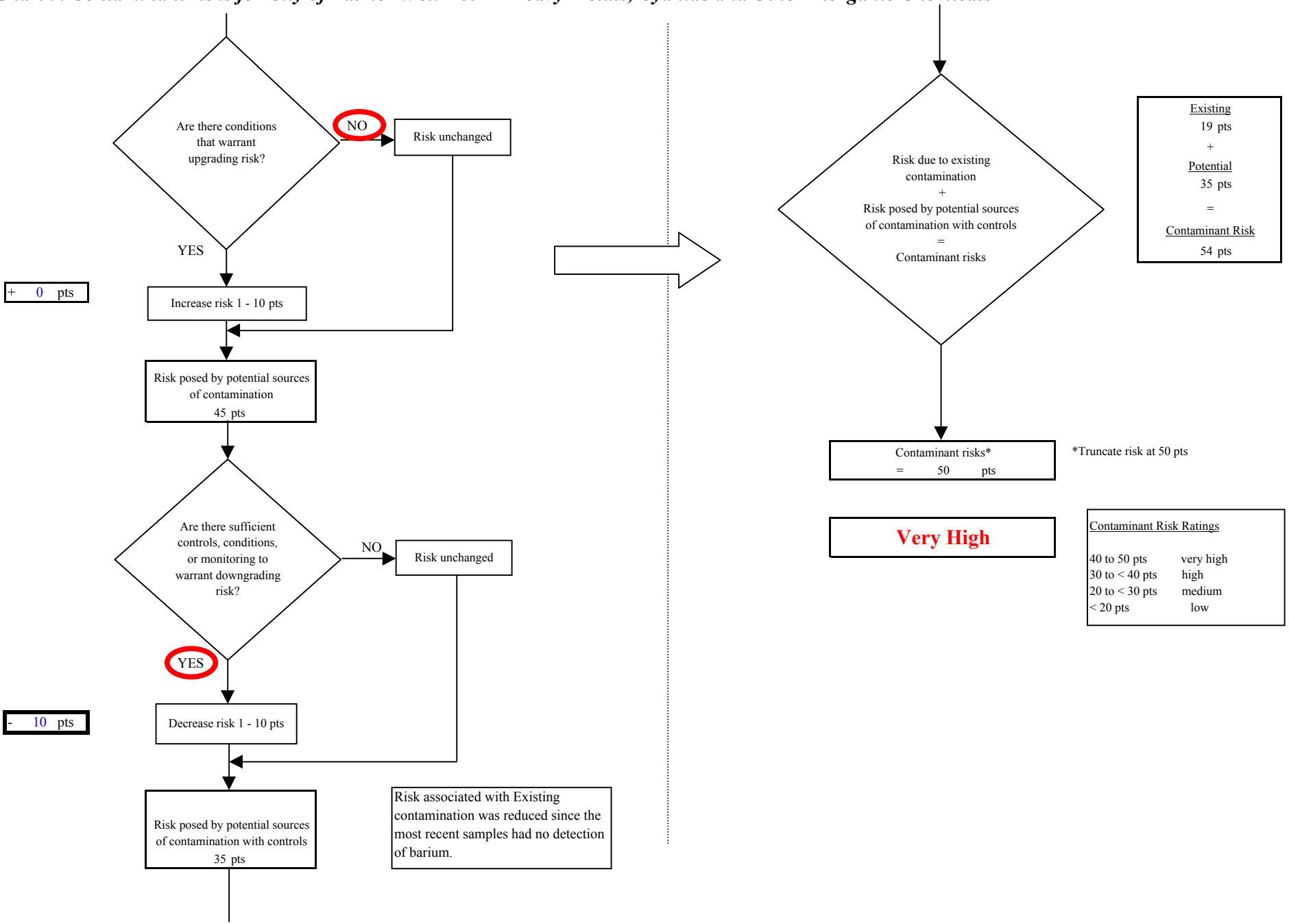


***Chart 10. Vulnerability analysis for City of Palmer Well No. 4 - Heavy Metals, Cyanide and Other Inorganic Chemicals***

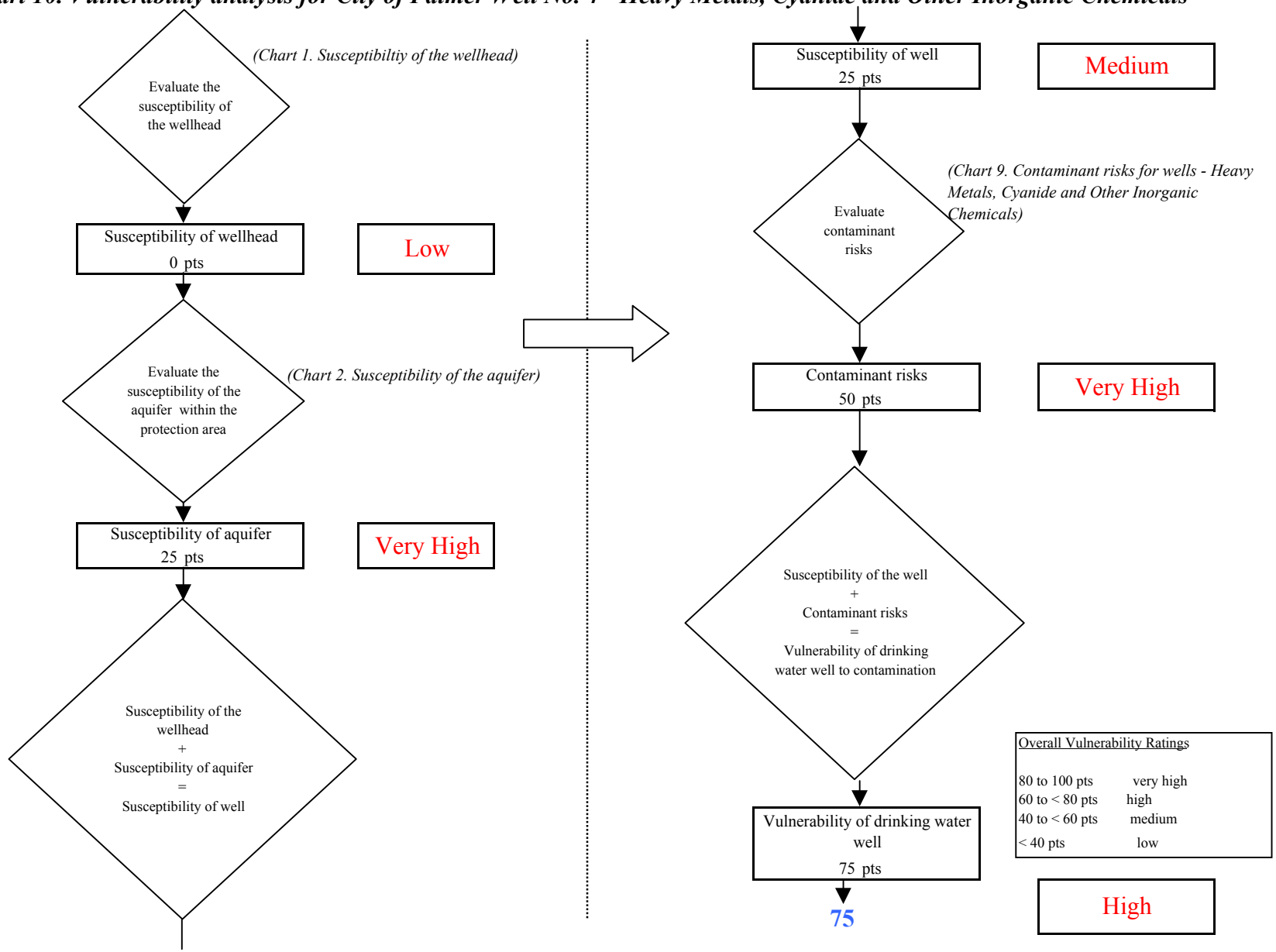
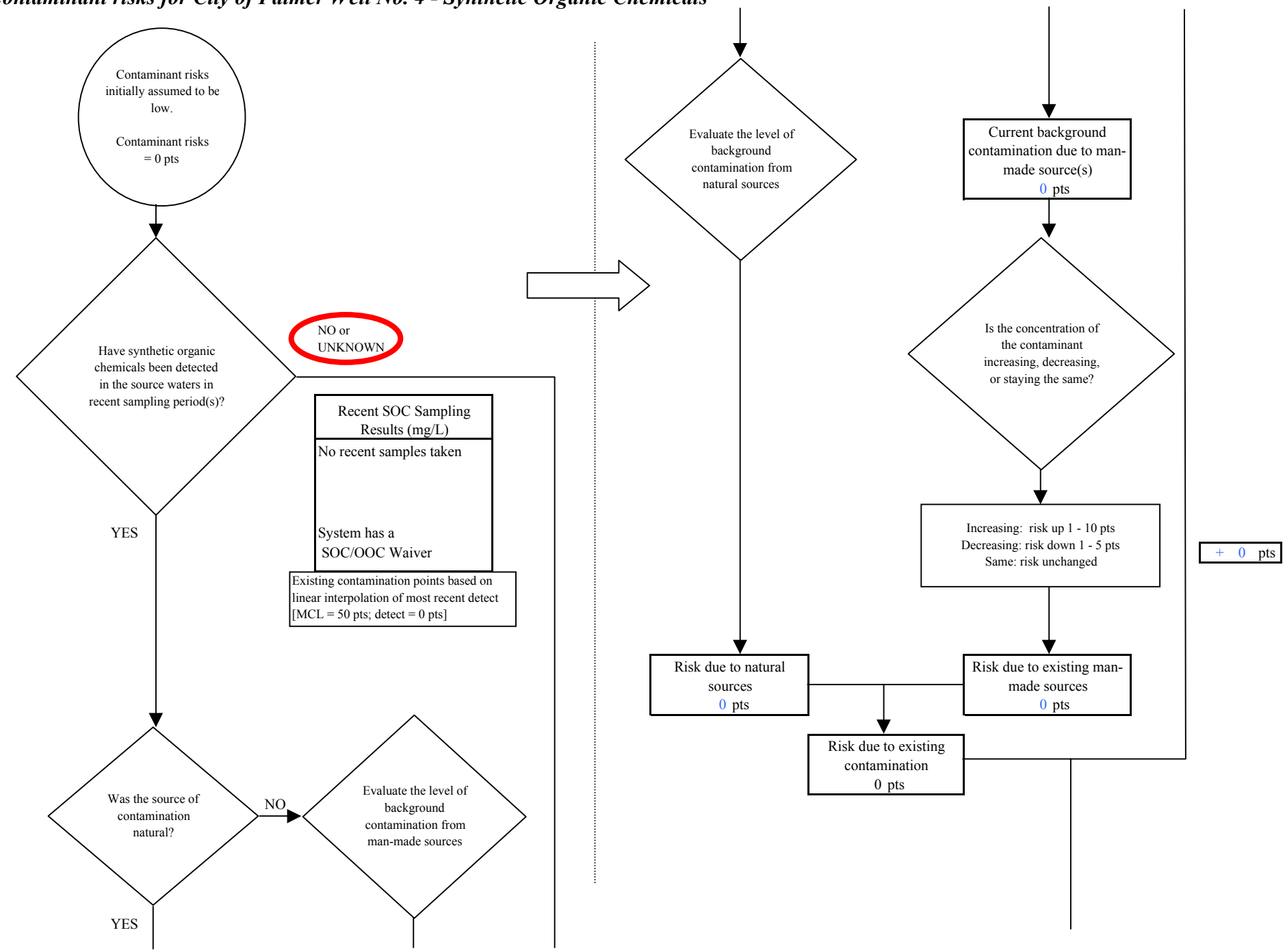


***Chart 11. Contaminant risks for City of Palmer Well No. 4 - Synthetic Organic Chemicals***



## *Chart 11. Contaminant risks for City of Palmer Well No. 4 - Synthetic 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) | 2 | 0 | 2 |
| Medium(s) | 2 | 0 | 2 |
| Low(s) | 3 | 3 | 6 |

| | **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

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

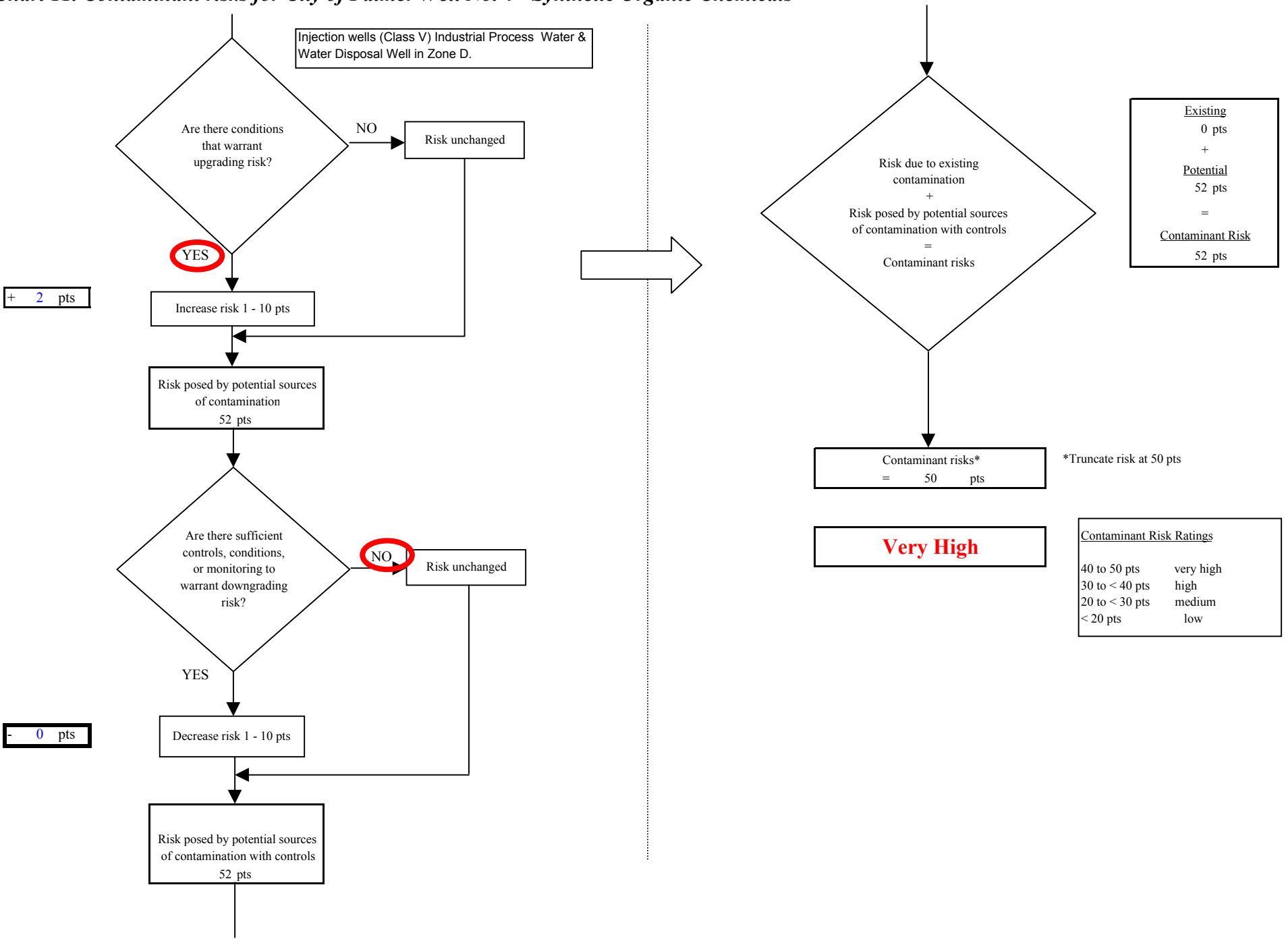
Risk unchanged

YES

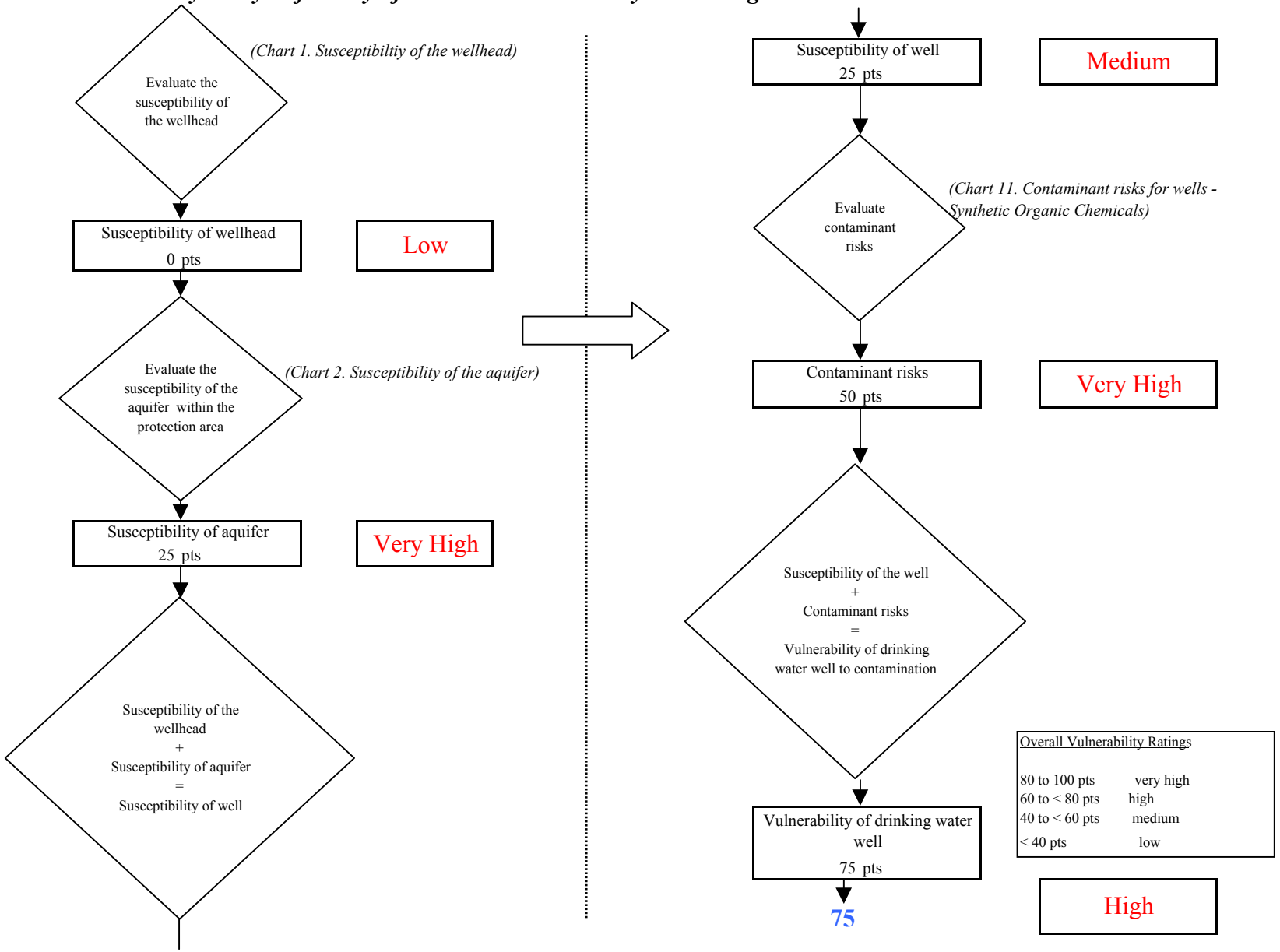
Increase risk 1 - 10 pts

+ 10 pts

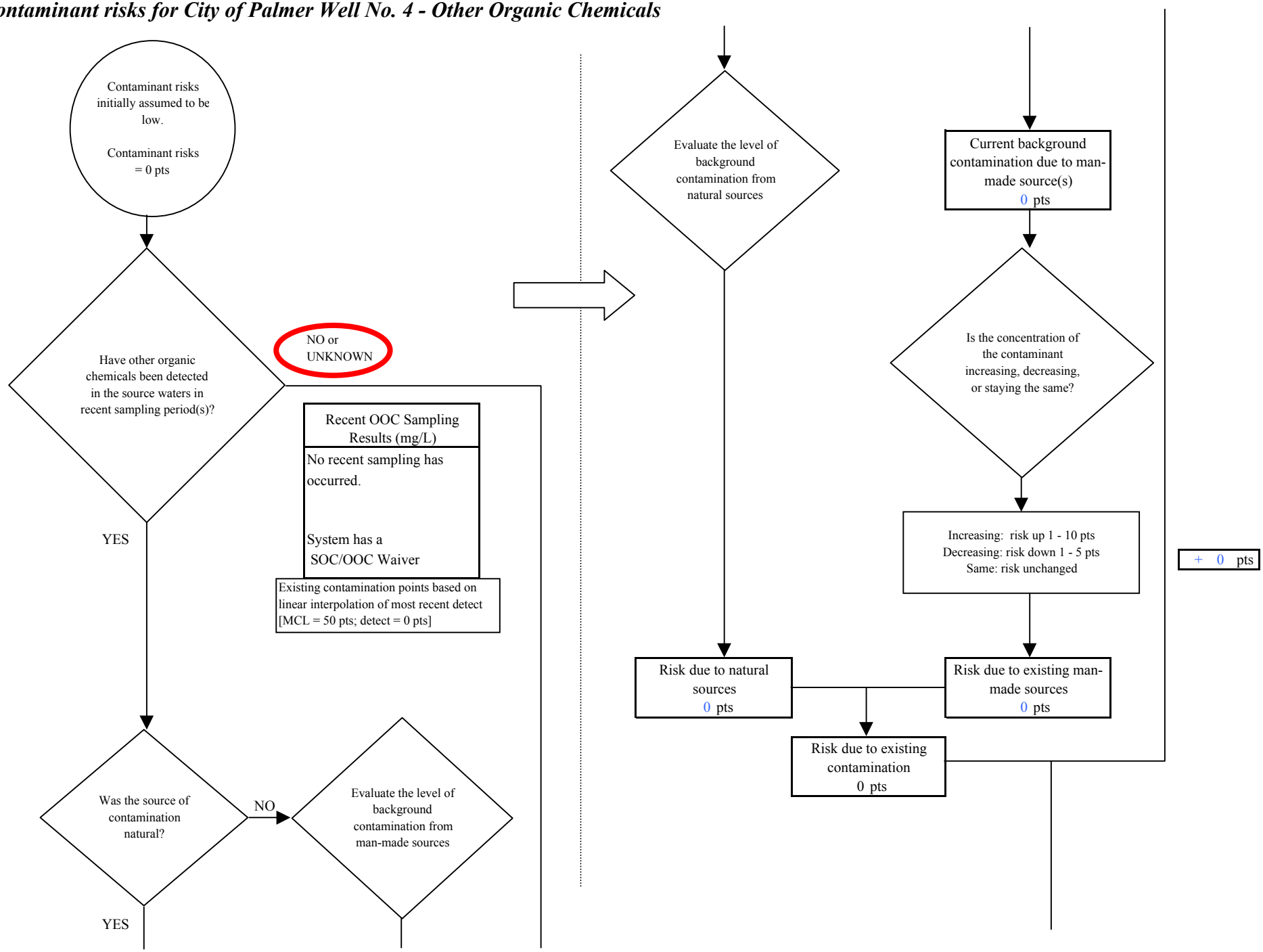
## *Chart 11. Contaminant risks for City of Palmer Well No. 4 - Synthetic Organic Chemicals*



## *Chart 12. Vulnerability analysis for City of Palmer Well No. 4 - Synthetic Organic Chemicals*



## *Chart 13. Contaminant risks for City of Palmer Well No. 4 - Other Organic Chemicals*



## *Chart 13. Contaminant risks for City of Palmer Well No. 4 - Other 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) | 1 | 0 | 1 |
| Medium(s) | 3 | 0 | 3 |
| Low(s) | 8 | 3 | 11 |

| | **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

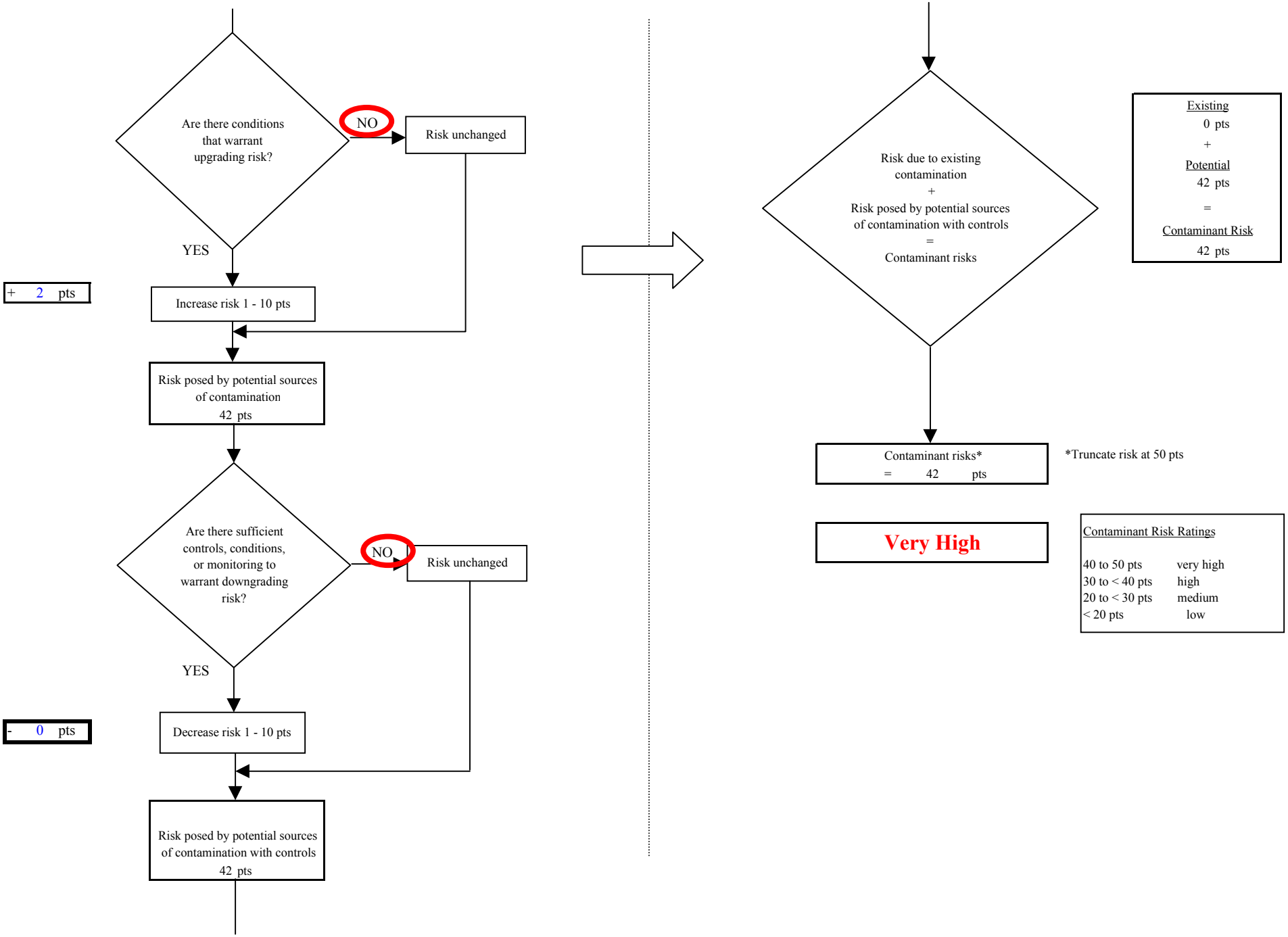
Risk unchanged

YES

Increase risk 1 - 10 pts

+ 10 pts

## *Chart 13. Contaminant risks for City of Palmer Well No. 4 - Other Organic Chemicals*



## *Chart 14. Vulnerability analysis forCity of Palmer Well No. 4 - Other Organic Chemicals*