Source Water Assessment for Alaska Children's Services Anchorage, Alaska

A Hydrogeologic Susceptibility and Vulnerability Analysis

DRINKING WATER PROTECTION PROGRAM REPORT 415
PWSID 210312.001

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A Hydrogeologic Susceptibility and Vulnerability Analysis

By Heather A. Hammond

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Public Water System for Alaska Children's Services is a Class A (non-transient/non-community) water system consisting of one well in the Anchorage area. Identified potential and current sources of contaminants for Alaska Children's Services public water system includes approximately 105 acres of residential area, residential septic systems, roads, construction trade areas, and parks and recreation trails. 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 drinking water source for Alaska Children's Services received a vulnerability rating of **low** for volatile organic chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals; and **medium** for bacteria and viruses, and nitrates and/or nitrites.

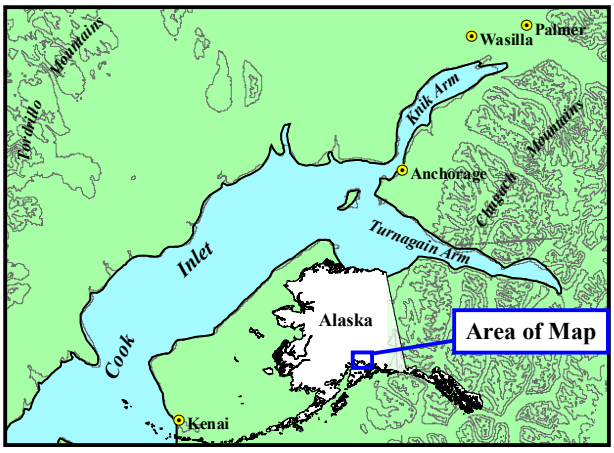


Figure 1. Index map showing the location of Anchorage, Alaska

INTRODUCTION

The purpose of this environmental 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. This assessment was completed for the source of public drinking water serving Alaska Children's Services. This water system consists of one well in the Anchorage area (see 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 ANCHORAGE AREA, ALASKA

Location

Anchorage, located in southcentral Alaska, encompasses 1,698 square miles of land and 264 square miles of water. The area containing a majority of the urban development, commonly referred to as the Anchorage Bowl, encompasses approximately 180 square miles [*Partick, Brabets, and Glass, 1989*] and envelopes the low lands of the area. This area is bounded on the east by the Chugach Mountains and the north, west, and south by the Knik and Turnagain Arms of Cook Inlet (Figure 1). In recent times, urban development has extended eastward along the flanks of the Chugach Mountains. This area, known locally as the Anchorage Hillside, contains development at elevations exceeding 3,700 feet in elevation above sea level.

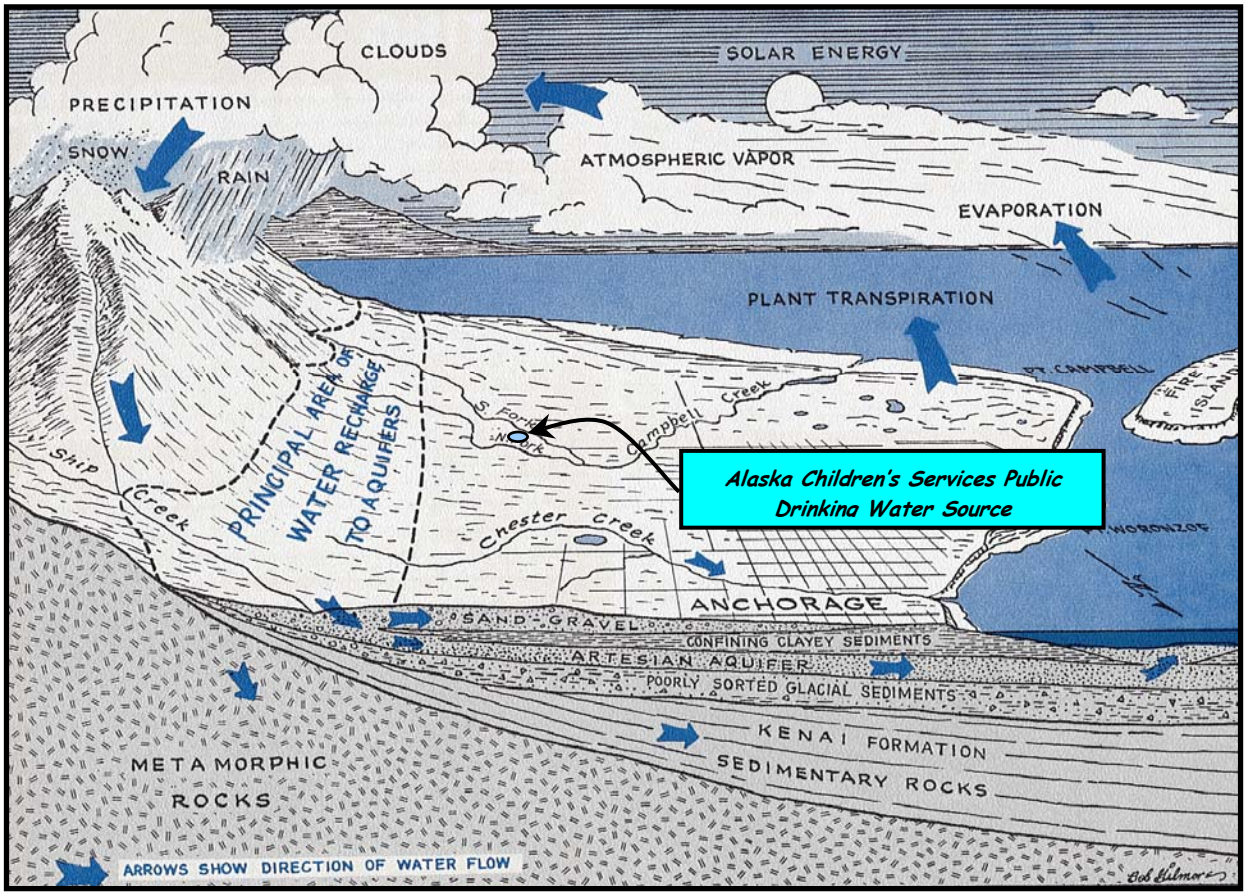


Figure 2. Generalized hydrologic cycle in the Anchorage area [*Barnwell, George, Dearborn,Weeks, and Zenone*, 1972].

Climate

The Anchorage area 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 at the Anchorage International Airport is approximately 16 inches per year. On average, Anchorage receives a total snow accumulation of 69 inches per year. Precipitation generally increases inland toward the Chugach Mountains where annual precipitation may exceed 160 inches per year [*Barnwell, George, Dearborn, Weeks, and Zenone*, 1972]. Mean daily temperature ranges from 65^{o} F during July to 8^{o} F in January [*Western Regional Climate Center*, 2000].

Physiography and Groundwater Conditions

Surface elevations in the Anchorage area range from sea level at Knik and Turnagain Arms to well over 5,000 feet in the peaks that bound the area. Glacial moraine and outwash deposits primarily mantle the surface of the Anchorage Bowl.

The backbone of the Chugach Mountains is composed primarily of metamorphic marine and volcanic rocks (bedrock). These high peaks that bound Anchorage's east side are flanked with colluvium or slope deposits. These slope deposits eventually grade into the glacial and stream deposits at lower elevations in the Anchorage Bowl.

In the Anchorage area, two principal groundwater flow systems or aquifers exist (see Figure 2). The upper unconfined aquifer or water-table aquifer is separated from a lower confined aquifer system by layers of silty, clayey glacially derived sediments (confining layer) [*Ulery and Updike*, 1983]. The lower confined aquifer system consists of a series of hydrologically interconnected layers and lenses of gravel, sand and silt that, collectively, form the confined aquifer. The confining layer ranges from 0 to 270 feet thick throughout the Anchorage area and generally thins with increasing distance from Cook Inlet, thus pinching out at the mountain front [*Patrick, Brabets, and Glass*, 1989].

Water enters or recharges these two aquifer systems in several different ways. Along the front of the Chugach

Mountains, groundwater seeps from fractures in bedrock into the sediments. At these higher elevations, rain and snowmelt also enters the sediments. This area along the mountain front is considered the principal recharge area for wells in the Anchorage area. Precipitation in the low lands may also percolate directly into the ground. Lastly, aquifers may also be recharged by streams where surface water percolates into surrounding permeable sediments (losing reaches of streams). Groundwater flow in the confined aquifer is generally east to west from the mountain front toward Cook Inlet and Turnagain Arm, except in areas where the direction of flow is influenced by large municipal or industrial production wells. The direction of groundwater flow in the upper unconfined aquifer is more variable due to the influence from surfacial topography as well as its close connection with surface water bodies.

ALASKA CHILDREN'S SERVICES PUBLIC DRINKING WATER SYSTEM

Alaska Children's Services Public Drinking Water System is a Class A (non-transient/non-community) water system, which is owned and operated by Alaska Children's Services. The system consists of one well, which is located off of Abbott Road on the lower hillside of Anchorage, at an elevation of approximately 500 feet above sea level (see Figure 3).

Installation of the well occurred August 5, 1966 to a total depth of 280 feet below ground surface and was completed in a 8-inch well casing. According to the most recent Sanitary Survey (10/25/01) there is no grouting surrounding the well casing. Proper grouting provides added protection against contaminants traveling from the ground surface and along the well casing into source waters. The Sanitary Survey also indicated that the well casing is topped with a sanitary seal and the topography surrounding the well is adequately drained and properly graded to divert surface water from flowing toward the well. The well is screened from 263 to 280 feet below ground surface.

This system operates year round and serves approximately 75 residents through 7 service connections.

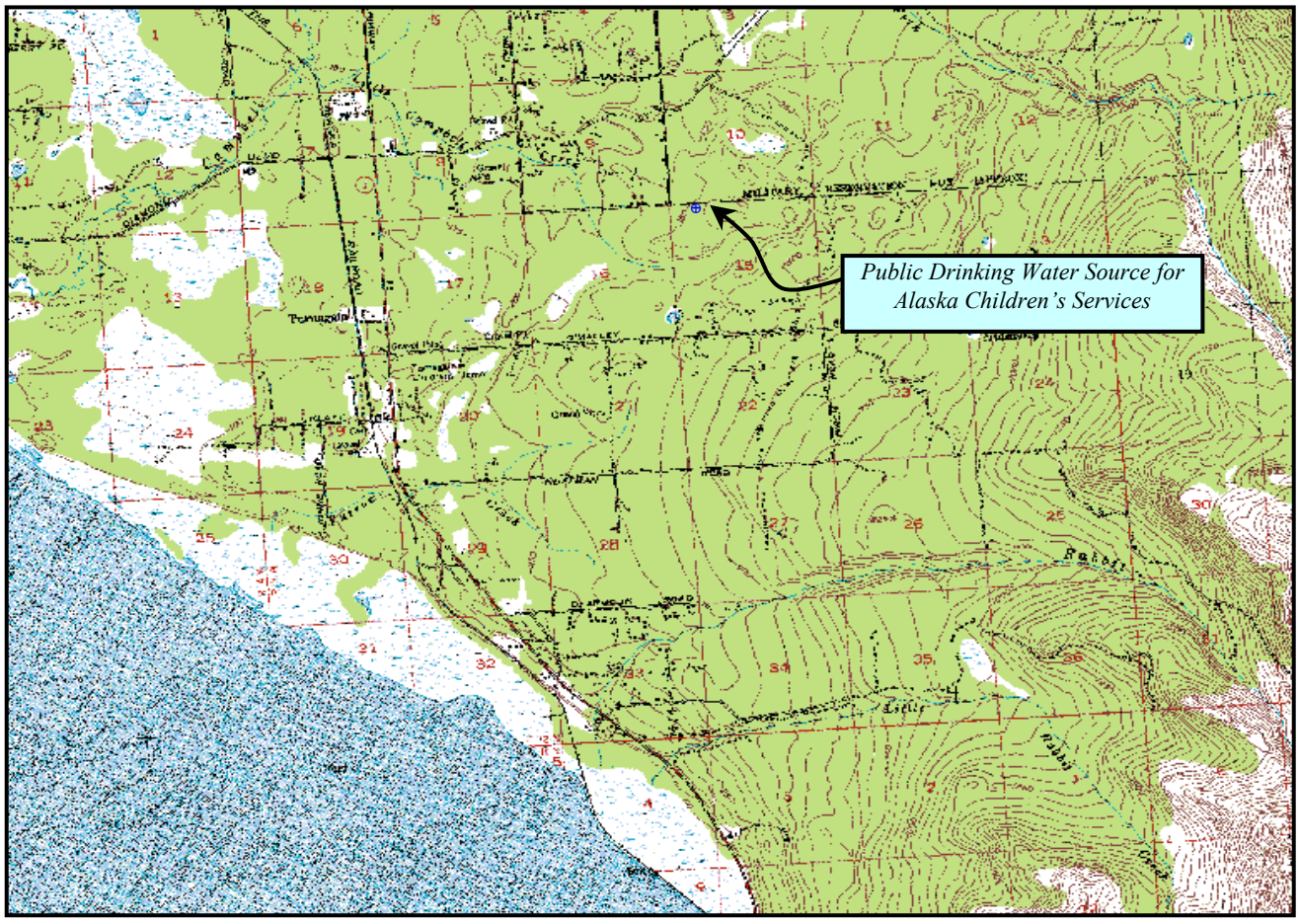


Figure 3. Map showing the location of the drinking water sources for Alaska Children's Services [Base: USGS Anchorage A8].

ASSESSMENT AND PROTECTION AREA FOR ALASKA CHILDREN'S SERVICES PUBLIC DRINKING WATER SOURCE

The Drinking Water Protection and Assessment Area that has been established for Alaska Children's Services source of public drinking water is the area that is most sensitive to contamination. This area serves as a basis for assessing the risk of the drinking water source to contamination. The zones around the drinking water source outline the most critical area for the preservation of the quality of the drinking water for this system. For simplicity, this area will be known as your Drinking Water Protection Area and will serve as the focus for voluntary protection efforts.

Conceptually, groundwater enters the aquifer systems along the front range of the Chugach Mountains (Figure 2) and flows toward Cook Inlet. An analytical calculation was used to determine 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 U.S. Geological Survey [*Patrick, Brabets, and Glass, 1989*]. This analytical calculation was used as a guide as the first step in establishing the protection area for each public drinking water source in Anchorage. Additional methods were further employed to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at meaningful and conservative protection areas 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 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 Area for Alaska Children's Services contains four zones, Zone A through Zone D (See Map 1 in Appendix A). Zone A corresponds to the area between the wells 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 wells may be on the order of several days to several hours. Zone A also extends downgradient from the wells to take into account the area of the aquifer that is influenced by pumping of the wells. Zone B corresponds to a time-of-travel of less than two years. Zones C and D correspond to those areas between 5 years and 10 years time-of-travel, respectively.

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 Drinking Water Protection Area for Alaska Children's Services. 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

Maps 2 through 4 in Appendix C depict the Contaminant Source Inventory for Alaska Children's Services. Table 1 in Appendix B lists the inventoried potential sources of contamination within Zones A through D. Below is a summary of the contaminant sources inventoried:

- Approximately 105 acres of residential area;
- residential septic systems;
- roads;
- construction trade areas;
- and parks and recreation trails.

These potential and existing contaminant sources present risk for all six categories of drinking water contaminants for the source of public drinking water serving Alaska Children's Services.

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 public drinking water wells.

VULNERABILITY OF ALASKA CHILDREN'S SERVICES PUBLIC 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 have been analyzed and an overall vulnerability score of 0 to 100 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)

According to the well log the well was completed in a confined aquifer to a total depth of 280 feet below ground surface. The depth to the top of the initial confining layer is approximately 17 feet below ground surface and consists of a layer of blue till and has a thickness of approximately 11 feet. Below this initial confining layer are intermittent layers of clay and silt. From 131 to 153 feet below ground surface there is confining layer of blue clay. These confining layers may provide a protective barrier against the movement of contaminants in the subsurface. However, near the base of the Chugach Mountains, these clay layers tend to be discontinuous and thin toward the mountains. Therefore, contaminants that enter the subsurface near the base of the mountains may enter the confined aquifer uninhibited by the absence of any protective layer.

Combining the susceptibility of the wellhead and the aquifer to contamination leads to a score (0 – 50 points) and rating of overall Susceptibility of the well to contamination (See Appendix D). Table 1 depicts the overall Susceptibility score and rating for the source of public drinking water serving Alaska Children's Services.

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

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	16	High
Natural Susceptibility	21	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 any existing or historical contamination that has been detected at the drinking water source through routine sampling. It also reviews contamination that has or may have occurred but has not arrived or been detected at the well. Table 2 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 2. Contaminant Risks to Alaska Children's Services Public Drinking Water Source

Contaminant Risks	Score	Rating
Bacteria and Viruses	22	Medium
Nitrates and/or Nitrites	33	High
Volatile Organic Chemicals	12	Low
Heavy Metals, Cyanide, And Other Inorganic Chemicals	12	Low
Synthetic Organic Chemicals	12	Low
Other Organic Chemicals	12	Low

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 Alaska Children's Services Public Drinking Water Source to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	45	Medium
Nitrates and Nitrites	55	Medium
Volatile Organic Chemicals	35	Low
Heavy Metals, Cyanide, and Other Inorganic Chemicals	35	Low
Synthetic Organic Chemicals	35	Low
Other Organic Chemicals	35	Low

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.

Residential areas and parks and recreation trails are sources of potential contamination that present a significant risk for bacteria and viruses and nitrates and/or nitrites. Residential septic systems because of their effluent discharge, are also a potential contaminant source for bacteria and viruses and nitrites and/or nitrites. Residential septic systems exist throughout the protection area which is driving the overall vulnerability rating of the well to potential contamination from bacteria and viruses and nitrates and/or nitrites.

Review of historical sampling data indicates that bacteria and viruses have not been detected in Alaska Children's Services source of public drinking water.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminanted 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].

Sampling history for Alaska Children's Services well indicates that low concentrations of nitrates have been detected (See Chart 5 – Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing nitrate concentration is approximately 12% of the Maximum Contaminant Level or MCL. 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. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water. Though existing nitrate contamination was detected at the site, concentrations remain at very safe levels with respect to human health.

Roads within the protection area are a significant source of potential contamination from bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Because roads do pose a potential for fuel spills to occur, major routes were ranked as a low potential source of contamination to the drinking water source. The construction trade areas, located in Zone C, present a very low potential risk from volatile organic chemicals.

Review of the historical sampling data indicates that no volatile organic chemical contamination has been detected in Alaska Children's Services source of public drinking water.

Potential sources of heavy metals, synthetic organic chemicals and other organic chemicals include residential areas, septic systems and roads. In review of the historical sampling data none of these contaminant were detected in the source waters.

SUMMARY

A *Source Water Assessment* has been completed for the source of public drinking water serving Alaska Children's Services. The overall vulnerability of this source to contamination is **low** for volatile organic

chemicals, heavy metals, synthetic organic chemicals, and other organic chemicals; and **medium** for bacteria and viruses, and nitrates and/or nitrites. 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 Alaska Children's Services 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 Alaska Children's Services public drinking water source.

REFERENCES CITED

Barnwell, W.W., George, R.S., Dearborn, L.L., Weeks, J.B., and Zenone, C., 1972, Water for Anchorage: an atlas of the water resources of the Anchorage area, Alaska: U.S. Geological Survey Open-File Report, 76 p.

Patrick, L.D., Brabets, T.P., and Glass, R.L., 1989, Simulation of ground-water flow at Anchorage, Alaska: U.S. Geological Survey Water-Resources Investigations Report 88-4139, 41p.

Ulery, C.A. and Updike, R.G, 1983, Subsurface structure of the cohesive facies of the Bootlegger Cove Formation, Southwest Anchorage, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 84, 5 p.

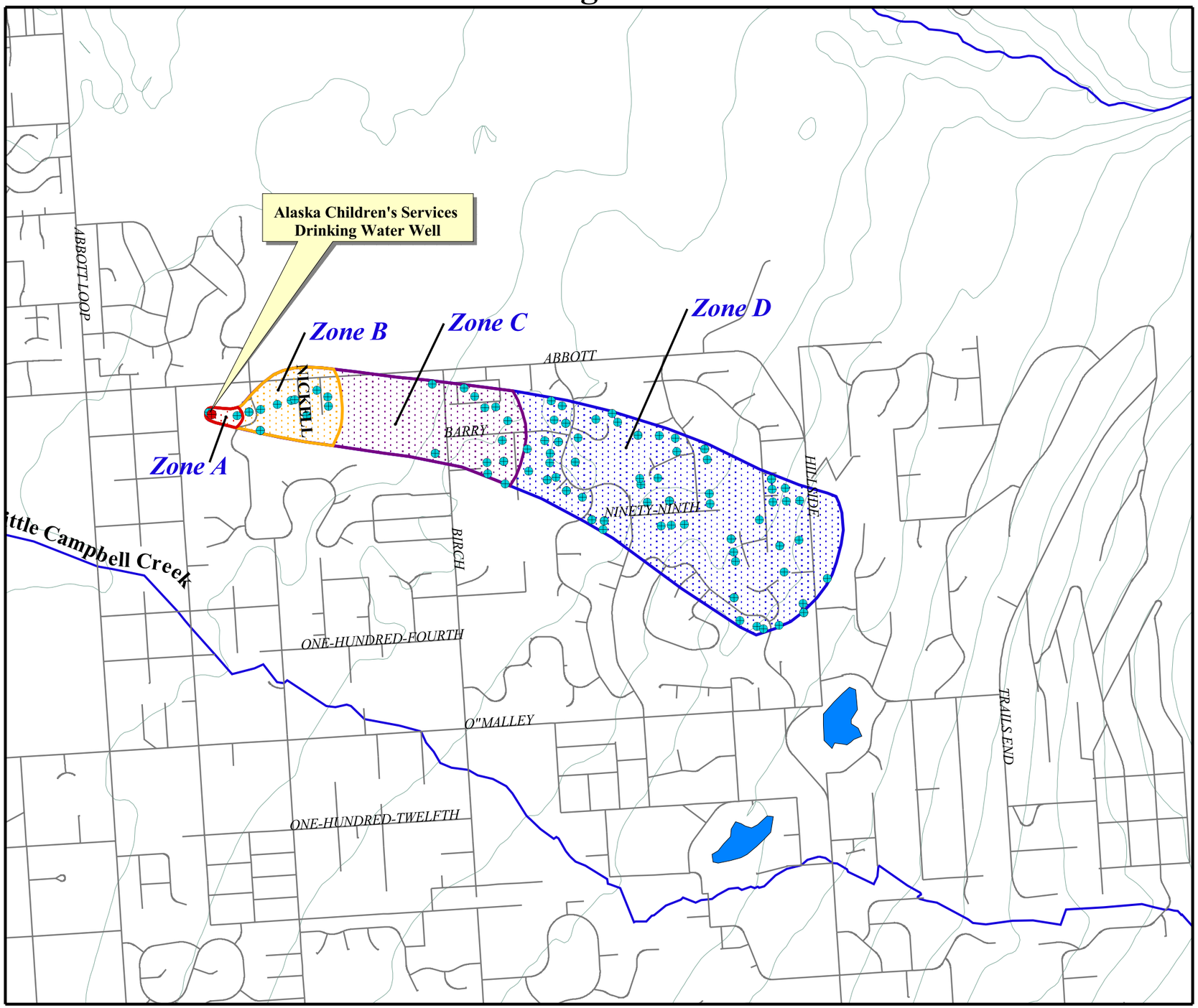
Wang, B., Strelakos, P.M., and Jokela, B., 2000, Nitrate Source Indicators In Groundwater of the Scimitar Subdivision, Peters Creek Area, Anchorage Alaska: U.S. Geological Survey Water-Resources Investigations Report 00-4137, 25p.

Western Regional Climate Center, 2000, August 24, Web extension to the *Western Regional Climate Center* [WWW document]. URL http://www.wrcc.dri.edu/index.html

APPENDIX A

Alaska Children's Services
Drinking Water Protection Area

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alaska Children's Services



- Alaska Children's Services DW Well
- Private and Public DW Wells

Zone A Protection Area
- Several Months Travel Time

Zone B Protection 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

- Anchorage Roads
- Streams
- Lakes
- Elevation Contours

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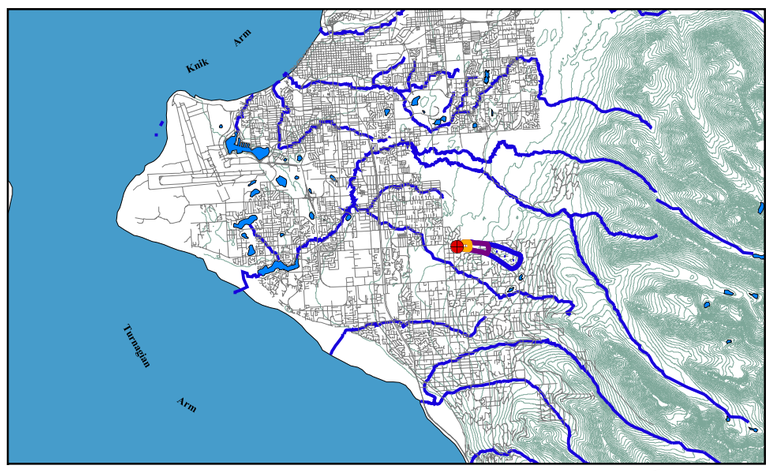

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Map 1

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services

Table 1

Contaminant Source Inventory for
Alaska Children's Services

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Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Septic systems (serves one single-family home)	R02	R2-1	A	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Off of Spring Hill Drive	3	
Residential Areas	R01	R1-2	B	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Septic systems (serves one single-family home)	R02	R2-10	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-22	B	Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-23	B	Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-3	B	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Off of Abbott Loop Road	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-8	B	Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Spring Hill Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Spring Hill Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Nickell Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Strutz Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Abbott Loop Road	2	
Municipal or city parks (with green areas)	X04	X4-1	B	Municipal or City parks intersecting Zone B	3	
Dog walking areas/foot trails	X46	X46-1	B	Trail along the south side of Abbott Loop Road	2	
Construction trade areas and materials	C09	C9-1	C	Off of Barry Ave.	2	
Construction trade areas and materials	C09	C9-2	C	Off of Brien Street	2	
Residential Areas	R01	R1-3	C	Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-25-59	C	All spetic systems located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-6-11	C	All roads located within Zone C	2	
Dog walking areas/foot trails	X46	X46-2-4	C	All trails located within Zone C	2	

Table 2

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services Sources of Bacteria and Viruses

PWSID 210312.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Septic systems (serves one single-family home)	R02	R2-1	A	Low	2	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	3	Off of Spring Hill Drive	3	
Residential Areas	R01	R1-2	B	Low	4	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Septic systems (serves one single-family home)	R02	R2-3	B	Low	5	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low	6	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low	7	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low	8	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low	9	Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low	10	Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-10	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-22	B	Low		Off of Strutz Circle	3	

Table 2 (continued)

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services Sources of Bacteria and Viruses

PWSID 210312.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-23	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low		Spring Hill Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low		Spring Hill Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Nickell Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Strutz Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Abbott Loop Road	2	
Municipal or city parks (with green areas)	X04	X4-1	B	Medium		Municipal or City parks intersecting Zone B	3	
Dog walking areas/foot trails	X46	X46-1	B	Low		Trail along the south side of Abbott Loop Road	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-25-59	C	Low		All spetic systems located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-6-11	C	Low		All roads located within Zone C	2	
Dog walking areas/foot trails	X46	X46-2-4	C	Low		All trails located within Zone C	2	

Table 3

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services
Sources of Nitrates/Nitrites

PWSID 210312.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Overall Rank after Analysis	Location	Map Number	Comments
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Septic systems (serves one single-family home)	R02	R2-1	A	Low	2	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	3	Off of Spring Hill Drive	3	
Residential Areas	R01	R1-2	B	Low	4	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Septic systems (serves one single-family home)	R02	R2-3	B	Low	5	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low	6	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low	7	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low	8	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low	9	Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low	10	Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-10	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-22	B	Low		Off of Strutz Circle	3	

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services Sources of Nitrates/Nitrites

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-23	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		Off of Abbott Loop Road	3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low		Spring Hill Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low		Spring Hill Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low		Nickell Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low		Strutz Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low		Abbott Loop Road	2	
Municipal or city parks (with green areas)	X04	X4-1	B	Medium		Municipal or City parks intersecting Zone B	3	
Dog walking areas/foot trails	X46	X46-1	B	Low		Trail along the south side of Abbott Loop Road	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-25-59	C	Low		All spetic systems located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-6-11	C	Low		All roads located within Zone C	2	
Dog walking areas/foot trails	X46	X46-2-4	C	Low		All trails located within Zone C	2	

Table 4

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services
Sources of Volatile Organic Chemicals

PWSID 210312.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Overall Rank after Analysis	Location	Map Number	Comments
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	2	Spring Hill Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low	3	Spring Hill Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low	4	Nickell Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low	5	Strutz Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	6	Abbott Loop Road	2	
Residential Areas	R01	R1-2	B	Low	7	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Septic systems (serves one single-family home)	R02	R2-1	A	Low	8	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	9	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-3	B	Low	10	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-10	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-22	B	Low		Off of Strutz Circle	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-23	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		Off of Abbott Loop Road	3	
Construction trade areas and materials	C09	C9-1	C	Low		Off of Barry Ave.	2	
Construction trade areas and materials	C09	C9-2	C	Low		Off of Brien Street	2	
Residential Areas	R01	R1-3	C	Low		Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-25-59	C	Low		All spetic systems located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-6-11	C	Low		All roads located within Zone C	2	

Table 5

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 210312.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Septic systems (serves one single-family home)	R02	R2-1	A	Low	2	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	3	Off of Spring Hill Drive	3	
Residential Areas	R01	R1-2	B	Low	4	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	5	Spring Hill Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low	6	Spring Hill Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low	7	Nickell Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low	8	Strutz Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	9	Abbott Loop Road	2	
Residential Areas	R01	R1-3	C	Low	10	Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-10	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Low		Off of Strutz Circle	3	

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-22	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-23	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-3	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		Off of Abbott Loop Road	3	
Municipal or city parks (with green areas)	X04	X4-1	B	Low		Municipal or City parks intersecting Zone B	3	
Construction trade areas and materials	C09	C9-1	C	Low		Off of Barry Ave.	2	
Construction trade areas and materials	C09	C9-2	C	Low		Off of Brien Street	2	
Septic systems (serves one single-family home)	R02	R2-25-59	C	Low		All spetic systems located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-6-11	C	Low		All roads located within Zone C	2	

Table 6

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services
Sources of Synthetic Organic Chemicals

PWSID 210312.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Overall Rank after Analysis	Location	Map Number	Comments
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Residential Areas	R01	R1-3	C	Low	3	Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Septic systems (serves one single-family home)	R02	R2-1	A	Low	4	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	5	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-3	B	Low	6	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low	7	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low	8	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low	9	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low	10	Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-10	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Low		Off of Strutz Circle	3	

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services

Sources of Synthetic Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-22	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-23	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		Off of Abbott Loop Road	3	
Municipal or city parks (with green areas)	X04	X4-1	B	Low		Municipal or City parks intersecting Zone B	3	
Septic systems (serves one single-family home)	R02	R2-25-59	C	Low		All spetic systems located within Zone C	3	

Table 7

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services
Sources of Other Organic Chemicals

PWSID 210312.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Overall Rank after Analysis	Location	Map Number	Comments
Residential Areas	R01	R1-1	A	Low	1	Residential areas located within Zone A	3	Approximately 1 acre of residential area.
Residential Areas	R01	R1-2	B	Low	2	Residential areas located within Zone B	3	Approximately 30 acres of residnetial area.
Residential Areas	R01	R1-3	C	Low	3	Residential areas located within Zone C	3	Approximately 74 acres of residential area.
Highways and roads, paved (cement or asphalt)	X20	X20-1	B	Low	4	Spring Hill Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low	5	Spring Hill Drive	2	
Highways and roads, paved (cement or asphalt)	X20	X20-3	B	Low	6	Nickell Circle	2	
Highways and roads, paved (cement or asphalt)	X20	X20-4	B	Low	7	Strutz Ave.	2	
Highways and roads, paved (cement or asphalt)	X20	X20-5	B	Low	8	Abbott Loop Road	2	
Septic systems (serves one single-family home)	R02	R2-1	A	Low	9	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-2	A	Low	10	Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-10	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-11	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-12	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-13	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-14	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-15	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-16	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-17	B	Low		Off of Nickell Circle	3	
Septic systems (serves one single-family home)	R02	R2-18	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-19	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-20	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-21	B	Low		Off of Strutz Circle	3	

Contaminant Source Inventory and Risk Ranking for Alaska Children's Services

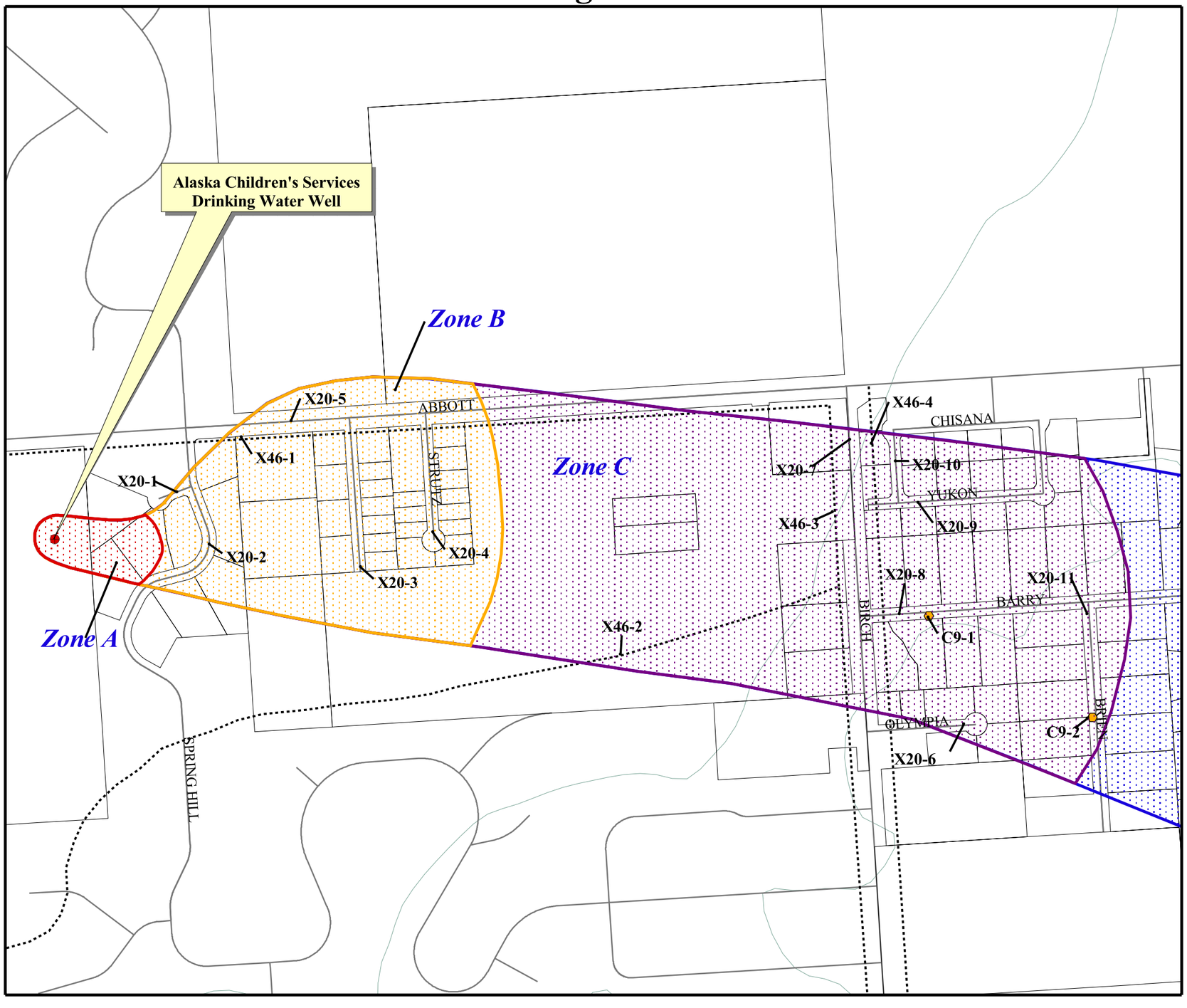
Sources of Other Organic Chemicals

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Septic systems (serves one single-family home)	R02	R2-22	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-23	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-24	B	Low		Off of Strutz Circle	3	
Septic systems (serves one single-family home)	R02	R2-3	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-4	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-5	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-6	B	Low		Off of Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-7	B	Low		Off of Abbott Loop Road	3	
Septic systems (serves one single-family home)	R02	R2-8	B	Low		Near Spring Hill Drive	3	
Septic systems (serves one single-family home)	R02	R2-9	B	Low		Off of Abbott Loop Road	3	
Construction trade areas and materials	C09	C9-1	C	Low		Off of Barry Ave.	2	
Construction trade areas and materials	C09	C9-2	C	Low		Off of Brien Street	2	
Septic systems (serves one single-family home)	R02	R2-25-59	C	Low		All spetic systems located within Zone C	3	
Highways and roads, paved (cement or asphalt)	X20	X20-6-11	C	Low		All roads located within Zone C	2	

APPENDIX C

Alaska Children's Services
Drinking Water Protection Area
and Potential & Existing Contaminant Sources

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alaska Children's Services



- Alaska Children's Services DW Well

Zone A Protection Area
- Several Months Travel Time

Zone B Protection 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
- Anchorage Land Parcels

Potential and Existing Sources of Contamination
- Construction Trade Areas and Materials (C9)
- Trails (X46)
- Anchorage Roads (X20)
- Elevation Contours

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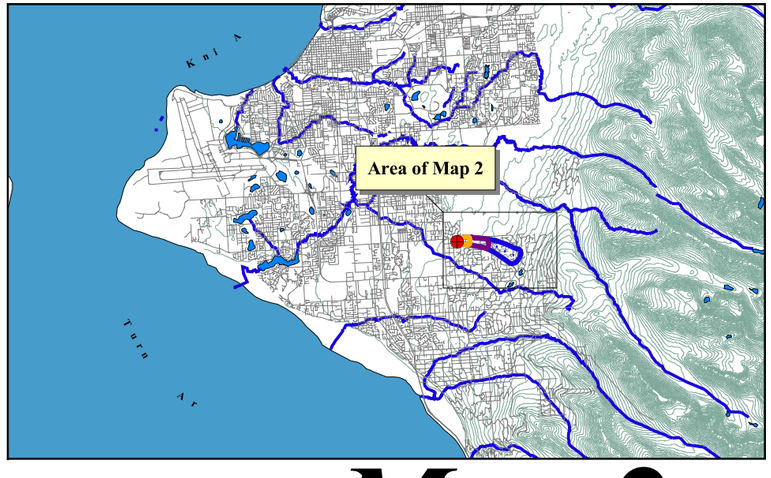
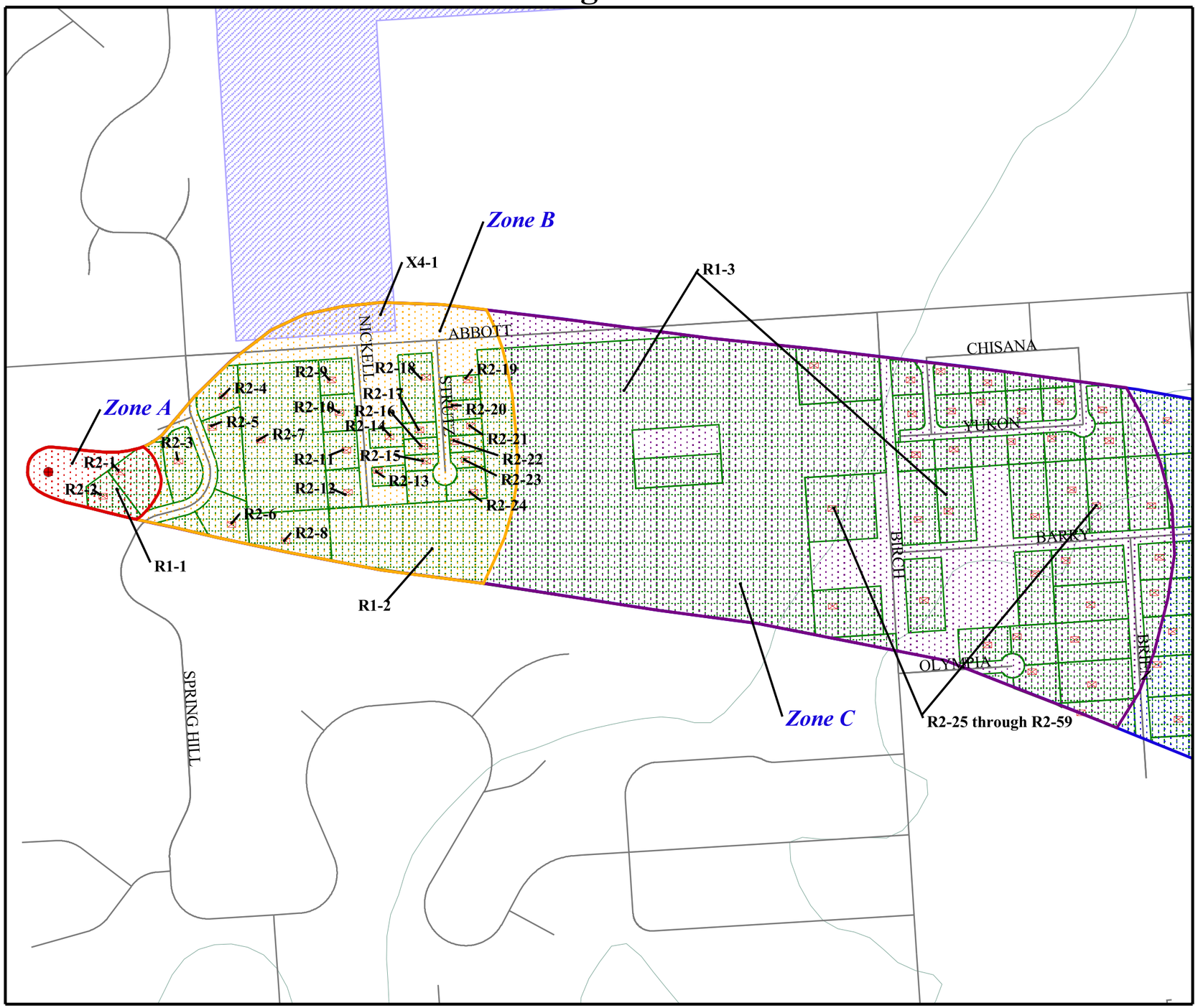


PWSID 210312.001

Map 2

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alaska Children's Services



- Alaska Children's Services DW Well

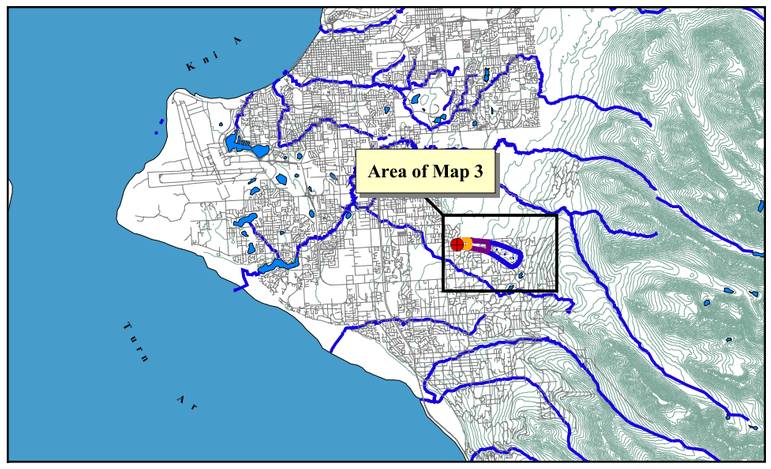
Zone A Protection Area
- Several Months Travel Time

Zone B Protection 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
- Lawns and Gardens (R1)
- Septic Systems (R2)
- Anchorage Parks (X4)
- Anchorage Roads (X20)
- Elevation Contours

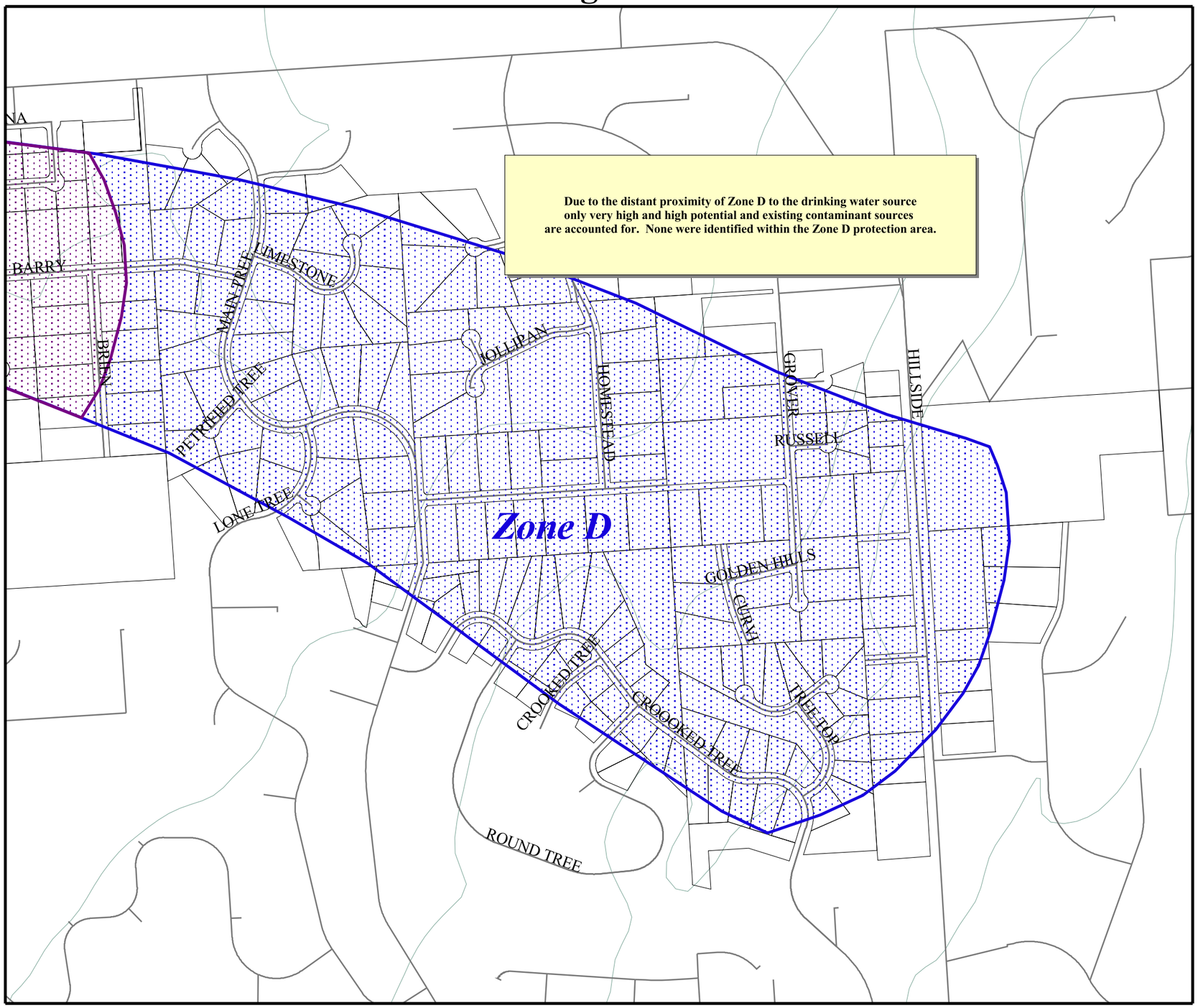
N W E S



PWSID 210312.001

Map 3

Drinking Water Protection Area and
Potential & Existing Contaminant Sources for Alaska Children's Services



- Alaska Children's Services DW Well

Zone A Protection Area
- Several Months Travel Time

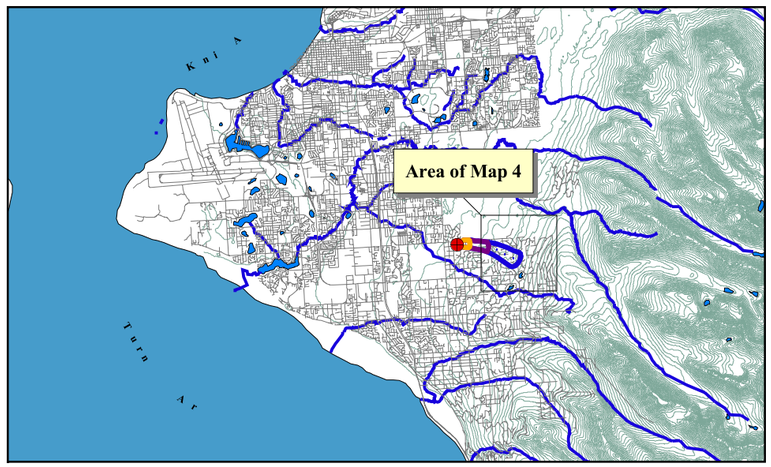
Zone B Protection Area
- Less Than 2 Years Travel Time

Zone C Protection Area
- Less Than 5 Years Travel Time

Zone D Protection Area
- Less Than 10 Years Travel Time

- Anchorage Land Parcels
- Anchorage Roads (X20)
- Elevation Contours

N
W E
S



PWSID 210312.001

Map 4

APPENDIX D

Vulnerability Analysis for Alaska Children's Services Public Drinking Water Source

Chart 1. Susceptibility of the wellhead - Alaska Children's Services

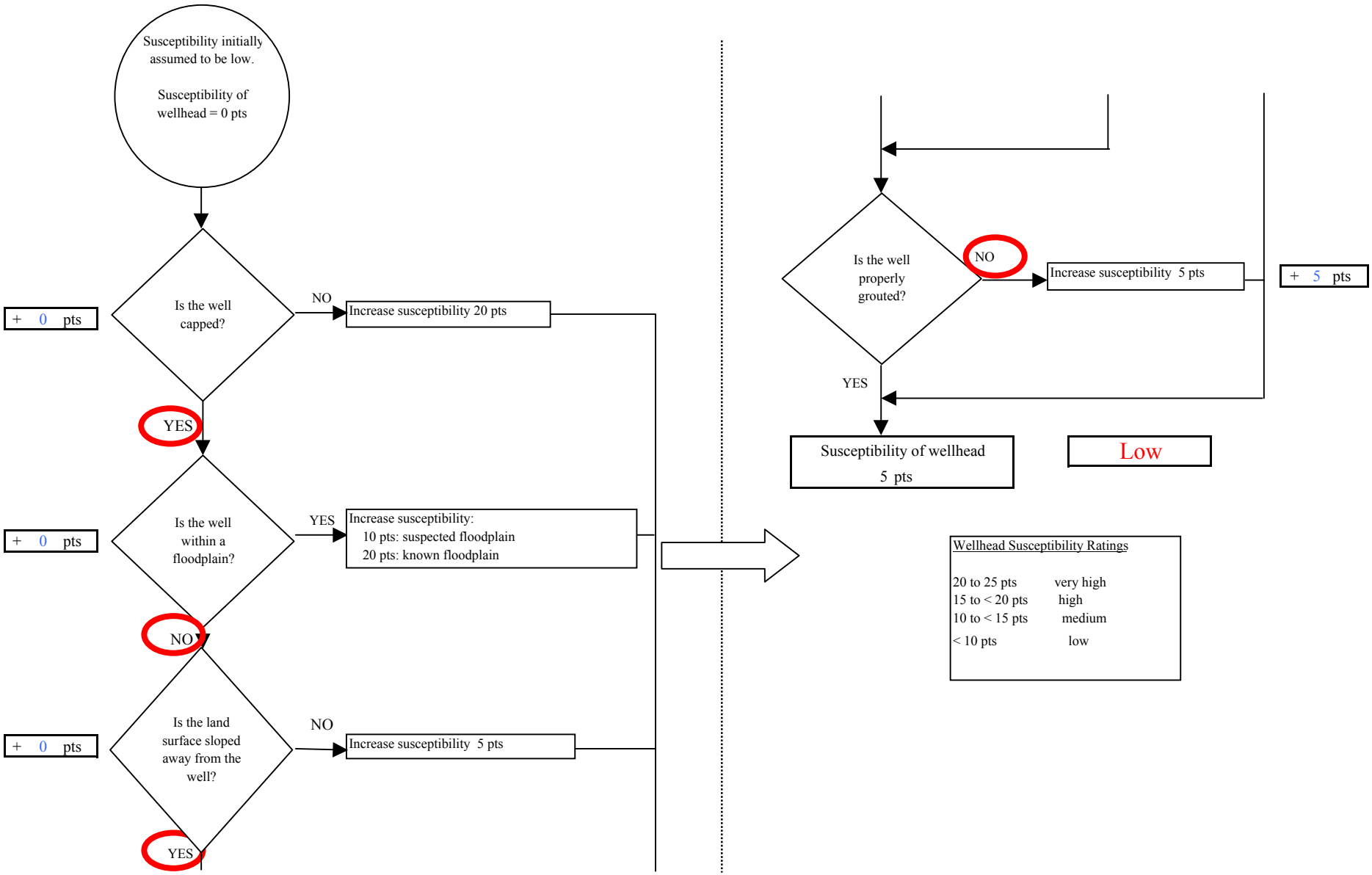


Chart 2. Susceptibility of the aquifer - Alaska Children's Services

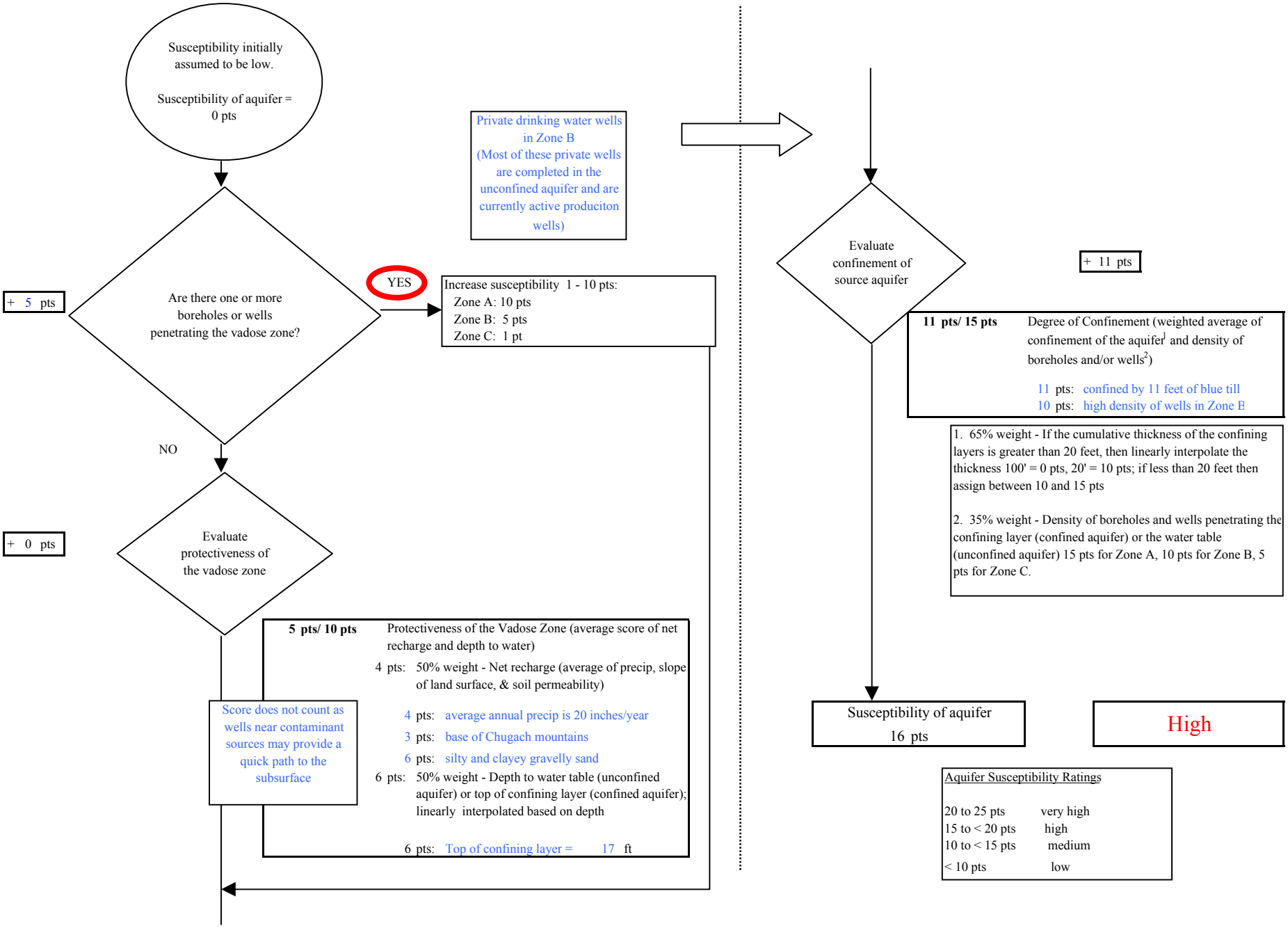
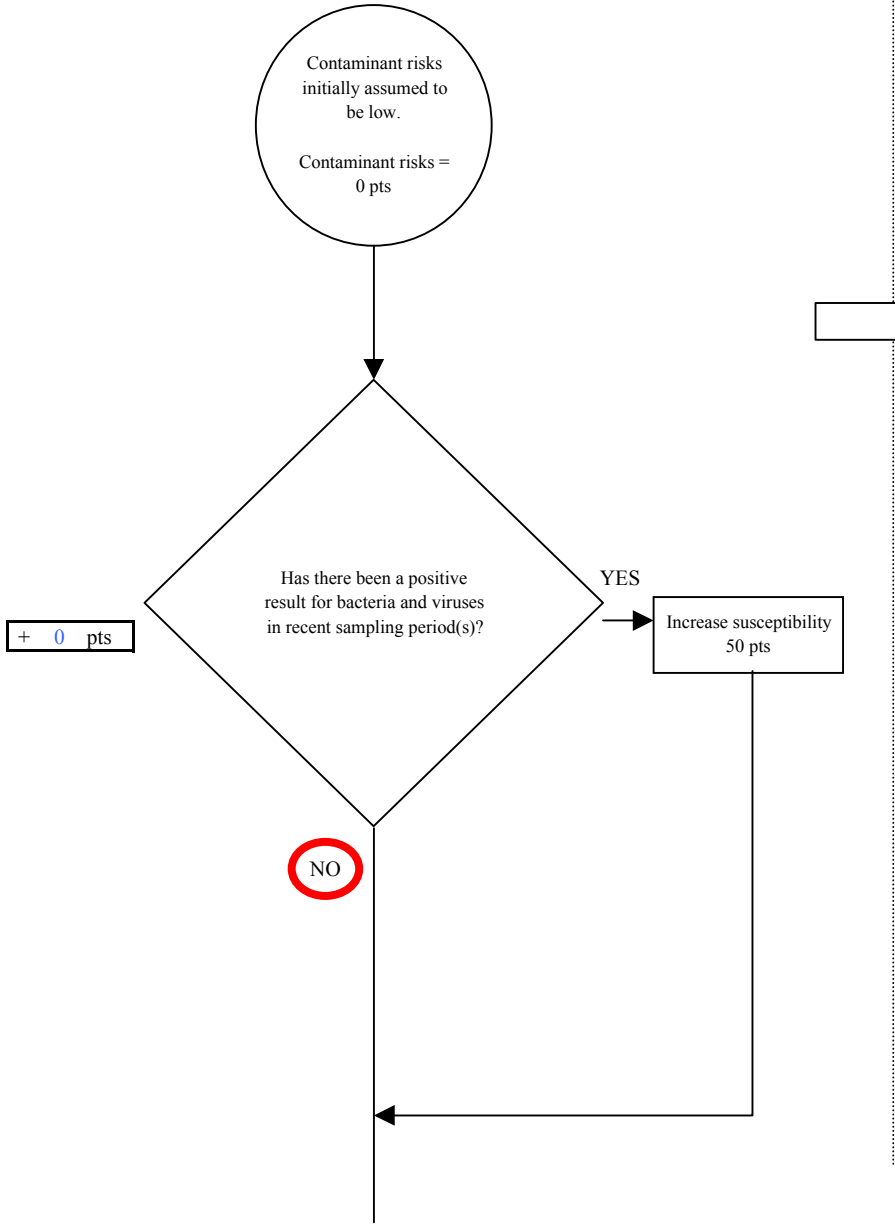
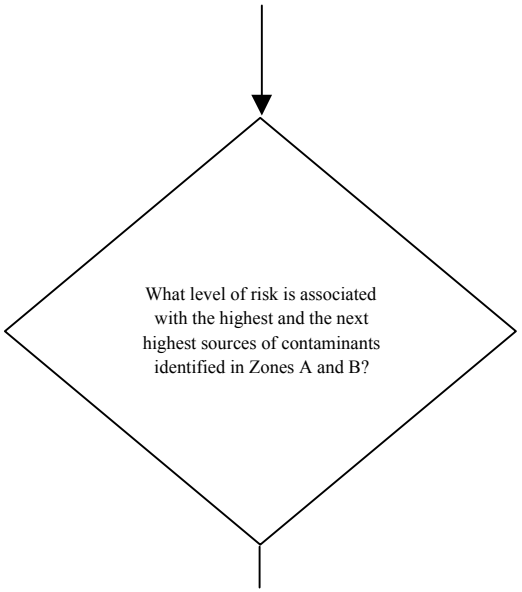


Chart 3. Contaminant risks for Alaska Children's Services - Bacteria & Viruses





+ 20 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	1	1
Low(s)	3	6	9

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

Matrix Score 20

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

Chart 3. Contaminant risks for Alaska Children's Services - Bacteria & Viruses

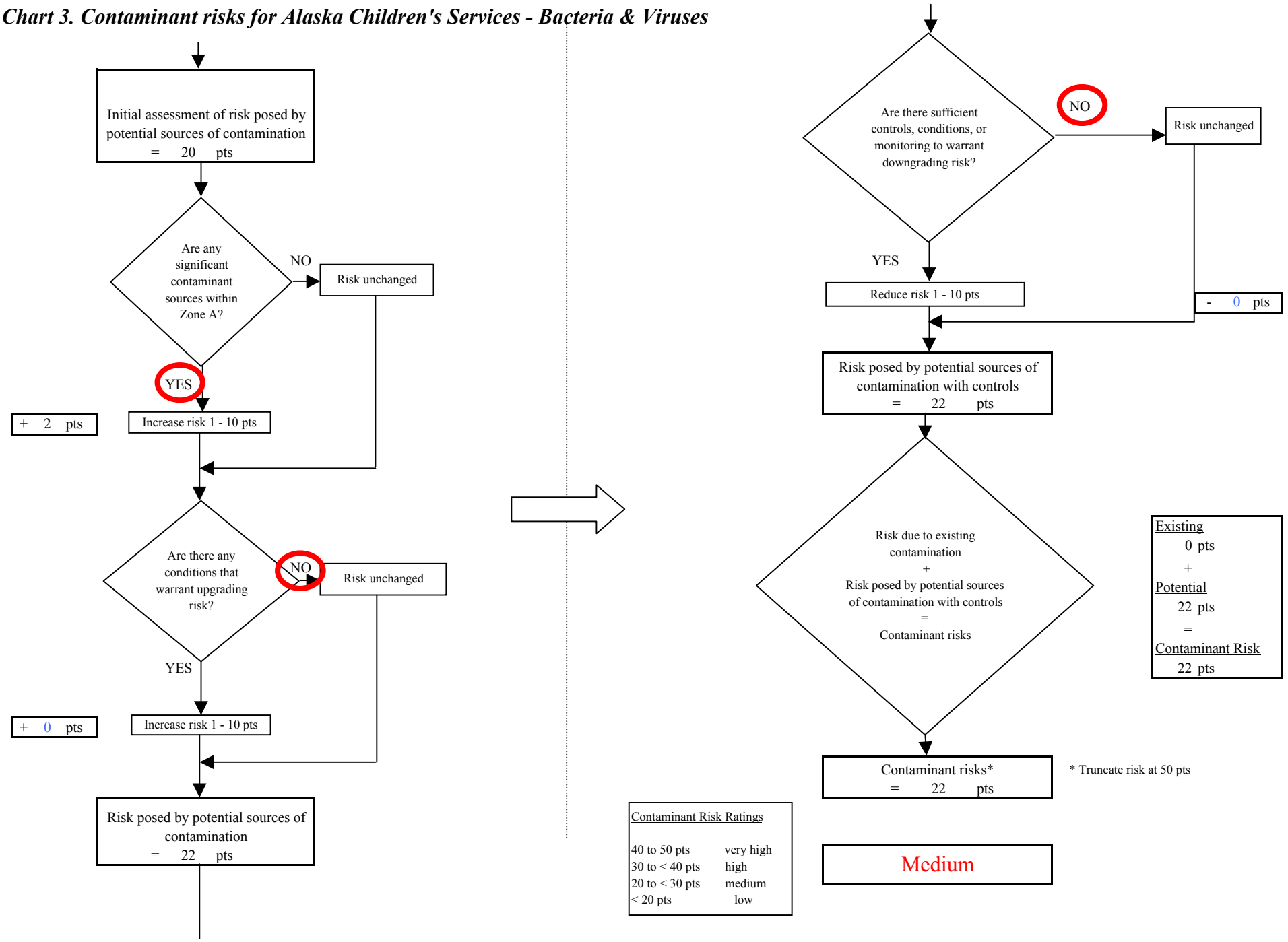


Chart 4. Vulnerability analysis for Alaska Children's Services - Bacteria & Viruses

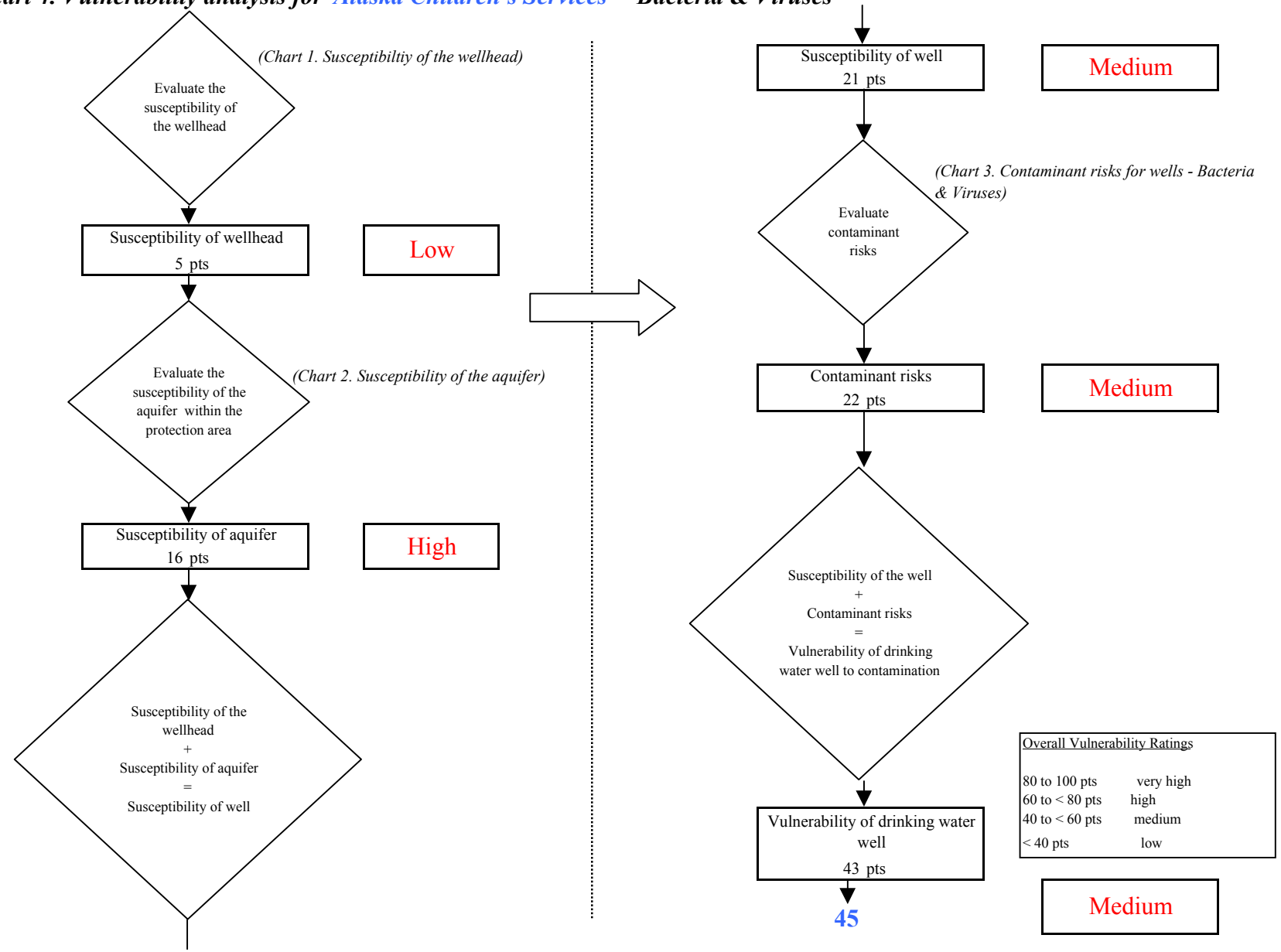


Chart 5. Contaminant risks for Alaska Children's Services - Nitrates and Nitrites

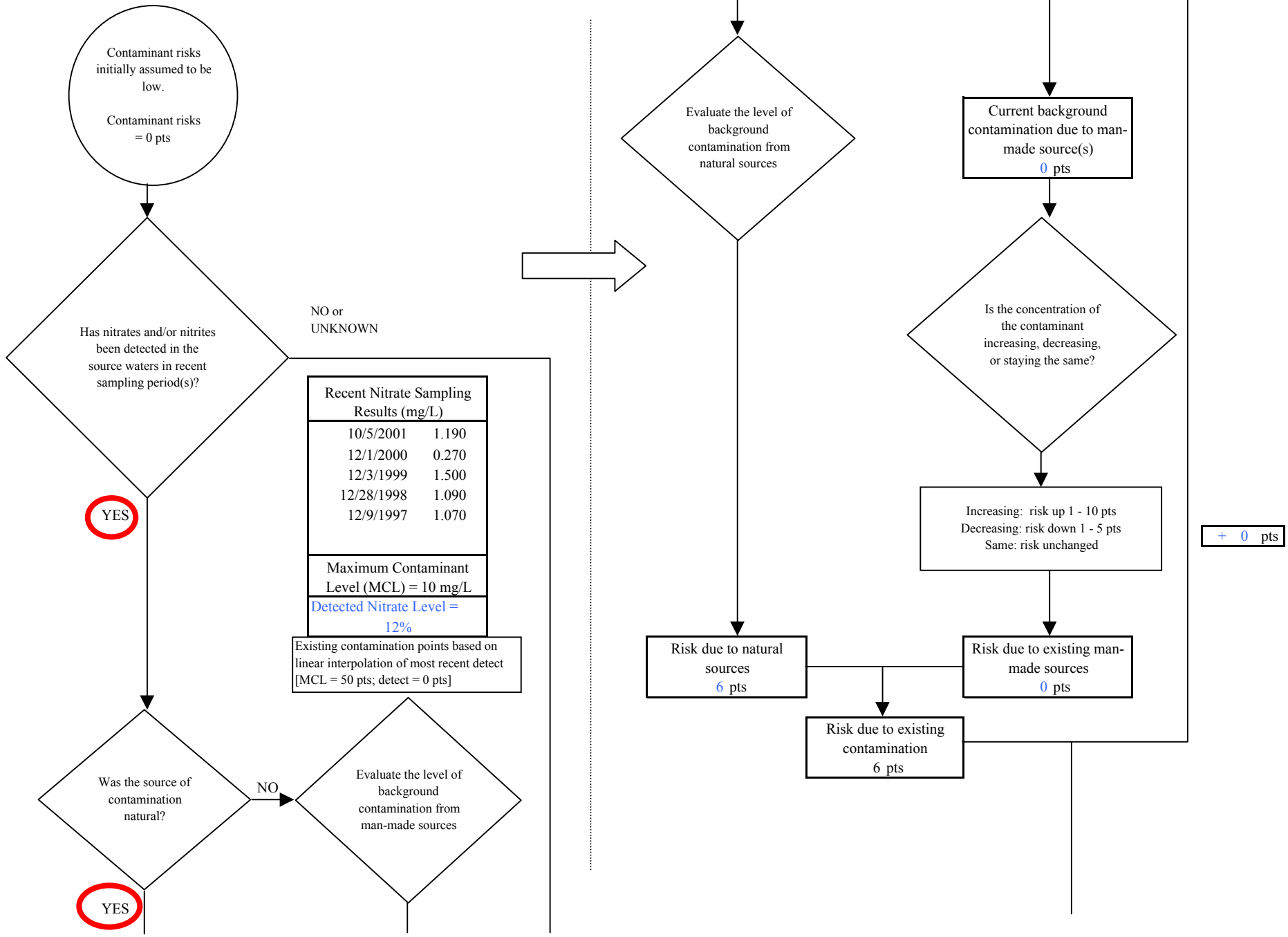


Chart 5. Contaminant risks for Alaska Children's Services - Nitrates and Nitrites

+ 25 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	1	1
Low(s)	3	11	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 25

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

Initial assessment of risk posed by potential sources of contamination = 25 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 5. Contaminant risks for Alaska Children's Services - Nitrates and Nitrites

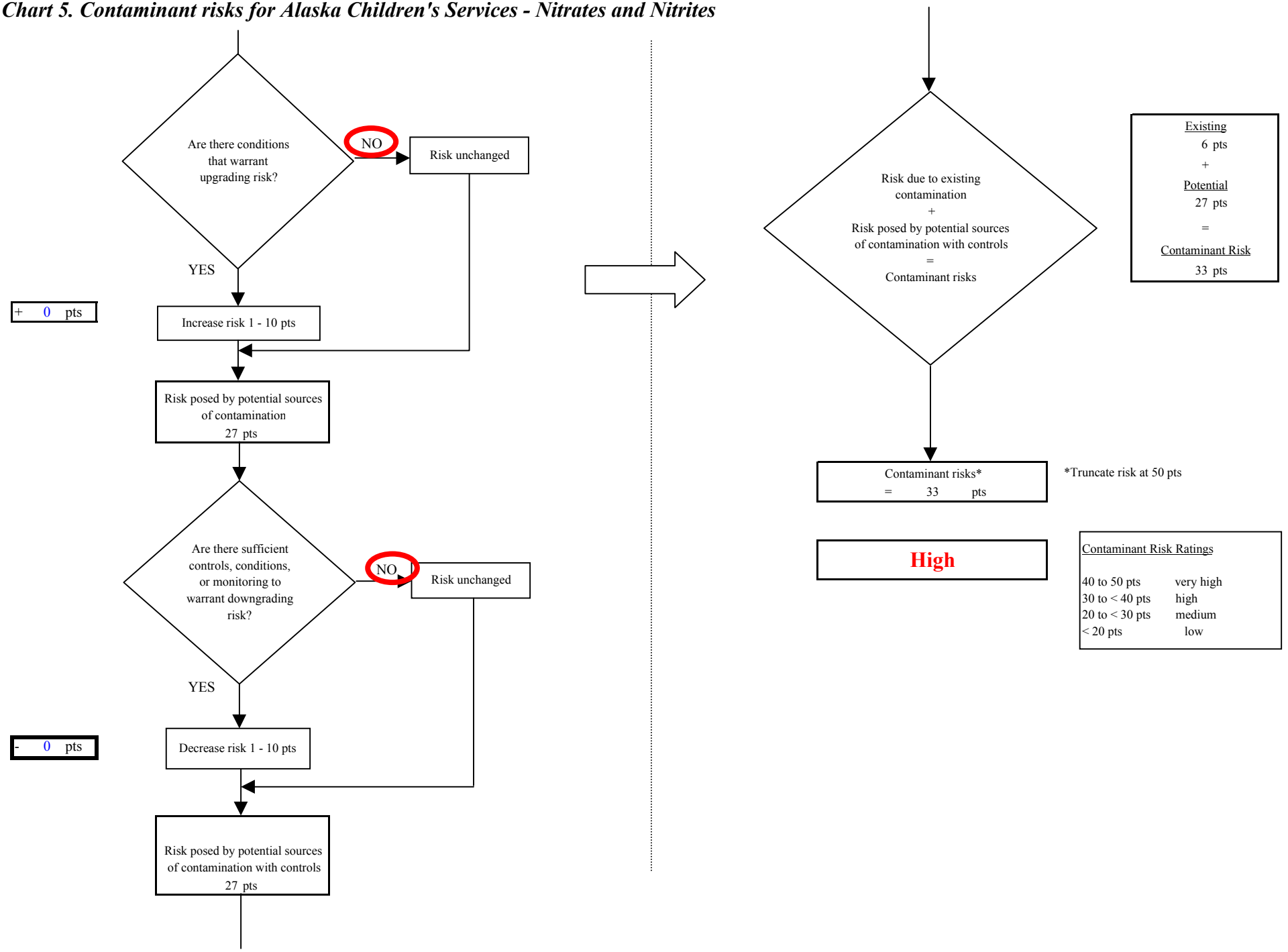


Chart 6. Vulnerability analysis for Alaska Children's Services - Nitrates and Nitrites

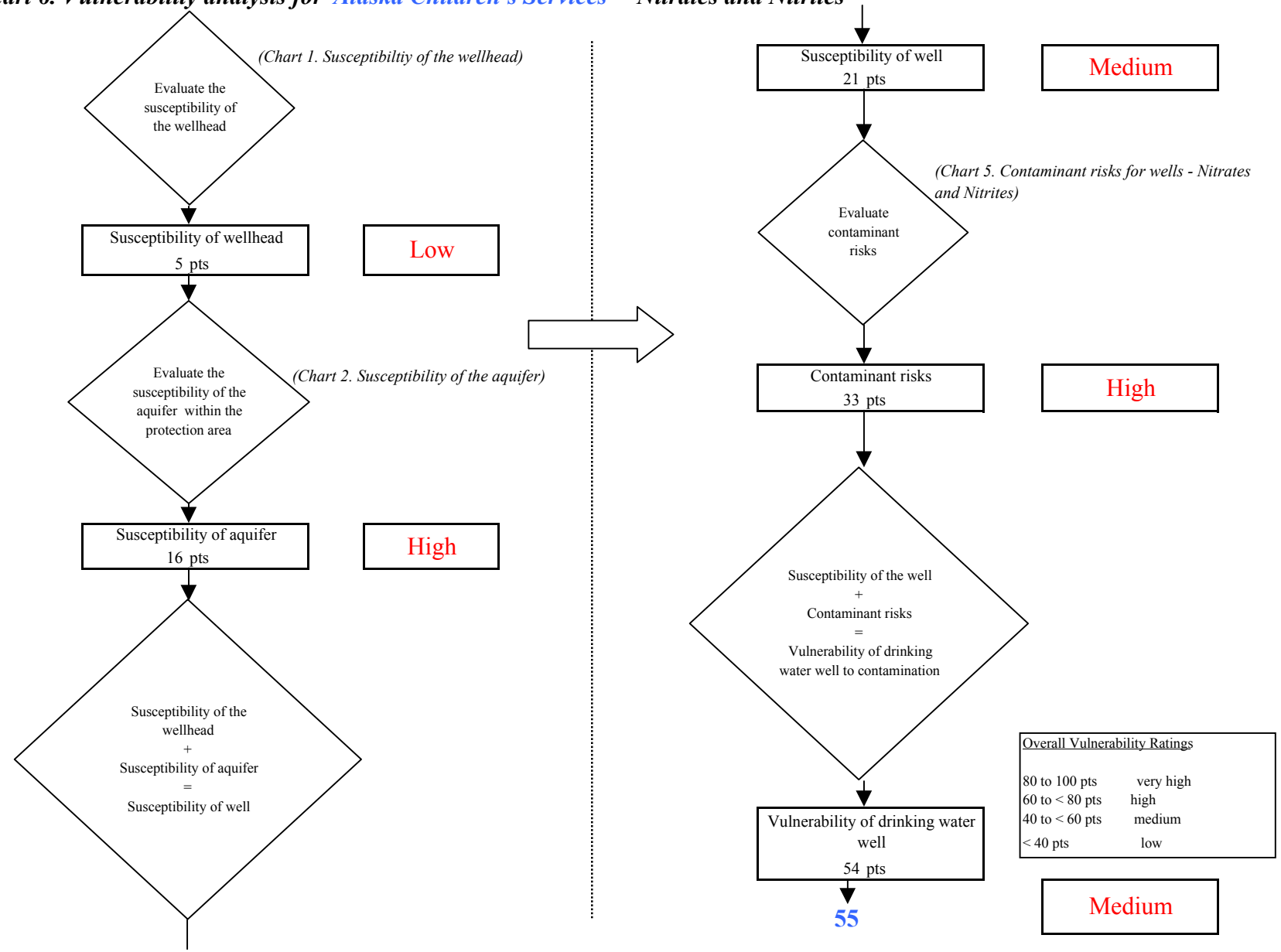


Chart 7. Contaminant risks for Alaska Children's Services - Volatile Organic Chemicals

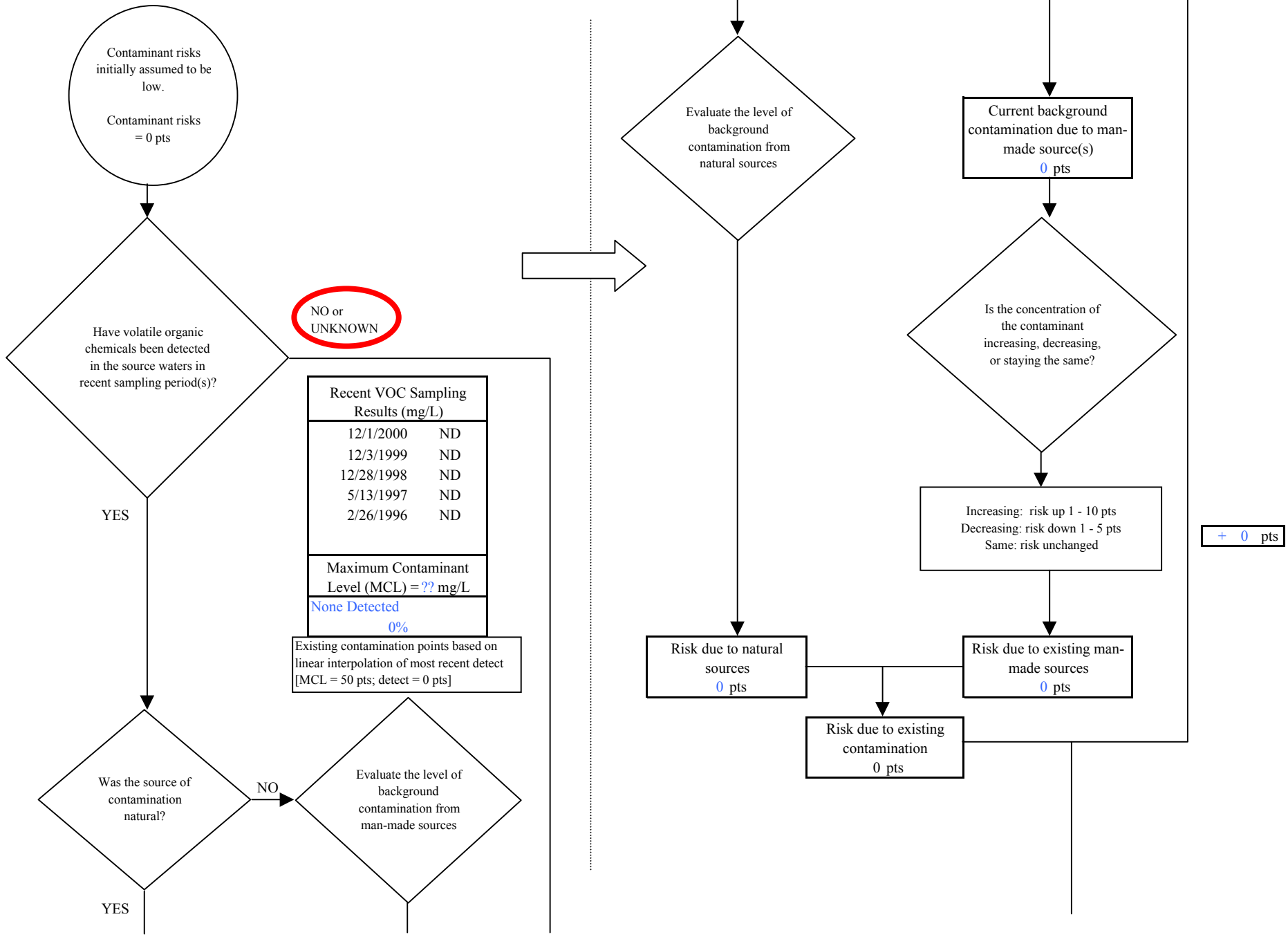
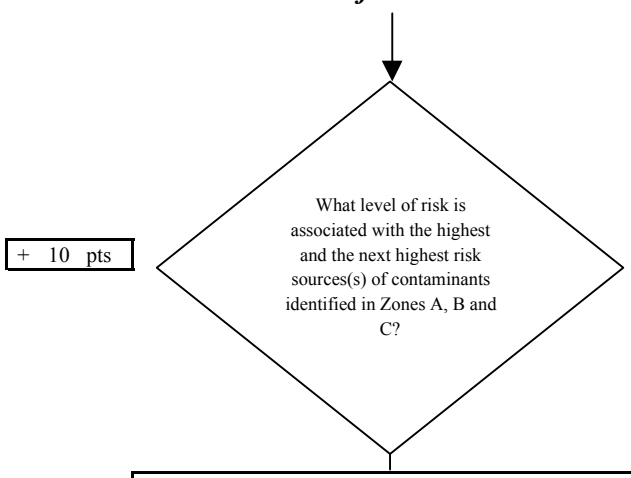


Chart 7. Contaminant risks for Alaska Children's Services - Volatile Organic Chemicals



Risk Levels for Contaminant Sources identified in Zones A, B and C			
	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	2	6	8

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

Matrix Score 10

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

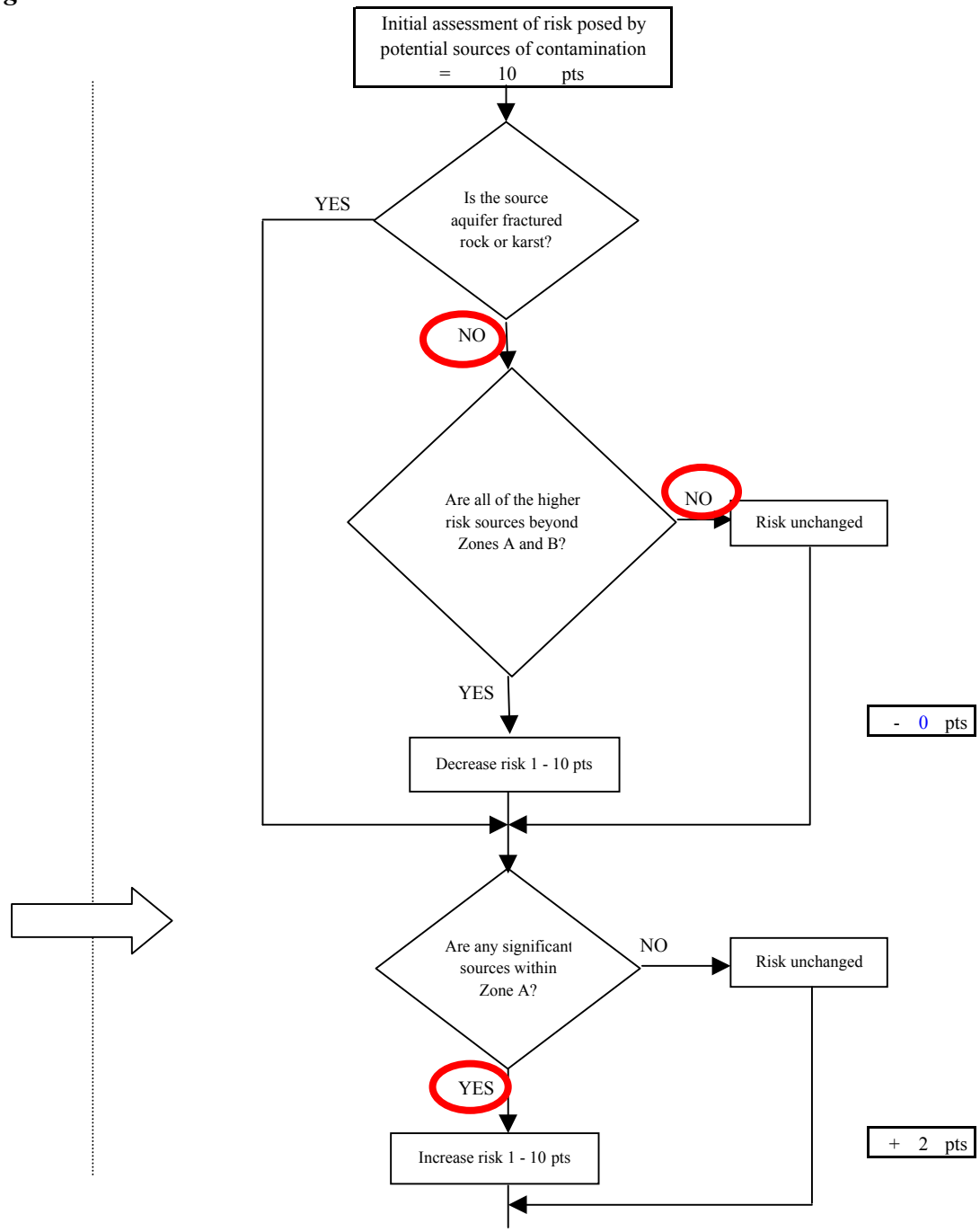


Chart 7. Contaminant risks for Alaska Children's Services - Volatile Organic Chemicals

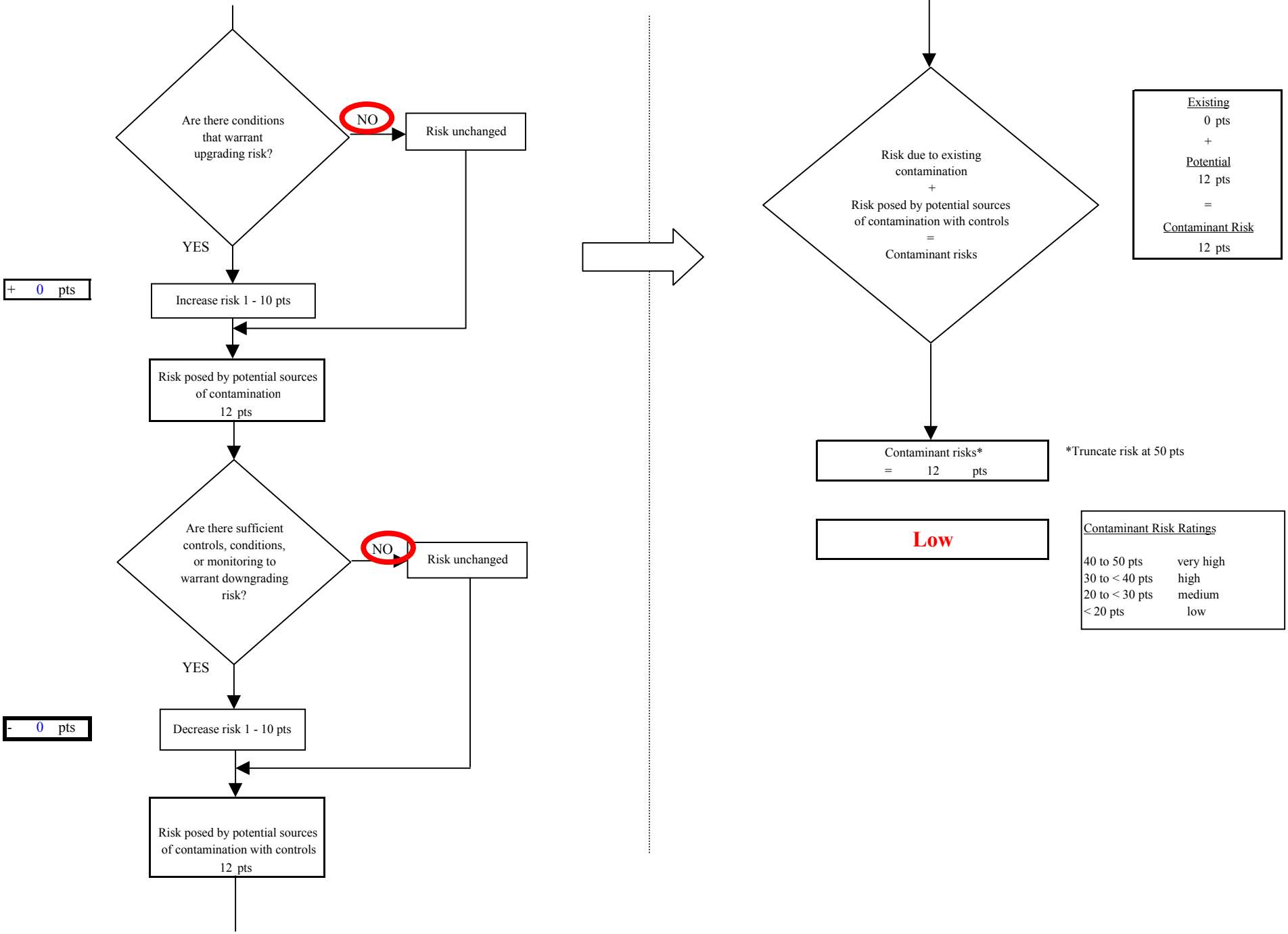


Chart 8. Vulnerability analysis for Alaska Children's Services - Volatile Organic Chemicals

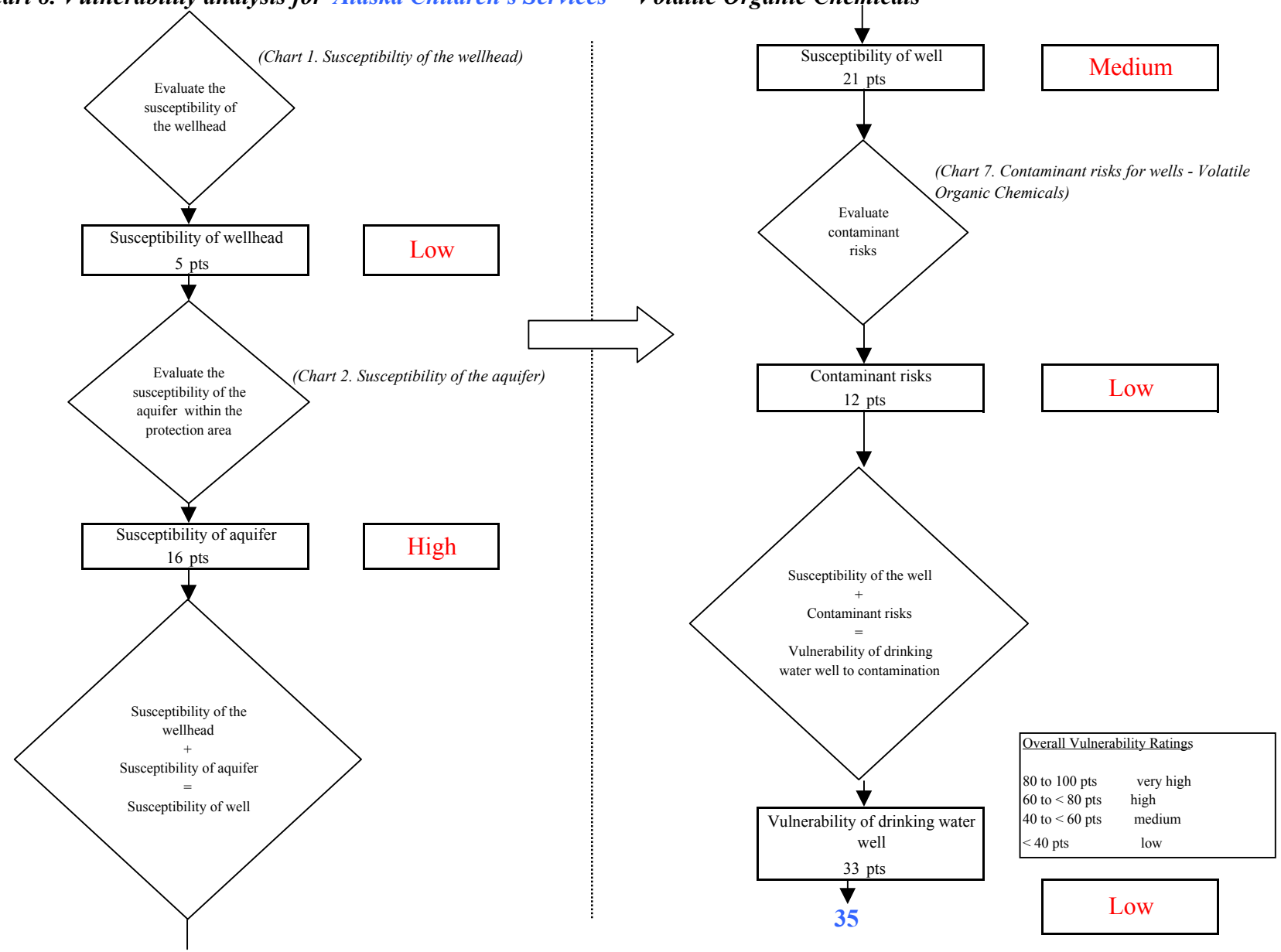


Chart 9. Contaminant risks for Alaska Children's Services - Heavy Metals, Cyanide and Other Inorganic Chemicals

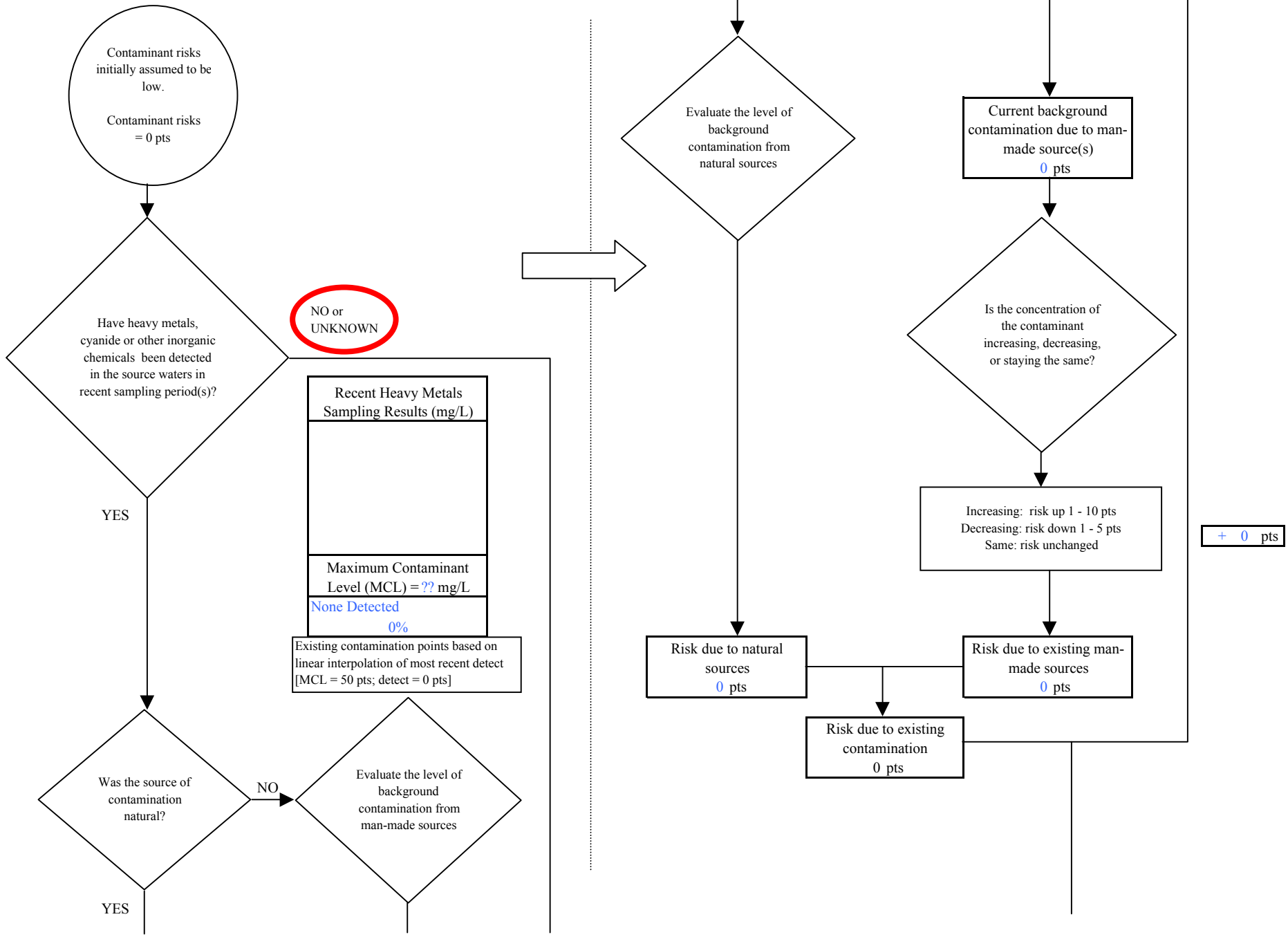


Chart 9. Contaminant risks for Alaska Children's Services - Heavy Metals, Cyanide and Other Inorganic Chemicals

Initial assessment of risk posed by potential sources of contamination = 10 pts

Is the source aquifer fractured rock or karst? — YES

NO

Are all of the higher risk sources beyond Zones A and B? — NO → Risk unchanged

YES → Decrease risk 1 - 10 pts — - 0 pts

Are any significant sources within Zone A? — NO → Risk unchanged

YES → Increase risk 1 - 10 pts — + 2 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?

+ 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)	2	6	8

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

Matrix Score 10

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

Chart 9. Contaminant risks for Alaska Children's Services - Heavy Metals, Cyanide and Other Inorganic Chemicals

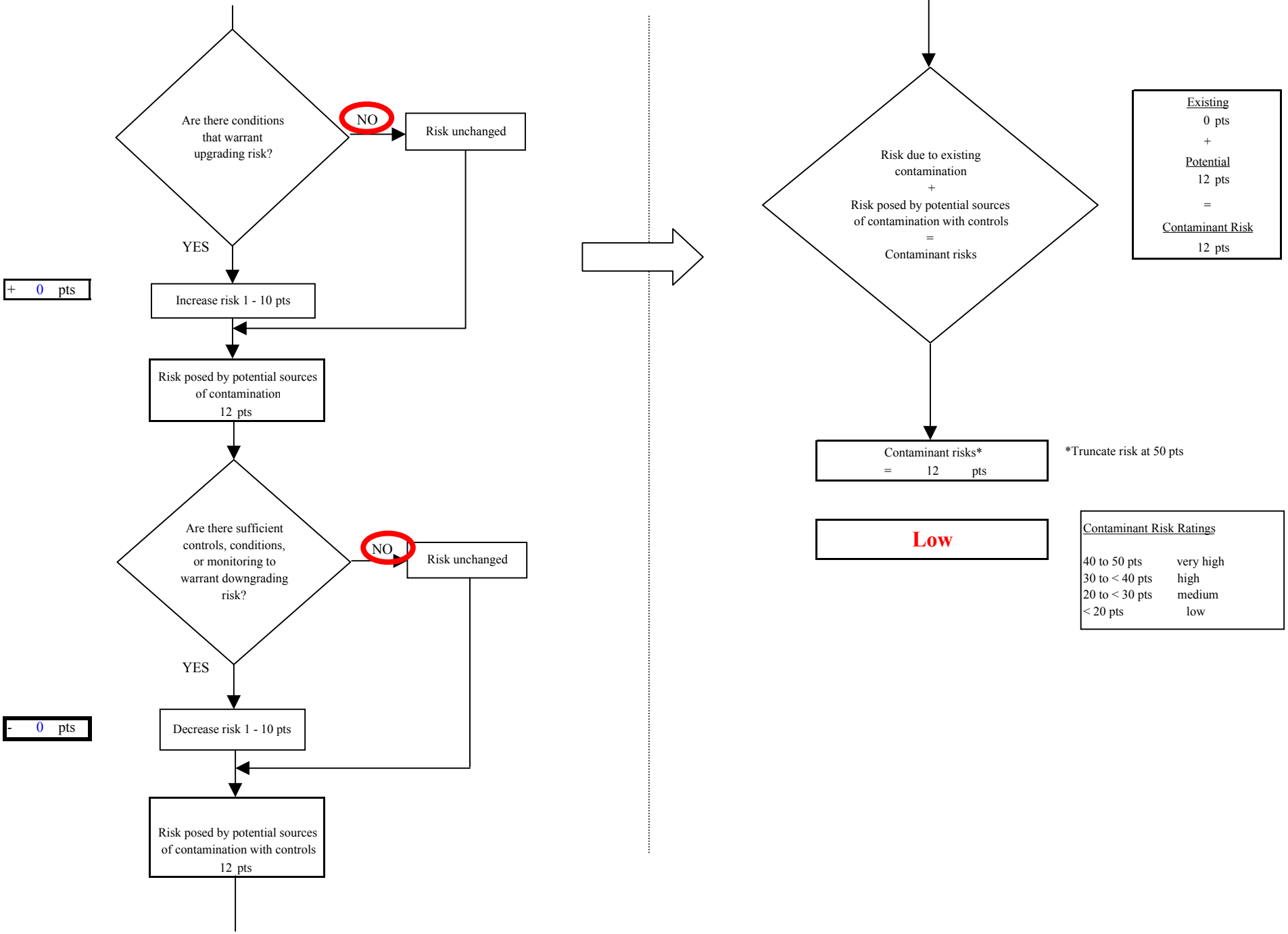


Chart 10. Vulnerability analysis for Alaska Children's Services - Heavy Metals, Cyanide and Other Inorganic Chemicals

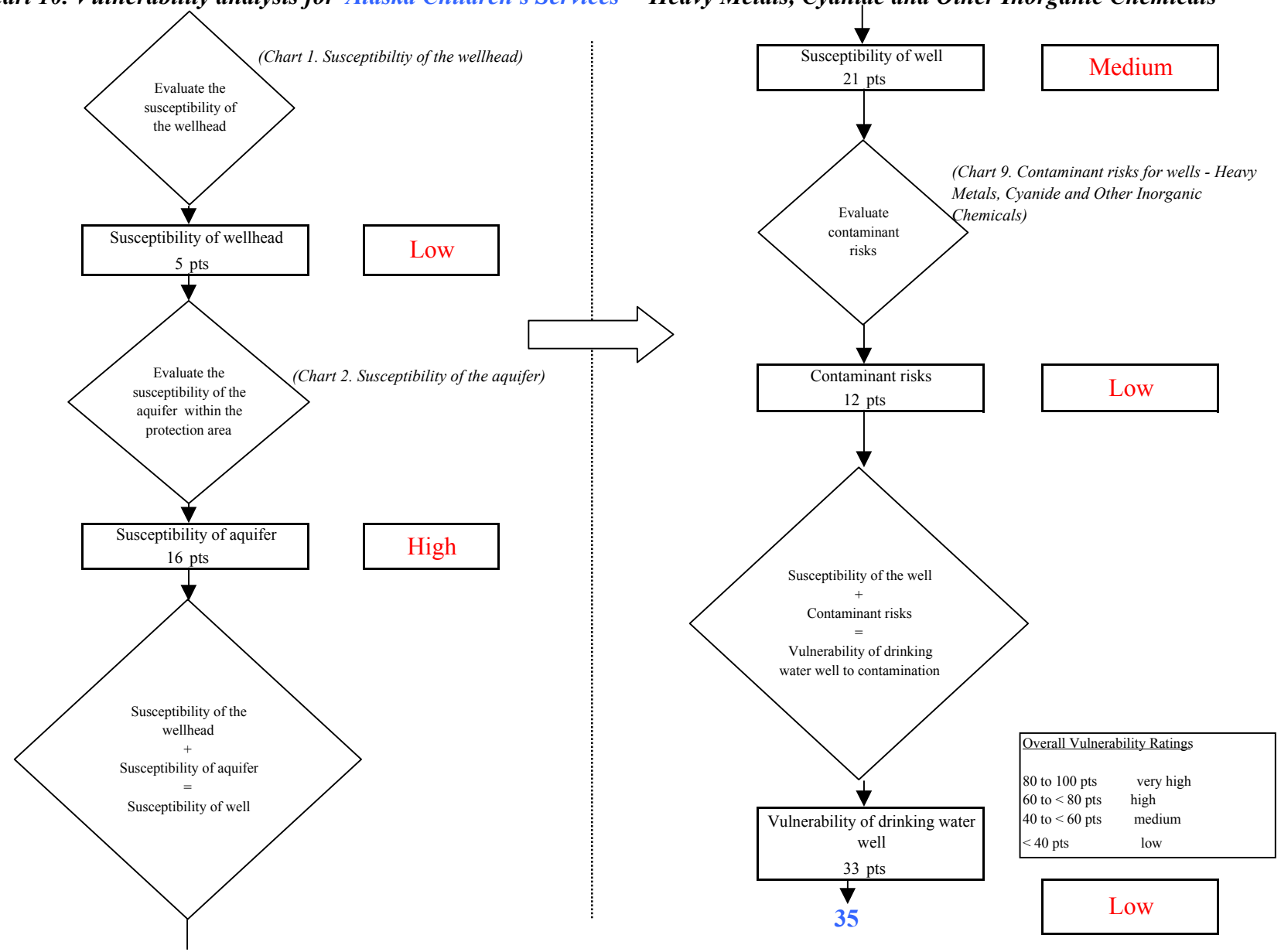


Chart 11. Contaminant risks for Alaska Children's Services - Synthetic Organic Chemicals

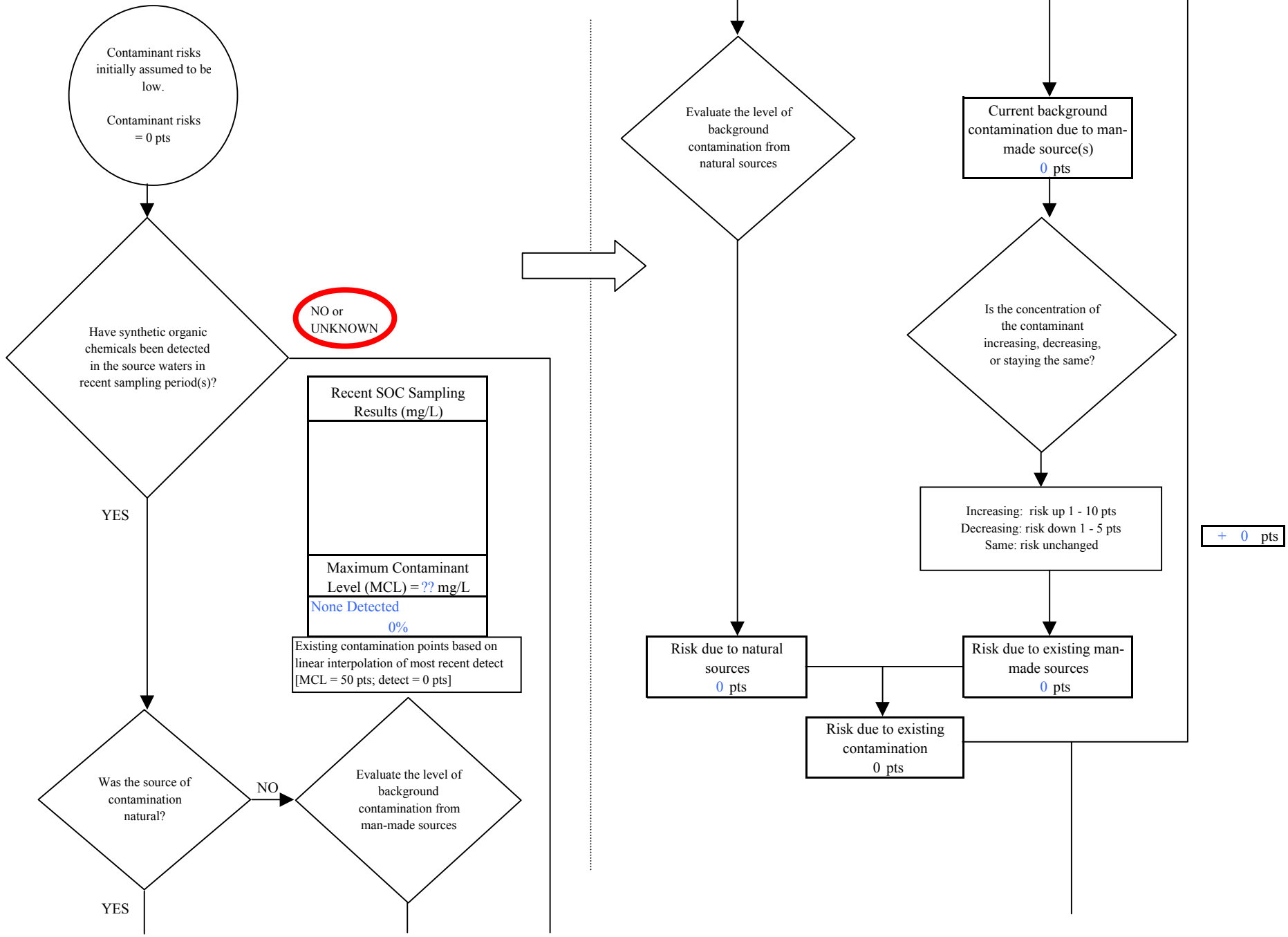
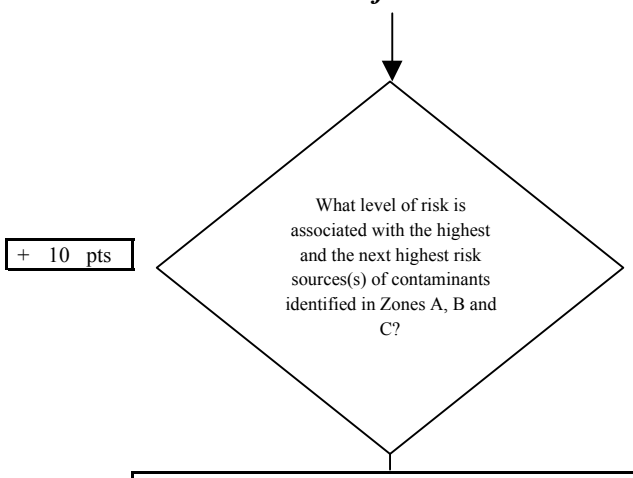


Chart 11. Contaminant risks for Alaska Children's Services - Synthetic Organic Chemicals



+ 10 pts

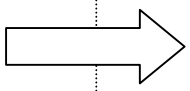
Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	2	3	5

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

Matrix Score 10

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



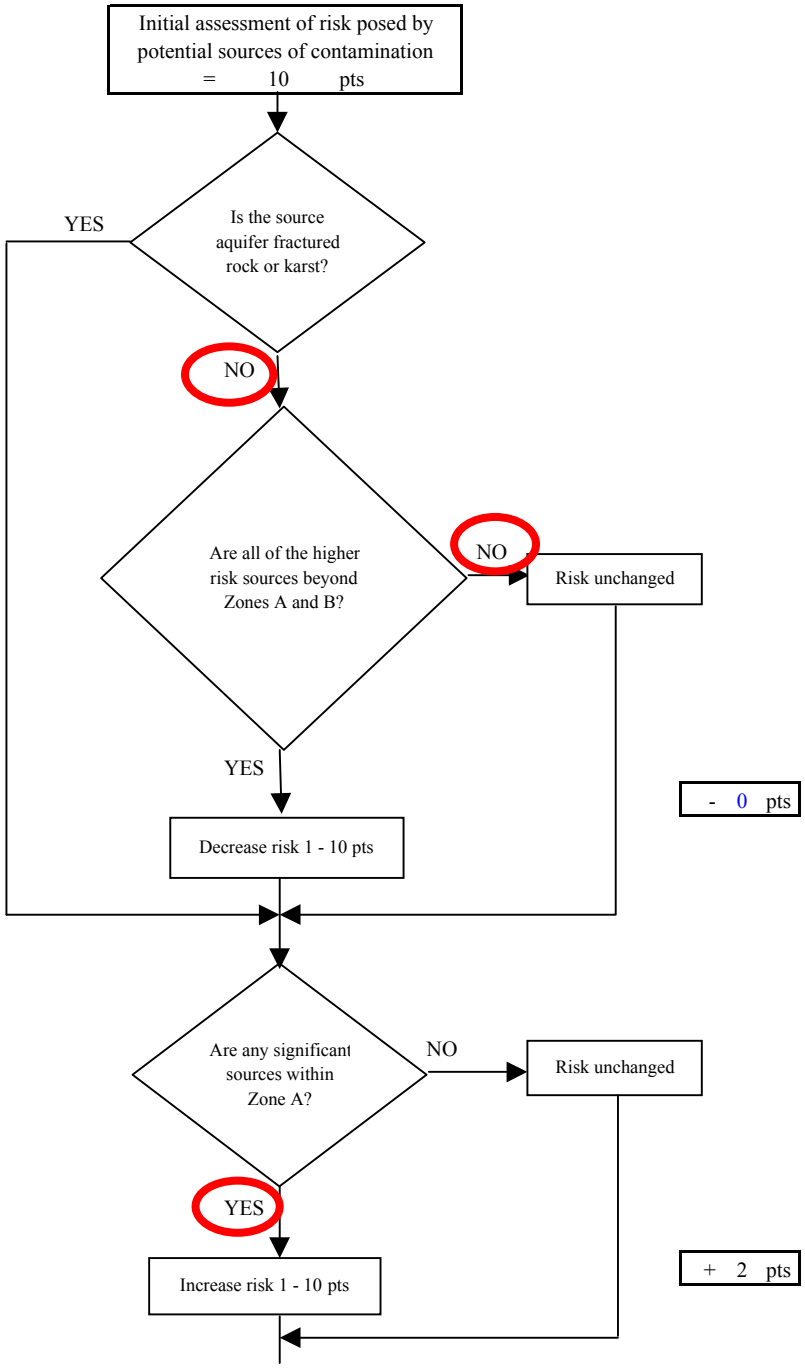


Chart 11. Contaminant risks for Alaska Children's Services - Synthetic Organic Chemicals

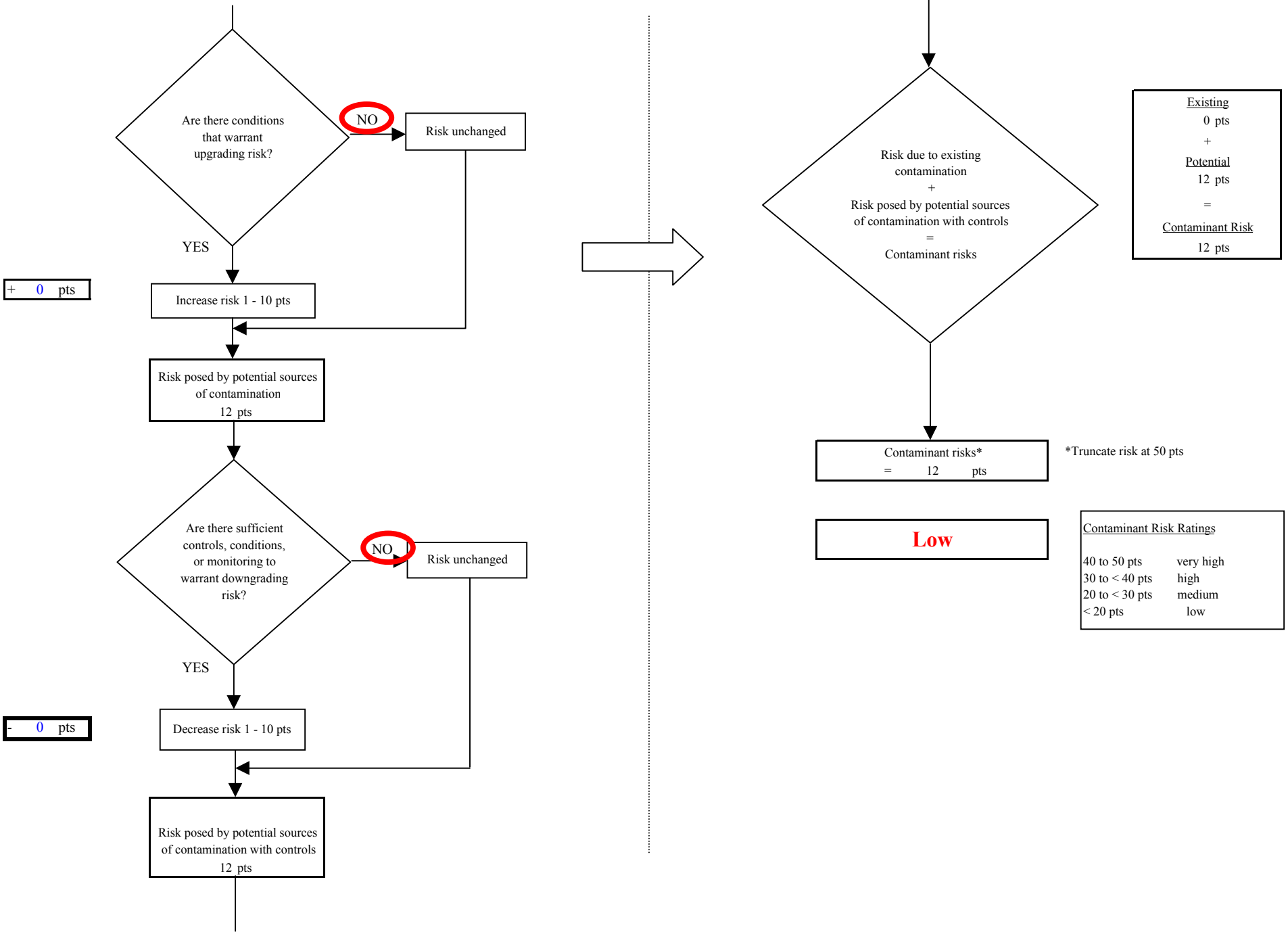


Chart 12. Vulnerability analysis for Alaska Children's Services - Synthetic Organic Chemicals

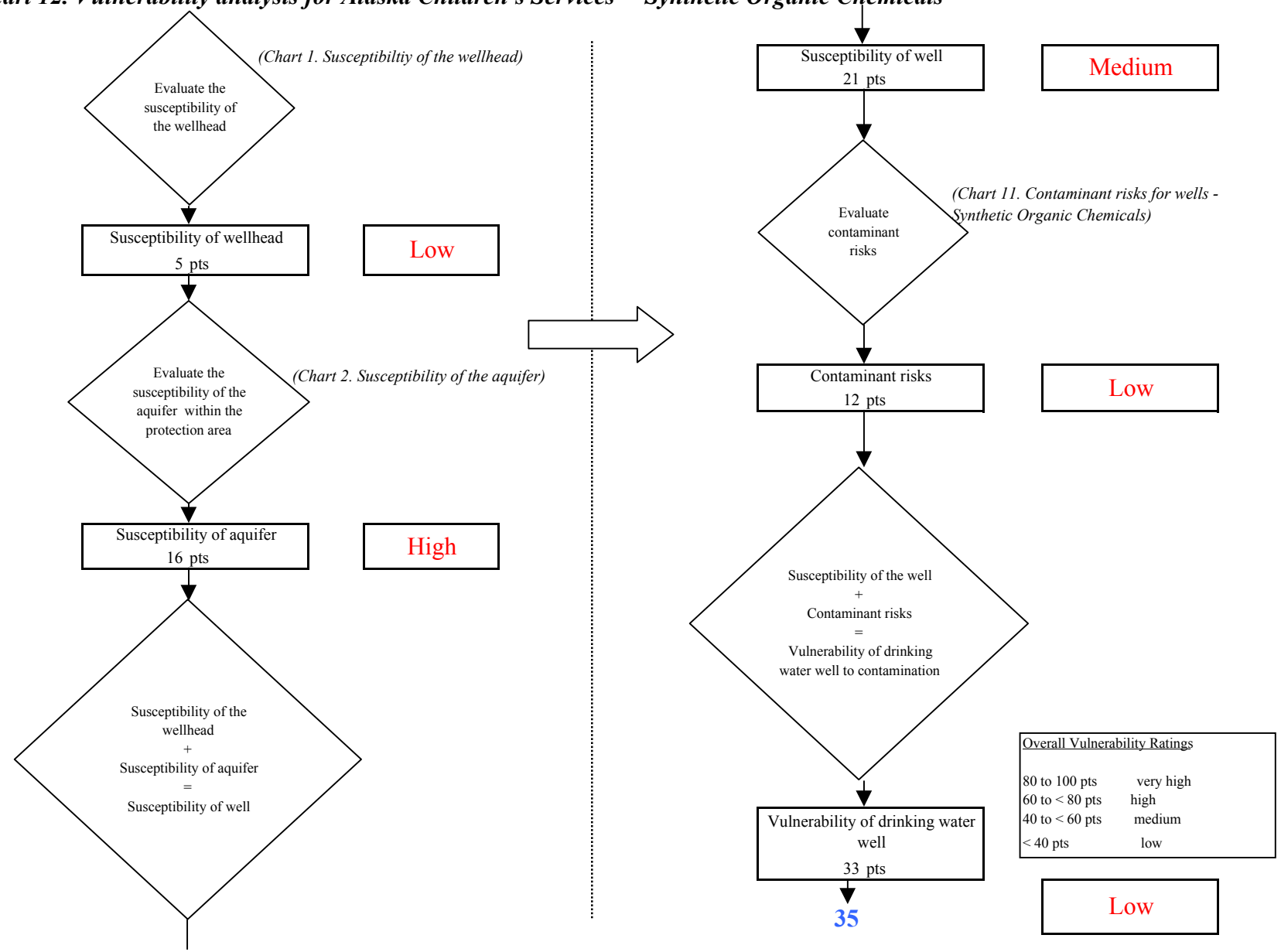


Chart 13. Contaminant risks for Alaska Children's Services - Other Organic Chemicals

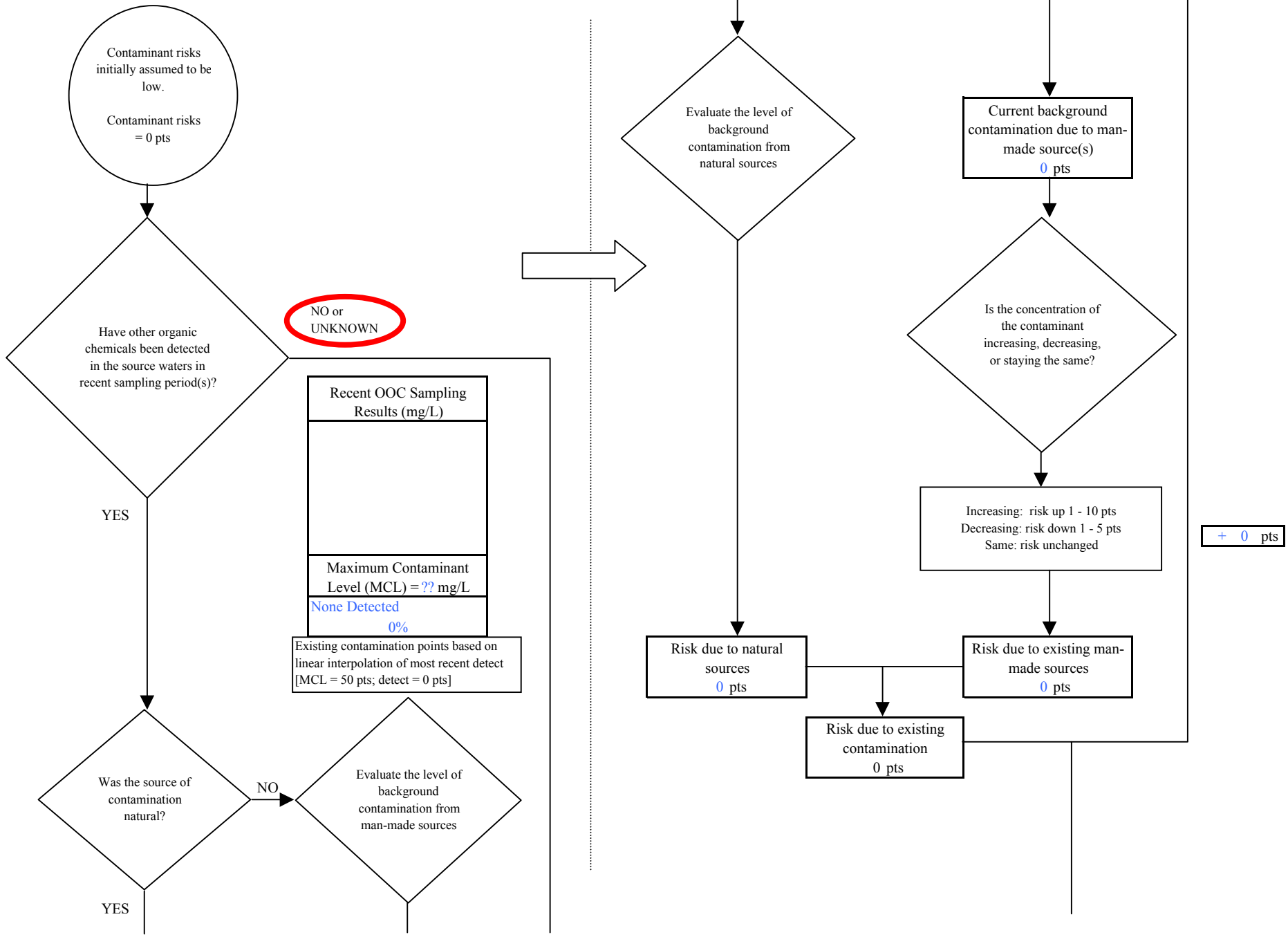


Chart 13. Contaminant risks for Alaska Children's Services - Other Organic Chemicals

+ 10 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	2	5	7

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

Matrix Score 10

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

Initial assessment of risk posed by potential sources of contamination = 10 pts

Is the source aquifer fractured rock or karst?

YES

NO

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

NO

Risk unchanged

YES

Decrease risk 1 - 10 pts

- 0 pts

Are any significant sources within Zone A?

NO

Risk unchanged

YES

Increase risk 1 - 10 pts

+ 2 pts

Chart 13. Contaminant risks for Alaska Children's Services - Other Organic Chemicals

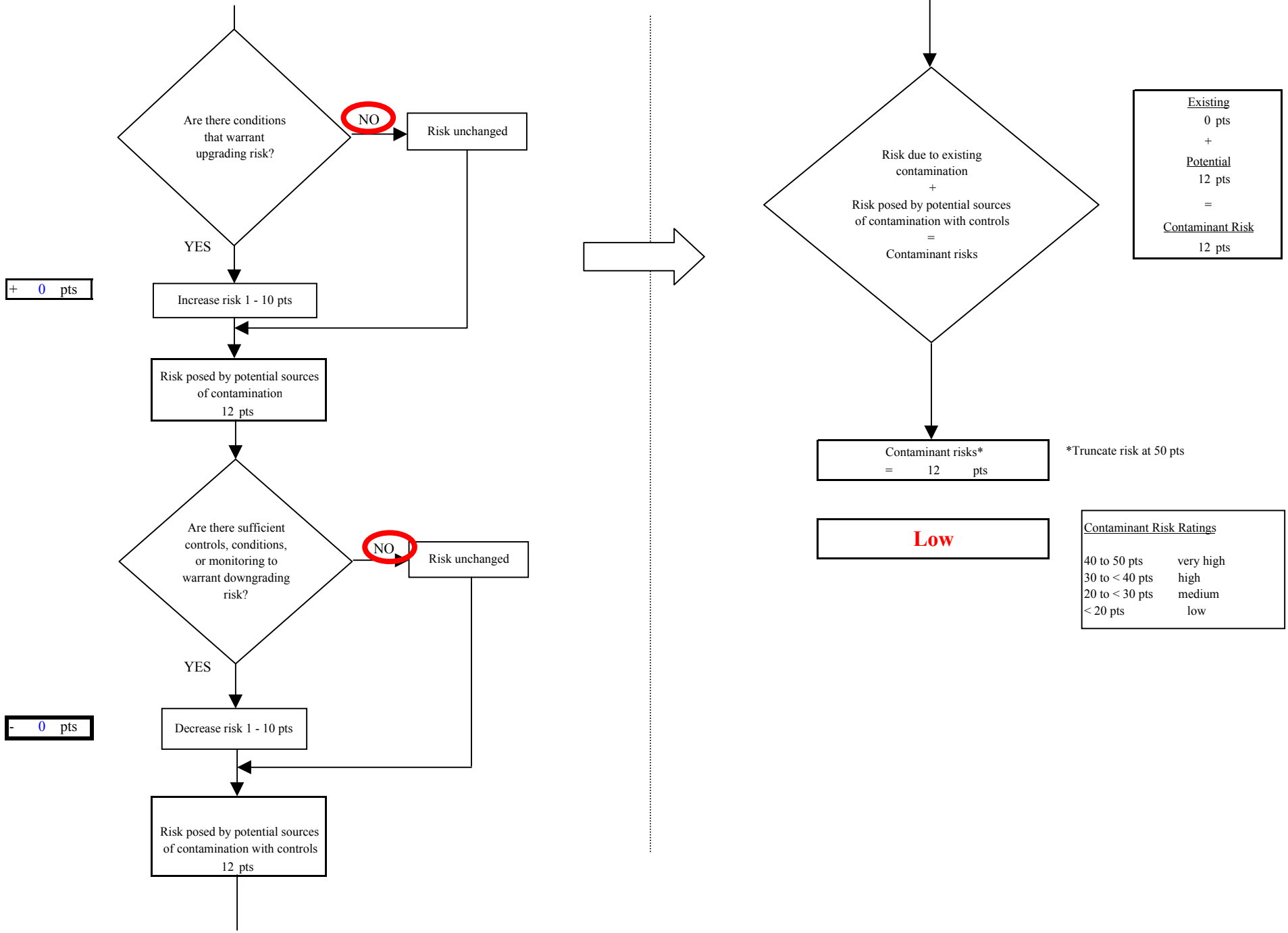


Chart 14. Vulnerability analysis for Alaska Children's Services - Other Organic Chemicals