Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Alaska Commercial Store Drinking Water System, King Salmon, Alaska

PWSID # 262822.001

March 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1211
Alaska Department of Environmental Conservation

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The Drinking Water Protection Program (DWPP) is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

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Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

Alaska Commercial Store (formally King Salmon City Market) has one Public Water System (PWS) well. The well (PWSID# 262822.001) is said to have been drilled around 1951 and has presumably been used as a drinking water source since that time.

The well is a Class B (transient/non-community) water system located behind the Alaska Commercial Store in King Salmon, Alaska. This system operates year-round and serves approximately 200 non-residents and five residents seasonally through two service connections. Well water is not treated. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **High** rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for the primary public drinking water source include: aboveground fuel tanks, sewer lines, ADEC recognized contaminated sites, roads, injection wells, and leaking underground storage tanks. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the water well received a vulnerability rating of **High** for the bacteria and viruses, a vulnerability rating of **High** for nitrates and nitrites, and a vulnerability rating of **Very High** for volatile organic chemicals contaminant categories.

ALASKA COMMERCIAL STORE PUBLIC DRINKING WATER SYSTEM

Alaska Commercial Store water well is a Class B (transient/non-community) public water system. The store is located on King Salmon-Naknek Road in King Salmon, Alaska (Sec. 23, T017S, R045W, Seward Meridian; see Map A of Appendix A). King Salmon is located on the north bank of the Naknek River near Bristol Bay. The village is located about 15 miles upriver from Naknek and 280 miles southwest of Anchorage. The community has a population of 392 (ADCED, 2003). Average annual precipitation in King Salmon is 20 inches, including approximately 45 inches of snowfall. Temperatures range from 42 to 63°F in summer and 29 to 44°F in winter. Temperatures can be as extreme as -46 to 88°F.

The community of King Salmon gets most of their water supply from individual wells. Most households are served by the piped sewage collection system and the remaining households have individual septic tanks (ADCED, 2003). King Salmon receives electrical power from the Naknek Electric Association operated by the REA Cooperative. Power generating facilities are fueled by diesel. Refuse is collected by the Peterson Sanitation Company and trucked to the landfill located at mile five of the King Salmon-Naknek Road (ADCED, 2003).

According to information supplied by ADEC for the Alaska Commercial Store PWS, the depth of the primary water well is 109 feet below the ground surface and is likely screened in an unconfined aquifer based on available construction details. Unconfined aquifers are likely more susceptible to groundwater impacts resulting from the downward migration of surface contaminants. Based on available data for PWSID's in the local area, the well is assumed to be screened in a sandy material. The well is not located in a floodplain.

Information acquired from a September 1999 sanitary survey for the public water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces potential of contaminant migration down the well casing annulus. It is assumed that the well is not grouted according to ADEC regulations based on the date of installation (1951). Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The entire Bristol Bay area was formerly covered by glaciers and the topography is representative of a postglacial area. Soils information is limited. Generally, the soils consist of silty sand overlying

relatively clean sand. The silty soils are slightly frost-susceptible. Isolated pockets of permafrost are scattered throughout the area (DOWL, 1982).

ALASKA COMMERCIAL STORE DRINKING WATER PROTECTION AREA

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

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the Alaska Commercial Store PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

The protection areas established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well (Please refer to the Guidance Manual for Class B Public Water Systems for additional information).

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

Table 1. Definition of Zones

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

The DWPA for the Alaska Commercial Store PWS was determined using an analytical calculation and includes Zones A, B, C, and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Alaska Commercial Store DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class B public water system assessments, three categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses,
- Nitrates and/or nitrites,
- Volatile organic chemicals.

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

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low,
- Medium,
- High, and
- Very High.

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well.

Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

VULNERABILITY OF THE ALASKA COMMERCIAL STORE DRINKING WATER SYSTEM

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

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains eight charts, which together form the 'Vulnerability Analysis' for a source water assessment for a public drinking water source. Chart 1 analyzes the 'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

A score for the Natural Susceptibility is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)
(Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points)
(Chart 2 of Appendix D)

=

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

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

The Alaska Commercial Store's water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the Susceptibility scores and ratings for both wells in this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Wellhead	5	Low
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	30	High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings	
40 to 50 pts	Very High
30 to < 40 pts	High
20 to < 30 pts	Medium
< 20 pts	Low

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	35	High
Nitrates and/or Nitrites	36	High
Volatile Organic Chemicals	50	Very High

Finally, an overall vulnerability score is assigned for each water system by combining each of the

contaminant risk scores with the natural susceptibility score:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

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

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings	
80 to 100 pts	Very High
60 to < 80 pts	High
40 to < 60 pts	Medium
< 40 pts	Low

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the three categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	65	High
Nitrates and Nitrites	65	High
Volatile Organic Chemicals	80	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **High**. The risk is primarily attributed to the presence of injection wells in Zone B and partially attributed to sewer lines and roads in Zones A and B (see Table 2 – Appendix B).

No positive bacteria counts were reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Only a small amount of bacteria and viruses are required to endanger public health.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination remains **High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **High**. The risk to this source of public drinking water is primarily attributed to the presence of injection wells in Zone B and partially attributed to sewer lines and roads in Zones A, B, and C (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in recent sampling events. However, the reported concentrations of nitrates do not exceed the maximum contaminant level (MCL) of 10 mg/L. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Nitrate levels are often derived from the decomposition of organic matter in soils. Although the nitrate source is unknown, such occurrences may be attributed to septic systems or other sources. After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to nitrate and nitrite contamination remains **High**.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of numerous DEC recognized contaminated sites and aboveground fuel tanks located in Zones A, B, and C. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

No recent sampling data was available in ADEC records for the Alaska Commercial Store (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination remains **Very High**.

Using the Source Water Assessment

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 the Alaska Commercial Store and the community of King Salmon 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 the drinking water source.

REFERENCES

Alaska Department of Community and Economic Development (ADCED), 2003 [WWW document]. URL: http://www.dced.state.ak.us/cbd/commdb/CF_COMDB.htm

Alaska Department of Environmental Conservation, Contaminated Sites Database, 2003 [WWW database], URL http://www.state.ak.us/dec/dspar/csites/cs_search.htm

Alaska Department of Environmental Conservation, Leaking Underground Storage Tank Database, 2003 [WWW database], URL http://www.dec.state.ak.us/spar/stp/ust/search/fac_search.asp

DOWL Engineers (DOWL), 1982, Upper Bristol Bay Region Community Planning Profiles.

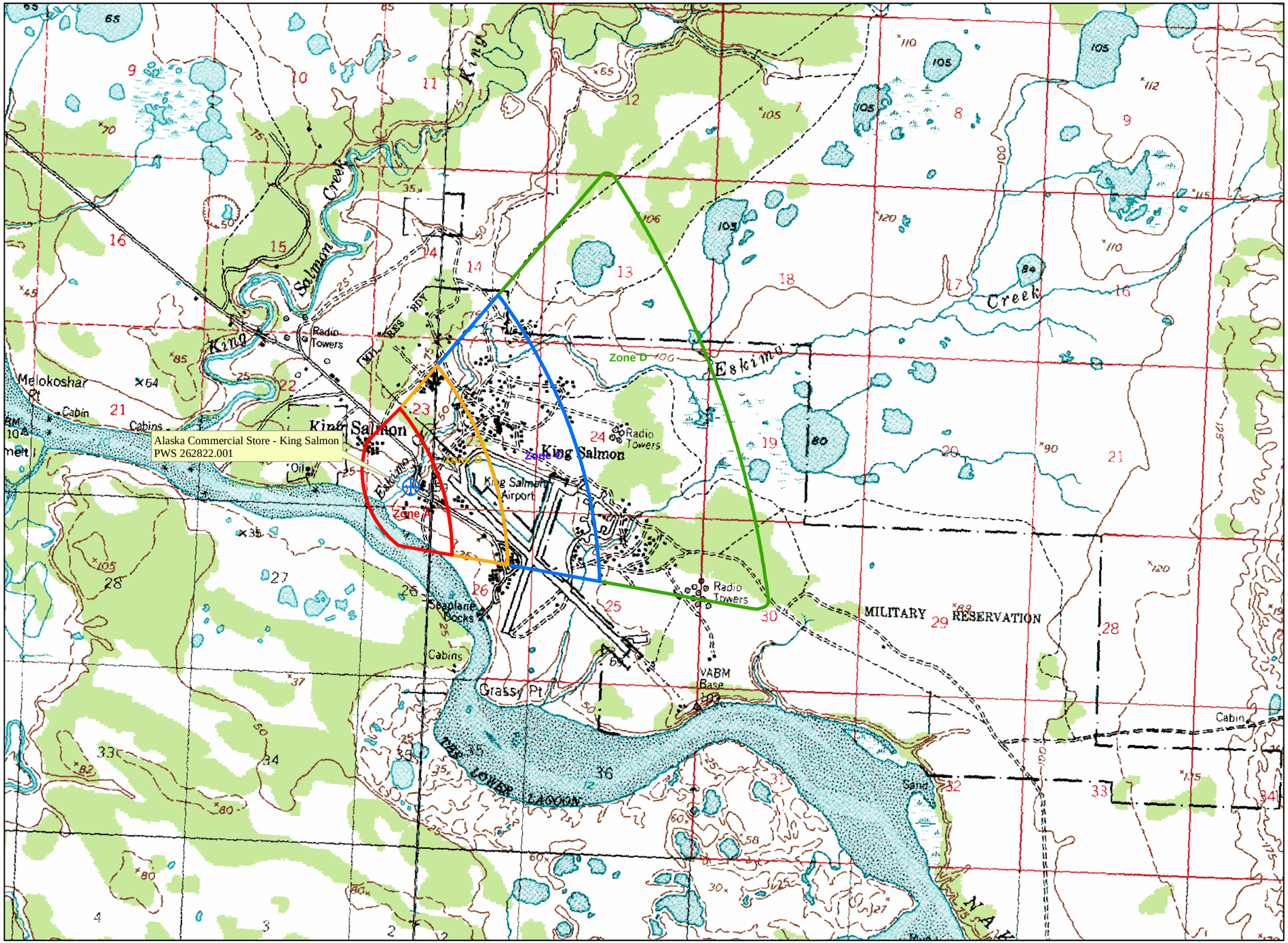
Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey

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

APPENDIX A

Drinking Water Protection Area Location Map
(Map A)

Public Water Well System for PWS #262822.001 Alaska Commercial Store - King Salmon (Former King Salmon City Market)



LEGEND

- Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours (approx. 50 ft.)

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)
- Road Ferry Crossing

Groundwater Protection Zones

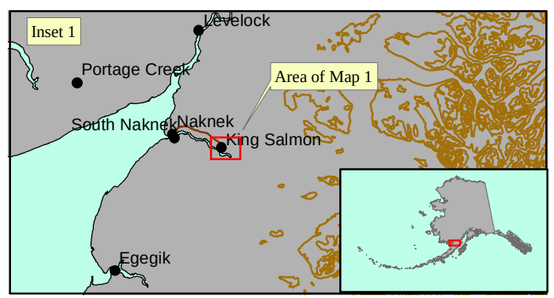
- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone C Protection Area– 5 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time

Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



0 0.25 0.5 1 1.5 2 Miles

Alaska Commercial Store
PWS 262822.001

Appendix A Map 1

APPENDIX B

Contaminant Source Inventory and Risk Rankings (Tables 1-4)

Table 1

Contaminant Source Inventory for ***AK Commercial Store***

PWSID 262822.00

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-01	A	C	Assumed to be 11-20 sewer lines located in Zone A
Residential Areas	R01	R01-01	A	C	Assumed to be less than 50 acres of residential area in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	C	Assumed to be 40 or less residential above ground heating oil tanks located in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-22	A	C	King Salmon AS OTO27 GW Zone 1. ADEC RecKey# - 199625X92801. Si status is active and unranked in priority. Petroleum and solvent contaminati site. Continued operation, monitoring of remediation system, and long term monitoring.
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	C	Assumed to be 20 or less roads located in Zone A
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-02	B	C	Assumed to be 21-30 sewer lines located in Zone B
Injection wells (Class V) Large-Capacity Septic System (Drainfie Disposal Method)	D10	D10-01	B	C	
Residential Areas	R01	R01-02	B	C	Assumed to be less than 100 acres of residential area in Zone B
Tanks, heating oil, residential (above ground)	R08	R08-02	B	C	Assumed to be 75 or less residential above ground heating oil tanks located in Zone B
Tanks, diesel (underground)	T08	T08-01	B	C	
Tanks, diesel (underground)	T08	T08-02	B	C	
Tanks, diesel (underground)	T08	T08-03	B	C	
Tanks, diesel (underground)	T08	T08-04	B	C	
Tanks, gasoline (underground)	T12	T12-01	B	C	
Tanks, gasoline (underground)	T12	T12-02	B	C	
Tanks, gasoline (underground)	T12	T12-03	B	C	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	B	C	MOGAS Station. ADEC RecKey# - 198825X020207. Site status is closed, v medium priority. Petroleum contamination at site. Site is currenty being remediated via. bioventing. Residual contamination present at site
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	B	C	King Salmon Air Station SS12U. ADEC RecKey# - 198825X120201. Site st is active with high priority. Soil and groundwater petroleum contamination site. Seepage into Naknek river. Passive remediation conducted at site via. natural attenuation.

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-03	B	C	King Salmon Air Station SS11. ADEC RecKey# - 198825X920204. Site stat is active with high priority. Soil and groundwater petroleum and solvent contamination at site. Treatment system is operated, moitored, maintained.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-04	B	C	King Salmon Air Station SS12L. ADEC RecKey# - 198825X120203. Site st is active with high priority. Soil and groundwater petroleum contamination site. Passive remediation conducted at site via. natural attenuation.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-05	B	C	King Salmon Air Station FT01/RAPCON. ADEC RecKey# - 198825X1202(Site status is active with high priority. Soil and groundwater petroleum and solvent contamination at site. Active remediation at site via air-sparging and bioventing.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-06	B	C	King Salmon Air Station SS16. ADEC RecKey# - 198825X120209. Site stat is closed with low priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-07	B	C	King Salmon Air Station SD09. ADEC RecKey# - 198825X120210. Site sta is closed with high priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-08	B	C	King Salmon Air Station SS15. ADEC RecKey# - 198825X133703. Site stat is active with medium priority. Soil and groundwater petroleum contaminatic present at site. Continued remediation at site and long term monitoring
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-09	B	C	King Salmon Air Station DP13. ADEC RecKey# - 198825X1920205. No further remedial action at site with low priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-10	B	C	King Salmon Air Station LF06. ADEC RecKey# - 198825X920206. No furt remedial action at site with low priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-11	B	C	King Salmon Air Station SS21. ADEC RecKey# - 198825X920208. Site stat is active with high priority. Solid waste disposal area. Continued bioventing a long term monitoring.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-12	B	C	King Salmon Air Station LF14. ADEC RecKey# - 1999025X904003. Site st is active with high priority. Solid waste disposal area. Continued operation o water treatment system and monitoring
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-13	B	C	King Salmon Air Station LF05. ADEC RecKey# - 1999025X904004. Site st is active with high priority. Solid waste disposal area. Continued operation o water treatment system and monitoring.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-14	B	C	King Salmon Air Station OT10. ADEC RecKey# - 1999025X904005. Site s is active with medium priority. Petroleum and PCB contamination at site. Remedial action conducted at site; however site has not been fully characteriz
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-15	B	C	King Salmon Combat Alert Cell. ADEC RecKey# - 1999225X014202. Site status is inactive with medium priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-16	B	C	Orphan Drums. ADEC RecKey# - 1999225X919301. Site status is active wi low priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-17	B	C	Mark Air King Salmon. ADEC RecKey# - 1993250120601. Site status is ac with high priority. Soil and groundwater petroleum contamination at site.

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-18	B	C	FAA King Salmon Warehouse. ADEC RecKey# - 1993250122551. Site stat is active with low priority. Petroleum contamination at site. Drinking water at King Salmon airport is no longer potable.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-19	B	C	NPS Katmai Spill. ADEC RecKey# - 1994250120201. Site status is closed v medium priority. Petroleum contamination at site.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-21	B	C	ADOT&PF Airport Maint. Bldg. -K.S. ADEC RecKey# - 1995250107201. S status is inactive with high priority. Suspect petroleum contamination at site Public well less than 1000 feet from site.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-24	B	C	King Salmon Air Station. ADEC RecKey# - 199725X104301. Site status is active with low priority. Petroleum contamination at site. Request submitted No Further Remedial Action Planned..
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-25	B	C	King Salmon Air Station DP23. ADEC RecKey# - 199725X104302. Site sta is closed with medium priority. Petroleum and other contamination at site. Remedial actions performed at site.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-26	B	C	King Salmon Air Station SS22. ADEC RecKey# - 199725X104303. Site stat is active with high priority. Petroleum and solvent contamination at site. Proposed long term annual monitoring, and institutional controls.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-27	B	C	King Salmon Air Station LF07. ADEC RecKey# - 199725X104304. Site sta is active with high priority. Former landfill. Remedial actions proposed.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-28	B	C	King Salmon Air Station SS20. ADEC RecKey# - 199725X104305. Site stat is closed with high priority. Old power plant building. Continued remedial actions and monitoring.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-29	B	C	King Salmon Air Station FT02. ADEC RecKey# - 199725X104306. Site sta is active with low priority.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-30	B	C	King Salmon Air Station FT04. ADEC RecKey# - 199725X104307. Site sta is active with high priority. Soil and groundwater are contaminated with petroleum and solvents. Final remedial actions proposed.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-31	B	C	King Salmon Air Station SS17. ADEC RecKey# - 199725X104308. Site stat is closed with high priority.
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-01	B	C	FAA - King Salmon. ADEC RecKey# - 1993250022551. High priority site. Gasoline and diesel contamination reported at site.
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	C	Assumed to be 20 or less roads located in Zone B
Domestic wastewater collection systems (sewer lines or lift stati	D01	D01-03	C	C	Assumed to be 1-10 sewer lines located in Zone C
Residential Areas	R01	R01-03	C	C	Assumed to be less than 100 acres of residential area in Zone C
Tanks, heating oil, residential (above ground)	R08	R08-03	C	C	Assumed to be 75 or less residential above ground heating oil tanks located in Zone C
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-20	C	C	Eskimo Creek - Eddie's Fireplace Inn. ADEC RecKey# - 1994250122801. S status is active with medium priority. Soil and groundwater petroleum contamination at site. Active groundwater and soil remediation at site.

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-23	C	C	King Salmon AS OTO28 GW Zone 2. ADEC RecKey# - 199625X92802. Si status is active and unranked in priority. Petroleum and solvent contaminati site. Continued operation, monitoring of remediation system, and long term monitoring.
Highways and roads, paved (cement or asphalt)	X20	X20-03	C	C	Assume to be less than 20 roads located in Zone C
Residential Areas	R01	R01-04	D	C	Assumed to be less than 50 acres of residential area in Zone D
Tanks, heating oil, residential (above ground)	R08	R08-04	D	C	Assumed to be 10 or less residential above ground heating oil tanks located in Zone C
Highways and roads, dirt/gravel	X24	X24-01	D	C	Assumed to be less than 20 roads located in Zone D

Table 2

Contaminant Source Inventory and Risk Ranking for AK Commercial Store Sources of Bacteria and Viruses

PWSID 262822.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	Assumed to be 11-20 sewer lines located in Zone A
Residential Areas	R01	R01-01	A	Low	C	Assumed to be less than 50 acres of residential area in Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Assumed to be 20 or less roads located in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-02	B	Medium	C	Assumed to be 21-30 sewer lines located in Zone B
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	B	High	C	

Table 3

Contaminant Source Inventory and Risk Ranking for AK Commercial Store Sources of Nitrates/Nitrites

PWSID 262822.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Medium	C	Assumed to be 11-20 sewer lines located in Zone A
Residential Areas	R01	R01-01	A	Low	C	Assumed to be less than 50 acres of residential area in Zone A
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Assumed to be 20 or less roads located in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-02	B	Medium	C	Assumed to be 21-30 sewer lines located in Zone B
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	B	High	C	
Residential Areas	R01	R01-02	B	Low	C	Assumed to be less than 100 acres of residential area in Zone B
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	C	Assumed to be 20 or less roads located in Zone B
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-03	C	Medium	C	Assumed to be 1-10 sewer lines located in Zone C
Residential Areas	R01	R01-03	C	Low	C	Assumed to be less than 100 acres of residential area in Zone C
Highways and roads, paved (cement or asphalt)	X20	X20-03	C	Low	C	Assume to be less than 20 roads located in Zone C

Table 4

Contaminant Source Inventory and Risk Ranking for AK Commercial Store
Sources of Volatile Organic Chemicals

PWSID 262822.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-01	A	Low	C	Assumed to be 11-20 sewer lines located in Zone A
Residential Areas	R01	R01-01	A	Low	C	Assumed to be less than 50 acres of residential area in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assumed to be 40 or less residential above ground heating oil tanks located Zone A
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-22	A	High	C	King Salmon AS OTO27 GW Zone 1. ADEC RecKey# - 199625X92801. S status is active and unranked in priority. Petroleum and solvent contamina at site. Continued operation, monitoring of remediation system, and long t monitoring.
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	C	Assumed to be 20 or less roads located in Zone A
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-02	B	Low	C	Assumed to be 21-30 sewer lines located in Zone B
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	B	Low	C	
Residential Areas	R01	R01-02	B	Low	C	Assumed to be less than 100 acres of residential area in Zone B
Tanks, heating oil, residential (above ground)	R08	R08-02	B	Medium	C	Assumed to be 75 or less residential above ground heating oil tanks located Zone B
Tanks, diesel (underground)	T08	T08-01	B	High	C	
Tanks, diesel (underground)	T08	T08-02	B	High	C	
Tanks, diesel (underground)	T08	T08-03	B	High	C	
Tanks, diesel (underground)	T08	T08-04	B	High	C	
Tanks, gasoline (underground)	T12	T12-01	B	High	C	
Tanks, gasoline (underground)	T12	T12-02	B	High	C	
Tanks, gasoline (underground)	T12	T12-03	B	High	C	
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-01	B	High	C	MOGAS Station. ADEC RecKey# - 198825X020207. Site status is closed with medium priority. Petroleum contamination at site. Site is currenty bei remediated via. bioventing. Residual contamination present at site
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-02	B	High	C	King Salmon Air Station SS12U. ADEC RecKey# - 198825X120201. Site status is active with high priority. Soil and groundwater petroleum contamination at site. Seepage into Naknek river. Passive remediation conducted at site via. natural attenuation.

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for AK Commercial Store Sources of Volatile Organic Chemicals

PWSID 262822.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-03	B	High	C	King Salmon Air Station SS11. ADEC RecKey# - 198825X920204. Site status is active with high priority. Soil and groundwater petroleum and sol contamination at site. Treatment system is operated, moitored, maintaine
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-04	B	High	C	King Salmon Air Station SS12L. ADEC RecKey# - 198825X120203. Site status is active with high priority. Soil and groundwater petroleum contamination at site. Passive remediation conducted at site via. natural attenuation.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-05	B	High	C	King Salmon Air Station FT01/RAPCON. ADEC RecKey# - 198825X120204. Site status is active with high priority. Soil and groundw petroleum and solvent contamination at site. Active remediation at site via sparging and bioventing.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-06	B	Low	C	King Salmon Air Station SS16. ADEC RecKey# - 198825X120209. Site status is closed with low priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-07	B	Low	C	King Salmon Air Station SD09. ADEC RecKey# - 198825X120210. Site status is closed with high priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-08	B	High	C	King Salmon Air Station SS15. ADEC RecKey# - 198825X133703. Site status is active with medium priority. Soil and groundwater petroleum contamination present at site. Continued remediation at site and long term monitoring
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-09	B	Low	C	King Salmon Air Station DP13. ADEC RecKey# - 198825X1920205. No further remedial action at site with low priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-10	B	Low	C	King Salmon Air Station LF06. ADEC RecKey# - 198825X920206. No fu remedial action at site with low priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-11	B	High	C	King Salmon Air Station SS21. ADEC RecKey# - 198825X920208. Site status is active with high priority. Solid waste disposal area. Continued bioventing and long term monitoring.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-12	B	High	C	King Salmon Air Station LF14. ADEC RecKey# - 1999025X904003. Site status is active with high priority. Solid waste disposal area. Continued operation of water treatment system and monitoring
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-13	B	High	C	King Salmon Air Station LF05. ADEC RecKey# - 1999025X904004. Site status is active with high priority. Solid waste disposal area. Continued operation of water treatment system and monitoring.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-14	B	High	C	King Salmon Air Station OT10. ADEC RecKey# - 1999025X904005. Site status is active with medium priority. Petroleum and PCB contamination a site. Remedial action conducted at site; however site has not been fully characterized.

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for AK Commercial Store Sources of Volatile Organic Chemicals

PWSID 262822.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-15	B	High	C	King Salmon Combat Alert Cell. ADEC RecKey# - 1999225X014202. Sit status is inactive with medium priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-16	B	Low	C	Orphan Drums. ADEC RecKey# - 1999225X919301. Site status is active low priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-17	B	High	C	Mark Air King Salmon. ADEC RecKey# - 1993250120601. Site status is active with high priority. Soil and groundwater petroleum contamination at
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-18	B	High	C	FAA King Salmon Warehouse. ADEC RecKey# - 1993250122551. Site st is active with low priority. Petroleum contamination at site. Drinking wat well at King Salmon airport is no longer potable.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-19	B	Low	C	NPS Katmai Spill. ADEC RecKey# - 1994250120201. Site status is closed with medium priority. Petroleum contamination at site.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-21	B	High	C	ADOT&PF Airport Maint. Bldg. -K.S. ADEC RecKey# - 1995250107201 Site status is inactive with high priority. Suspect petroleum contamination site. Public well less than 1000 feet from site.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-24	B	High	C	King Salmon Air Station. ADEC RecKey# - 199725X104301. Site status i active with low priority. Petroleum contamination at site. Request submitte for No Further Remedial Action Planned..
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-25	B	High	C	King Salmon Air Station DP23. ADEC RecKey# - 199725X104302. Site status is closed with medium priority. Petroleum and other contamination site. Remedial actions performed at site.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-26	B	High	C	King Salmon Air Station SS22. ADEC RecKey# - 199725X104303. Site status is active with high priority. Petroleum and solvent contamination at Proposed long term annual monitoring, and institutional controls.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-27	B	High	C	King Salmon Air Station LF07. ADEC RecKey# - 199725X104304. Site status is active with high priority. Former landfill. Remedial actions propos
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-28	B	High	C	King Salmon Air Station SS20. ADEC RecKey# - 199725X104305. Site status is closed with high priority. Old power plant building. Continued remedial actions and monitoring.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-29	B	High	C	King Salmon Air Station FT02. ADEC RecKey# - 199725X104306. Site status is active with low priority.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-30	B	High	C	King Salmon Air Station FT04. ADEC RecKey# - 199725X104307. Site status is active with high priority. Soil and groundwater are contaminated w petroleum and solvents. Final remedial actions proposed.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-31	B	High	C	King Salmon Air Station SS17. ADEC RecKey# - 199725X104308. Site status is closed with high priority.

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for AK Commercial Store

Sources of Volatile Organic Chemicals

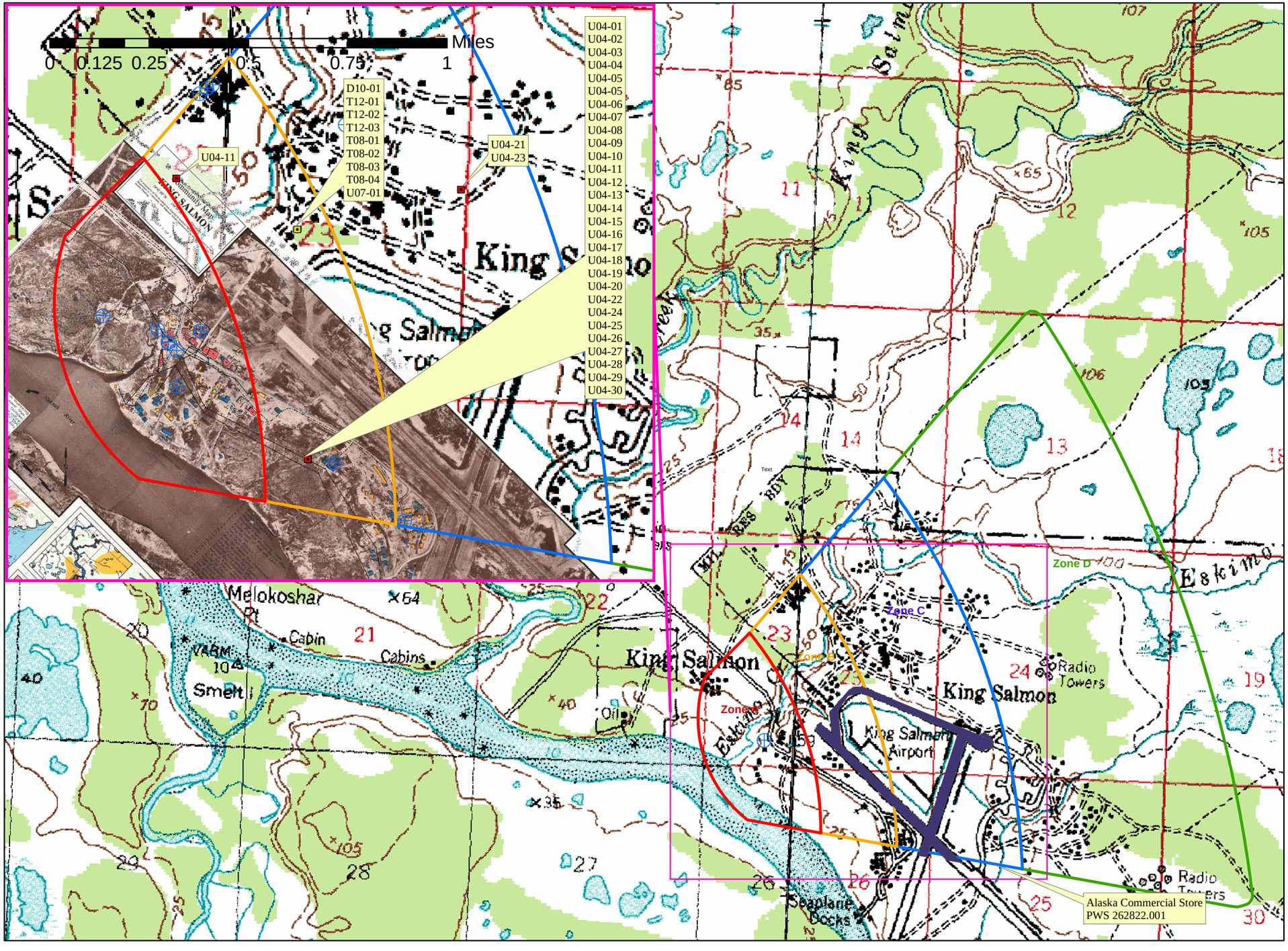
PWSID 262822.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U07-01	B	High	C	FAA - King Salmon. ADEC RecKey# - 1993250022551. High priority sit Gasoline and diesel contamination reported at site.
Highways and roads, paved (cement or asphalt)	X20	X20-02	B	Low	C	Assumed to be 20 or less roads located in Zone B
Domestic wastewater collection systems (sewer line or lift stations)	D01	D01-03	C	Low	C	Assumed to be 1-10 sewer lines located in Zone C
Residential Areas	R01	R01-03	C	Low	C	Assumed to be less than 100 acres of residential area in Zone C
Tanks, heating oil, residential (above ground)	R08	R08-03	C	Medium	C	Assumed to be 75 or less residential above ground heating oil tanks located Zone C
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-20	C	High	C	Eskimo Creek - Eddie's Fireplace Inn. ADEC RecKey# - 1994250122801. status is active with medium priority. Soil and groundwater petroleum contamination at site. Active groundwater and soil remediation at site.
Contaminated sites, DEC recognized, non-Superfun non-RCRA	U04	U04-23	C	High	C	King Salmon AS OTO28 GW Zone 2. ADEC RecKey# - 199625X92802. status is active and unranked in priority. Petroleum and solvent contamina at site. Continued operation, monitoring of remediation system, and long t monitoring.
Highways and roads, paved (cement or asphalt)	X20	X20-03	C	Low	C	Assume to be less than 20 roads located in Zone C

APPENDIX C

Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map C)

Public Water Well System for PWS #262822.001 Alaska Commercial Store - King Salmon (Former King Salmon City Market)
Showing Potential and Existing Sources of Contamination



LEGEND

- Public Water System Well

Hydrography/Physical

- Parcels
- Stream
- Lake or Pond
- Contours

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)
- Road Ferry Crossing

Groundwater Protection Zones

- Zone A Protection Area– Several Months Travel Time
- Zone B Protection Area– 2 Years Travel Time
- Zone C Protection Area– 5 Years Travel Time
- Zone D Protection Area– 10 Years Travel Time

Existing or Potential Contaminant Sources

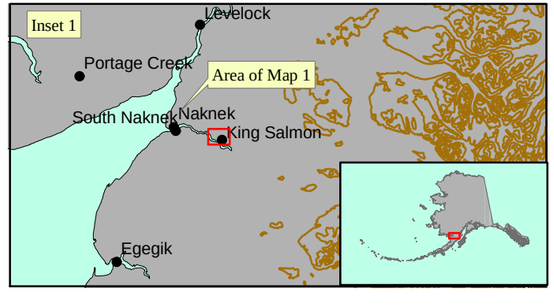
- Injection wells Large-Capacity Septic Systems (Drainfield Disposal Method) (D10)
- Tanks, diesel (underground) (T08)
- Tanks, gasoline (underground) (T12)
- Contaminated sites, DEC recongnized, non-Superfund, non-RCRA (U04)
- Open Leaking Underground Fuel Storage Tank (LUST) (lubricants or other petroleum products) (U07)
- Airport/Landing Strip (X14)

Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

All other data:
United States Geological Survey (USGS)

Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class B Public Water Systems" published by ADEC

URS Corporation does not guarantee the accuracy or validity of the data provided.



0 0.25 0.5 1 1.5 2 Miles

Alaska Comercial Store - King Salmon
PWS 262822.001

Appendix C Map C

APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-8)

Chart 1. Susceptibility of the wellhead - AK Commercial Store (262822.001)

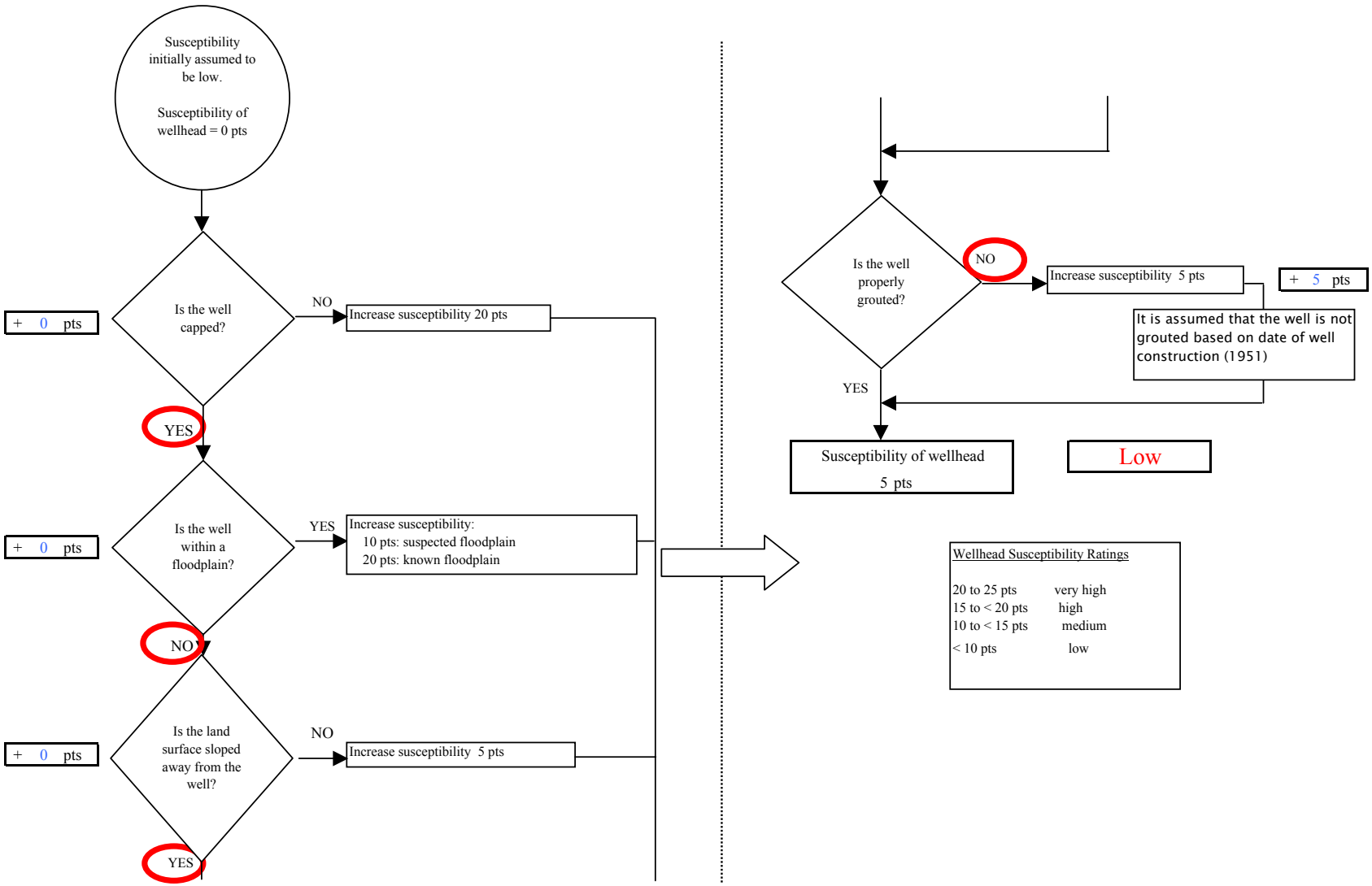


Chart 2. Susceptibility of the aquifer - AK Commercial Store (262822.001)

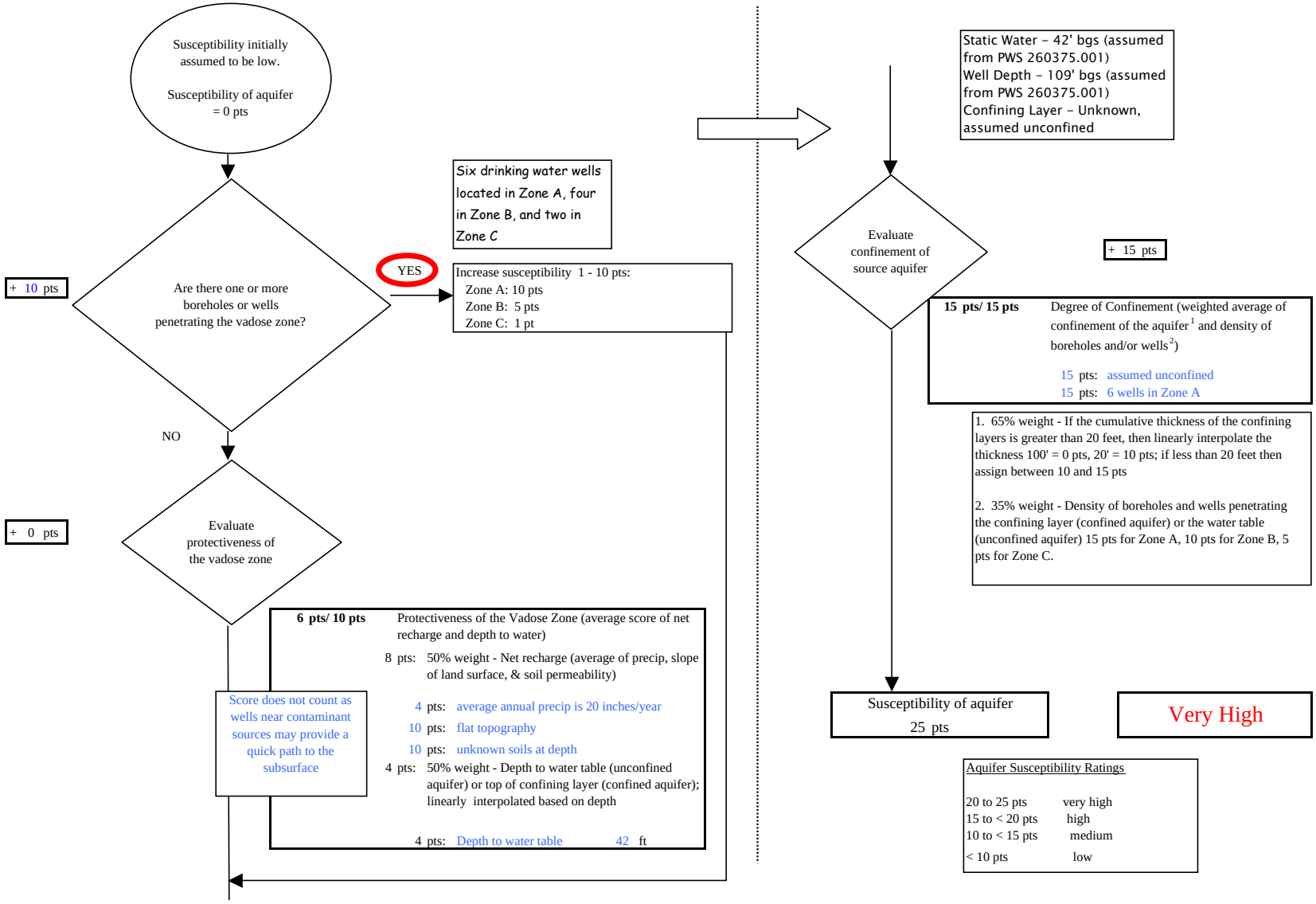
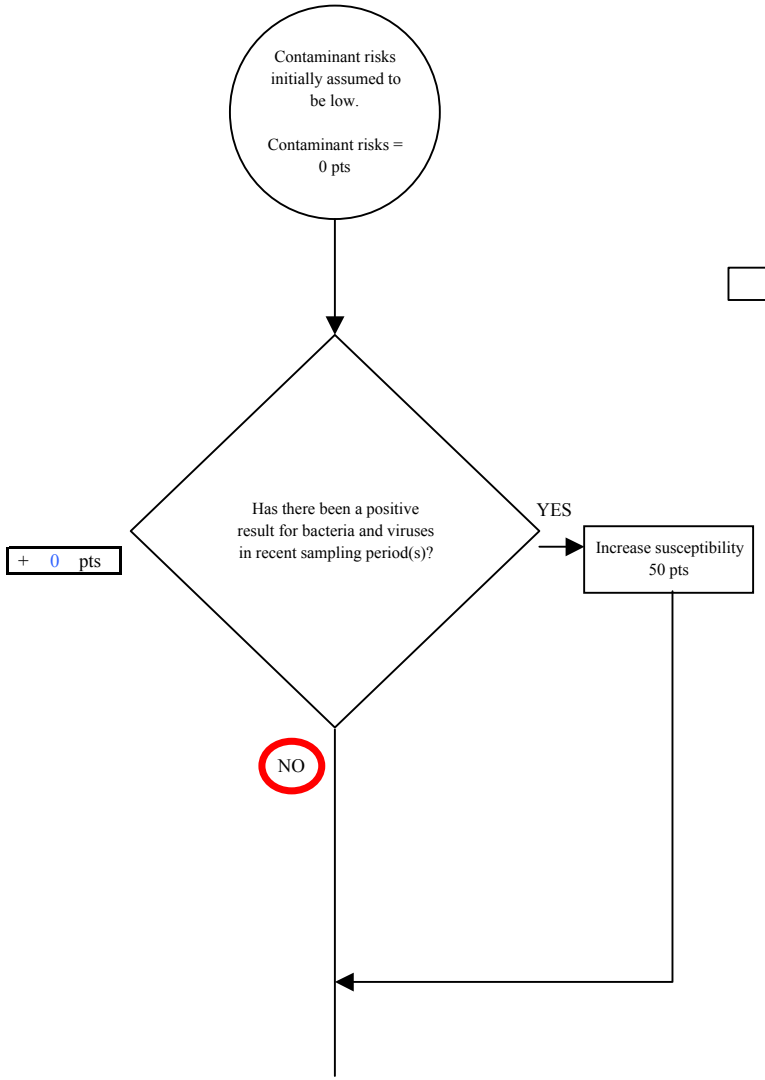
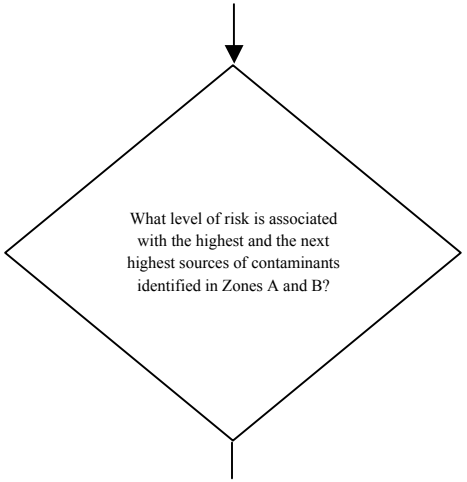


Chart 3. Contaminant risks for AK Commercial Store (262822.001) - Bacteria & Viruses





+ 30 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	1	1
Medium(s)	1	0	1
Low(s)	2	1	3

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

Matrix Score 30

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

Chart 3. Contaminant risks for AK Commercial Store (262822.001) - Bacteria & Viruses

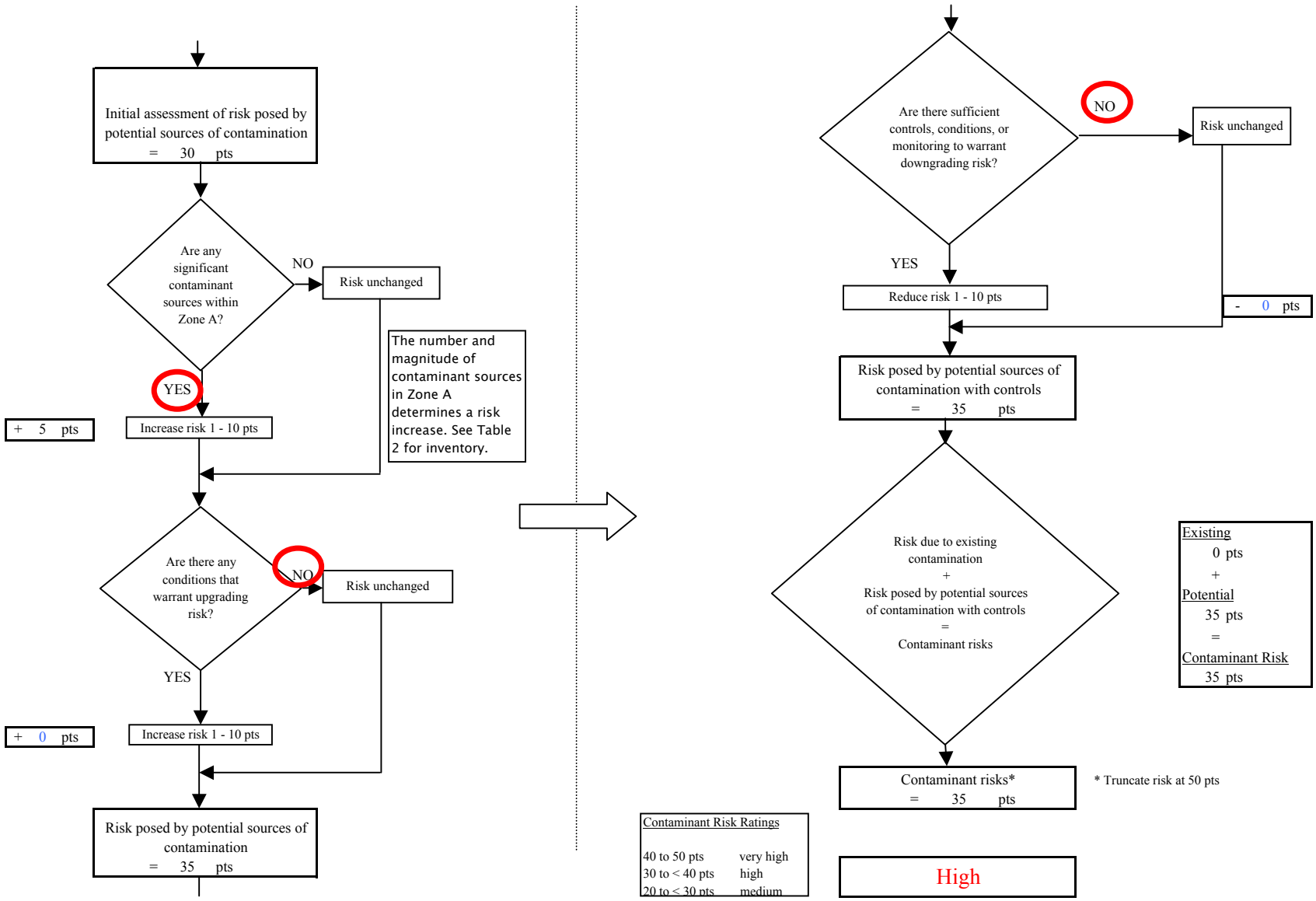


Chart 4. Vulnerability analysis for AK Commercial Store (262822.001) - Bacteria & Viruses

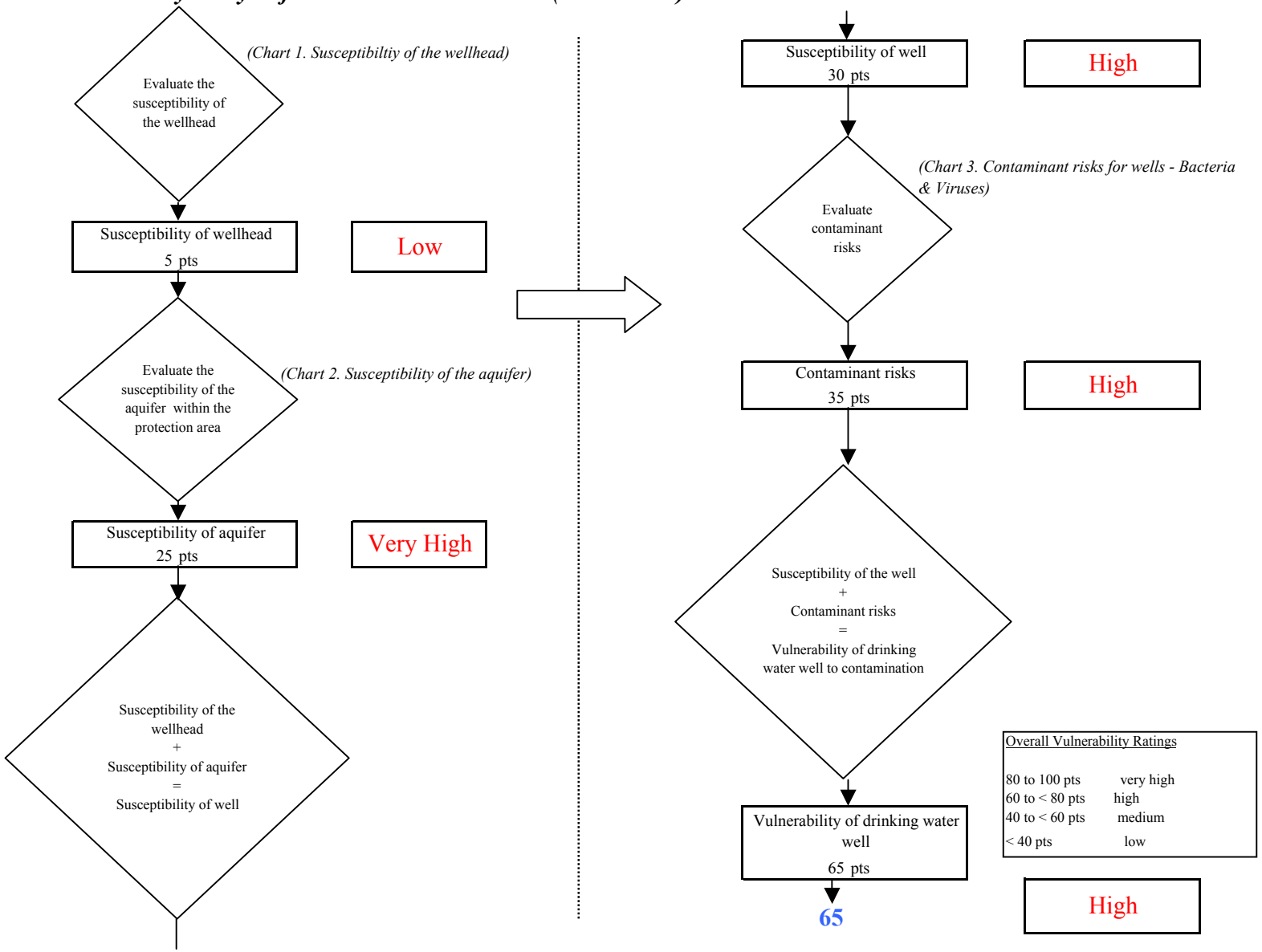


Chart 5. Contaminant risks for AK Commercial Store (262822.001) - Nitrates and Nitrites

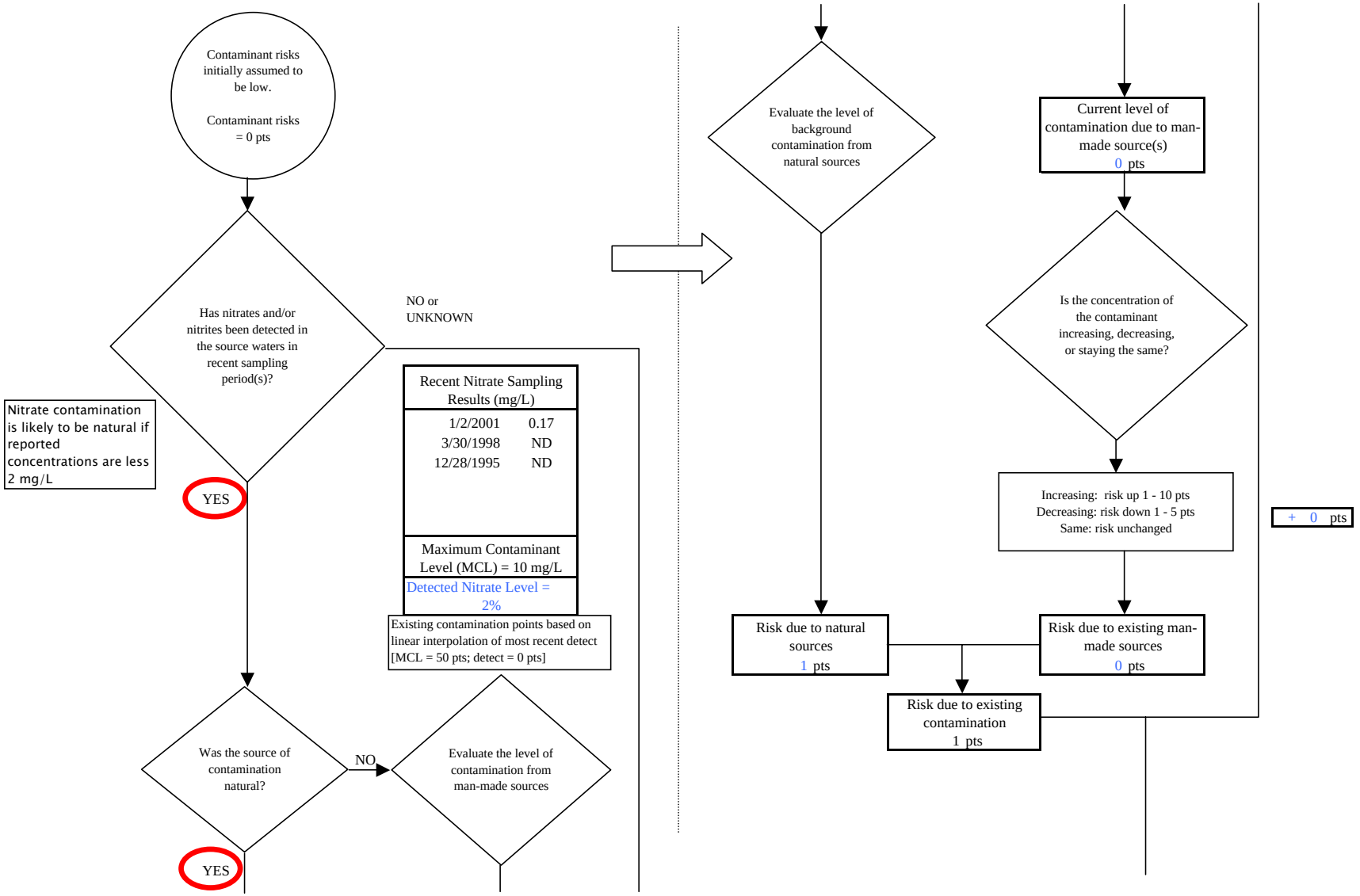


Chart 5. Contaminant risks for AK Commercial Store (262822.001) - Nitrates and Nitrites

+ 30 pts

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

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

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	0	1	1
Medium(s)	1	0	1
Low(s)	2	4	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 30

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

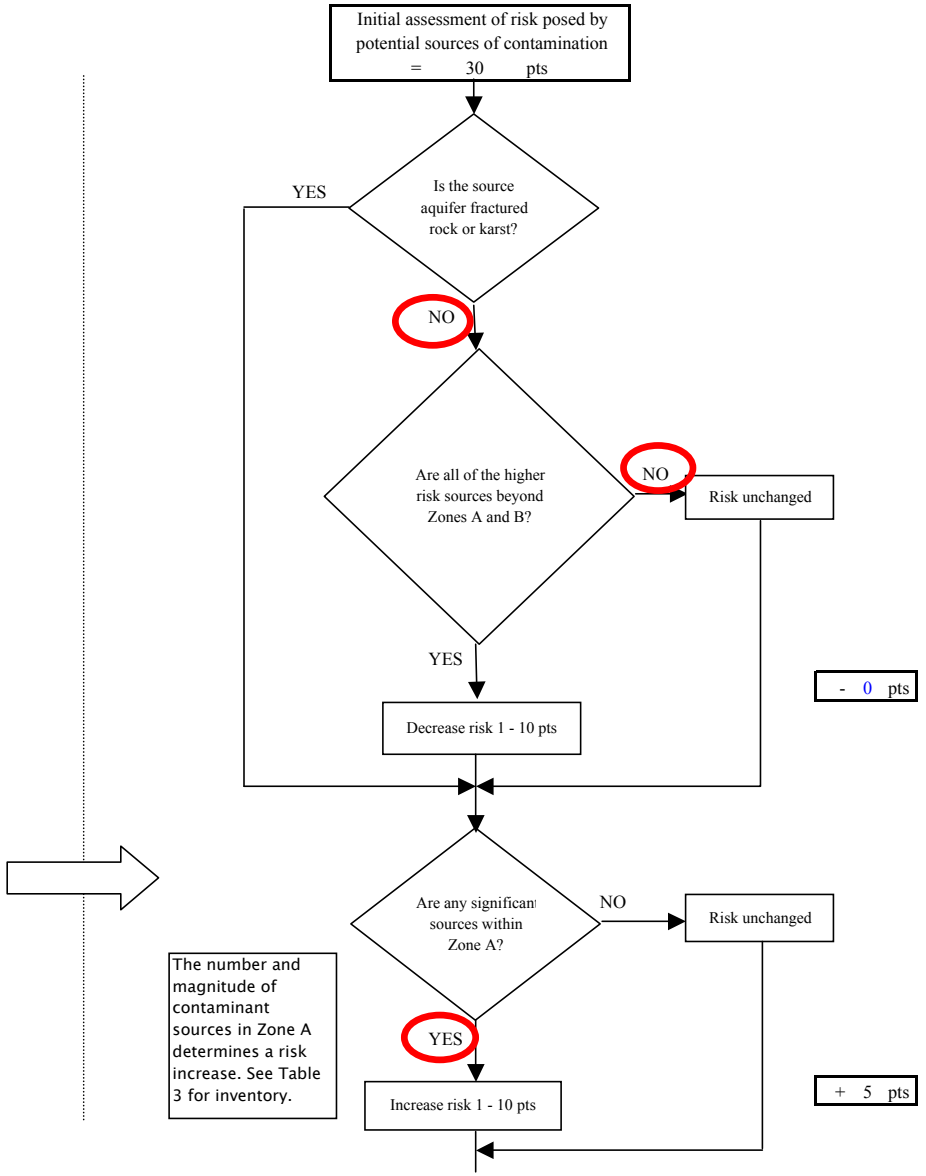


Chart 5. Contaminant risks for AK Commercial Store (262822.001) - Nitrates and Nitrites

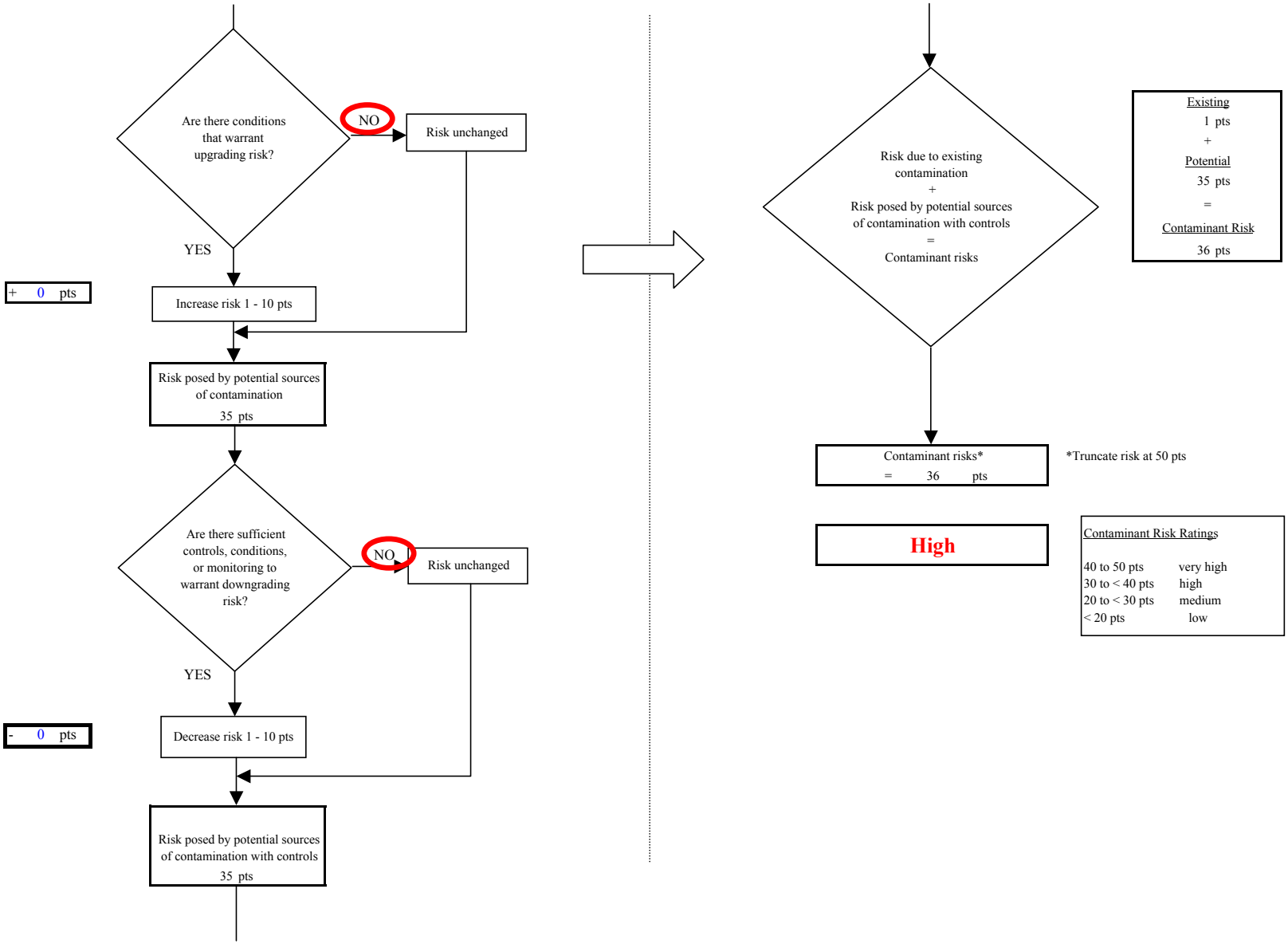


Chart 6. Vulnerability analysis for AK Commercial Store (262822.001) - Nitrates and Nitrites

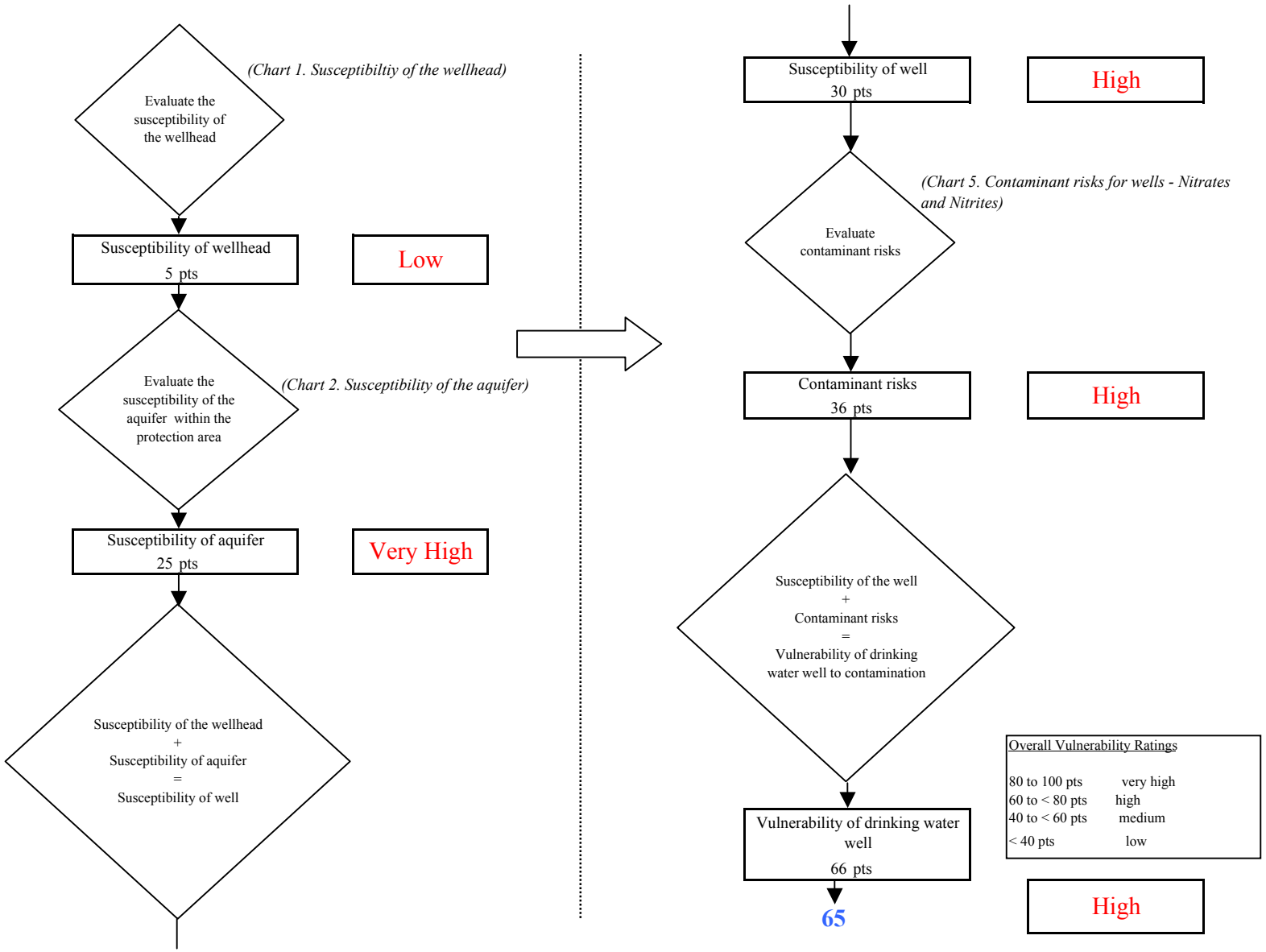


Chart 7. Contaminant risks for AK Commercial Store (262822.001) - Volatile Organic Chemicals

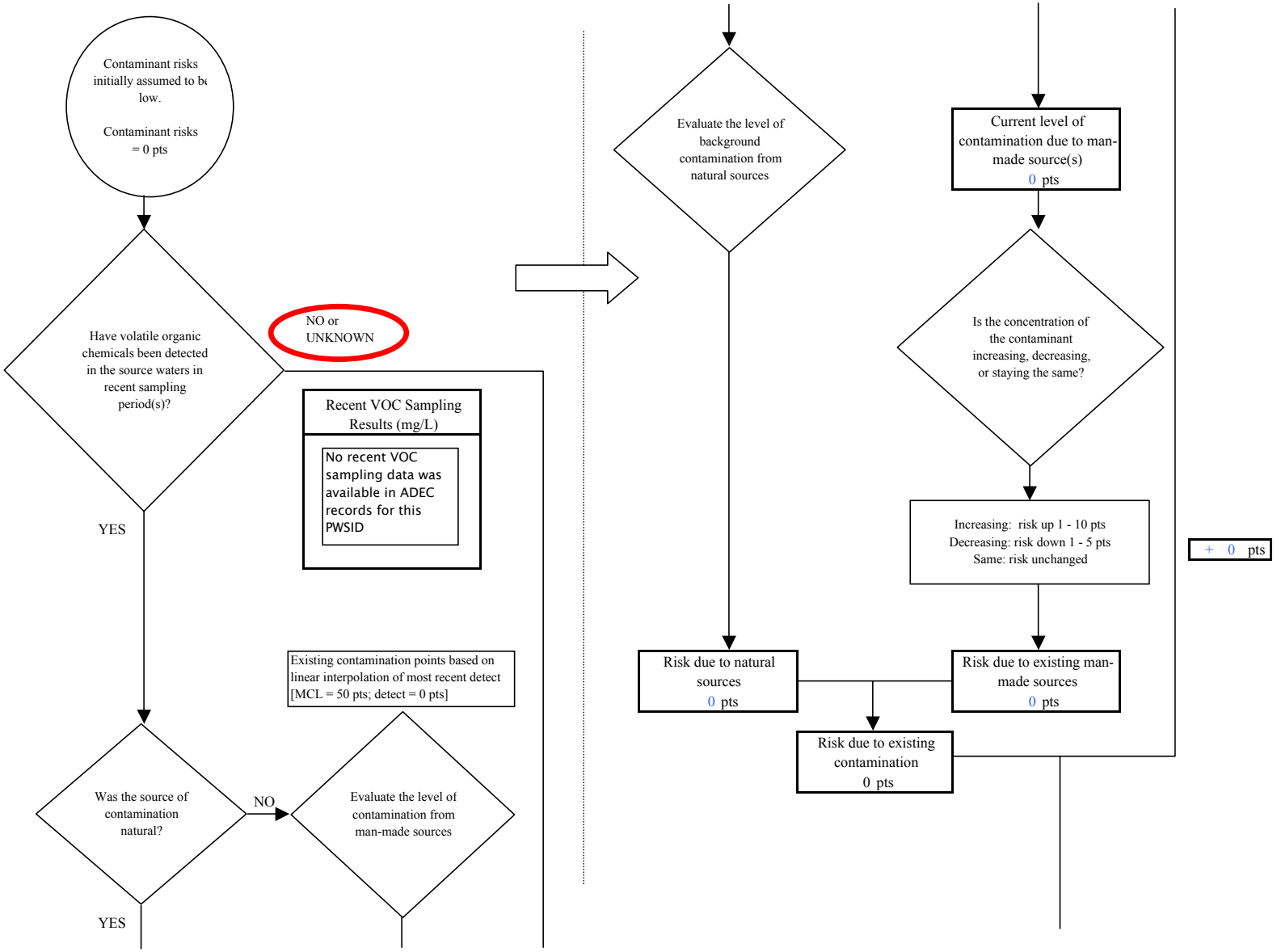


Chart 7. Contaminant risks for AK Commercial Store (262822.001) - Volatile Organic Chemicals

+ 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)	1	32	33
Medium(s)	1	2	3
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 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individua 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.

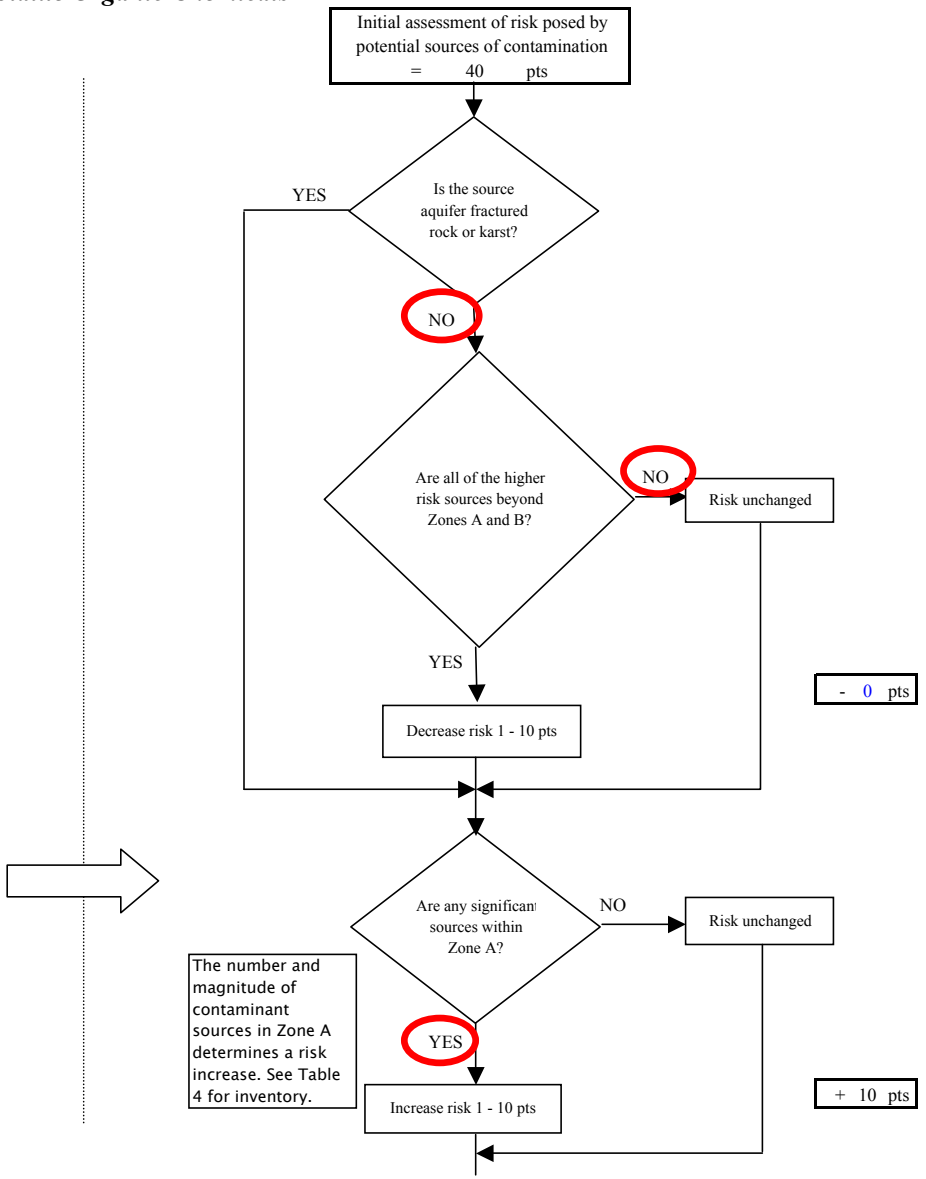


Chart 7. Contaminant risks for AK Commercial Store (262822.001) - Volatile Organic Chemicals

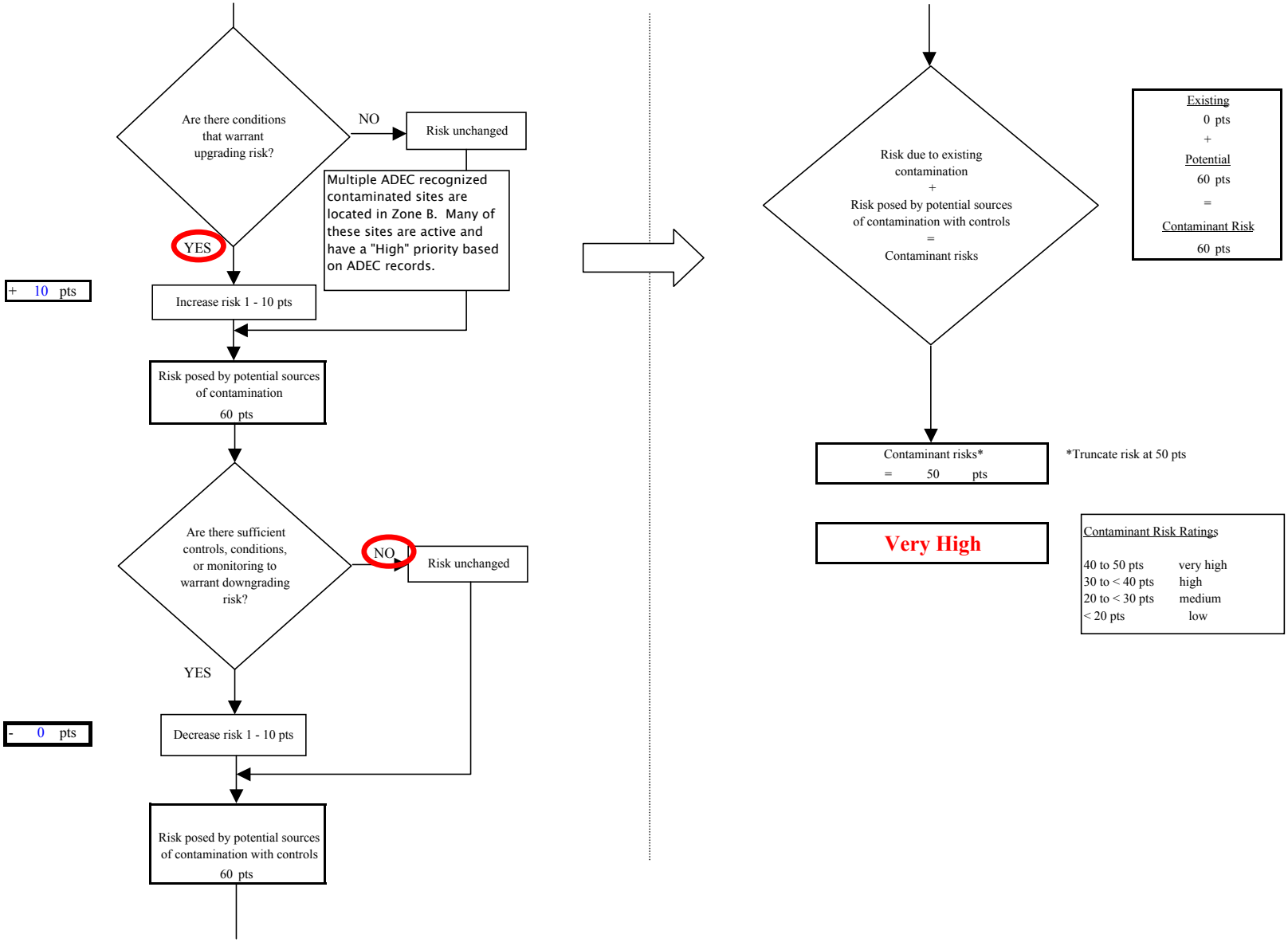


Chart 8. Vulnerability analysis for AK Commercial Store (262822.001) - Volatile Organic Chemicals