Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for
Ninilchik Fair Association
Drinking Water System,
Ninilchik, Alaska
PWSID # 242018
June 2003

DRINKING WATER PROTECTION PROGRAM REPORT # 613
Alaska Department of Environmental Conservation

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By Ecology & Environment, Inc.

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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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By Ecology & Environment, Inc.

Drinking Water Protection Program
Alaska Department of Environmental Conservation

Executive Summary

Ninilchik Fair Association is a Class B (transient/non-community) water system consisting of one spring in Ninilchik, Alaska. The spring outlet and intake received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High.** Combining these two ratings produces a rating for the natural susceptibility of the spring of **High**. Identified potential and current sources of contaminants for Ninilchik Fair Association public drinking water source include: roads, residential areas, septic systems, injection wells, aboveground and underground fuel tanks, RV dump stations, laundromats, active logging areas, DEC-recognized contaminated sites, leaking underground fuel storage tanks, and campgrounds/RV parks. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Ninilchik Fair Association received a vulnerability rating of **Very High** for bacteria and viruses, **Very High** for nitrates and nitrites, and **High** for volatile organic chemicals.

Introduction

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

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

Description of the Ninilchik Area

Location

Ninilchik is located at mile 134 to 138 of the Sterling Highway, on the Kenai Peninsula, approximately 180 miles south of Anchorage and 38 miles southwest of the City of Kenai (see the inset of Map 1 or 2 in Appendix A). The population was 772 in 2000 (ADCED 2003). The economy centers on commercial and sport fishing, and tourism.

Precipitation

The Ninilchik area averages about 17.5 inches of precipitation per year (WCI 2003). The region receives approximately 53 inches of annual snowfall (ACRC 2003).

Topography and Drainage

Ninilchik is located between the base of the Caribou Hills and Cook Inlet, at the mouth of the Ninilchik River. Deep Creek enters the Inlet just to the south. The topography is relatively gentle, with some small hills. Drainage patterns are often poorly defined in the Ninilchik lowlands, and hummocky terrain and muskeg are the predominant features. Channels draining the Caribou Hills uplands are better defined (Savard & Scully, 1984).

Groundwater Use

The majority of households in the Ninilchik area either has private wells, or hauls their own water. There is a community well operated by the Ninilchik Village Council. Two-thirds of residences have individual septic systems; the remainder use outhouses. A little over half of the residences are occupied on a seasonal basis (ADCED 2003).

Geology and Soils

The vast majority of sediments exposed along the western side of the Kenai Peninsula are Quaternary sediments (Magoon, Adkison, and Egbert, 1976). These sediments are from former glacial streams, abandoned-channel deposits, glacial moraines and deposits from existing streams (Glass, 1996). They generally consist of a combination of sand, gravel, silt, and clay. There can be significant variation in the composition of sediment layers over relatively small areas. As a consequence, aquifers in the area may be either confined or unconfined, depending on the local sequence of sediment layers (Glass, 1996). The Tertiary-aged Sterling Formation is exposed along the shoreline cliffs of eastern Cook Inlet, from approximately Kasilof to Happy Valley. It comprises sandstone, siltstone and some coal (Magoon, Adkison, and Egbert, 1976).

Ninilchik Fair Association Public Drinking Water System

Ninilchik Fair Association is a Class B (transient/non-community) water system. The system consists of one spring near mile 136 of the Sterling Highway. The most recent Sanitary Survey (8/05/99) indicates that the spring intake is adequately constructed. This system operates year-round and serves approximately 5 residents and more than 60 non-residents.

Ninilchik Fair Association Drinking Water Protection Area

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

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

The Drinking Water Protection Areas established for springs by the Alaska Department of Environmental Conservation (ADEC) are separated into zones. The Drinking Water Protection Area for the Ninilchik Fair Association source contains three zones, Zone A through Zone C (See Maps 1 & 2 in Appendix A). Zone A corresponds to an area within 1000 feet of the spring intake. Zone B identifies the area within one mile, and Zone C encompasses the entire watershed upslope of the spring. (Please refer to the Guidance Manual for Class B Water Systems for additional information).

The following is a summary of the three DWPA zones:

Table 1. Definition of Zones

Zone	Definition
A	1000 Feet from Spring
B	1 Mile from Spring
C	Entire Watershed of Spring

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 Ninilchik Fair Association DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination of 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 water system assessments, three categories of drinking water contaminants were inventoried. They include:

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

Inventoried potential sources of contamination within Zones A through Zone C were associated with residential and light industrial type activities. The sources are displayed on Maps 3-6 of Appendix C and summarized in the tables in Appendix B.

Ranking of Contaminant Risks

Once the potential and existing sources of contamination have been identified, they are 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. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the spring. Ranking 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 C due to the probability of contaminant dilution by the time the contaminants get to the spring.

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 Ninilchik Fair Association Drinking Water Source

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 Spring Outlet/Intake' to contamination by looking at the construction of the outlet/intake and the 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 spring. 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 achieved by analyzing the properties of the spring and the aquifer.

Susceptibility of the Spring Outlet and Intakes
(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 Spring)
(0 – 50 Points)

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

The spring for Ninilchik Fair Association arises from an unconfined aquifer. Because unconfined aquifers are recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer.

Table 2 shows the Susceptibility scores and ratings for Ninilchik Fair Association (see Appendix D, Charts 1 and 2).

Table 2. Susceptibility

	Score	Rating
Susceptibility of the Spring Outlet and Intakes	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 or 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 (see Appendix D, Charts 3, 5, and 7).

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	45	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 (see Appendix D, Charts 4, 6, and 8).

Table 4. Overall Vulnerability to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	80	Very High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	75	High

Bacteria and Viruses
The contaminant risk for bacteria and viruses is Very High, with the septic system, sewage, and industrial wastewater injection wells representing the greatest risk to the drinking water source (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the spring outlet/intake, the overall vulnerability of the spring to contamination is Very High .

Nitrates and Nitrites
The contaminant risk for nitrates and nitrites is Very High, with with the septic system, sewage, and industrial wastewater injection wells representing the greatest risk to this source of public drinking water (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Nitrates are very mobile, moving at approximately the same rate as water.

The last five years' sampling history for Ninilchik Fair Association public water source indicates the most recent concentration detected was 1.300 mg/L on 1/2/01, which represents 13% of the Maximum Contaminant Level (MCL). While nitrates and nitrites can occur naturally in groundwater, a level greater than 20% of the MCL or more is considered to be due to manmade sources. Water with levels of nitrates/nitrites below 100% of the MCL is considered safe to drink by ADEC. After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the spring outlet/intake, the overall vulnerability of the spring to contamination is Very High.

Volatile Organic Chemicals
The contaminant risk for volatile organic chemicals is Very High, with the motor vehicle and industrial wastewater injection wells, the leaking underground fuel storage tank site, and the airport posing the greatest risk for volatile organic chemicals (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Residents in the area typically heat their homes with various types of on-site fuel sources, including propane and heating oil stored in aboveground or underground storage tanks. Although this report does not address heating oil tanks (unless their location is known), they can pose a risk of volatile organic chemical contamination to drinking water sources. The most common causes of fuel leaks of these heating oil systems are overfilling the tank, ruptured fuel lines, leaking storage tanks, damaged or faulty valves and vandalism. Secondary containment around the tank and regular system maintenance can help prevent many of these harmful fuel leaks and help protect the drinking water supply.

Class B water systems generally are not required to test for volatile organic chemicals. After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the spring outlet/intake, the overall vulnerability of the spring to contamination is High.

References Cited

Alaska Climate Research Center (ACRC), 2002, Alaskan Climatology Data [WWW document]. URL http://climate.gi.alaska.edu/climatology/data.html.

Alaska Department of Community and Economic Development (ADCED), 2002, Alaska Community Database [WWW database]. URL http://www.dced.state.ak.us/cbd/commdb/CF_BLOCK.cfm

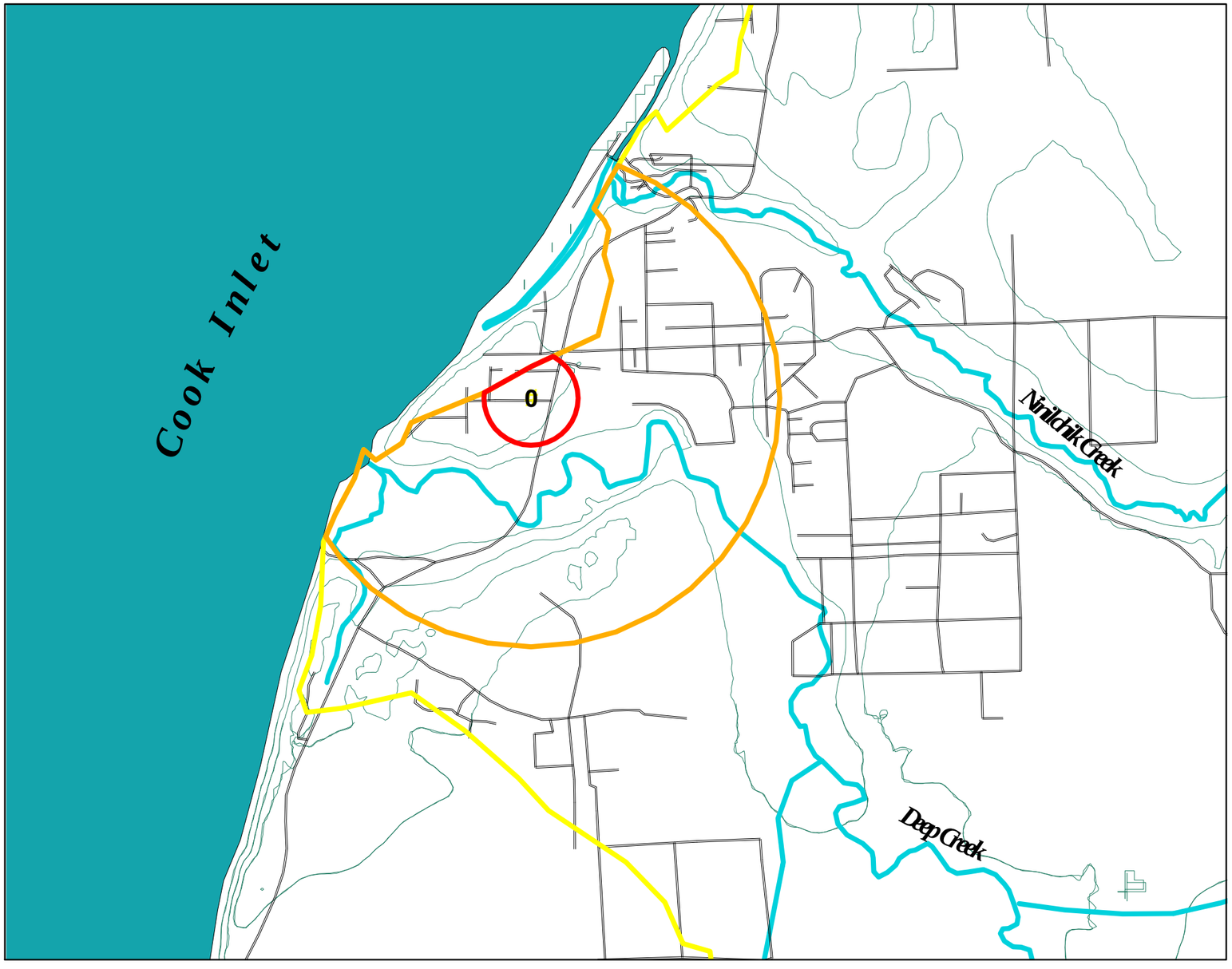
Savard, C.S. and Scully, D.R., 1983, *Surface-Water Quantity and Quality in the Lower Kenai Peninsula, Alaska*, Department of the Interior, USGS Water-Resources Investigations Report 84-4161, Anchorage, Alaska.

The Weather Channel Interactive, Inc. (WCI), 2003, Monthly Averages for Ninilchik, AK, World Wide Web site http://www.weather.com/weather/climatology/monthly/USAK0168, accessed February 24, 2003.

APPENDIX A

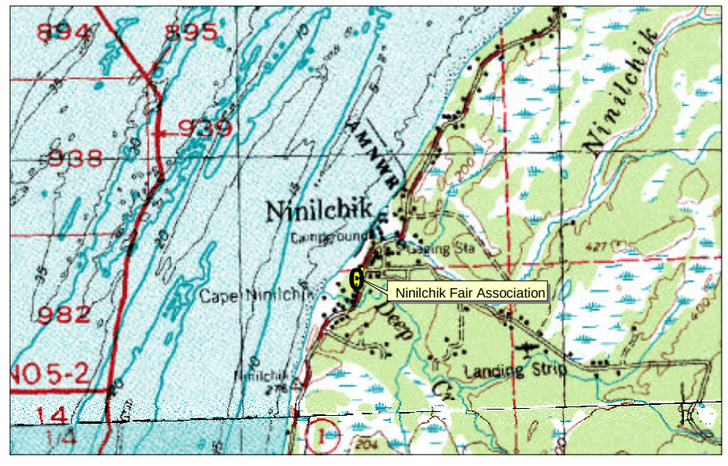
Ninilchik Fair Association
Drinking Water Protection Area
(Maps 1 & 2)

Drinking Water Protection Area for Ninilchik Fair Association



0 Ninilchik Fair Association Spring Intake
Zone A (1000' Feet From Spring Intake)
Zone B (1Mile from Spring Intake)
Zone C (Entire Watershed)
Area Roads

N
W E
S

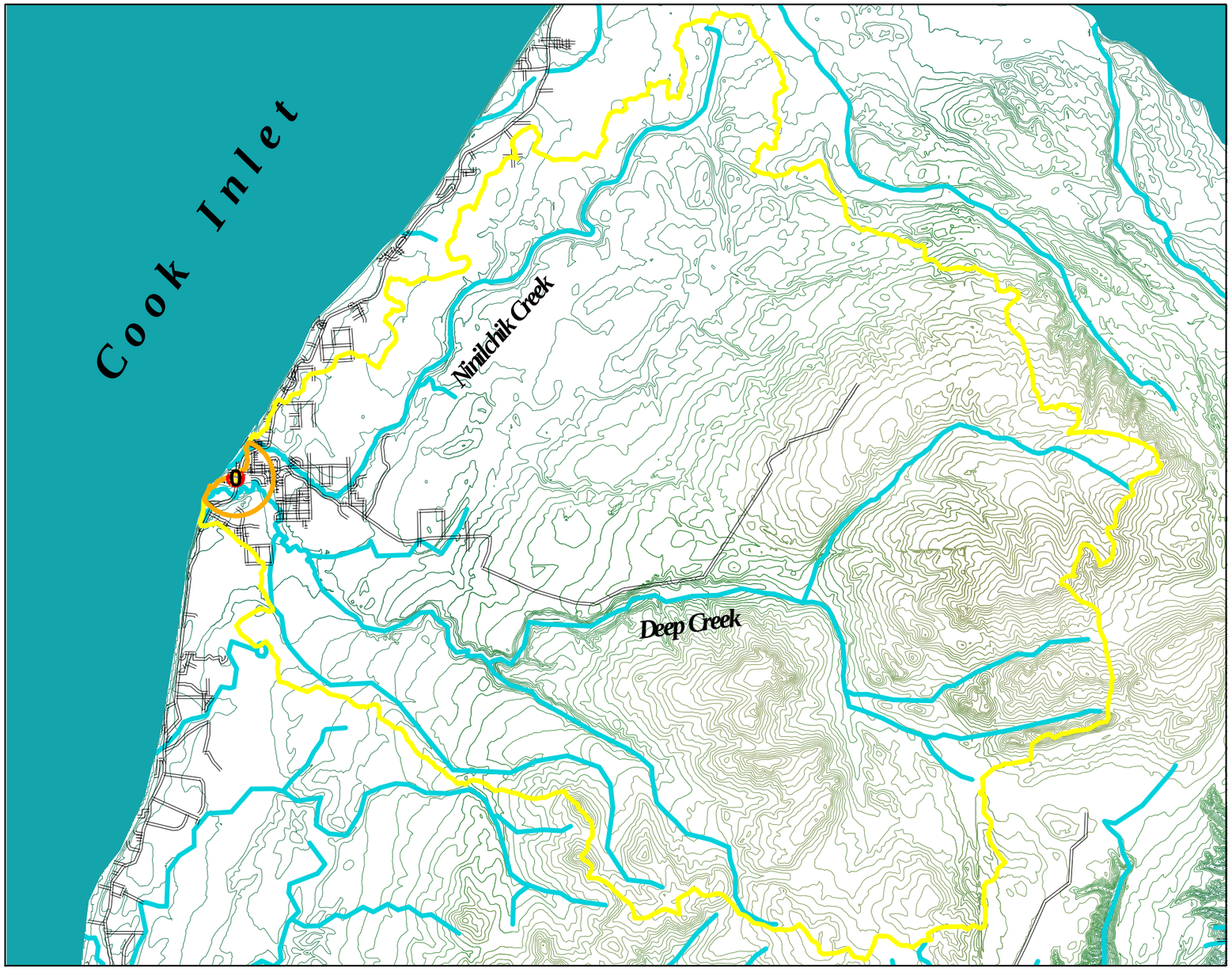


1 0 1 2 Miles

PWSID 242018.001

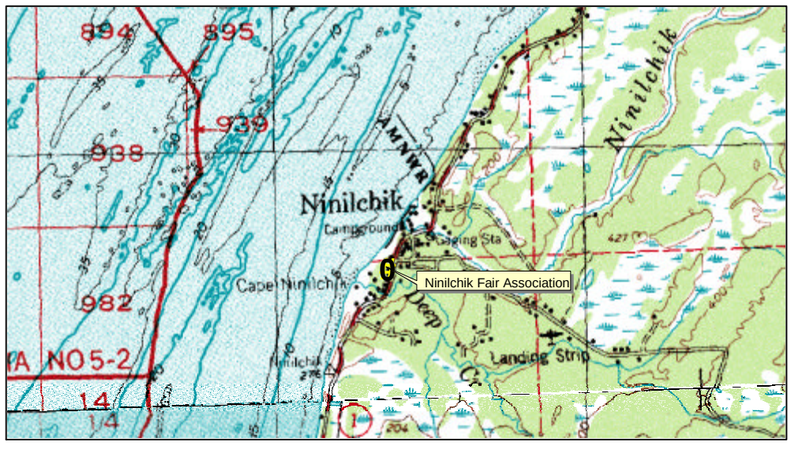
Map 1

Drinking Water Protection Area For Ninilchik Fair Association



0 Ninilchik Fair Association Wells
Zone A (1000' Feet From Spring Intake)
Zone B (1Mile from Spring Intake)
Zone C (Entire Watershed)
Area Roads

N
W E
S



PWSID 242018.001

Map 2

APPENDIX B

Contaminant Source Inventory and
Risk Ranking for Ninilchik Fair Association
(Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 242018.001***

Ninilchik Fair Association

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A		3	
Residential Areas	R01	R1-1	A		3	5.4 acres
Septic systems (serves one single-family home)	R02	R2-1--5	A		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-3	A		3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Sterling Hwy	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Geilo St	3	
Highways and roads, dirt/gravel	X24	X24-2	A	Sandra St	3	
Highways and roads, dirt/gravel	X24	X24-3	A		3	
Campgrounds and RV Parks	X35	X35-1	A		3	
Laundromats without dry cleaning	C22	C22-1	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-10	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-11	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-12	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-13	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-14	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-15	B		3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-16	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-17	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	B		3	18 Injection wells
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-7	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-8	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-9	B		3	
Injection wells (Class V) Untreated Sewage Waste Disposal Wells	D14	D14-1	B		3	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-1	B		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-2	B		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-3	B		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-4	B		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-5	B		4	
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-1	B	Deep Creek Custom Packing	3	
Logging (active)	E02	E2-1	B	Palmer WI et al	3	
Logging (active)	E02	E2-2	B	Catherine P. Oliver	3	
Residential Areas	R01	R1-2	B		3	244 acres
Septic systems (serves one single-family home)	R02	R2-6--85	B		4	
Closed tanks, gasoline (underground)	T13	T13-1	B	ADOTPF Ninilchik	3	
Closed tanks, diesel (underground)	T09	T9-1	B	ADOTPF Ninilchik	3	

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U7-1	B	ADOTPF Ninilchik	3	ADOTPF Ninilchik Facility, RecKey 1998230000801. Fuel contamination identified during UST closures.
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Oilwell Rd	3	
Highways and roads, dirt/gravel	X24	X24-4--24	B		3	22 Roads
Campgrounds and RV Parks	X35	X35-2--4	B		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-18	C		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-19	C		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-20	C		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-21	C		3	
RV dump stations	D18	D18-1	C		3	
RV dump stations	D18	D18-2	C		3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	C		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-4--7	C		3	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-2	C	Klukwan Forest Products	4	Klukwan Forest Products. Contaminated site not listed in Contaminated Sites Database.
Airports	X14	X14-1	C	Ninilchik Landing Strip	4	

Table 2

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Bacteria and Viruses

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High		3	
Residential Areas	R01	R1-1	A	Low		3	5.4 acres
Septic systems (serves one single-family home)	R02	R2-1--5	A	Low		3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Sterling Hwy	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	Geilo St	3	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	Sandra St	3	
Highways and roads, dirt/gravel	X24	X24-3	A	Low		3	
Campgrounds and RV Parks	X35	X35-1	A	Low		3	
Laundromats without dry cleaning	C22	C22-1	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-10	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-11	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-12	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-13	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-14	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-15	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-16	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-17	B	High		3	

Table 2 (continued)

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Bacteria and Viruses

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	B	High		3	18 Injection wells
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-7	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-8	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-9	B	High		3	
Injection wells (Class V) Untreated Sewage Waste Disposal Wells	D14	D14-1	B	High		3	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-1	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-2	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-3	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-4	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-5	B	Low		4	
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-1	B	High	Deep Creek Custom Packing	3	
Residential Areas	R01	R1-2	B	Low		3	244 acres
Septic systems (serves one single-family home)	R02	R2-6--85	B	Low		4	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low	Oilwell Rd	3	
Highways and roads, dirt/gravel	X24	X24-4--24	B	Low		3	22 Roads
Campgrounds and RV Parks	X35	X35-2--4	B	Low		3	

Table 2 (continued)

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Bacteria and Viruses

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Campgrounds and RV Parks	X35	X35-2--4	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-18	C	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-19	C	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-20	C	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-21	C	High		3	
RV dump stations	D18	D18-1	C	Low		3	
RV dump stations	D18	D18-2	C	Low		3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	C	Low		3	

Table 3

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Nitrates/Nitrites

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	High		3	
Residential Areas	R01	R1-1	A	Low		3	5.4 acres
Septic systems (serves one single-family home)	R02	R2-1--5	A	Low		3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Sterling Hwy	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	Geilo St	3	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	Sandra St	3	
Highways and roads, dirt/gravel	X24	X24-3	A	Low		3	
Campgrounds and RV Parks	X35	X35-1	A	Low		3	
Laundromats without dry cleaning	C22	C22-1	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-10	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-11	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-12	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-13	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-14	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-15	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-16	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-17	B	High		3	

Table 3 (continued)

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Nitrates/Nitrites

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	B	High		3	18 Injection wells
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-7	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-8	B	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-9	B	High		3	
Injection wells (Class V) Untreated Sewage Waste Disposal Wells	D14	D14-1	B	High		3	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-1	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-2	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-3	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-4	B	Low		4	
Pit toilets (vaulted) nonresidential (one or more)	D17	D17-5	B	Low		4	
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-1	B	High	Deep Creek Custom Packing	3	
Logging (active)	E02	E2-1	B	Low	Palmer WI et al	3	
Logging (active)	E02	E2-2	B	Low	Catherine P. Oliver	3	
Residential Areas	R01	R1-2	B	Low		3	244 acres
Septic systems (serves one single-family home)	R02	R2-6--85	B	Low		4	
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low	Oilwell Rd	3	

Table 3 (continued)

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Nitrates/Nitrites

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Highways and roads, dirt/gravel	X24	X24-4--24	B	Low		3	22 Roads
Campgrounds and RV Parks	X35	X35-2--4	B	Low		3	
Campgrounds and RV Parks	X35	X35-2--4	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-18	C	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-19	C	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-20	C	High		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-21	C	High		3	
RV dump stations	D18	D18-1	C	Low		3	
RV dump stations	D18	D18-2	C	Low		3	
Airports	X14	X14-1	C	Low	Ninilchik Landing Strip	4	

Table 4

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Volatile Organic Chemicals

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1	A	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-2	A	Low		3	
Residential Areas	R01	R1-1	A	Low		3	5.4 acres
Septic systems (serves one single-family home)	R02	R2-1--5	A	Low		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1	A	Low		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-2	A	Low		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-3	A	Low		3	
Highways and roads, paved (cement or asphalt)	X20	X20-1	A	Low	Sterling Hwy	3	
Highways and roads, dirt/gravel	X24	X24-1	A	Low	Geilo St	3	
Highways and roads, dirt/gravel	X24	X24-2	A	Low	Sandra St	3	
Highways and roads, dirt/gravel	X24	X24-3	A	Low		3	
Campgrounds and RV Parks	X35	X35-1	A	Low		3	
Laundromats without dry cleaning	C22	C22-1	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-10	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-11	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-12	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-13	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-14	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-15	B	Low		3	

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Volatile Organic Chemicals

PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-16	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-17	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-3	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-4	B	Low		3	18 Injection wells
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-5	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-6	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-7	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-8	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-9	B	Low		3	
Injection wells (Class V) Untreated Sewage Waste Disposal Wells	D14	D14-1	B	Low		3	
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-1	B	High	Deep Creek Custom Packing	3	
Logging (active)	E02	E2-1	B	Low	Palmer WI et al	3	
Logging (active)	E02	E2-2	B	Low	Catherine P. Oliver	3	
Residential Areas	R01	R1-2	B	Low		3	244 acres
Septic systems (serves one single-family home)	R02	R2-6--85	B	Low		4	
Closed tanks, gasoline (underground)	T13	T13-1	B	Medium	ADOTPF Ninilchik	3	
Closed tanks, diesel (underground)	T09	T9-1	B	Medium	ADOTPF Ninilchik	3	

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Ninilchik Fair Association Sources of Volatile Organic Chemicals

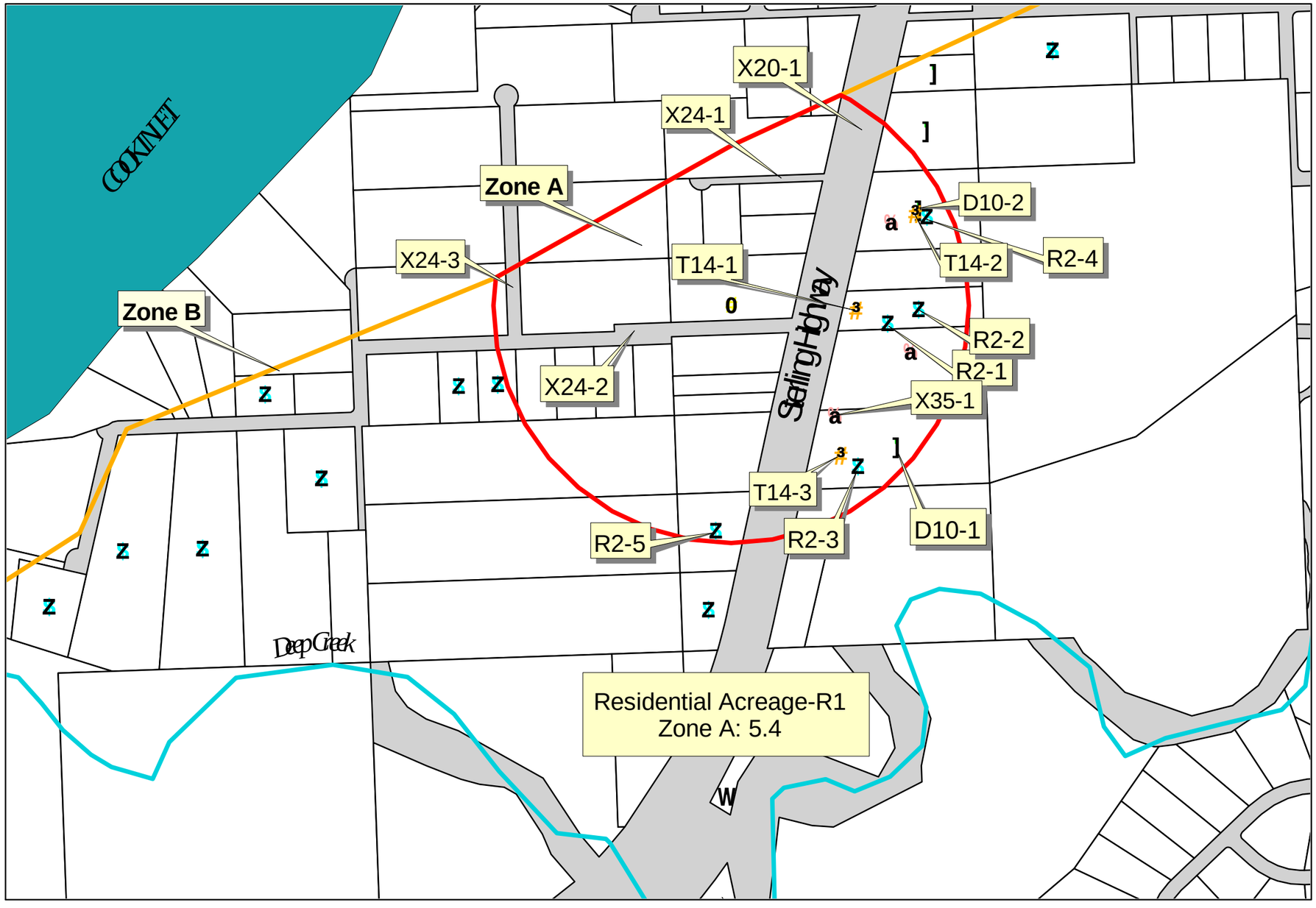
PWSID 242018.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Location*	*Map Number*	*Comments*
Open Leaking Underground Fuel Storage Tank (LUST) Sites	U07	U7-1	B	High	ADOTPF Ninilchik	3	ADOTPF Ninilchik Facility, RecKey 1998230000801. Fuel contamination identified during UST closures.
Highways and roads, paved (cement or asphalt)	X20	X20-2	B	Low	Oilwell Rd	3	
Highways and roads, dirt/gravel	X24	X24-4--24	B	Low		3	22 Roads
Campgrounds and RV Parks	X35	X35-2--4	B	Low		3	
Campgrounds and RV Parks	X35	X35-2--4	B	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-18	C	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-19	C	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-20	C	Low		3	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-21	C	Low		3	
RV dump stations	D18	D18-1	C	Low		3	
RV dump stations	D18	D18-2	C	Low		3	
Injection wells (Class V) Motor Vehicle Waste Disposal Well	D42	D42-1	C	High		3	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-4--7	C	Low		3	
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U4-2	C	Medium	Klukwan Forest Products	4	Klukwan Forest Products. During field inspection of logging site several areas of surficial staining were observed as well as a pit containing partially buried drums of motor fuel.Total extent of contamination & impact to human health unknown
Airports	X14	X14-1	C	High	Ninilchik Landing Strip	4	

APPENDIX C

Ninilchik Fair Association
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Maps 3, 4, 5 & 6)

Drinking Water Protection Area For Ninilchik Fair Association and Potential and Existing Sources of Contamination



Contaminants in Zone A

- Ninilchik Fair Association Well
- Public Water Sources
- Tanks, heating oil , nonresidetial, (above ground)-T14
- Pit toilets (vaulted) nonresidential (one or more)-D17
- Injection wells (Class V) Septic System (Drainfield Disposal Method)-D10
- Septic systems (serves one single-family home and/or less than 20 people)-R2
- Logging Areas- E2
- Zone A (1000' Feet From Spring Intake)
- Zone B (1Mile from Spring Intake)

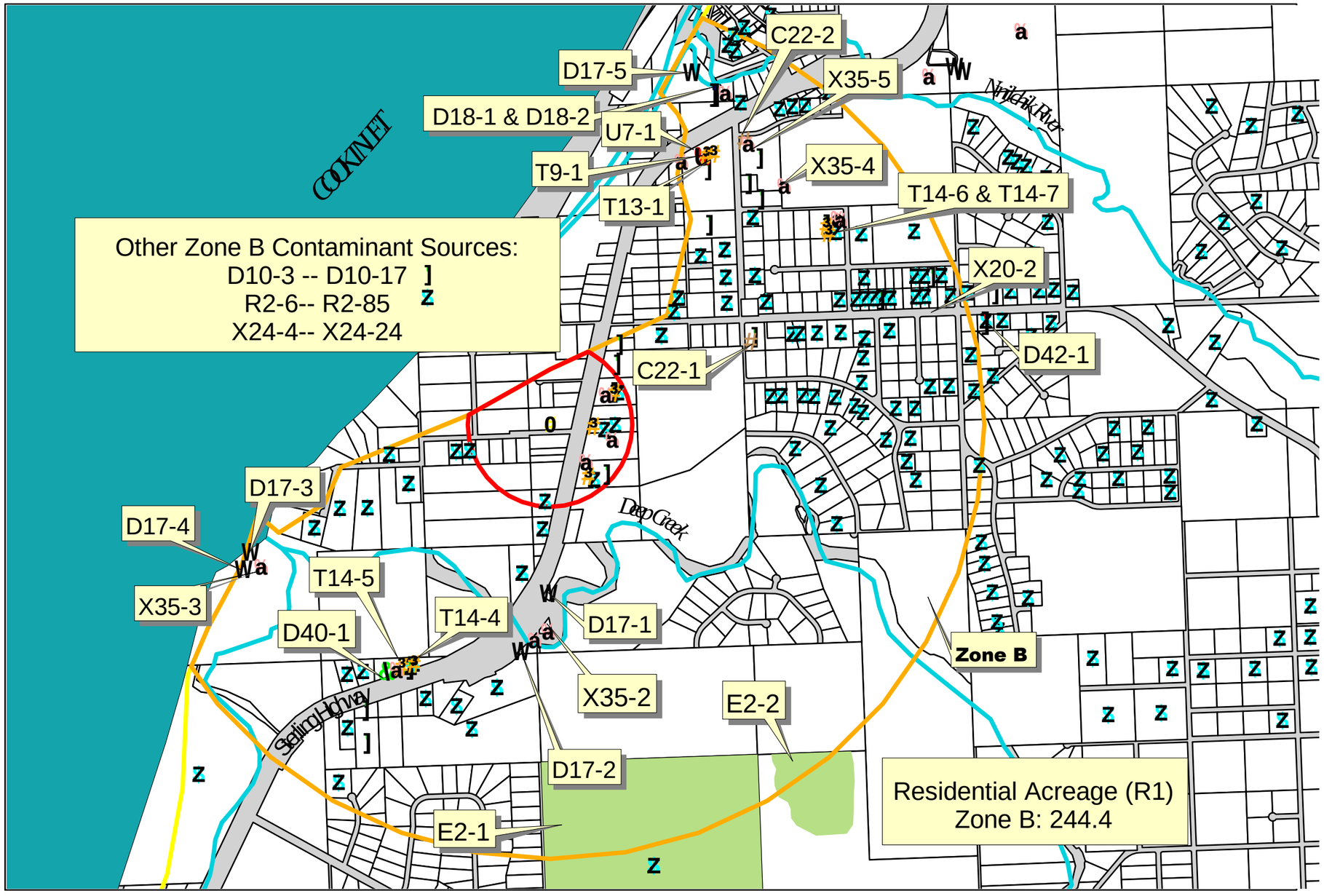
See Map 4 for contaminants in Zone B, and Maps 5 & 6 for Zone C contaminants

N W E S

PWSID 242018.001

Map 3

Drinking Water Protection Area for Ninilchik Fair Association and Existing and Potential Sources of Contamination



Contaminants in Zone B

- Ninilchik Fair Association
- Public Wells
- Open Leaking Underground Fuel Storage Tank (LUST)- U7
- Closed tanks, diesel (underground)- T9
- Closed tanks, gasoline (underground)- T13
- Tanks, heating oil, nonresidential (aboveground)- T14
- Laundromats without dry cleaning- C22
- Pit toilets (vaulted) nonresidential (one or more)- D17
- RV dump stations- D18
- Injection wells-Industrial Process Water & Water Disposal Wells- D40
- Injection wells septic system (Drainfield Disposal Method)-D10
- Septic system (Serves a single-family home and/or less than 20 people)-R2
- Logging Areas- E2
- Zone A (1000 Feet from Spring Intake)
- Zone B (1 Mile from Spring Intake)
- Zone C (Entire Watershed)

N W E S

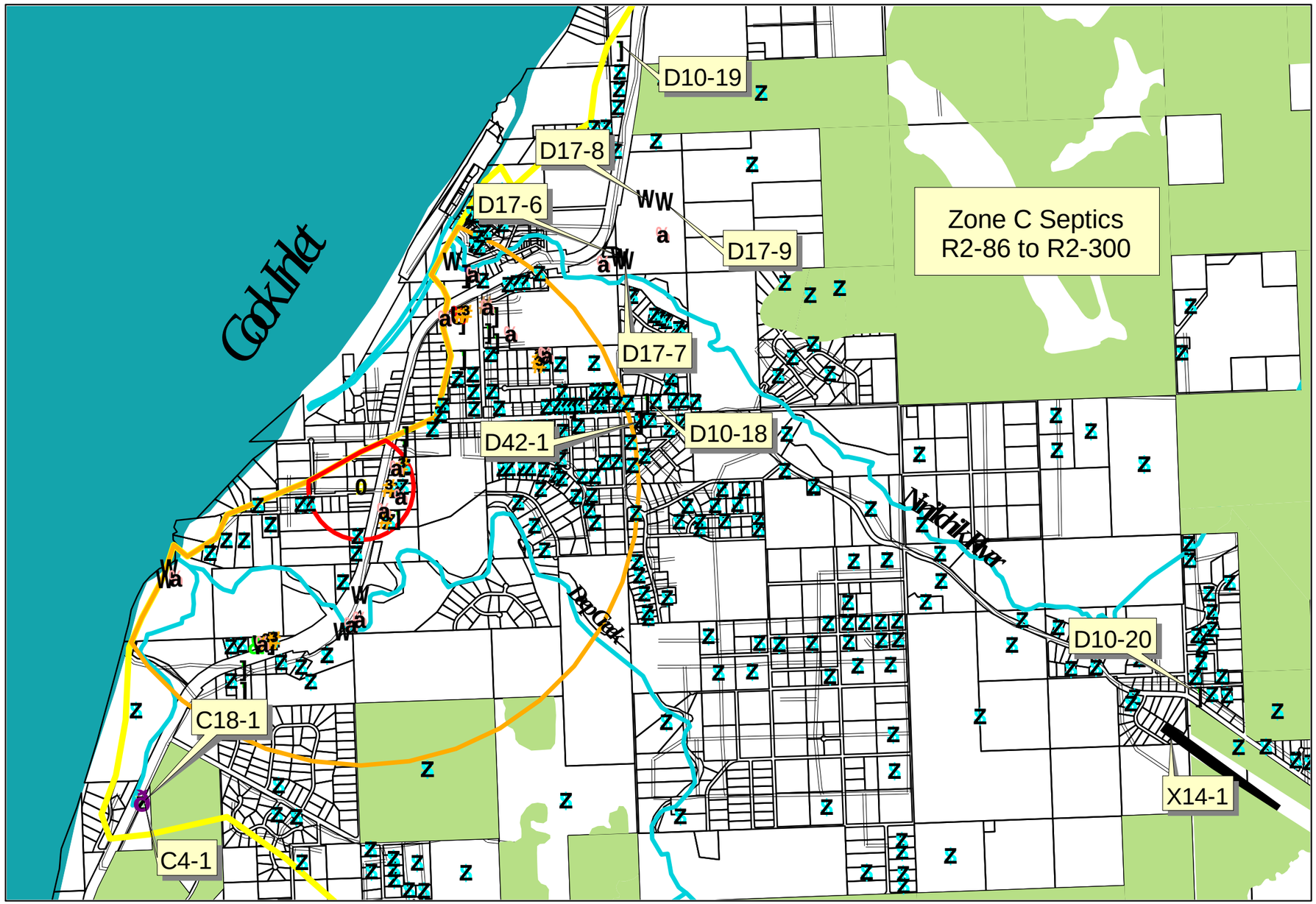
See Map 3 for Zone A Contamintants and Maps 5 & 6 for Zone C Contaminants

2000 0 2000 4000 6000 8000 Feet

PWSID 242018.002

Map 4

Drinking Water Protection Area For Ninilchik Fair Association and Potential and Existing Sources of Contamination



Contaminants in Lower Zone C

- 0 Ninilchik Fair Association Spring Intake
- a Public Wells
- % Contaminated sites, DEC recognized, non-Superfund, non-RCRA-U04
-] Pit toilets (vaulted) nonresidential-D17
- z Septic systems (serves one single-family home and/or less than 20 people)-R2
-] Injection wells (Class V) Septic System (Drainfield Disposal Method)-D10
- z Heavy equipment rental/ storage- C18
- ð Boat engine/ body repair shop- C4
- Landing Strip-X14
- Area Roads- X20, X24
- Logging Areas-E2
- Zone A (1000 Feet from Spring Intake)
- Zone B (1Mile from Spring Intake)
- Zone C (Entire Watershed)

N W E S

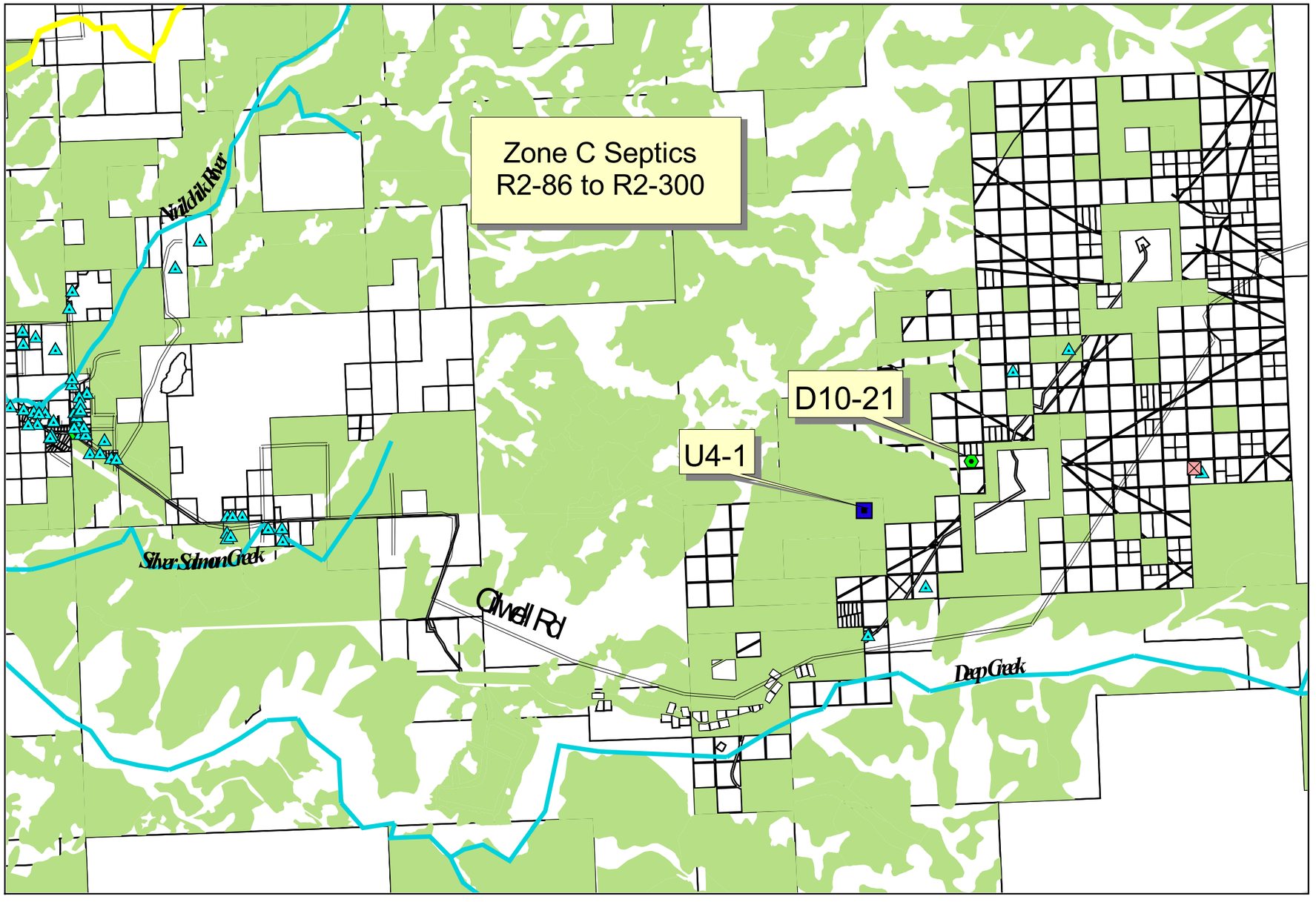
See Map 3 for Zone A contaminants,
Map 4 for contaminants in Zone B, and
Map 6 for contaminants in upper Zone C.

1 0 1 2 Miles

PWSID 242018.002

Map 5

Drinking Water Protection Area For Ninilchik Fair Association and Potential and Existing Sources of Contamination



Contaminants in Upper Zone C

- Public Wells
- Contaminated Site- DEC recognized, non-Superfund, non-RCRA- U4
- Injection well septic systems (Drainfield Disposal Method)-D10
- Septic System (Serves a single-family home and/or less than 20 people)-R2
- Area Roads
- Logging Areas-E2
- Zone C (Entire Watershed)

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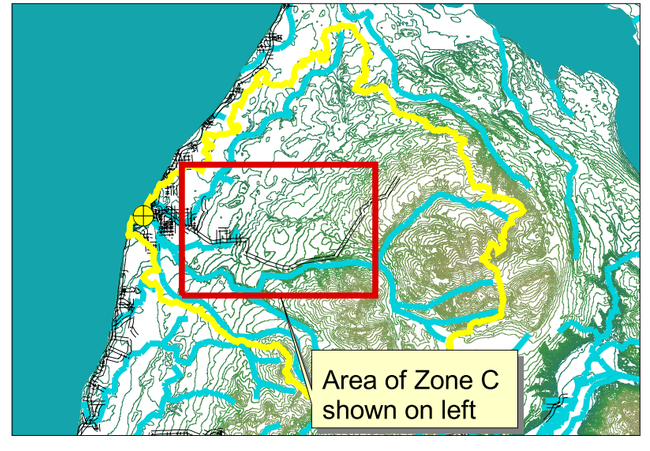


See Map 3 for Zone A contaminants,
Map 4 for contaminants in Zone B, and
Map 5 for contaminants in lower Zone C.

2 0 2 4 6 Miles

PWSID 242018.001

Map 6

APPENDIX D

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

Chart 1. Susceptibility of the spring outlet/intake - Ninilchick Fair Association

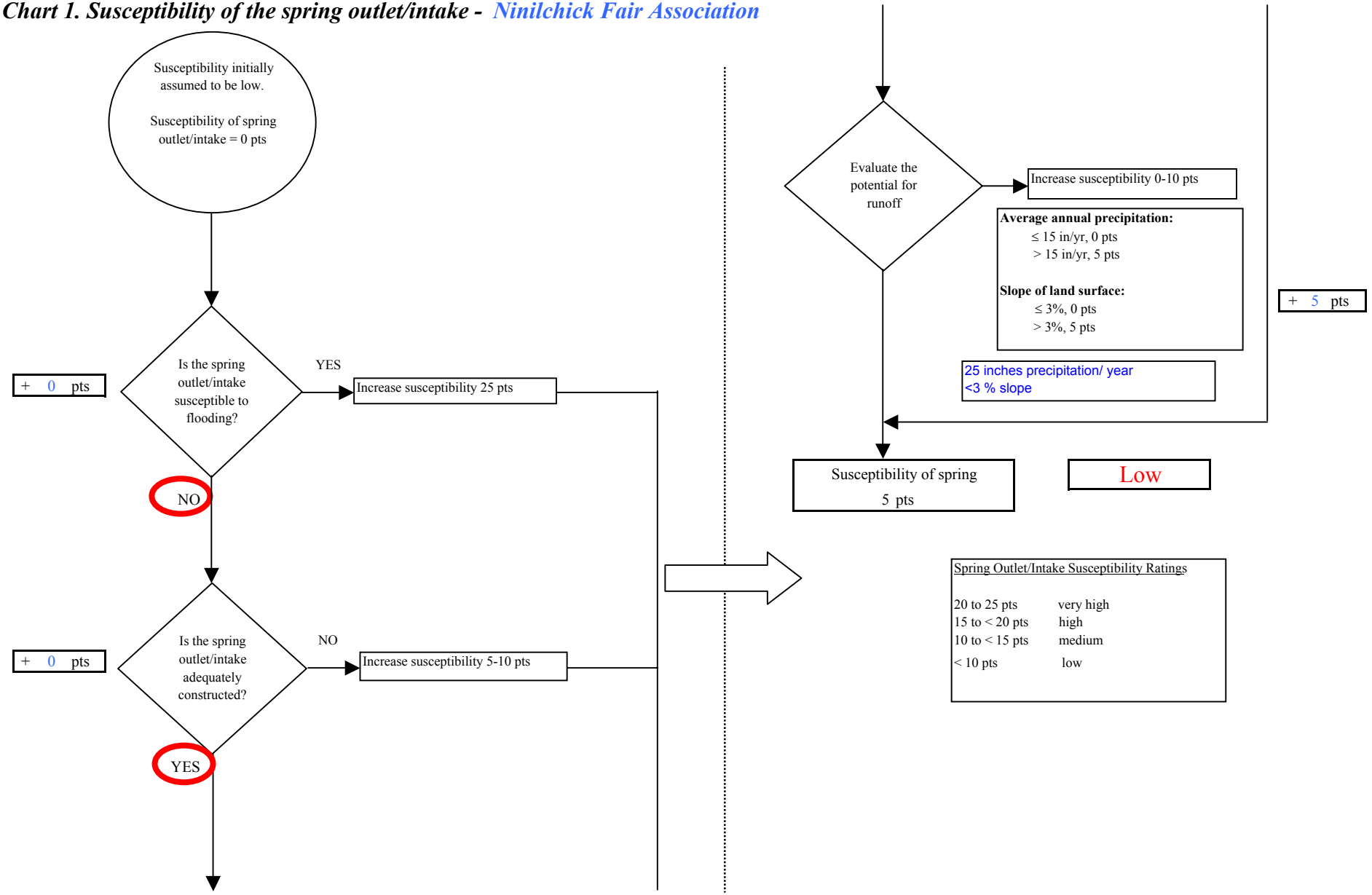


Chart 2. Susceptibility of the aquifer - Ninilchick Fair Association

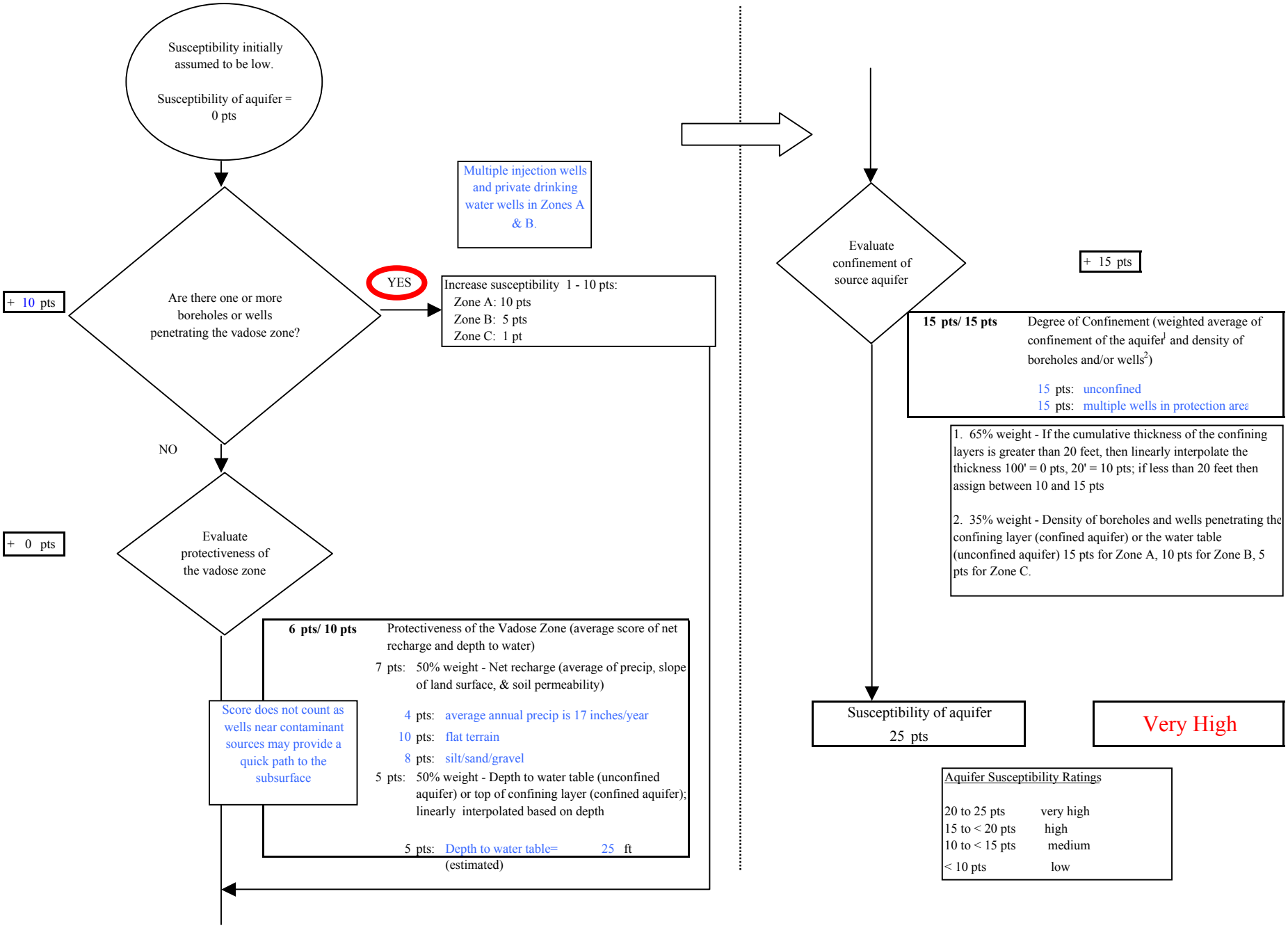
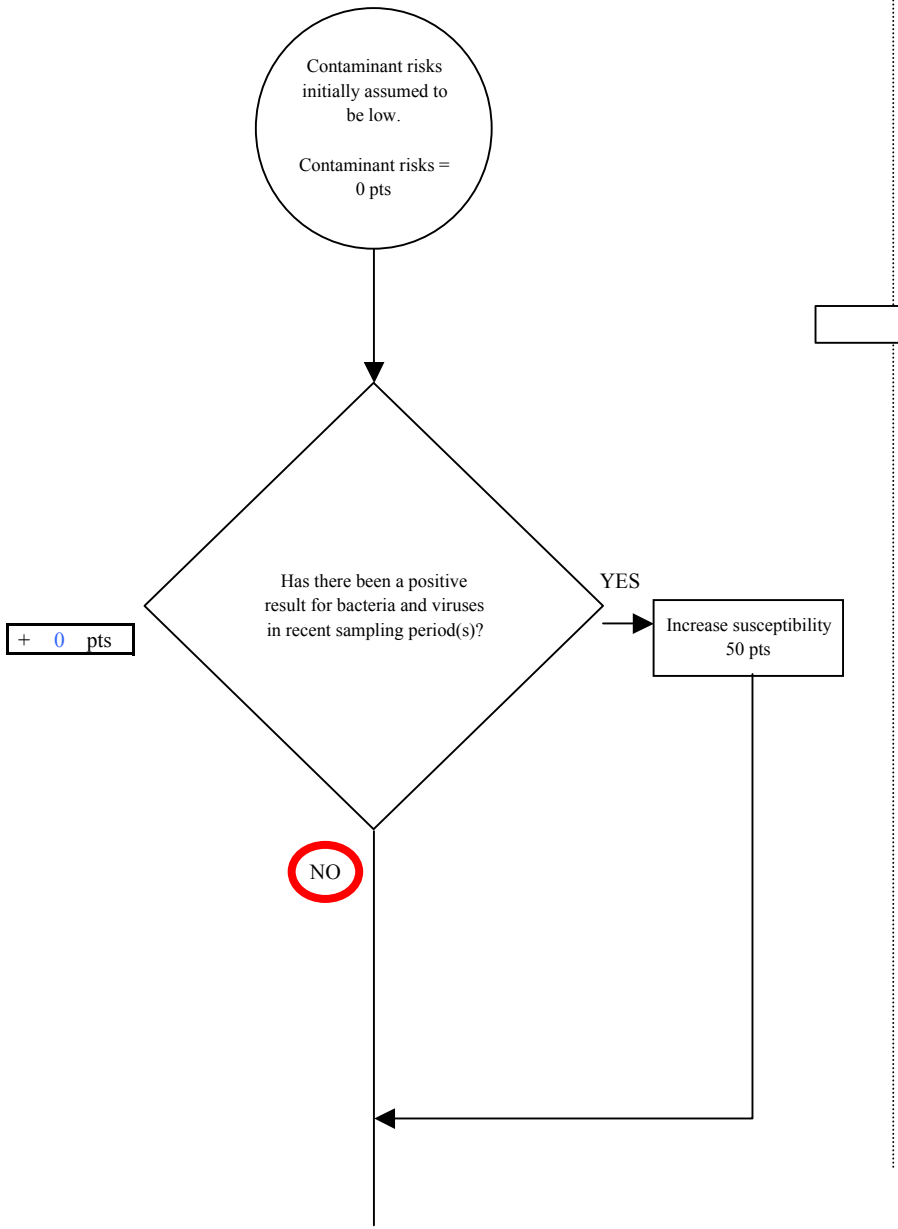
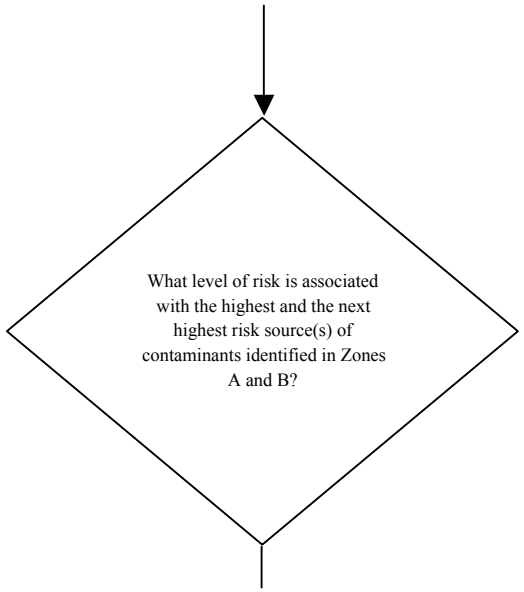


Chart 3. Contaminant risks for Ninilchick Fair Association - Bacteria & Viruses





+ 40 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)	2	17	19
Medium(s)	0	0	0
Low(s)	4	28	32

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

Matrix Score 40

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

Chart 3. Contaminant risks for Ninilchick Fair Association - Bacteria & Viruses

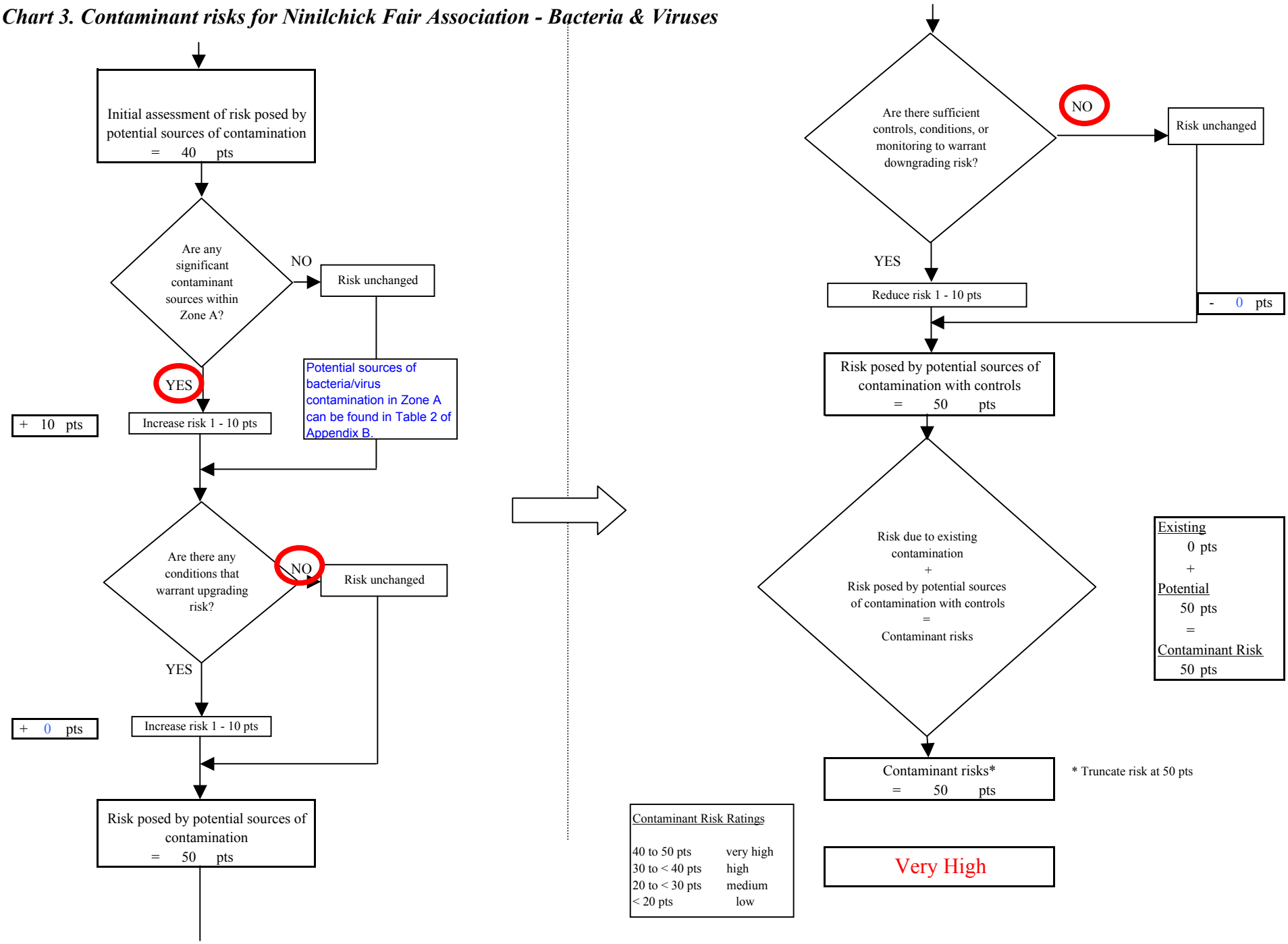


Chart 4. Vulnerability analysis for Ninilchick Fair Association - Bacteria & Viruses

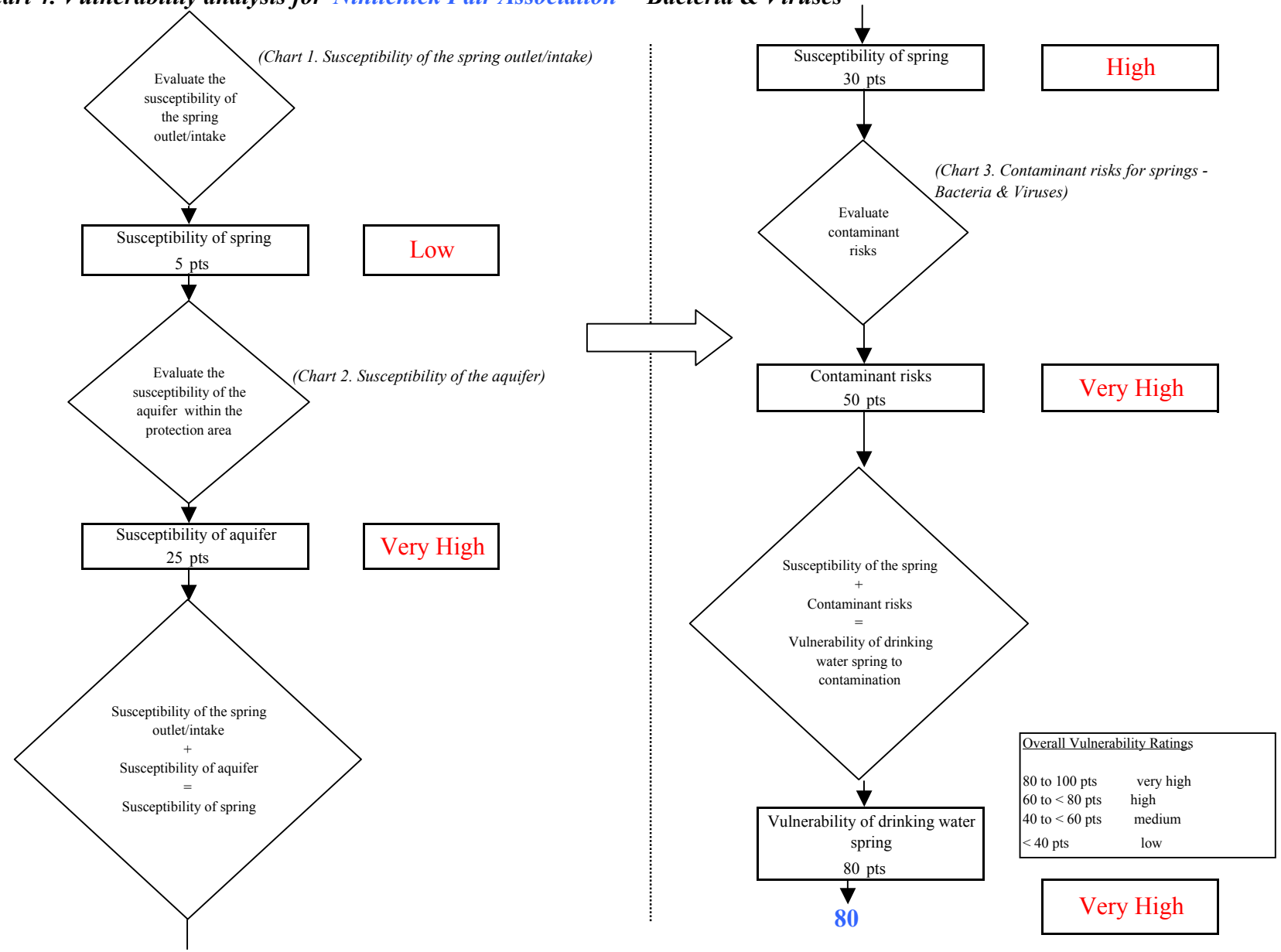


Chart 5. Contaminant risks for Ninilchick Fair Association - Nitrates and Nitrites

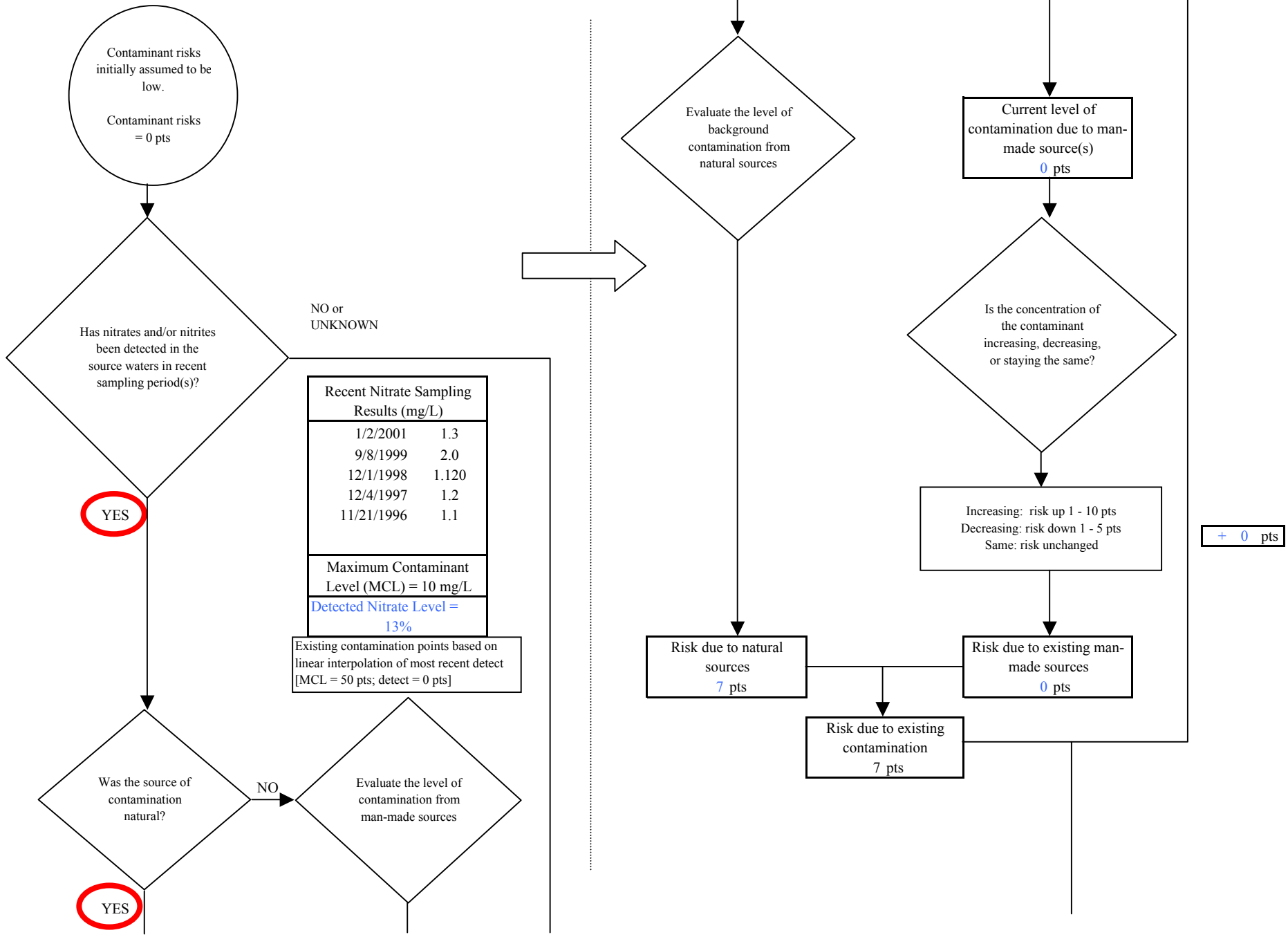
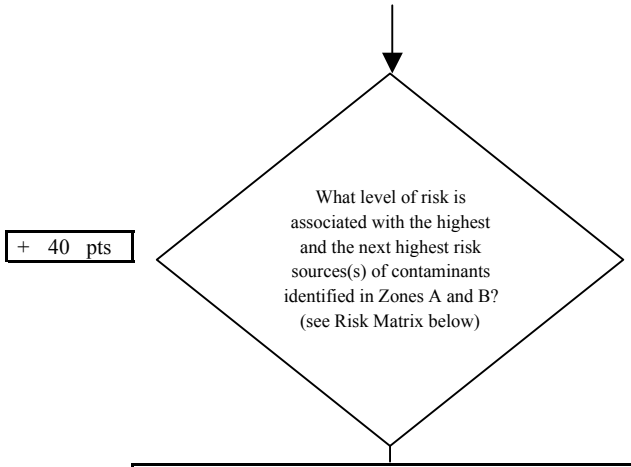


Chart 5. Contaminant risks for Ninilchick Fair Association - Nitrates and Nitrites



+ 40 pts

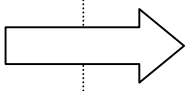
Risk Levels for Contaminant Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	2	17	19
Medium(s)	0	0	0
Low(s)	4	27	31

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

Matrix Score 40

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



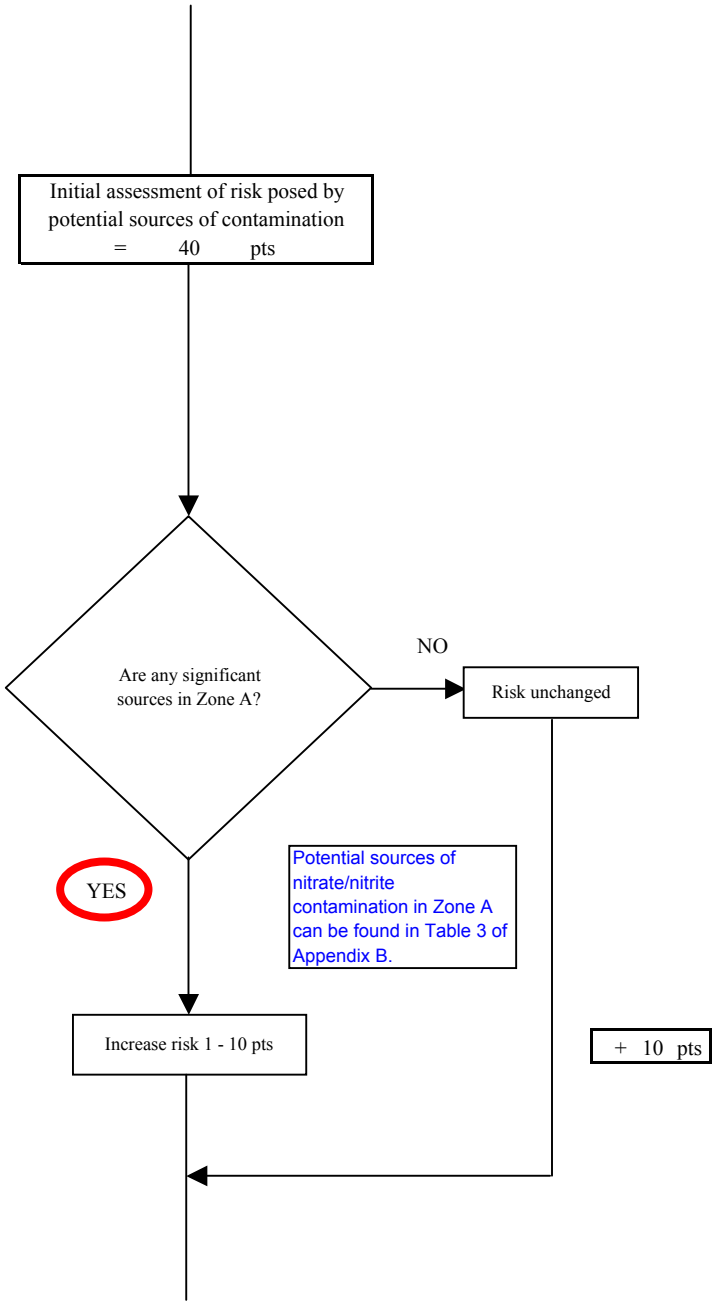


Chart 5. Contaminant risks for Ninilchick Fair Association - Nitrates and Nitrites

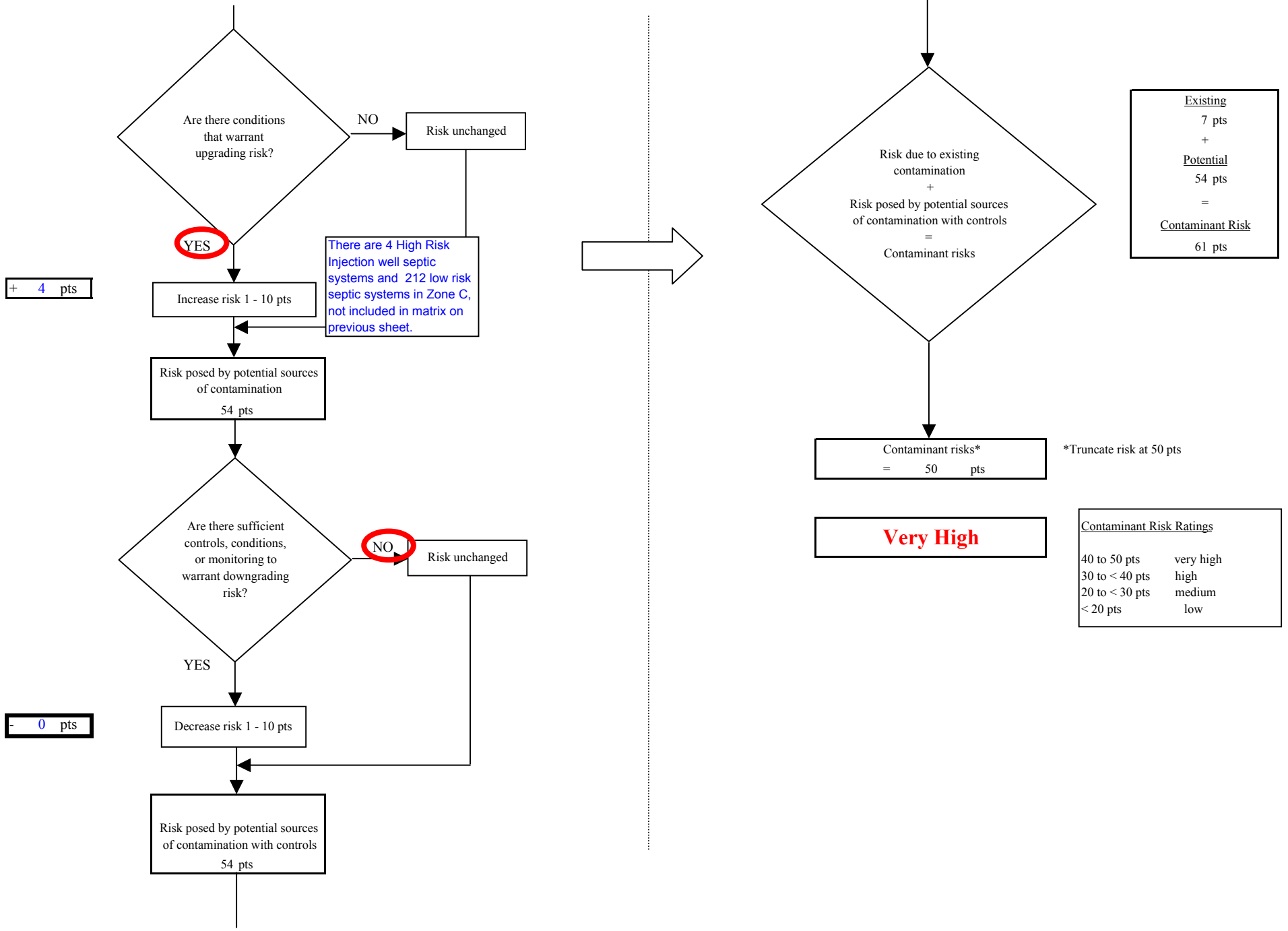


Chart 6. Vulnerability analysis for Ninilchick Fair Association - Nitrates and Nitrites

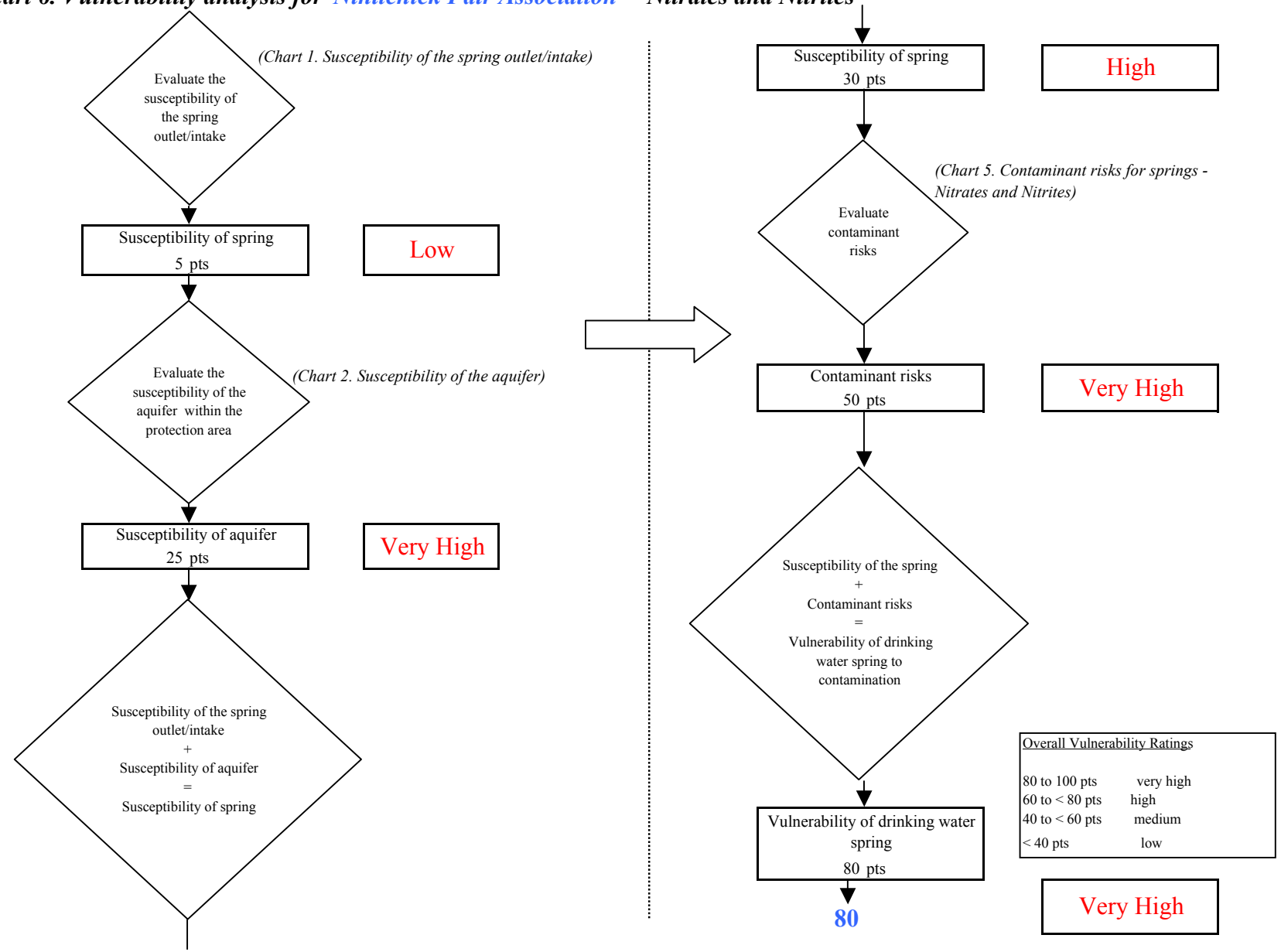


Chart 7. Contaminant risks for Ninilchick Fair Association - Volatile Organic Chemicals

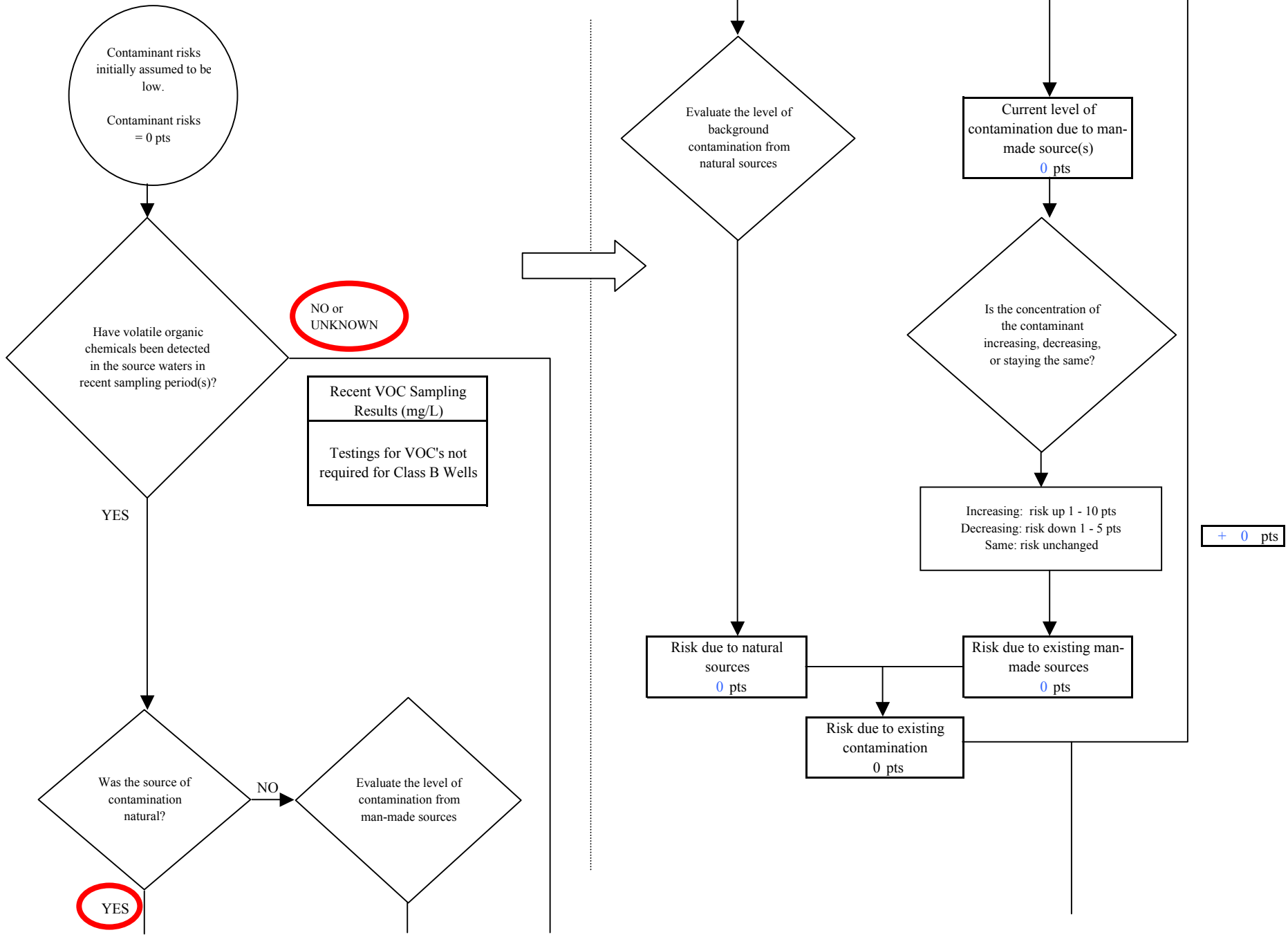
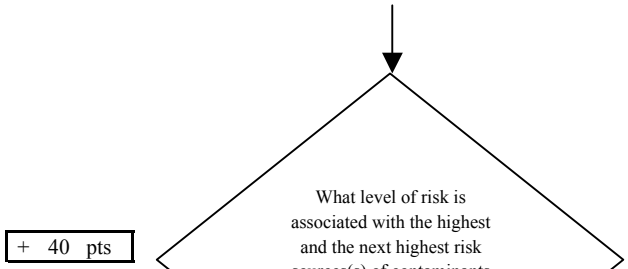


Chart 7. Contaminant risks for Ninilchick Fair Association - Volatile Organic Chemicals



+ 40 pts

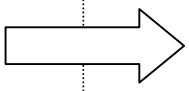
Risk Levels for Contaminant Sources identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	0	2	2
Medium(s)	0	2	2
Low(s)	9	26	35

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

Matrix Score 40

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



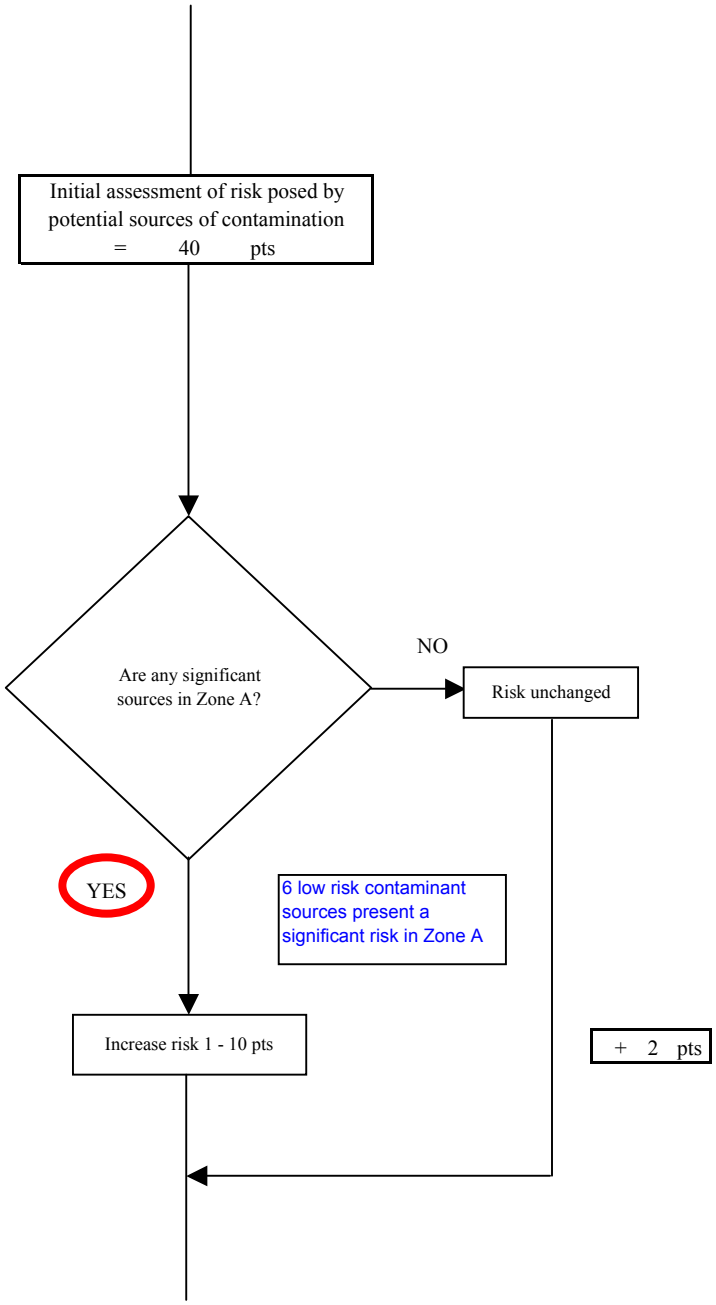
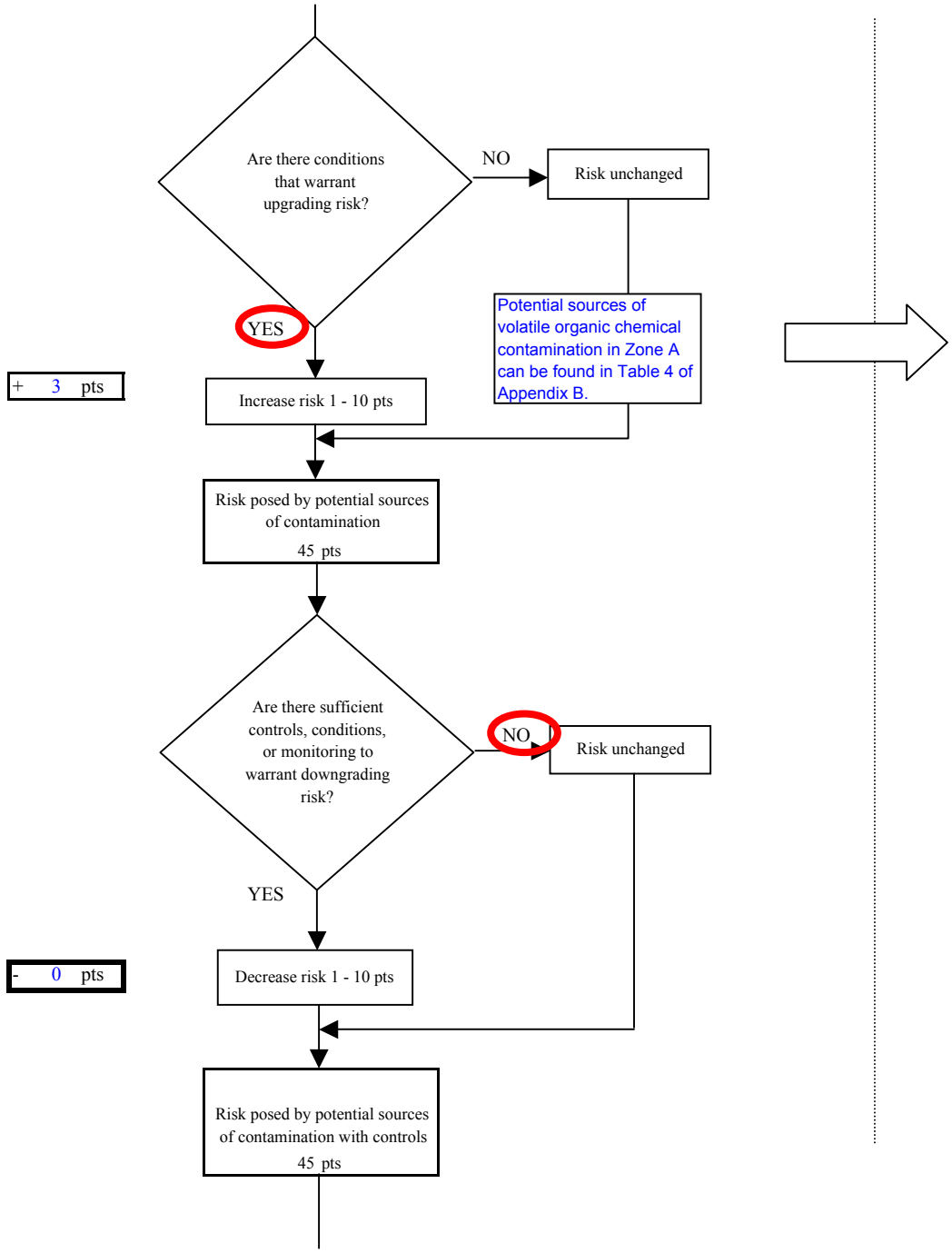
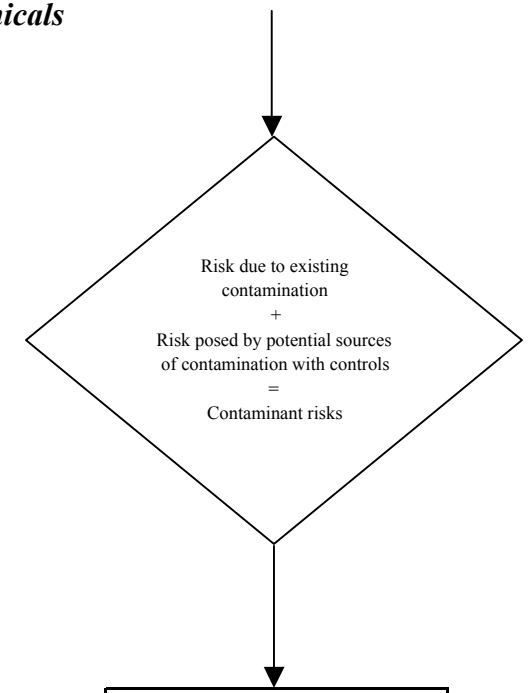


Chart 7. Contaminant risks for Ninilchick Fair Association - Volatile Organic Chemicals





Existing
0 pts
+
Potential
45 pts
=
Contaminant Risk
45 pts

Contaminant risks*
= 45 pts

*Truncate risk at 50 pts

Very High

Contaminant Risk Ratings

40 to 50 pts	very high
30 to < 40 pts	high
20 to < 30 pts	medium
< 20 pts	low

Chart 8. Vulnerability analysis for Ninilchick Fair Association - Volatile Organic Chemicals