GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT

February 23, 2022

Brice Environmental
3700 Centerpoint Drive, Suite 800
Anchorage, Alaska 99503

Reference: Eareckson Air Force Station (EAS) SWA Addendum

An update to the existing Source Water Assessment (SWA) for the Eareckson Air Force Station (EAS) was completed by Goldstream Engineering, Inc. (GEI) and submitted to Brice on May 14, 2021. This document is intended to be an addendum to the SWA and shall be attached to that document.

During the time of our assessment, ongoing efforts were being conducted by Brice to classify waste found during the Hangar 4 demolition and a Waste Characterization Report was to be created. Please refer to that report for more information. From that report, it is our understanding that there were exceedances in:

- Sump 1 – DRO, PFOS, PFOA, arsenic, Tetrachloroethane, and Trichloropropane
- Sump 2 – DRO, PFOS, PFOA, arsenic, and trichloroethene
- Sump 3 – Arsenic
- Sump 4 – PFOS, arsenic, and pentachlorophenol

The sumps were discovered to be unconfined and it is possible that they were connected to the existing sewer system. These items are located within the watershed area for the infiltration gallery and should be removed to the extent possible.

The presence of the identified contaminants above does not change the risk level in the CS Rankings and the Overall Vulnerability remains High.

Sincerely,

Goldstream Engineering, Inc.

Electronic Copy: Ryan Rapuzzi, Brice Environmental, rrapuzzi@briceenvironmental.com

Attachments: 2021 Source Water Assessment

www.goldstreamengineering.com
projects@goldstreamengineering.com
Office: (907) 456-3853
401 College Road
Fairbanks, Alaska 99701

UNITED STATES AIR FORCE
611TH AIR SUPPORT GROUP
611TH CIVIL ENGINEER SQUADRON

ELMENDORF AFB, ALASKA

DRINKING WATER SOURCE ASSESSMENT INFILTRATION GALLERY

EARECKSON AIR STATION
SHEMYA, ALASKA

UPDATED 05/14/2021
BY GOLDSTREAM
ENGINEERING INC.

UNITED STATES AIR FORCE
611TH AIR SUPPORT GROUP
611TH CIVIL ENGINEER SQUADRON

ELMENDORF AFB, ALASKA

DRINKING WATER SOURCE ASSESSMENT INFILTRATION GALLERY

EARECKSON AIR STATION
SHEMYA, ALASKA

UPDATED 5/13/2021
BY GOLDSTREAM ENGINEERING INC.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

TABLE OF CONTENTS
(continued)

<u>**SECTION**</u> <u>**PAGE**</u>

APPENDICES

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

APPENDICES
(continued)

ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AST	aboveground storage tank
BTEX	benzene, toluene, ethylbenzene, and xylenes
BOSS	Base Operational Support Services
CCR	Consumer Confidence Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DNR	Alaska Department of Natural Resources
DWPG	Drinking Water Protection Group
EPA	U.S. Environmental Protection Agency
EAS	Eareckson Air Station
GIS	Geographic Information System
GWUDISW	groundwater under the direct influence of surface water
HDPE	high-density polyethylene
HMCIC	heavy metals, cyanide, and other inorganic chemicals
IRP	Installation Restoration Program
Jacobs	Jacobs Engineering Group Inc.
MCL	maximum contaminant levels
mg/L	milligram per liter
MSL	mean sea level
NTNC	Non-Transient, Non-Community
O&M	operations and maintenance
OOC	other organic contaminants
POL	petroleum, oil and lubricant
PWS	public water systems
PWSID	Public Water System Identification
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
ROWPU	reverse osmosis water purification unit

ACRONYMS AND ABBREVIATIONS

SDWA	Safe Drinking Water Act
SOC	synthetic organic contaminants
SOP	standard operating procedure
SWA	Source Water Assessment
TCE	trichloroethylene
TPH	total petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers, Alaska
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USAF	U.S. Air Force
USGS	U.S. Geological Survey
ASRC	Arctic Slope Regional Corporation
UST	underground storage tank
VOC	volatile organic compounds
WTP	Water Treatment Plant
WWII	World War II
µg/L	micrograms per liter

EXECUTIVE SUMMARY

PURPOSE

The purpose of this assessment is to update and identify contaminant sources within the Eareckson Air Station drinking water protection area and to determine source water susceptibility to potential, current, and historic contaminants within the protected area. Most of the information contained in this document has not changed since the last Source Water Assessment dated May 2010 by Jacobs Engineering Group, Inc. and has been updated based on information collected in November 2020 by Goldstream Engineering Inc.

FINDINGS

Eareckson Air Station is located on Shemya Island in the North Pacific Ocean near the end of the Alaska Aleutian Chain. An infiltration gallery is the sole source of public drinking water for the island. The system was classified as groundwater under the direct influence of surface water in 1999. The gallery is old, dating from the 1950s, but well maintained. The gallery is owned by the U.S. Air Force and operated by Arctic Slope Regional Corporation (ASRC under contract to provide Base Operational Support Services (BOSS). The drinking water protection area (i.e., the watershed) was identified in the 2003 assessment around the gallery. The area is subdivided into Zone A (defined by a 1,000-foot radius circle upstream of the gallery intake) and Zone B (defined by a one-mile radius circle upstream of the gallery intake). The watershed boundary is believed to be hydrologically correct (Figure B-1).

Potential, current, and historic sources of contamination were evaluated for the level of threat posed to the drinking water source. Shallow groundwater, near the infiltration gallery, has already been contaminated with volatile organic compounds (VOC) (ADEC 2009a). The area around the infiltration gallery is a contaminated site, currently managed under the Installation Restoration Program (IRP). The site is designated as OT 48 and the primary Contaminant of Concern (COC) is trichloroethylene (TCE). Some contamination reached the gallery collection tubes and sump. Between 1988 and 1996, there was a persistent presence of TCE in the infiltration gallery (OT 48). Since 1996, the concentrations of TCE have been declining in and near the water source. Refer to Appendix B, Figure B-2 for a description of the contamination around the water source. The contamination is being monitored, and the water treatment plant is working to treat the drinking water for VOC.

The overall calculated vulnerability of the source water is high due to the infiltration gallery water being under the direct influence of surface water which is considered as vulnerable to contamination as surface water. The high natural susceptibility of the watershed as well as historic contamination of land and water are major contributors. In 2004, the Alaska Department of Environmental Conservation, Environmental Health, Drinking Water Protection Program (now called the Drinking Water Protection Group) released a Source Water Assessment Report. The executive summary from this report states:

> “The public water system for USAF Eareckson is a Class A water system consisting of 1 source intake(s). The water system is located on Shemya and the intake for this Public Water System Identification (PWSID) is a groundwater well. The wellhead received a susceptibility of "very high" and the aquifer received a susceptibility rating of "low". Combining these scores produces a natural susceptibility of "high" for the source. In addition, this water system has received a vulnerability rating of "low" for bacteria/viruses, "very high" for nitrates/nitrites, "very high" for volatile organic chemicals, "very high" for heavy metals, "low" for other organic chemicals, and "low" for synthetic organic chemicals.” (ADEC 2004)

The above excerpt from the Alaska Department of Environmental Conservation (ADEC) Source Water Assessment notes the source as a groundwater well. Due to the template nature of this report and the large number of reports generated in a short amount of time, there have been some inconsistencies noted, such as referring to the infiltration gallery source intake as a groundwater well when this is clearly not the case. Since the ADEC report was produced, the terminology for public water systems in Alaska has changed. The U.S. Air Force (USAF) Eareckson system is now classified as a Non-Transient, Non-Community Public Water System per federal criteria. The Installation Restoration Program (IRP) and source water protection efforts can mutually benefit each other by sharing and integrating data.

(intentionally blank)

1.0 INTRODUCTION

This Source Water Assessment (SWA) has been updated by Goldstream Engineering after collecting updated information during a November 9-11, 2020 onsite inspection. Most of the information contained in this report has not changed and is from the previous May 2010 SWA completed in support of the mission at Eareckson Air Station through the Environmental Support Services.

1.1 PURPOSE

The purpose of this assessment is to identify contaminant sources within the drinking water protection area as well as to determine source water susceptibility to potential, current, and historic contaminants within the protected area. A review of the natural hydrologic sensitivity has been combined with potential, current, and historic contaminant risks to arrive at an overall decision about the vulnerability of the drinking water source to contamination. This assessment has been completed to assist the U.S. Air Force (USAF) in protecting drinking water at Eareckson Air Station, Shemya Island, AK.

1.2 AGENCY ASSISTANCE

Numerous individuals assisted in the development of this assessment. Assistance was received from Elmendorf Air Force Base, Eareckson Air Station (EAS), U.S. Army Corps of Engineers (USACE), Alaska Department of Natural Resources (DNR), U.S. Geological Survey (USGS), and the Alaska Department of Environmental Conservation (ADEC).

1.3 BACKGROUND INFORMATION

This document is an updated version of the Source Water Assessment (SWA) completed in May 2010 that was completed in support of the mission at Eareckson Air Station through the Environmental Support Services. This document includes information collected in 2003 by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM), the ADEC 2004 Source Water Assessment, and the infiltration gallery drinking water protection area designated in 2001 by ADEC. Source water protection requirements are addressed in ADEC 18 AAC 80.015.

1.3.1 Safe Drinking Water Act

The 1986 and 1996 Safe Drinking Water Act Amendments required all states, which have primacy over their drinking water regulations, to assess every public drinking water source in their state. The U.S. Environmental Protection Agency (EPA) approved Alaska's Drinking Water Protection Program (a combination of Source Water Assessments and Wellhead Protection Programs) in April 2000. The combined program meets the statutory requirements of the State of Alaska, the Safe Drinking Water Act (SDWA), and subsequent amendments [18 Alaska Administrative Code (AAC) 80, 2002; 18 AAC 80.015, 2002]. Administration of the program is handled by the ADEC Environmental Health, Drinking Water Program, Anchorage, AK.

1.3.2 ADEC Drinking Water Program Mission

As part of the EPA's SDWA requirements, the Alaska Drinking Water Program is responsible for requiring public water systems to supply safe drinking water for public consumption that meets minimum federal health-based standards. Alaska has had primary enforcement responsibility of the public water system supervision program (Safe Drinking Water Program) since 1978. Personnel at ADEC provide guidance to owners and operators supervising the public water systems (PWS) on the design, installation, and maintenance of drinking water facilities. They review project descriptions and engineered plans for new and modified systems to ensure that appropriate standards are met to protect human health and minimize the impact to the environment. ADEC provides access to office files on local public drinking water systems, as well as technical and compliance assistance, and workshops on regulatory, engineering, and drinking water public health-related issues (ADEC 2008).

1.3.3 Drinking Water Protection Group

Drinking water in Alaska is obtained from many different sources, including wells, springs, lakes, rivers, and streams. The Drinking Water Protection Group (DWPG) is the primary regulatory point of contact for source water protection and assessment. The DWPG is located in the Technical Resources Section, which is part of the Drinking Water Program at ADEC. The DWPG Program encompasses both groundwater and surface water sources. It also includes sources that are considered groundwater under the direct influence of surface water (GWUDISW) such as the infiltration gallery at Eareckson. The regulations and treatment methods for GWUDISW are very similar to the regulations and treatment methods for surface water sources. Prior to 2008, the DWPG was designated as the Drinking Water Protection Program and had the focus of providing every public water system in the state with a source water assessment of every potable water source between 1999 and 2005. Although assessment methods for groundwater and surface water are different, ADEC has outlined three steps for all source water assessments:

- Identify the area of potential impact around the drinking water source (i.e., the protection area)
- Conduct an inventory of contaminant sources within the area
- Determine the vulnerability of the drinking water source to contamination (ADEC 2001)

1.3.4 Source of Drinking Water at Eareckson Air Station

Eareckson Air Station is designated as a Non-Transient, Non-Community (NTNC) Public Water System. Drinking water for Eareckson Air Station, Shemya Island, AK is obtained from a buried infiltration gallery system. The raw water is under the direct influence of surface water. The drinking water system supplies potable water to military and civilian personnel, workers, contractor personnel, and visitors to Shemya Island.

1.4 PAST SOURCES OF WATER SUPPLY AT EARECKSON AIR STATION

The island was first occupied as a military base in 1942 (USGS 1976). Initially, the water supply for the island was surface water from small streams along the southern coast. In 1943, construction of an east-west runway began and disrupted the water supply from the streams. Surface water from 16 lakes on the island was then used as a source of drinking water. To supplement the water supply from the lakes, approximately 30 wells were drilled in 1943 and 1944 (USAF 1991; USGS 1976), mostly in the western half of the island. These wells were drilled into the bedrock groundwater system. Most of these wells experienced problems with salt-water intrusion, and were abandoned at the time the infiltration gallery was constructed in the 1950s. Wells 4 and 29, perhaps the oldest of these wells, were rehabilitated in the 1950s by the USACE and served as the backup water supply. The reactivated wells 4 and 29 were renumbered as wells 400 and 410, respectively. These wells were the backup water supply for the island until they were decommissioned in 1998 (Jacobs 1998). Currently, all of the water supply wells, including wells 400 and 410, are capped and abandoned.

2.0 DESCRIPTION OF SHEMYA ISLAND

Shemya Island is one of the Near Islands, the westernmost group in the chain of Aleutian Islands extending southwest and west from the Alaskan Peninsula (Appendix B, Figure B-1). The Near Islands consist of Attu, Agattu, Shemya, Alaid, and Nizki Islands; the last three are known as the Semichi Islands.

Shemya Island is remote. Transportation to the island is by airplane or boat only. It is about 1,450 miles from Anchorage, AK, and several hundred miles from Russia. The island is approximately 4.5 miles long and 2.5 miles wide. Eareckson Air Station, a USAF installation, occupies the entire island.

Significant industrial development on the island occurred in 1943 during World War II (WWII). The island was operated as an active military installation until 1995. During the active years, the island had a population of about 700 people. In 1995, the base was put on caretaker status under a base operations and support contract, and active duty personnel were demobilized. The population dropped to about 60 to 70 people after deactivation in 1995. The BOSS Contractor, ASRC, has maintained the facilities and infrastructure on the island since October 1, 2020. Prior to that date, records were kept by the previous BOSS Contractor Chugach McKinley Incorporated (CMI) since 2003. Current plans for the island are for continued operation under caretaker status.

Much of the island's natural terrain has been disturbed by military and construction activities, which began during the WWII era. Many of the island's areas are covered with fill material placed to provide stable construction sites and road surfaces. Many of the old structures have been demolished, but old construction fill remains as surface material (Jacobs 1999).

2.1 VOLCANOES, EARTHQUAKES, AND TSUNAMIS

Shemya Island is located in the "Ring of Fire", an area around the Pacific Ocean that is subject to volcanic activity, earthquakes, and tsunamis. In this area, the volcanoes are near the margin of the bordering continent or in island arcs that lie along the continental margin, including Shemya Island. The volcanoes are associated with geologically young and still growing mountains. Tectonic activity has been partly responsible for the formation and modification of Shemya Island. The island is located above a subduction zone formed as the Pacific Tectonic Plate dips below the westward moving North American Tectonic Plate (Toksoz 1975). This volcanism formed the Aleutian Island chain (including Shemya Island), and the contiguous Aleutian Range on the Alaska Peninsula. On 2 February 1975, a magnitude 7.56 earthquake shook Shemya Island and broke several drinking water supply lines (USGS 1976) and compromised the integrity of the above groundwater storage tanks. Damage of the tanks can still be seen on the old tanks near the water treatment plant. An 8.7 magnitude earthquake is the maximum expected for the Shemya Island area (USAF 2000b).

2.2 PHYSIOGRAPHY AND CLIMATE

Shemya Island is a flat-topped seamount in the North Pacific Ocean. The topography gently slopes south-southwest from a maximum elevation of about 275 feet to sea level. Coastal sea cliffs and the higher ground are located on the island's north side. The natural surface of the island where undisturbed by human activities, is composed of hummocky glaciated terrain and tundra. Numerous small natural ponds and low-lying marshy areas are found on the island. Most natural surface and subsurface drainage flows in the south-southwest direction of the gentle structural tilt. In some localized parts of the island, construction activities have altered the natural drainage pathways. Interior drainage is poor, primarily caused by tundra degradation, frost ponds, and depressions, which create standing water.

The climate on the island is considered marine, with typical moist conditions and temperature variances moderated by the Pacific Ocean. As a result, the climate is milder than expected considering the island's latitude. Mean annual temperature is around 39.4 degrees Fahrenheit; mean annual precipitation is 30.3 inches. The island's unique location in the North Pacific Ocean is mainly responsible for the persistent strong and severe wind conditions. Local weather conditions are influenced by the island's location within a constant low-pressure system, where conditions are cool, windy, and rainy throughout most of the year. Mean annual wind speed is 15.3 knots. Persistent hydrologic behavior and almost constant wind frequently interfere with air transportation to and from the island (Jacobs 1999, 2000, 2001).

2.3 GEOLOGY

Shemya Island is a wave-cut platform. At some time in the past, presumably in Late Tertiary/Early Quaternary time, the bedrock platform of the island was planed off by marine erosion, covered by marine deposits, uplifted and tilted to the south, and then glaciated. The marine deposits were partly removed by glacial erosion, which cut into the bedrock surface. Glacial till was deposited on the higher part of the island. The glaciers melted due to natural climate variability. As a result of melting, outwash sand and gravel were deposited, covering the one known area of glaciated bedrock surface. Only relatively thin layers of unconsolidated material are found on this platform (USGS 1976).

Bedrock is composed of volcanic, pyroclastic, and minor amounts of intrusive rocks. The oldest rocks are interbedded sedimentary and volcanic rocks of Tertiary age, which make up the western two-thirds of the island. Interbedded pyroclastic rocks, which have been intruded by small igneous bodies and are overlain locally by volcanic rocks, comprise the bulk of the eastern third of the island. The bedrock of Shemya Island has intense jointing. In some places the rock is so fractured that it breaks easily into fragments small enough for road construction. Joints are closely spaced in the bedrock. In addition, many faults are present in the bedrock (USGS 1976).

The surficial geology of Shemya Island was mapped in 1976 (USGS 1976). Pleistocene glacial deposits, consisting of ground moraine and outwash sand, gravel, and boulders, are present on the island. The average thickness of these deposits is 5 feet, but locally may be as much as 12 feet or more. The youngest geologic materials are sand, gravel, and boulder deposits on modern and old raised beaches, peat deposits which range in thickness from a few inches to as much as 15 feet, and aeolian sand in dunes on the south-central part of the island. Peat deposits are the predominant surficial deposit on the island (USGS 1976).

2.4 WATER RESOURCES

The source of all fresh water on Shemya Island is precipitation. Some of this precipitation moves directly overland as surface water to lakes, ponds, and streams. Some of the precipitation percolates downward where it becomes groundwater. Most surface and subsurface drainage flows to the south-southwest due to the topographic and structural tilt.

2.4.1 Surface Water

In 1992, the USAF developed the management zone approach to evaluate the potential for widespread and/or localized contamination across the island (Jacobs 1995b). The island was divided into eight different management zones based on topography and surface water divides, and to a lesser extent on groundwater flow direction and divides. Therefore, the management zone boundaries correspond to watershed boundaries for surface water. Most watersheds contain lakes or ponds; some contain a stream.

A total of 16 named lakes or ponds exist on the island. On the western side of the island, the Western Lake Complex includes Upper Lake, Middle Lake, Lower Lake, and Pudge Lake. Except for the Western Lake Complex, most lakes and ponds on the island have poorly defined drainage. In the northern and north-central part of the island are Headquarters Lake, Grace Lake, Jeanne Lake, and Hospital Lake. The eastern part of the island has Wash Pond, Twin Ponds, June Lake, Myrtle Lake, Sweeney Lake, and Rock Crusher Pond.

The only named creeks on the island are Gallery Creek, Lake Creek, and Abandoned Drum Disposal Area Drainage. Flow in these creeks is to the south-southwest. Of these creeks, Gallery Creek is the most significant, since the location of the island's potable water supply is adjacent to the creek.

2.4.2 Groundwater

There are two recognized groundwater systems on Shemya Island: a shallow unconfined system and a deeper bedrock system. These systems may not be true aquifers. Both the shallow and deep groundwater systems have very limited yields due to hydraulic and hydrogeologic characteristics existing on the island. Both systems have been used in the past for potable water supply (USGS 1976). The aquifers on the island do not appear to be capable of significant quantities of water production and may be more accurately described as aquitards; however, these aquitards are permeable enough to study the groundwater flow throughout the island. Precipitation is the source of water for both systems.

Surface water infiltrates and percolates down through unconsolidated surficial material (peat, sand, and gravel deposits). Within the surficial material are extensive lenses and layers of organic peat that absorb large quantities of water and trap it below the surface as perched water deposits. These trapped subsurface water deposits drain to the subsurface. Below the peat layer is unconsolidated sand and gravel, which rests on bedrock. A shallow unconfined groundwater system is present underneath most of the island and occurs at the boundary between the bottom of the unconsolidated surface material and the uppermost part of the bedrock layer. These surficial deposits are often quite thin or are poor transmitters of water. Well yields are poor, averaging only 25 gallons per minute. Most of the shallow groundwater follows topography and travels south discharging as seeps or springs or at the shoreline. This groundwater zone typically occurs between 10 to 30 feet below ground surface (USGS 1976).

Groundwater also occurs in the bedrock fractures. Only the upper 10 to 15 feet of the bedrock is severely fractured. Deep groundwater is available only where large fractures extend to considerable depth. Large yields from wells in bedrock are uncommon. Because of the southward sloping structural tilt, groundwater in the uppermost part of the fractured bedrock flows south and discharges at the shoreline. The bedrock groundwater system (including the volcanic, intrusive, and pyroclastic rocks) has a wide range of hydrologic properties. Porosity and permeability depend on secondary fracturing or jointing. Many wells drilled on Shemya Island in the past were completed in the bedrock system. These wells range in depth from 40 to 205 feet and some were completed below sea level. Nearly all the wells produced groundwater from fractures rather than from a really extensive and homogeneous aquifer. Available groundwater data suggest an irregular piezometric surface sloping to the south.

2.4.3 Groundwater/Surface Water Connection

Precipitation supplies the water that becomes surface water; some surface water becomes shallow groundwater; some shallow groundwater is discharged as surface water; and some shallow groundwater becomes deep groundwater within the fractured bedrock. There is good hydraulic communication between surface water and groundwater on Shemya Island. Because of the strong surface water/groundwater connection, all natural water supplies on the island are very sensitive to contamination from surface activities.

2.5 INSTALLATION RESTORATION PROGRAM AT SHEMYA ISLAND

Significant military industrial development and construction activities occurred on Shemya Island during and after World War II, leading to environmental contamination in various parts of the island (Figure B-2). During the 1970s and 1980s, contaminated sites were discovered, which prompted the Department of Defense and the USAF to initiate an IRP in the 1980s to remediate these sites. Subsequent investigation activities identified the nature of the contamination, as well as the lateral and vertical extent of contamination at each site. Currently, remediation is ongoing at many sites including OT 48 which is located inside the delineated watershed area of the Shemya drinking water source.

2.6 SUMMARY

Shemya Island is in an extremely remote location in the North Pacific Ocean, 1,450 miles from Anchorage and several hundred miles from Russia. Eareckson Air Station, a U.S. military installation, occupies the entire island. The island is located in a seismically active area that experiences earthquakes and tsunamis. The island is a wave-cut platform that has been planed off by marine erosion, covered by marine deposits, uplifted and tilted to the south, glaciated, and de-glaciated. The island has sustained significant surface modifications from military and construction activities. The climate on the island is harsh with strong winds and precipitation almost every day. Abundant precipitation sustains surface water and groundwater on the island. Surface and groundwater are hydraulically connected. Two groundwater systems have been used for potable water supply on the island: a shallow unconfined peat/sand/gravel system (infiltration gallery), and a deeper fractured bedrock system. Over the years, unintentional environmental contamination has occurred. However, efforts since the 1980s have worked to remediate much of this contamination and avoid future contamination. Currently, remediation is ongoing at many sites. At this time the installation is in caretaker status.

(intentionally blank)

3.0 TECHNICAL APPROACH AND METHODS

A Source Water Assessment is comprised of three basic components that make up the technical approach and method of assessment. The first part of the assessment is the delineation of the protection area using an accepted means of delineation. The second is the contaminant source inventory involving many different data sources. The third is assessing the overall vulnerability of the water source to contamination.

3.1 PROTECTION AREA DELINEATION

The drinking water protection area around the infiltration gallery was identified in 2001 by ADEC, and again in 2003 by USACHPPM. This area consists of all portions of the Infiltration Gallery Watershed. This delineated protection area (Infiltration Gallery Watershed) is the most sensitive area where protection efforts can have the greatest positive impact as well as where it is most susceptible to adverse impacts from contaminant sources. Therefore, it is critical that contaminant sources in this area are inventoried and managed appropriately. Based on ADEC guidance, the drinking water protection area is divided into three zones based on distance from the intake (Figure B-2). At Eareckson Air Station, Zone A is 1,000 feet upstream of the intake, and Zone B is 1 mile upstream of the intake. Because Zone B covers the entire watershed, there is no Zone C (Appendix B, Figure B-1).

3.2 CONTAMINANT SOURCE INVENTORY

The contaminant source inventory identifies potential sources of contamination associated with specific activities, industries, and land uses located within the delineated source water assessment area (Appendix B, Figure B-2).

3.2.1 Strategy

Conducting an inventory of current and potential contaminant sources within the drinking water protection area defines the current and potential future risks of contamination (Appendix C, Table C-1). Existing sources (or existing contamination) are those already in the source water which have been pulled into the gallery (i.e., detected in a sample). Existing sources pose a current risk to the water supply at some level. Existing contamination may be man-made (i.e., a spill or leak), or naturally occurring (i.e., metals and nitrates dissolved in source water from the surrounding rock/soil). Potential sources (or potential contamination) may be in the source water or on the ground surface, but have not reached the gallery; potential sources have not yet contaminated the water supply. Potential sources may be a current structure or activity (i.e., an aboveground storage tank [AST] containing fuel), or it may be historic contamination in the source water that has not yet reached the water supply.

The inventory of current and potential sources at Eareckson Air Station was conducted by performing fieldwork and a literature search. The fieldwork focused on visually identifying potential sources of contamination at the ground surface. The literature search focused mainly on identifying and documenting historic contamination from past activities at the station.

3.2.2 Fieldwork

Fieldwork was accomplished by visual reconnaissance on 9-11 November 2020. The drinking water watershed was surveyed by driving and walking the zones and visually identifying sources of contamination. The visual reconnaissance resulted in an inventory of contaminant sources in the Infiltration Gallery Watershed. Inventoried sources of contamination included activities, facilities, or structures that use, produce, or store products or waste that can be released, accidentally or by design, in quantities that can have a significant impact on the quality of the source water. The contaminant source inventory is located in Appendix D.

3.2.3 Literature Search

During the 2003 and 2009 Source Water Assessments, a literature search was conducted at Elmendorf Air Force Base and Eareckson Air Station for documents, reports, and maps that contain information on the watershed boundary, precipitation on the island, surface and subsurface hydrology of the watershed, the location and nature of historic contamination, and potential contaminant sources in and around the watershed. The 611 Civil Engineer Squadron (CES) at Elmendorf maintains a library of information about Eareckson Air Station. Many reports and documents, mainly related to the cleanup of past contamination by the Installation Restoration Program (IRP) were found at the Elmendorf library as part of the previous survey. A literature search was conducted at Eareckson Air Station, mainly at the Water Treatment Plant. Additional information has been provided by Brice Environmental.

Included in the internet search was the ADEC website for the ADEC Spill Prevention and Response, Contaminated Sites database that was last modified on December 4, 2020. The search focused on the location and nature of known contaminated sites at Eareckson Air Station. The search results were useful in assessing the risk to the water source. The results of the search contained a list of many sites at Eareckson Air Station known to be contaminated. Multiple sites occur in and around the infiltration gallery and the water supply watershed.

3.2.4 Update

The data from the fieldwork and literature search were used to update the list created by USAF, USACPPM and ADEC of contaminant sources in and around the drinking water protection area. The list was sorted by category of contaminants regulated in drinking water sources.

3.2.5 Ranking

The contaminant sources were ranked according to the degree of risk posed to human health based on the volume of contaminants typically associated with the inventoried activity, facility, or structure, and the toxicity, persistence, and mobility of contaminants involved. This was accomplished by comparing the inventoried source to the previous ADEC risk-ranking list to determine the rank. Five ranks are defined: very high, high, medium, low, and very low.

3.3 ASSESSING VULNERABILITY

The results of the contaminant source inventory, along with information about the construction of the gallery and the hydrological characteristics of the watershed, were used to assess the vulnerability of the drinking water source to contamination (Appendix C, Table C-3).

Vulnerability is described by ADEC: natural susceptibility + contaminant risks = vulnerability of surface water source. The components in the equation (natural susceptibility and contaminant risks) are defined by analyses which incorporate various physical/hydrological criteria (Appendix C, Table C-1). The criteria for the analysis have been specified by the Alaska regulatory authorities (ADEC 2001). Each analysis results in a numerical score. The two numerical scores are added together to provide an overall vulnerability for the source water.

A series of flow charts (Appendix F) for conducting the vulnerability assessment and guidance on how to use the charts was provided by the ADEC (ADEC 2001). The charts provide a structure for evaluating numerous criteria associated with each analysis. Natural susceptibility was assessed by applying the criteria in Table C-1 to the watershed and gallery using the charts provided by the ADEC in order to obtain numerical scores for each analysis (ADEC 2001).

The procedure for evaluating contaminant risk is somewhat different. Six major categories of contaminants are regulated for drinking water sources by the State of Alaska (Appendix C, Table C-2). Contaminant risk was assessed by progressing through the charts six times, once for each category of contaminants, providing a numerical score for each category of contaminant. Numerical scores for each of the two analyses (natural susceptibility and contaminant risks) were combined to provide an overall vulnerability for the water source (Appendix C, Table C-3).

4.0 WATERSHED AND WATER SUPPLY SYSTEM

The current water supply at Eareckson Air Station consists of an infiltration gallery that collects water from the shallow groundwater system in the Infiltration Gallery Watershed. It is a hybrid surface water/groundwater system extracting shallow groundwater under the direct influence of surface water. The infiltration gallery, installed in the 1950s, has proven adequate to serve the water supply needs of the island, despite the seasonal variations in quality and quantity of water. In the past, wells drilled into the fractured bedrock system have provided additional water for the island, including emergency backup. A significant portion of the information below has been extracted from a report by Jacobs Engineering (Jacobs 1996).

4.1 WATER SUPPLY WATERSHED

The water supply watershed is in the east-central part of the island and north of the main runway (Appendix B, Figure B-2). The basin covers about 265 acres (USAF 2000a). Gallery Creek is the main surface water drainage for the basin. The infiltration gallery is located in a topographic depression in the southern end of the basin adjacent to Gallery Creek and Building 705. The gallery may be adjacent to or on top of an intersection of two potential fracture zones within the bedrock (Jacobs 1996).

The basin slopes from north to south at a grade of about four percent (USAF 2000a). At the northern end of the basin, there is a topographic and groundwater divide very close to the edge of the island, located along a ridge. The topographic slope in the area around the Hangar 4 pad flattens somewhat, perhaps due to past construction activities. The slope begins to steepen moving south from the Hangar 4 pad, approaching the infiltration gallery.

4.1.1 Geology

The primary surficial deposit within the watershed is a highly organic peat layer from 1 to 10 feet thick. There are areas in the watershed where peat is not encountered, generally caused by past military and construction activities. The moist to wet peat layer contains varying amounts of silt, sand, and gravel. This peat layer acts as a sponge absorbing a large amount of precipitation.

Below the peat layer is a sequence of silt, sand, and gravel ranging from 8 to 20 feet thick. This layer is composed of angular gravels up to one inch in diameter mixed with fine-grained sand and silt. Gravel clasts have been identified as gray hornblende dacite porphyry, an indication of a weathered bedrock zone. During past borehole drilling activities, auger refusal has been noted at depths of less than 20 feet. This indicates the unconsolidated surficial layers are thin and bedrock is within 20 feet of the surface. Bedrock under the Gallery Creek watershed consists of shallow intrusive or extrusive dacite and andesite porphyry (Jacobs 1996).

4.1.2 Surface Water

Gallery Creek represents the only significant surface water body in the water supply watershed. Precipitation supplies the majority of water that flows through the creek. Limited recharge in the lower reaches occurs by shallow groundwater discharge from the peat layer. A number of small ponds and lakes also occur within the watershed and may contribute some flow to the creek. The creek drains the entire water supply watershed. It originates in the northern part of the watershed and extends southward to a culvert that carries water under the active runway to a discharge point along the southern coast. Except for the culvert, the general direction of surface water flow within Gallery Creek does not appear to have changed significantly during the operational history of the air station. The drainage flows at about 80 gallons per minute (less than 1 cubic feet per second); higher flows occur on high precipitation days (Jacobs 1996).

4.1.3 Groundwater

Shallow groundwater in the water supply watershed occurs at the bedrock/unconsolidated deposits boundary. Groundwater elevations in the watershed range from a low of 81 to 87 feet above mean sea level (MSL) in the south to a high of 131 feet above MSL in the north (Jacobs 1996). The groundwater elevation near the infiltration gallery averages about 118 feet above MSL. Depth to groundwater in the watershed ranges from 4 to 18 feet below ground surface. The horizontal hydraulic gradient within the watershed varies from 0.015 to 0.043 vertical foot/horizontal foot (USACHPPM 2002).

Data from IRP monitoring wells show that hydraulic conductivity of shallow groundwater in the infiltration gallery watershed is about 3.7 to 0.001 centimeters per second. Geotechnical analysis of soil samples from the watershed show an average porosity of 0.44. These data, along with hydraulic gradient information, were used to determine an average groundwater velocity of about 2,523 feet per year (USACHPPM 2002).

4.1.4 Industrial Facilities

A gravel pit operation about 0.5-miles upgradient from the infiltration gallery is adjacent to the northwestern boundary of the watershed. The location of this operation is in a topographic depression known as the “Grand Canyon”. This canyon is a natural feature of the island that has been subsequently modified for industrial and military purposes. Hangar 4, was located about 0.25-miles upgradient of the infiltration gallery and was only used for miscellaneous storage. This structure was recently removed. All buried utilities for the building (water, sewer, and fuel) have been abandoned. Brice Environmental conducted a Waste Characterization for contaminants found during the demolition and have summarized their finding in a separate report. The watershed also contains the infiltration gallery pump house (Building 705). There are several paved and unpaved roads that run east-west and traverse the northern, central, and southern parts of the watershed.

4.1.5 Watershed Activities and Protection Measures

All industrial activities which use hazardous materials or produce hazardous waste are now prohibited within the watershed. A hazardous materials inventory was conducted in 2010 to identify and remove all current and potential contaminant sources. The watershed boundaries are marked with signs that prohibit potential pollution activities and this is clearly described during orientation when new guests arrive to the island. Some of the roads within the watershed have been removed and have been allowed to revegetate (USAF 2000a).

There is a standard operating procedure (SOP) for transportation of environmentally hazardous substances through the watershed. This SOP states: “Transporters will notify the base Environmental Department by radio before and after transporting any environmentally hazardous substances through the watershed area. If there is an alternate route to avoid the watershed area, the alternate route should be taken to protect our drinking water source.” (USAF 2000a)

4.2 CURRENT WATER SUPPLY

4.2.1 System Information

The current public water system at Eareckson Air Station is an infiltration gallery. The following description of the current system comes from field observations during the November 9-11, 2020 period and reports from prior assessments (USAF 2000a; ADEC 2009a).

4.2.2 Class and Identification

The ADEC has identified the Eareckson Air Station infiltration gallery system as a non-transient, non-community, groundwater under the direct influence of surface water, public water source. The Public Water System Identification (PWSID) number is 260511. The gallery system supplies potable water for human consumption, including cooking and bathing.

4.2.3 Owner/Operator

The water system is owned by the USAF, 611th CES/CEAN 10471 20th Street, Suite 337, Elmendorf Air Force Base, AK, 99506-2200, telephone: (907) 552-5655. The 611th CES Water Compliance Manager point of contact at Elmendorf Air Force Base is Jessica Morris. It is operated and maintained under contract by ASRC as of October 1, 2020. The ASRC Envirionmental Manager is Michael McCart and the ASRC EAS Site Manager is Brad Johnson.

4.2.4 Status and Operation of Water System

The water system status was active during the field investigation for this study. The system operates every day throughout the year. The contractor, ASRC, employs a minimum of one certified water treatment operator on-site at all times.

4.2.5 System Modifications

The gallery system has been extensively modified in the past in order to improve water quality and to meet the water supply needs of the Air Force. It has been maintained to meet permit and regulatory standards. The water supply, treatment, and storage systems were substantially upgraded between 1986 and 1992 to serve the resident population and other industrial uses (USAF 2000a). Air strippers were originally installed in 1994 to remove trichloroethylene (TCE) from the raw water due to upgradient contamination from an IRP site (Site OT 48). The air strippers are currently part of the treatment process. The system is also in the process of installing a Granular Activated Carbon (GAC) filtration unit. A new Mixed-Oxidant (MIOX) hypochlorite generator unit was installed in 2014/2015 and is used in place of the gas/chlorine set up.

4.2.6 Gallery Collection System

Precipitation and surface water percolate through the shallow subsurface into a number of buried pipes. The pipes consist of 655 linear feet of 18-inch diameter high-density polyethylene (HDPE) perforated pipe laterals buried in sand 10 to 14 feet below ground. Water collects in the pipes and flows into a 16-foot by 16-foot by 15-foot concrete cistern (also called a clear well) capable of holding about 24,000 gallons of raw water. The cistern is located under Building 705. The cistern is gravity fed and the recharge rate is unknown. In a 24-hour period, approximately 260,000 gallons of water can be produced and treated.

4.2.7 Treatment

The raw water is injected with potassium permanganate at Building 705 to remove iron and manganese. Oxidized iron (ferric hydroxide) becomes the primary coagulant during conveyance of the raw water to the Water Treatment Plant (WTP). Three submersible pumps carry the raw water from the gallery cistern to the WTP, Building 3057, through an 8-inch ductile iron raw water transmission line. At the WTP, the water first goes through a secondary coagulant polymer injection system. The water then flows through three vertical pressure filters with greensand media for turbidity, iron, and manganese removal. Filtered water is then piped through two to three shallow tray air strippers for volatile organic compounds (VOC) removal. The water cascades through the air stripper trays at atmospheric pressure. The water is then chlorinated between the air stripper and the storage tanks using hypochlorite generated from the MIOX unit.

4.2.8 Storage

After treatment, water is pumped to storage tanks with effluent pumps. There are a total of three above-ground steel storage tanks with a capacity of one million gallons: two 300,000-gallon tanks and one 400,000-gallon tank. The tanks are cathodically protected. The finished water is stored in the storage tanks and provides sufficient contact time to meet disinfection requirements. There are also two above ground steel storage tanks for fire fighting: one 288,000-gallon tank and one 400,000-gallon tank located at the DCSC and Power Plant Buildings.

4.2.9 Distribution System

When needed, the water is pumped through the distribution system to the buildings where people work, eat, and sleep. The water system operators work in conjunction with the contract plumbers on the station to operate the distribution system. Detailed maps, pipe material and sizing information are kept at the station for review. Many of the buildings that are not actively being used have been disconnected from service to cut down on the occurrence of dead-end piping.

4.2.10 Connections

There are at least 26 service connections associated with the distribution system including but not limited to the facility headquarters, gym, hangars, warehouses, power plant, office buildings, shops, fire pump stations, dormitories, and communication buildings.

4.2.11 Cross Connection Control Program

There was not an active cross-connection control program available at the time of the November 9-11, 2020 onsite investigation but a cross-connection training manual was onsite and the operator was familiar with what a cross-connection was. This training manual will likely suffice as the cross-connection control program that is operated and managed for Eareckson Air Station. A cross connection control survey of the devices and the program was recently conducted with assistance from the onsite plumber.

4.2.12 Population Served

A total population of about 100 people, non-community / non-transient, is served by this water source. The entire population on Eareckson Air Station is present for work purposes.

4.2.13 Water Use

Workers and visitors use the water in the buildings for consumption, cooking, washing, cleaning, fire fighting, and other potable purposes. Water pressure, quantity, and quality are reported by ADEC to comply with current regulations.

4.2.14 Contingency Plan

In case of an accidental release of contaminants in the watershed that entered the infiltration gallery, the water supply system would be shut down. Eareckson Air Station currently has ample stored potable water in the water storage tanks as well as a stored supply of bottled water that could be utilized in the event of a short-term interruption of water production, and additional bottled water would be flown to Eareckson Air Station to meet immediate and interim needs. Additionally, a portable reverse osmosis package plant is on the island and can be usedto provide a safe source of drinking water until the problem has been solved.

4.2.15 Emergency Response Plan

In the event of a catastrophe (i.e., an earthquake or tsunami), stored bottled water and the onsite RO unit may be used. Recognizing that access to Shemya could be delayed, it is suggested that the drinking water emergency plan be reexamined and updated as necessary. It is recommended that the base should continue storing bulk water and bottled water on site, routinely inspecte and test the RO unit, and keep spare parts for the RO unit available onsite..

4.3 SUMMARY

A shallow subsurface infiltration gallery system is providing potable water to the USAF Eareckson Air Station, Shemya Island, AK. The gallery collector pipes are located in a small watershed at the boundary between a thin layer of unconsolidated peat, sand, and gravel deposits and the underlying bedrock. Gallery Creek and a few small ponds/lakes are in hydraulic communication with the underlying shallow groundwater, and provide surface water drainage for the watershed. Because of this hydraulic connection, the raw water is highly vulnerable to contamination from the surface. The system is old, dating to the 1950s, but has undergone significant modifications to meet the needs of the USAF, and maintained to meet permit and regulatory standards. The current system is being maintained properly. The ADEC refers to this system as non-community / non-transient public water system with the PWSID 260511, and has designated the source as groundwater under the direct influence of surface water. Currently, the system serves about 100 people throughout the year. The potable water is treated, disinfected, stored in tanks, and distributed to various buildings throughout the island. The importance of this water supply as well as its susceptibility to contamination has led the Air Force to protect the water supply watershed by removing certain industrial activities, restricting transportation, and developing a contingency plan.

5.0 INVENTORY OF CONTAMINANT SOURCES

Potential, current, and historic sources of contamination were inventoried (Appendix D), and the locations of all inventoried sources were mapped (Figure B-2). Both onsite fieldwork and a records search were used to create the inventory. Potential sources of contaminants were inventoried because they represent the possibility of future contamination. Historic sources were inventoried because they resulted in surface/subsurface contamination that is now present in the water supply. For the purposes of this report, historic sources are much more significant than potential sources.

5.1 POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are defined as those that pose a future risk to the drinking water source. For example, an AST that has never leaked is not a current source of contamination, but it is possible for the tank to leak in the future. Therefore, the tank presents a potential for future contamination.

Potential sources of contamination are mainly associated with the use of two buildings (the cold storage building and Building 110), plus the paved and unpaved roads that traverse the watershed (Appendix D). As discussed below, none of these are significant sources of contaminants, with the possible exception of a transportation accident.

Hangar 4 was a large building just north of the infiltration gallery. This hangar has been removed and the only thing visible was remnants of the foundation. Therefore, based on the field observations and available data, remnants from Hanger 4 are not a significant potential source of contaminants. The cold storage building (Building 700) is a light tan building with two locking doors and no windows. It is located northwest of the infiltration gallery, and west of Hangar 4 (removed) off Tower Road. It is our understanding that hazardous material and waste was discovered inside the building by an unknown contractor and the USAF is in the process of remedying the situation. The floor is reported to be concrete. No hazardous materials, hazardous waste, POL products, or any liquid substances are allowed inside this building. A small parking lot is in front of the building; while the remaining three sides of the building are surrounded by grassy vegetation. This building is designated for storage of non-hazardous materials only. Based on the existing information and USAF policies, the cold storage building is not a significant source of contaminants once the existing hazardous materials are removed.

Building 110 is located in the northern part of the watershed, just north of North Road. It was used by the Navy for Classic Owl radar operations, and is currently in an inactive state of use and is mostly empty. The building and the immediate area around it are in the northern part of the watershed. The building is light tan, has a sloped roof, many doors, and a concrete floor. There is an AST located on the north side of the building. Based on the above information and conversations with base personnel, this building is not a significant source of contaminants.

Paved and dirt/gravel roads run through Zones A and B of the drinking water watershed. The major concern for potential sources of contamination is spills occurring as a result of a transportation incident, releasing hazardous materials directly to the ground and infiltrating downward to groundwater. Winter presents a special hazard for vehicle transportation through the watershed due to persistent ice and snow during winter months. Eareckson Air Station has acknowledged the transportation incident risk and has a current plan of action in the event one should occur. In addition, an SOP for transportation of environmentally hazardous substances was implemented to restrict transportation in the water supply watershed unless absolutely necessary.

5.2 HISTORIC SOURCES OF CONTAMINATION

Historic sources of contamination are defined as sources that have already contaminated the surface or subsurface, particularly groundwater. For example, if an underground storage tank (UST) or an above ground storage tank (AST) leaked a sufficient amount of POL product in the past, it has contaminated groundwater. Even if the UST/AST (the source) has been removed, contaminated soil or groundwater may still be present. These situations have usually been discovered and documented, the source has been removed, and the contamination has typically undergone some form of remediation.

Historic sources of contamination within the drinking water protection area are found at six IRP sites (Figure B-2):

- OT 48 - infiltration gallery area - Active
- SS 25 – Bulk fuel storage facility - Active
- SS 13 – asphalt tar drum storage area – Cleanup Complete
- ST 39 – USTs 110-1 to 110-4 – Cleanup Complete – Institutional Controls
- ST 40 – USTs 600-1 to 600-4 – Cleanup Complete
- SS 14 – base operations spill – Cleanup Complete
- ST 37 – UST 729-1 to UST 729-9 – Cleanup Complete
- ST 45 – fuel spill – Cleanup Complete

Groundwater contamination has been documented in all of these areas (USACHPPM 2002). The contamination history of these areas is complex and extends back to the 1940s. These areas were characterized by groundwater monitoring wells installed to monitor contamination, where present. The contaminant source inventory contains a complete list of the monitoring wells within these areas and each individual source location (Appendix D). Data from the wells document the nature of the contamination, plus what is known about the lateral and vertical extent of the contamination. Each IRP site is discussed below and a map showing the locations can be found in Appendix B.

5.2.1 Installation Restoration Program Site OT 48 – Infiltration Gallery Area

5.2.1.1 Location

IRP site OT 48 is located in the south-central portion of the island, south of Hangar 4 (removed) and east of Hangar 3 (removed). This area is in the immediate vicinity of the water gallery. It extends north to Pearl Drive and east to Gallery Creek. The western boundary is just east of Tower Road; the southern boundary is just north of Building 719.

5.2.1.2 Contamination Source Areas

Most of the areas adjacent to the water gallery have been affected to some degree by base activities (Jacobs 1996). Individual sources within site OT 48 have not been documented. Rather, various sources have contributed contamination to the overall water gallery area. The POL spill areas and potential source areas are located within the Infiltration Gallery Watershed. Although currently abandoned, a sanitary sewer traverses the watershed near the infiltration gallery. It may have contributed contamination to the OT 48 area. Two IRP sites (SS 13 and SS 39) are upgradient of the infiltration gallery; three additional IRP sites (SS 14, ST 37, and ST 45) are downgradient of the gallery. All of these sites may have contributed contamination to OT 48.

5.2.1.3 Monitoring Wells

There are 23 monitoring wells in and around the OT 48 IRP site. These monitoring wells have detected groundwater contamination in the shallow groundwater that serves as the source water for the infiltration gallery.

5.2.1.4 Type and Magnitude of Contamination

Volatile organic compounds (VOC) and heavy metals are the primary contaminants found in the shallow groundwater around the infiltration gallery. Two types of VOCs were found: TCE and POL products, mainly fuel-related compounds such as benzene, toluene, ethylbenzene, and xylenes (BTEX).

From 1988 to 1995, the monitoring wells detected a persistent presence of TCE in the groundwater. The TCE concentrations were as high as 22 µg/L at well WGW4 (Jacobs 1996), and typically exceeded the EPA maximum contaminant levels (MCL) of 5.0 µg/L. In general, elevated concentrations were found at the water gallery sump and well WGW4. Investigation of the gallery collection tubes showed that most of the TCE contamination was coming from the tubes to the west of the center manhole. These two tubes were also providing most of the flow to the system. The TCE concentrations in these tubes ranged from 3 µg/L to 7 µg/L. From 1995 to early 2000, TCE concentrations dropped to nondetect in the wells (USAF 2000b). However, in April 2000, TCE was again detected in some wells at 0.98 µg/L. Recent concentrations show that TCE levels have been decreasing in the area. In July of 2009 a draft version of the Record of Decision (ROD) for the site indicated No Further Action was recommended for the site. However, in the last round of sampling, one sample returned a TCE result just above the cleanup level. Three rounds of sampling must be completed and the TCE concentrations must be below the cleanup levels before site closure will be permitted. On 20 November 2009 the State of Alaska sent a letter to the USAF approving the USAF to finalize the ROD for OT 48 with the new conditions. As of 2020 a project was created with the objective of groundwater sampling at eight sites, surface water sampling at four sites, sediment sampling at three sites, and conduct IC inspections at 19 sites.

BTEX was also detected in the monitoring wells around OT 48. The range of concentrations found were benzene (nondetect to 4,358 µg/L); toluene (nondetect to 22,662 µg/L); ethylbenzene (nondetect to 1,900 µg/L); and xylenes (nondetect to 22,252 µg/L). The wells detecting BTEX compounds were WGW1 and WGW2 (Jacobs 1996).

The following metals (and associated concentrations) were found in wells WGW3 and WGW4: antimony (31.1 µg/L); cadmium (2.7 µg/L); chromium (53.54 µg/L); mercury (2 µg/L); selenium (2.9 µg/L); silver (2 µg/L); and thallium (1.6 µg/L).

Perfluorooctane sulfonate (PFOS) and perfluorooctanioic acid (PFOA) were detected in well WGW7 in a concentration sum of 120 ng/L, which is above the EPA health advisory level of 70 ng/L. In 2018, treated water from the WTP had a combined sum of 53.9 ng/L. ADEC later required quarterly testing for PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFBS for water supplies currently in use that contain PFAS levels at or above ½ of the action levels.

In summary, groundwater quality in the OT 48 area has been affected by TCE, BTEX, some heavy metals, and PFAS. TCE has been detected consistently over many years at locations in the water gallery, as well as in wells located downgradient from the gallery. The BTEX compounds and some heavy metals have been detected sporadically in the recent past. Based on the results of groundwater samples collected at locations hydrogeologically downgradient of the water gallery, it appears that TCE and BTEX are migrating to some degree (Jacobs 1996). PFAS is currently being monitored and mitigation work plans have been approved by ADEC.

5.2.1.5 Risk Assessment Results

In 1996, a human health risk assessment was conducted at the OT 48 water gallery area (Jacobs 1996). The assessment concluded that contaminated groundwater from the water gallery system was a direct pathway into the drinking water supply. Compounds evaluated in the risk assessment included TCE and antimony in groundwater. Both compounds exceeded federal and State of Alaska MCLs. Although groundwater treatment for VOC contamination is currently in place at the WTP, untreated groundwater was evaluated in the risk assessment to determine whether treatment should be maintained. The Risk Assessment concluded that, "TCE and antimony in groundwater were determined not to pose a threat to people" (Jacobs 1997). Additionally, PFOS and PFOA combined concentrations in the treated water is below the EPA health advisory limit of 70 ng/L.

5.2.2 Installation Restoration Program Site SS 13 – Asphalt Tar Drum Storage Area

The asphalt tar drum storage area is located in the central part of the island, about 600 feet north of Hangar 4 (removed) (Jacobs 1995b, 1995c). Prior to 1985, the storage area held more than 4,000 drums containing Pavex, a proprietary asphalt product used for roadway construction and asphalt hardstands. In 1984 and 1985, some of these drums were observed leaking onto the ground.

In 1985, the tar drums were removed (Jacobs 1995b, 1995c). In 1988, soil sampling documented surface and shallow subsurface soil contamination. In 1994, about 1,200 cubic yards of tar and tar-contaminated soil were excavated and removed from the area. The excavation was backfilled with clean sand and gravel. After the removal action was complete, confirmation soil sample results show that VOC, SVOC, and total petroleum hydrocarbons (TPH) concentrations were below cleanup levels.

Depth to groundwater at the site was estimated to be over 50 feet (Jacobs 1995b, 1995c). In addition, groundwater quality was not believed to be affected by the site. Therefore, no groundwater monitoring wells were drilled. Since no surface soil contamination was left in-place, this removed any direct contact exposure to people. As a result, no risk assessment was performed for the site. Mobility and potential release to groundwater for the tar/soil mixture was determined to be unlikely. No further action was taken at the site. The site closure was approved 17 January 1996 (ADEC 2009a).

5.2.3 Installation Restoration Program Site ST 39 – USTs 110-1 through 110-4

IRP site ST 39 is located on a topographic high in the north-central part of the island (Jacobs 1996). Grace Lake is located directly north of ST 39; Hospital Lake is about 800 feet to the southeast. The area surrounding ST 39 includes a large area of relatively flat tundra and surface gravel that gradually slope from Grace Lake to the south. No surface water drainages are apparent from the lakes or in the ST 39 area.

Building 110 and associated USTs are the major features of ST 39 (Jacobs 1997). UST 110-2 and UST 110-3 were located on the eastern side of the building; they were removed in 1993. UST 110-1 was located north of the building, and was removed in 1992. UST 110-4 was never found; it is believed to have been removed or abandoned before the IRP investigation.

Surface and subsurface soil were sampled at ST 39. Low level TPH, BTEX, and polychlorinated biphenyl (PCB) contamination was found in the soil. No concentrations of human health or ecological concern were found. Modeling concluded that leaching of compounds from soil down to groundwater is not a concern (USACHPPM 2002).

Monitoring well COE-12 was sampled and no organic constituents were detected (Jacobs 1997). Because COE-12 is potentially upgradient or crossgradient from ST 39, no groundwater data exist that are representative of the ST 39 source. To address future impacts of groundwater, fate and transport modeling was conducted on the soil. Model results indicated constituent concentrations were not a human health or ecological concern. ADEC signed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) ROD for sites SS 07 and ST 39 on 11 November 2008. The signature of the ADEC documents the USAF and ADEC approval of the determination of no further action required under CERCLA for IRP sites SS 07 and ST 39 at Eareckson AS, Alaska (ADEC 2009a).

5.2.4 Installation Restoration Program Site SS 14 – Base Operations Spill

IRP site SS 14 is located in the south-central portion of the island on the asphalt parking area near the former Base Operations Terminal (Jacobs 1997). Site SS 14 is the location of a reported 50-gallon JP-4 spill on the parking area. The SS 14 source area is a flat, graded area that is primarily paved.

On 9 August 1983, a cracked fuel tank in a damaged C5-A aircraft spilled approximately 50 gallons of JP-4 fuel on the asphalt parking area. The Fire Department hosed the fuel off the asphalt with water, which then drained into the sandy soils south of the runway. The fuel-saturated soils were excavated, stored in barrels, and disposed of at the fire training area.

Surface and subsurface soil samples collected during the remedial investigation/ feasibility study (RI/FS) demonstrated that no fuel-related constituents existed at SS 14 in concentrations that would pose an unacceptable risk to human health or the environment. No groundwater contamination exists that can be directly associated with the fuel impacted soils. This spill has been sufficiently remediated through soil removal and natural attenuation. A risk assessment was not performed because there were no constituents detected in concentrations that would pose an unacceptable risk to humans or ecological species. No further action was taken at the site.

SS 14 is currently ranked as Cleanup Complete. The Technical Document to Support Installation Restoration Decision, Base Operations Spill (SS 14) Initial Ranking was completed in November 2004 and is listed in the database as the ROD. An initial ranking with Exposure Tracking Model was completed February 2008. ADEC determination for Cleanup

Complete was issued in 2012.

5.2.5 Installation Restoration Program Site ST 37 – UST 729-1 through UST 729-9

IRP site ST 37 is comprised of two smaller sites. One of the sites is immediately south of OT 48, the other site is immediately east of SS 14. Both of these smaller sites had USTs in the past where diesel fuel was stored. UST 729-1 through UST 729-9, plus UST 731-1 through UST 731-5 were stored at site ST 37 (Jacobs 1995b). From about 1979 to the mid to late 1980s, diesel fuel leaked or was spilled at this site. Site ST 37 has subsequently been remediated and no further action has occurred on the original two small sites. The ADEC database confirms the site closure.

5.2.6 Installation Restoration Program Site ST 45 – Fuel Spill

IRP site ST 45 is located immediately north of SS 14 (Figure B-2). It is the site of fuel spills from USTs located at old Building 729 (Jacobs 1995b). The quantity and dates of the spill are unknown. Site ST 45 has subsequently been remediated and no further action has occurred.

5.3 OTHER HISTORIC SOURCES OF CONTAMINATION

During the site visit, various species of birds and one mammal species (small arctic foxes called scruffies) were observed on the island and in the watershed. There is a potential that these species may contribute bacteria/viruses and nitrates to the watershed, however, the potential is judged to be negligible. Several factors have led to this decision. First, a very small number of individual animals were observed in the watershed. Second, migratory birds do not nest on the island due to the presence of the foxes. Third, U.S. Fish and Wildlife Service personnel control the animal population on the island (Jacobs 2001). No other known potential or historic contaminant sources exist within the drinking water protection area for the Eareckson Air Station water supply watershed.

5.4 SUMMARY

Both potential and historic sources of contamination were inventoried in and around the drinking water protection area for the water supply watershed at Eareckson Air Station, Shemya Island, AK. Few potential sources were found, mainly comprised of buildings and roads. Over the years, USAF has been proactive in protecting the water supply, which may account for the very few potential sources of contamination. Of the risks that could provide a potential source of contamination, the most serious is a transportation accident spilling hazardous materials directly onto the ground and contaminating surface and groundwater. Historic groundwater contamination is a far more significant threat to the infiltration gallery at Eareckson Air Station. Shallow groundwater has already been contaminated, mainly with TCE, BTEX, and PFAS. Past contamination has reached the gallery collection tubes and sump. Groundwater in the area is currently being monitored through the IRP program. In addition, the drinking water is being treated at the WTP to remove VOC.

The USAF and Eareckson Air Station have been very proactive in protecting the water supply watershed over the last 10 to 15 years. During the late 1980s, TCE was discovered in the infiltration gallery raw water (refer to Section 6.3). This discovery initiated various actions to protect the water supply. In 1991, a critical resource protection plan was written (USAF 1991). The watershed is the sole source of drinking water for the island, so protection of the resource is necessary to sustain operations and the mission of Eareckson Air Station. It was deemed cost-prohibitive to ship water to the island, therefore, the plan was written to protect the resource and develop future efforts to sustain a good quality water supply for the island. Along with the plan, the watershed boundary was placed on base maps to alert all personnel to the location of this critical resource. In 2000, a drinking water management plan was written. The plan explains how to provide a reliable, high-quality water supply to meet the long-term capacity needs and regulatory requirements of the island. Since the discovery of TCE contamination in the raw water, all of the above efforts have assisted in protecting and maintaining the drinking water supply at Eareckson Air Station. This is perhaps why very few sources of potential contamination were found in the watershed.

6.0 SORTING AND RANKING CONTAMINANT SOURCES

Potential and historic sources of contamination were sorted and ranked according to the type and level of risk they present. Contaminant sources were sorted into six categories regulated for drinking water sources and then ranked from very high to very low.

Contaminant sources were ranked based on guidance from the State of Alaska (ADEC 2001). In situations where no guidance was given, professional judgment was used. For example, the State of Alaska does not provide guidance on ranking contaminated sites or groundwater monitoring wells that may define the lateral and vertical extent of contamination at a site. Therefore, professional judgment was used to rank these contaminant sources based on four factors:

- The lateral and vertical extent, plus the nature and magnitude of the contamination
- The toxicity and volumes associated with a given source
- The number and density of contaminant sources
- The proximity of sources to the infiltration gallery

The six major categories of contaminants are bacteria and viruses; nitrites and nitrates, VOC, heavy metals, synthetic organic contaminants (SOC), and other organic contaminants (OOC). These contaminant categories and the possible sources are listed in Table C-2. The results of the sorting and ranking can be found in Appendix E.

6.1 SORTING CONTAMINANT SOURCES

Contaminant sources were sorted into six categories (Table C-2). The results of the sorting produced six tables of inventoried contaminant sources (Appendix E). Each table is for one category of regulated drinking water contaminants.

6.2 RANKING CONTAMINANT SOURCES

Contaminant sources were ranked based on risk criteria mentioned above (Appendix E). Five risk ranks are defined: very high, high, medium, low, and very low (ADEC 2001). The contaminant source category that showed the highest risk was Voc. About three fourths of the contaminant sources (24 of 33) ranked high for VOC. Of the remaining nine sources, the vast majority of potential and historic sources are associated with TCE and POL products, mainly fuels. The contaminant source category that showed the next highest risk was heavy metals, cyanide, and other inorganic chemicals (HMCIC). About three fourths of the contaminant sources (24 of 33) ranked medium for HMCIC; the other fourth ranked low (Appendix E, Table E-4). The vast majority of sources ranked very low for both bacteria/viruses and nitrates/nitrites (Appendix E, Tables E-1 and E-2). However, one source (the Building 110 septic system) ranked high for these two contaminant categories. Similarly, almost all of the contaminant sources ranked low/very low for synthetic organic contaminants (SOC) and OOC (Appendix E, Table E-5 and Table E-6). Only one source (the Hangar 4 incinerator) had ranked high for OOC, but it has since been removed.

6.3 SUMMARY

Both potential and historic sources of contamination at Eareckson Air Station were sorted into six categories regulated for drinking water sources, then ranked from very high to very low risk. Only the sources in Zones A and B were sorted and ranked. The most striking feature of the sorting and ranking is that high-risk sources mainly involve TCE, POL, and PFAS products. This is expected because historic TCE, POL, and PFAS contamination of the shallow groundwater system has been documented and the majority of current potential contaminant sources are POL- related.

7.0 VULNERABILITY OF DRINKING WATER SOURCE

The water supply watershed and the infiltration gallery were analyzed for vulnerability to contamination using guidance from the State of Alaska (ADEC 2001). Vulnerability is a combination of watershed susceptibility and contaminant risks. Watershed susceptibility is given a value from 30 (minimum susceptibility) to 50 (maximum susceptibility). Contaminant risks range from a value of 0 (no contaminant risk) to 50 (maximum contaminant risk). The equation used to determine vulnerability is:

Watershed susceptibility + contaminant risks = vulnerability (30 to 100)

According to ADEC, all surface water bodies have a high natural susceptibility to contamination; therefore, a minimum score of 30 is assigned to all surface water sources (ADEC 2001). A score for natural susceptibility is achieved by analyzing watershed properties and the drinking water intake. Natural susceptibility is composed of three parts: initial susceptibility (assumed 30) + runoff/dilution susceptibility (0 to 10) + intake susceptibility (0 to 10) = watershed susceptibility (30 to 50). Contaminant risks to a drinking water source depend on the type, density, and distribution of sources. A score of 0 to 50 points is assigned based on the findings of the contaminant risk inventory. Each of the six categories of drinking water contaminants has been analyzed and a score of 30 (lowest vulnerability) to 100 (highest vulnerability) has been assigned.

7.1 VULNERABILITY ASSESSMENT

A series of charts for conducting the vulnerability assessment on the watershed and the water supply intake were provided by the ADEC (ADEC 2001). These charts are presented in Appendix F. Chart F-1 shows the watershed susceptibility analysis. The vulnerability to each category of regulated contaminants is shown in charts F-2 to F-19.

7.2 WATERSHED SUSCEPTIBILITY ANALYSIS

The watershed susceptibility score is 45 points (Chart F-1). Based on guidance from the ADEC, this score means a very high susceptibility to contamination. The high natural susceptibility of a surface water source (assumed by ADEC), small basin size, high runoff potential, low dilution capacity, and the contamination history of the basin are mainly responsible for the score. The basin is very small (0.5 square miles), receives a significant amount of annual precipitation (about 30 inches per year), has very little discharge (<1 cubic foot per second), and is somewhat steep (4% slope). Furthermore, TCE contamination has been present in the watershed and detected in the infiltration gallery for over 21 years.

7.3 VULNERABILITY TO BACTERIA /VIRUSES

A water source's vulnerability to bacteria and virus contamination is usually attributed to wastewater release through sewage lagoons or septic systems.

7.3.1 Vulnerability Scoring

The source water score for vulnerability to bacteria/viruses is 65, with a rating of high (see Charts F-2 through F-5 and Table C-3). The high score is a result of very high susceptibility of the watershed plus a medium risk for bacteria/viruses. The very high rating of the watershed is somewhat expected due to the assumed high natural susceptibility. However, the medium risk of bacteria/viruses is not expected based on the limited possible sources.

7.3.2 Contaminant Risk

There is some uncertainty about the bacteria/viruses contaminant risk. Only one significant source of bacteria/viruses (Building 110 septic system) has driven the contaminant risk from very low to medium. The northern boundary of the watershed is identified in two different places on maps of Eareckson Air Station. Therefore, there is some uncertainty regarding whether the septic system will discharge effluent north to the Bering Sea or south into the drinking water watershed. The bacteria/viruses score of 65 was calculated assuming the effluent discharges into the watershed. If this is determined to be inaccurate at some time in the future, then the score and rating can be reduced.

7.4 VULNERABILITY TO NITRATES/NITRITES

A water source's vulnerability to nitrates and nitrites contamination is usually attributed to septic systems, fertilizers, and animal manure piles.

7.4.1 Vulnerability Scoring

The nitrates/nitrites score is 70 with a rating of high (Charts F-6 through F-9 and Table C-3). This score, the high rating, and the reason for it are very similar to those presented for bacteria/viruses. The high natural susceptibility of the watershed contributed 45 points to the score. Nitrate detections in the raw water contributed 5 points. Historically, low levels of nitrates have been detected in the infiltration gallery raw water (USAF 2000b). In addition, the presence of the Building 110 septic system contributed 20 points.

7.5 VULNERABILITY TO VOLATILE ORGANIC COMPOUNDS

A water source's vulnerability to VOC contamination is usually attributed to a spill of gasoline, fuels, or heating oil in the watershed.

7.5.1 Vulnerability Scoring

The VOC present a high risk situation for the Eareckson Air Station drinking water supply due to the past contamination events located in or near the watershed recharge area. The VOC vulnerability score is 88 (Charts F-10 to F-13 and Table C-3). The rating for this score is very high. Watershed susceptibility is responsible for 45 points. Contaminant risks (mainly from TCE detections in the infiltration gallery) contributed the remaining 43 points.

7.5.2 Contaminant Risk

The very high score is not surprising because shallow groundwater around the infiltration gallery is already contaminated with TCE and other VOC above screening criteria and MCLs. In addition, the infiltration gallery has had a history of TCE detections, most likely from IRP site OT 48, which is in the immediate vicinity of the gallery in all directions. A historic raw water sample was collected from the infiltration gallery pump discharge header and analyzed for primary and secondary drinking water parameters (USAF 2000b). TCE was detected at 0.98 µg/L. One other VOC, cis-1,2-Dichloroethene, a breakdown product of TCE, was detected at 0.3 µg/L. Both of these VOCs were below their MCLs of 5 µg/L and 70 µg/L, respectively. In 2013, TCE was found at a concentration of 4.7 µg/L. Nevertheless, their presence is partly responsible for the very high VOC vulnerability rating.

7.6 VULNERABILITY TO HEAVY METALS, CYANIDE, AND OTHER INORGANIC CHEMICALS

A water source's vulnerability to heavy metals contamination is usually attributed to inorganic chemicals, cyanide, and landfill leaching.

7.6.1 Vulnerability Scoring

Just like VOC, heavy metals present a very high-risk situation for drinking water. The score for heavy metals was 90 with a rating of very high (Charts F-14 to F-17 and Table C-3). Historically heavy metals have been detected in the source water of the infiltration gallery. The score is composed of two equal parts: the watershed (45 points) and heavy metals (45 points). The heavy metals contaminant risk score (45 points) is the sum of existing contamination (25 points) and potential contamination (20 points).

7.6.2 Contaminant Risk

The existing contamination component (25 points) comes from iron, manganese, and zinc. Historic raw water sampling had iron, manganese, and zinc concentrations of 0.313, 0.525, and 0.01 mg/L, respectively (USAF 2000b). The iron secondary MCL (0.3 mg/L) was exceeded; the manganese secondary MCL (0.05 mg/L) was exceeded; the zinc secondary MCL (5 mg/L) was not. These MCLs are secondary standards which mean they are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. The sources of these are unknown. Secondary MCLs are not considered health risks; therefore, the documented MCL exceedances will not cause health effects in people drinking the water. Therefore, the presence of iron, manganese, and zinc in the raw water, although important, is not as significant as toxic heavy metals. The risk score of 25 points for existing contamination from iron, manganese, and zinc is consistent with ADEC guidance.

The potential contamination component (20 points from detections in the surrounding groundwater) involved toxic heavy metals. The IRP site OT 48 monitoring wells WGW3 and WGW4 had detected antimony, cadmium, chromium, mercury, selenium, and thallium in the shallow groundwater in and around the infiltration gallery. These metals had not been detected in the infiltration gallery raw water, but the shallow groundwater around the infiltration gallery is already contaminated with these heavy metals. Antimony was judged to be a constituent of potential concern at IRP site OT 48 since it was above screening criteria, and was included in the risk assessment (Jacobs 1996). Hangar 04 was tested and detected arsenic in the shallow groundwater. Arsenic is judged to be an additional constituent of potential concern, since it was above the screening criteria. The naturally high watershed susceptibility plus the presence of various metals account for the very high vulnerability to metals rating.

7.7 VULNERABILITY TO SYNTHETIC ORGANIC CONTAMINANTS

The score for susceptibility to synthetic organic contaminants (SOC) is 80 (Appendix F, Charts F-18 to F-21 and Table C-3), which is a very high rating. Very few (SOC) sources are present other than what was discovered and classified in the Brice report referenced earlier; the high natural susceptibility of the watershed is mainly responsible for the rating.

7.8 VULNERABILITY TO OTHER ORGANIC CONTAMINANTS

The OOC score is 57 with a rating of medium (Appendix F, Charts F-22 through F-24 and Table C-3). This score and the medium rating are mainly due to two factors: the high natural susceptibility of the watershed and five low-risk sources in Zone A The susceptibility of the watershed to OOC has been well documented. While the risk rating is medium, the potential of introducing additional OOC into the watershed is minimal, so no further description of this contaminant is provided.

7.9 OPTIMIZING ONGOING ACTIVITIES

The results of the source water assessment can be used to optimize ongoing activities that have the potential to affect the quality of the drinking water source. This is true for the historic contamination in the drinking water watershed. It is recommended that Figure B-1 (the drinking water protection area), plus Table C-3 (the susceptibility/vulnerability results for the source water and the infiltration gallery) be integrated into the planning and execution of the IRP, particularly any future efforts that involve shallow groundwater remediation.

7.10 FUTURE VULNERABILITY

Although the air station is currently in caretaker status, there are ongoing activities at the facility. Airplanes still routinely arrive, refuel, and depart from the island. Some IRP activities are ongoing, as well as other environmental monitoring projects. With continuing activities at Eareckson Air Station, conditions, structures, activities, and potential sources of contamination may change.

The IRP and other environmental projects may reduce the number of contaminant sources within the drinking water protection area. This may result in a reduced overall vulnerability for the source water. However, other aviation and industrial activities may increase the contaminant sources. Therefore, there is some uncertainty about the future vulnerability for the watershed and the infiltration gallery.

The State of Alaska recommends source water assessment updates for active facilities every 5 years following initial assessments to reflect changes in local conditions (ADEC 2001). It would be prudent to update this source water assessment in 5 years to reflect changes in local conditions. The range of time given reflects the current reduced activity status of the air station (i.e., caretaker status). It is recommended the USAF consult with ADEC regarding the future need to update this plan.

7.11 CONTINGENCY WATER SUPPLY

The search for a reliable, good quality water supply on Shemya Island has consumed a significant amount of resources. Surface water (including lakes and streams) and groundwater (from the fractured bedrock groundwater system) have provided a potable water supply for the island in the past. Both of these sources have been contaminated and subsequently discontinued in favor of the current water supply from the shallow groundwater system. If the current water supply is contaminated or made unusable, an equivalent water supply may not be found. The contingency plan for the island is to shut down the current drinking water system raw water supply. Bottled water stored onsite would be used to meet immediate needs (USAF 2000b). More bottled water could also be flown in to supplement the existing supply. Additionally, a portable reverse osmosis package plant is available onsite and can be used to provide a safe source of drinking water until the problem has been solved.

7.12 SUMMARY

The overall vulnerability of the Eareckson Air Station source water is judged to be high (Table C-3). The high natural susceptibility of the watershed is a major contributor. There are few bacteria/viruses, nitrate/nitrite, and OOC contaminant sources at the surface. However, VOCs (particularly TCE) and heavy metals from natural and historic sources have already contaminated the shallow groundwater system. SOCs have been recently discovered near the Hangar 4 site but it is not currently know if it is present in the groundwater. Please reference the Environmental Services Waste Characterization report by Brice Environmental Services Corporation. The source water vulnerability to these two contaminant sources is very high. All of the factors combined produce an overall vulnerability of high (Table C-3). Both the source water protection efforts and ongoing remediation efforts can benefit by sharing and integrating data. As time goes on, the future vulnerability of the source water may change. Updating this source water assessment further in the future may be prudent. Protection of the current water supply cannot be understated since an alternate equivalent water supply on the island most likely does not exist.

(intentionally blank)

8.0 RESULTS COMMUNICATION

It is most important that the owners/operators of the water system, consumers of the water produced by the system, and anyone who can preserve or compromise the quality of the water in the system receive the results of this assessment.

8.1 USAF COMMUNICATION

The majority of these people are USAF personnel and their contractors at Elmendorf Air Force Base and Eareckson Air Station. Because of this, it is recommended that Table C-3 (the susceptibility/vulnerability results for the watershed and raw water source) be published in the CCR.

8.2 PUBLIC COMMUNICATION

Typically, Source Water Assessments are distributed to water system owners and operators, local governments, and other entities with an interest in preserving the quality of the water supply. In addition, the results are posted on the ADEC Drinking Water Protection Program web site (www.state.ak.us/dec/water/source), and placed on reserve at a local library in the area of the water system. This document may be distributed to the public to meet the goals of Alaska's drinking water program, however; the document is often only summarized for the public due to security concerns. It is recommended that direct coordination with the ADEC be conducted to determine the appropriate public communication.

9.0 SUMMARY

9.1 LOCATION AND MISSION

Shemya Island is a very remote island in the North Pacific Ocean, several hundred miles from Russia with seismic activity, earthquakes, and tsunamis occurring in the area. Eareckson Air Station, a U.S. military installation, occupies the entire island. At this time the installation in caretaker status. The island has sustained significant surface modifications from military and construction activities.

9.2 GEOLOGY AND HYDROGEOLOGY OF SHEMYA ISLAND

Abundant precipitation sustains surface water and groundwater on the island. Two groundwater systems have historically been used for a potable water supply on the island: a shallow unconfined peat/sand/gravel, and wells in a deeper fractured bedrock system. Over the years, unintentional environmental contamination has occurred. However, efforts since the 1980s have remediated much of the contamination and remediation is ongoing at many sites.

9.3 WATER SUPPLY

An infiltration gallery is the source of drinking water for people at Eareckson Air Station. The drainage flows south toward the infiltration gallery and eventually drains into Gallery Creek. The infiltration gallery intercepts water flow by a shallow subsurface system of perforated piping that collects and stores passing water in a concrete sump. The water system is owned by the USAF. The water in the system is treated, stored, and distributed.

The infiltration gallery system is regulated as a GWUDISW, non-community, non-transient, public water system by the State of Alaska. A source water assessment of the system is required under Alaska's Drinking Water Protection Program. The assessment must include identification of the drinking water protection area, an inventory of contaminant sources in the protected area, and a vulnerability assessment.

9.4 DRINKING WATER PROTECTION AREA

The drinking water protection area identified around the infiltration gallery is comprised of the entire Gallery Creek watershed upstream of the gallery collection point. Geographic Information System (GIS) technology was used to display the watershed boundary. The area is subdivided into Zones A and B corresponding to a 1,000-foot and a 1-mile radius circles upstream from the gallery intake, respectively. Zones C and D are not present because of the small size of the watershed. The watershed boundary, as displayed in Appendix B, Figure B-2, is believed to be hydrologically correct and is the boundary used for the source water assessment.

9.5 CONTAMINANT SOURCES

Potential, current, and historic sources of contamination were inventoried, sorted, and ranked. Few current sources were found, but historic groundwater contamination is significant. Shallow groundwater has already been contaminated, mainly with TCE, POL, and PFAS products. Contamination has reached the infiltration gallery collection tubes and sump. Groundwater in the area is currently being monitored through the IRP program. In addition, the drinking water is being treated via air stripping at the WTP to remove VOC. Re-evaluation of this treatment is recommended as the levels of TCE and POL potentially drop below the maximum contaminant levels in the raw water.

9.6 VULNERABILITY ASSESSMENT

The overall vulnerability of the source water is high (Appendix C, Table C-3). The high natural susceptibility of the watershed is a major contributor. In addition, TCE and heavy metals have already contaminated the shallow groundwater system. The IRP and any source water protection efforts can mutually benefit each other by sharing and integrating data. A review and possible update of this assessment is recommended 5 to 10 years from this report. In the meantime, vigilance will be needed to protect the Eareckson Air Station water supply.

9.7 COMMUNICATION

In order to meet the regulatory requirements of notification to the public about the water source, the Executive Summary of the Source Water Assessment should be published in the annual Consumer Confidence Report (CCR). It is recommended that Table C-3 (the susceptibility vulnerability results for the watershed and raw water source) and Figure B-1 (the watershed protection area map) be published in the CCR.

10.0 RECOMMENDATIONS

- Integrate the drinking water protection area (the water supply watershed), plus the results of the vulnerability analysis for Eareckson Air Station into the planning and execution of the IRP, particularly the remediation efforts around the water gallery.
- Coordinate directly with ADEC to determine appropriate public communication.
- Consult with ADEC regarding the future need to update this plan.
- Publish the Executive Summary, Table C-3, and Figure B-1 in the CCR.
- Re-examine the drinking water emergency plan for adequacy.
- Test the portable RO unit at least yearly and store adequate replacement parts.
- Reevaluate Drinking Water Source Area in five years.
- Additional recommendations regarding the water system are included in the Eareckson Air Force Station PWS Recommendation Letter submitted May 14, 2021 by Goldstream Engineering, Inc.

11.0 REFERENCES

ADEC (Alaska Department of Environmental Conservation). 2009a. *Contaminated Site Database, Site Reports*.

ADEC. 2008. *Mission and Services*.

ADEC. 2004. *Source Water Assessment Infiltration Gallery Eareckson Air Station.*

ADEC. 2001. *Alaska Drinking Water Protection Program: Guidance Manual for Class A (Community and Non-transient Non-community) Public Water Systems - Guidance on the Completion and Meaning of Source Water Assessments and Options for the Protection of Public Drinking Water Sources, Drinking Water and Wastewater Program*. 555 Cordova Street, Anchorage, AK 99501, (907) 269-7647.

Jacobs (Jacobs Engineering Group Inc.). 2009. *Backflow Prevention Cross Connection Control Survey Report,* Eareckson Air Station, Shemya, AK, prepared for USAF 611 CES, Elmendorf Air Force Base, AK June.

Jacobs (Jacobs Engineering Group Inc.). 2001 (April). *Year 2000 Basewide Monitoring Program Report, Draft Final*. Eareckson Air Station, Shemya Island, AK, prepared for USAF 611th CES, Elmendorf Air Force Base, AK.

Jacobs. 2000 (January). *Comprehensive Basewide Monitoring Report, June 1999 Basewide Monitoring Activities and Findings-Final*. Eareckson Air Station, Shemya Island, AK, prepared for USAF 611th CES, Elmendorf Air Force Base, AK, 31.

Jacobs. 1999 (June). *Remedial Investigation Basewide Groundwater Monitoring Report, August-September 1998 Basewide Monitoring Activities and Findings-Final*. Eareckson Air Station, Shemya Island, AK, prepared for USAF 611th CES, Elmendorf Air Force Base, AK.

Jacobs. 1998 (January). *Remediation Plan, SS07 (Engineered Wetland) and ST46 (Well Decommissioning)*. Eareckson Air Station, Alaska (formerly Shemya Air Force Base, AK), prepared for USAF 611th Air Support Group, 611th CES, Elmendorf Air Force Base, AK, and the AFCEE, Brooks Air Force Base, TX.

Jacobs. 1997 (April). *Final Decision Document Report*. Volume III. Eareckson Air Station, AK (formerly Shemya Air Force Base, AK), prepared for USAF 611th Air Support Group, 611th CES, Elmendorf Air Force Base, AK, and the Project 31-MA-00Y3-02, Eareckson Air Station, Alaska, 10-14 Jun and 9-14 Sep 2002 A-3 AFCEE, Brooks Air Force Base, TX.

Jacobs. 1996 (January). *Final Remedial Investigation/Feasibility Study*. Volume III. Eareckson Air Station, AK (formerly Shemya Air Force Base, AK), prepared for USAF 611th Air Support Group, 611th CES, Elmendorf Air Force Base, AK, and the AFCEE, Brooks Air Force Base, TX. Anchorage, AK: Jacobs Engineering Group Inc.

Jacobs. 1995b (August) . *Final Remedial Investigation/ Feasibility Study*. Volume I. Eareckson Air Station, AK (formerly Shemya Air Force Base, AK), prepared for USAF 611th Air Support Group, 611th CES, Elmendorf Air Force Base, AK, and the USAF Center for Environmental Excellence (AFCEE), Brooks Air Force Base, TX. Anchorage, AK: Jacobs Engineering Group Inc.

Jacobs. 1995c (August). *Final Remedial Investigation/ Feasibility Study*. Volume II. Eareckson Air Station, AK (formerly Shemya Air Force Base, AK), prepared for USAF 611th Air Support Group, 611th CES, Elmendorf Air Force Base, AK, and the AFCEE, Brooks Air Force Base, TX. Anchorage, AK: Jacobs Engineering Group Inc.

Toksoz,, M. Nafi. 1975. *The Subduction of the Lithosphere*, pp. 125-135, W.H. Freeman and Company, San Francisco.

USACHPPM (U.S. Army Center for Health Promotion and Preventative Medicine). 2002. *Source Water Assessment.* PWSID No. 260511, Eareckson Air Station, Shemya Island, AK.

USAF. 2001. *Oil Discharge Prevention and Contingency Plan*, USAF Eareckson Air Station, Shemya Island, AK 611 CES, Elmendorf Air Force Base, AK January 2001.

USAF. 2000a (December). *Final Drinking Water Quality Management Plan*, USAF Eareckson Air Station, Shemya Island, AK, 611th CES, Elmendorf Air Force Base, AK.

USAF. 2000b. *Operating Instruction 19-3, Transportation of Environmentally Hazardous Substances*. Eareckson Air Station, AK.

USAF. 1991. *Critical Resource Protection Plan, Water Gallery*. Shemya Air Force Base, AK, 5099 Civil Engineering Operations Squadron, Elmendorf Air Force Base, AK.

USGS (U.S. Geological Survey). 1976. *Geohydrology and Water Supply, Shemya Island, AK*, Open-File Map Report 76-82, prepared by Alvin J. Feulner, Chester Zenone, and Catherine M Reed, U.S. Government Printing Office, Washington D.C.

PERSONNEL CONTACT LIST

Jessica Morris, USAF, 611 CES/CEPT, 10471 20th Street Suite 315, Joint Base Elmendorf-Richardson, AK 99506, commercial: 907-552-5655, DSN: 317-552-5655, Jessica.morris.14@us.af.mil

Charley Palmer, ADEC, 555 Cordova St., Anchorage, AK 99501, 907-269-0292

Chris Miller, ADEC, Hydrogeologist, 555 Cordova St., Anchorage, AK, 907-269-7549

Connie J. Phillips, Water and Wastewater Plant Operator, 1800 West 48th Ave, Suite C, Anchorage, AK 99517. 907-392-4828. cophillips@asrcfederal.com

Col. Paul Cornwell, 10471 20th Street, Suite 265, Joint Base Elmendorf-Richardson, AK, commercial: 907-552-3442

(intentionally blank)

APPENDIX A

Photo Log

Photo No. 1 Water Gallery Looking Northeast

Photo No. 2
Water Gallery Looking East

Photo No. 3 Water Gallery View
Looking South

Photo No. 4 Building 700 and
Hangar 4 Pad,
View Looking North

Photo No. 5 Water Gallery
View Looking North, Hangar 4 Pad

Photo No. 6 Water Gallery
View Looking West, Gallery Creek

APPENDIX B

Figures

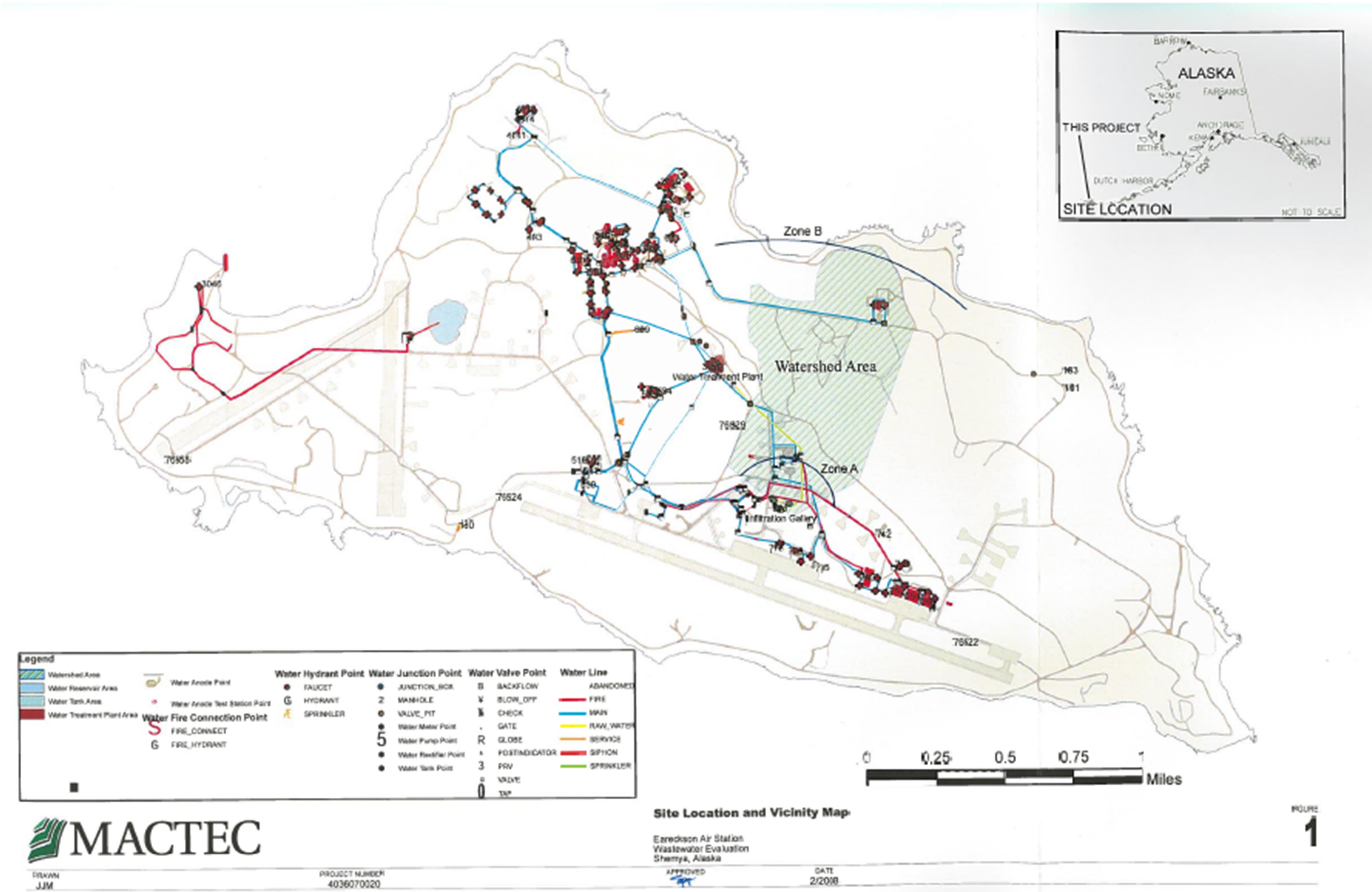
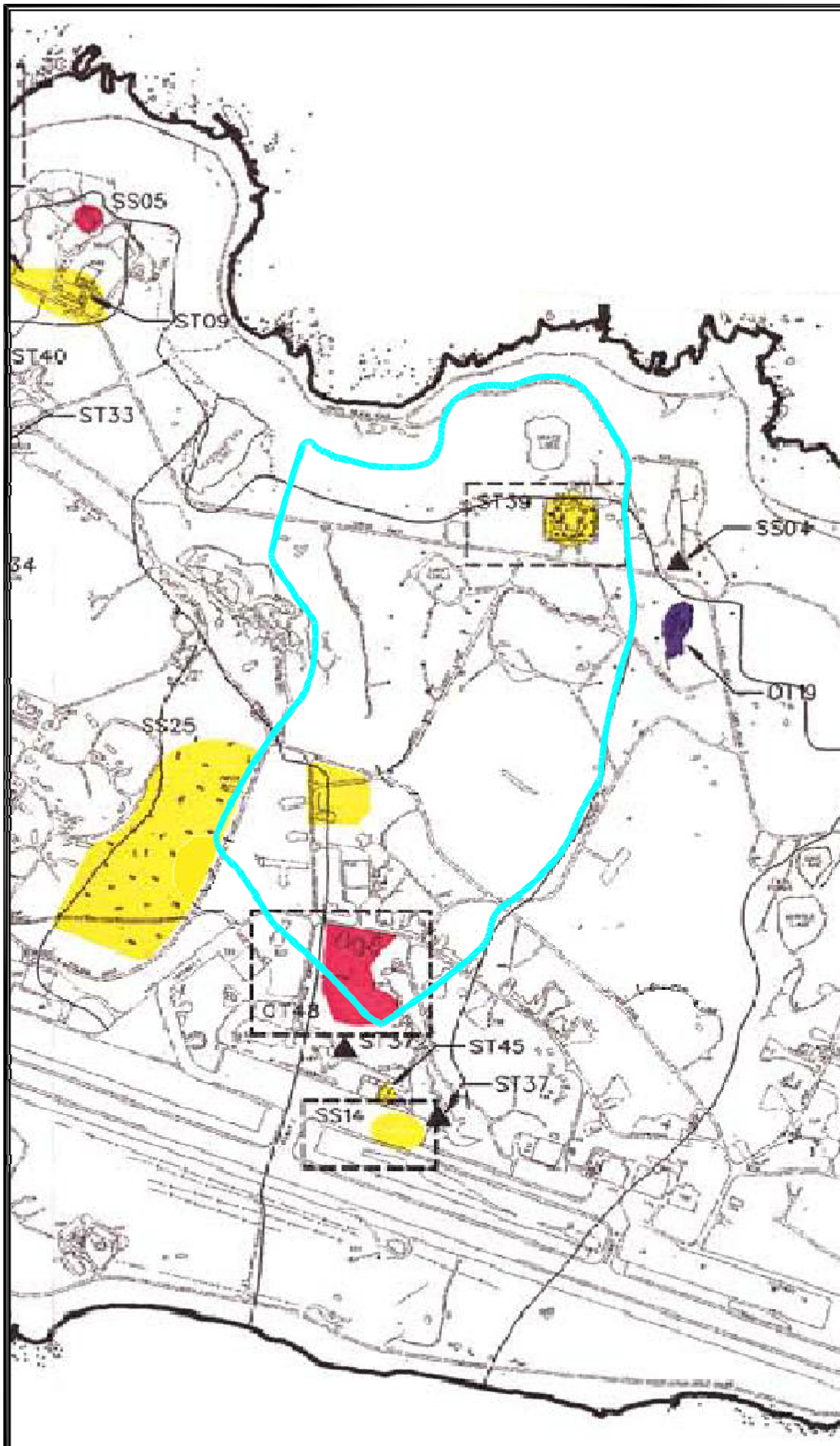

ALASKA
THIS PROJECT
SITE LOCATION
Zone B
Watershed Area
Water Treatment Plant
Zone A
Infiltration Gallery
Legend
Water Hydrant Point
Water Junction Point
Water Valve Point
Water Line
Water Fire Connection Point
0 0.25 0.5 0.75 1 Miles
MACTEC
Site Location and Vicinity Map
Eareckson Air Station
Wastewater Evaluation
Shemya, Alaska
FIGURE
1
DRAWN
JJM
PROJECT NUMBER
4036070020
APPROVED
DATE
2/2008

Figure B-1



LEGEND

- HAZARDOUS SUBSTANCE CONTAMINATION SOURCE AREAS
- POL CONTAMINATION AREA
- WATERSHED

DRAWING NOT TO SCALE

Source: Jacobs Engineering Group, Inc., 1996, Final Remedial Investigation/Feasibility Study, Volume III, Eareckson Air Station, Alaska (formerly Shemya Air Force Base, Alaska), prepared for U.S. Air Force 611th Air Support Group, 611th Civiil Engineering Squadron, Elmendorf Air Force Base, Alaska, and the U.S. Air Force Center for Environmental Excellence (AFCEE), Brooks Air Force Base, Texas, prepared by Jacobs Engineering Group, Inc., 4300 B Street, Suite 600, Anchorage, Alaska, January.

Eareckson Air Station IRP Contamination Source Areas

SHEMYA ISLAND, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO. :
	09 February 2010	S. Witzman	B-2

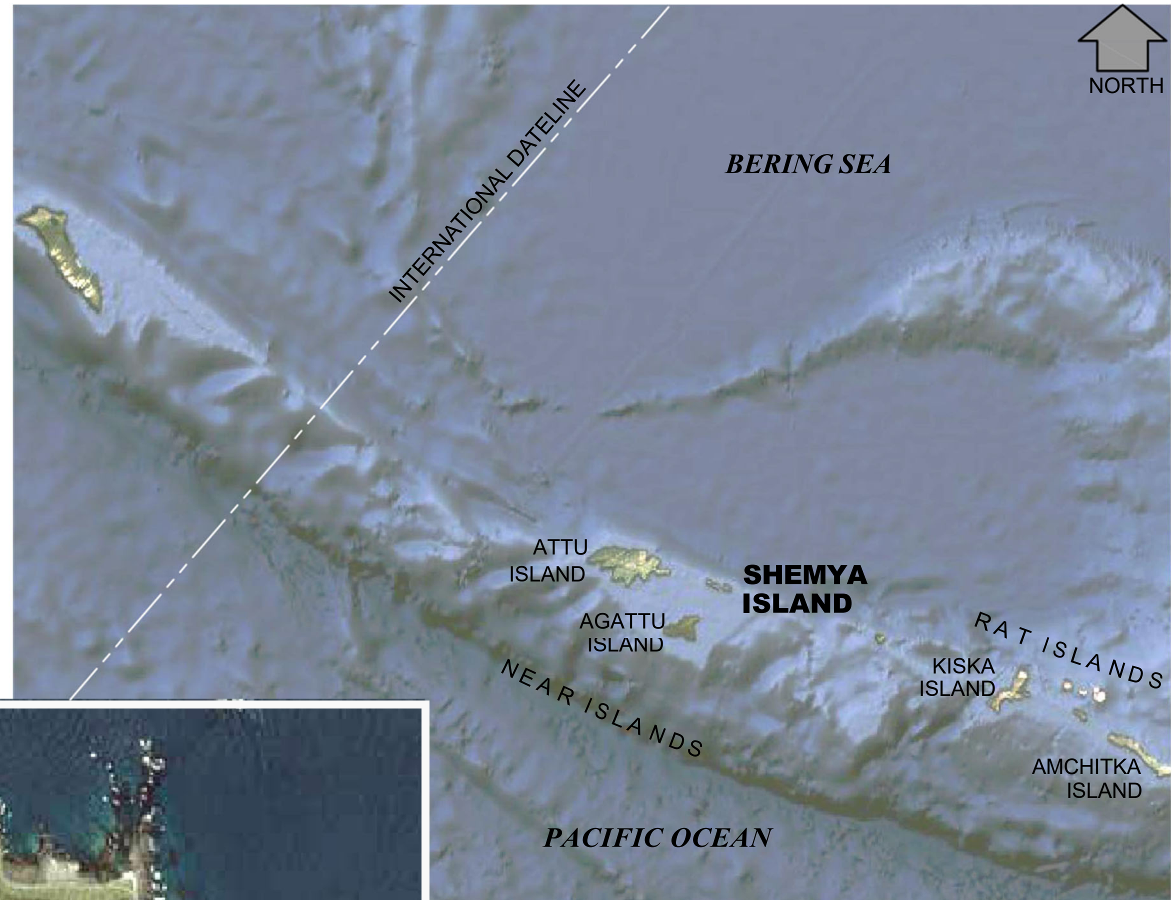


IMAGE SOURCE: GOOGLE EARTH

JACOBS

EARECKSON AIR STATION
LOCATION AND VICINITY
MAPS

DATE
09 February 2010

PROJECT MANAGER
S. Witzmann

FIGURE NO
B-3

APPENDIX C

Tables

Table C-1. Methodology for Assessing Surface Water Vulnerability in Alaska.

<table>
<tr><th>Task</th><th colspan="5">Criteria</th></tr>
<tr><td>1. Delineate drainage area around intake</td><td colspan="5">Define the boundary of the watershed contributing water to the intake. It should show the upper reaches of the watershed and the lower watershed boundary near the drinking water intake.</td></tr>
<tr><td>2. Delineate assessment areas</td><td colspan="5">Three assessment areas must be delineated around the drinking water intake: zones A, B, and C. They are defined as: zone A = 1000 foot radius circle; zone B = 1 mile radius circle; zone C = remainder of watershed.</td></tr>
<tr><td>3. Conduct inventory.</td><td colspan="5">Intense and comprehensive inventory conducted in zones A and B using Contaminant Source Inventory Checklist (AK DEC, 2001, Appendix B). Less intense in zone C.</td></tr>
<tr><td rowspan="7">4. Evaluate natural susceptibility of surface water source</td><td>Initial susceptibility</td><td colspan="4">All surface water bodies assumed to be highly susceptible.
Initial susceptibility = 30 pts</td></tr>
<tr><td rowspan="2">intake adequately constructed</td><td colspan="4">Yes = 0 points</td></tr>
<tr><td colspan="4">No = 5 points</td></tr>
<tr><td rowspan="2">Runoff potential</td><td>Precipitation</td><td colspan="3">$\le$ 15 in. / year = 0 points ; > 15 in. / year = 2 points</td></tr>
<tr><td>Slope</td><td colspan="3">$\le$ 3 % = 0 points; > 3 % = 3 points</td></tr>
<tr><td>Dilution capacity</td><td colspan="4">Discharge: $\ge$ 90K cfs = 0 pts; 20K to <90K cfs = 5 pts; <20K cfs = 10 pts
Area: >1 mi^2 = 0 pts; $\le$ 1 mi^2 = 5 pts
Residence time: $\le$ 1yr. = 0 pts; >1yr. = 5 pts</td></tr>
<tr><td colspan="5">Initial susceptibility + intake construction + runoff potential + dilution capacity = natural susceptibility of source. Ratings: very high = 40 to 50 pts; high = 30 to < 40 pts</td></tr>
<tr><td rowspan="11">5. Evaluate contaminant risks</td><td rowspan="2">Existing sources</td><td rowspan="2">regulated substance detected in source water</td><td>Due to Natural Processes</td><td colspan="2">>MCL = 50 pts; 0.5 to <MCL=20 pts;0.2 to 0.5 MCL=10 pts; detect to 0.2 MCL = 5 pts</td></tr>
<tr><td>Due to Man-made contamination</td><td>>MCL= 50 pts;0.5 to<MCL= 20 pts; 0.2 to 0.5 MCL= 10 pts; detect - 0.2 MCL=2 pts</td><td>increasing = 1-10 pts
decreasing = -1-5 pts
stable = 0 pts</td></tr>
<tr><td rowspan="8">Potential sources within zones A and B</td><td>Highest risk source</td><td colspan="3">Very high = 40 pts; High = 30 pts; Medium = 20 pts;
Low = 10 pts; Very low = 5 pts</td></tr>
<tr><td>Next highest risk source</td><td colspan="3">Very high: $\ge$ 1 source = 10 pts
High: $\ge$ 2 sources = 10 pts
Med: $\ge$ 2 sources + highest risk source is med = 5 pts;
$\ge$ 5 sources + highest risk source is high = 5 pts;
$\ge$ 10 sources + highest risk source is very high= 5 pts
Low: $\ge$ 10 sources + highest risk source is low= 10 pts;
$\ge$ 10 sources + highest risk source is med= 5 pts;
$\ge$ 20 sources + highest risk source is high= 5 pts
Very low: $\ge$ 10 sources = 5 pts</td></tr>
<tr><td colspan="2" rowspan="2">Significant sources <1000 ft. from gallery/ in floodplain</td><td colspan="2">Yes = increase 1 to 10 pts</td></tr>
<tr><td colspan="2">No = 0 pts</td></tr>
<tr><td colspan="2" rowspan="2">Any conditions warrant upgrading risk</td><td colspan="2">Yes = increase 1 to 10 pts</td></tr>
<tr><td colspan="2">No = 0 pts</td></tr>
<tr><td colspan="2" rowspan="2">Sufficient controls and /or monitoring to reduce risk</td><td colspan="2">Yes = decrease 1 to 10 pts</td></tr>
<tr><td colspan="2">No = 0 pts</td></tr>
<tr><td colspan="5">Risk from existing sources+ risk from potential sources with controls = contaminant risks
Ratings: very high = 40-50 pts; high = 30- < 40 pts; medium = 20- < 30 pts; low=< 20 pts</td></tr>
<tr><td colspan="2">6. Evaluate vulnerability of surface water source</td><td colspan="4">Natural susceptibility (0-50) + contaminant risks (0-50) = vulnerability of source (0-100); Ratings: very high = 80-100 pts; high = 60 -<80 pts; medium = 40 -<60 pts; low=< 40 pts</td></tr>
</table>

Table C-2. Six Major Categories of Contaminants Regulated for Drinking Water Sources.

CONTAMINANT CATEGORY	POSSIBLE SOURCE
1. Bacteria/Viruses	Sewage lagoons, septic systems
2. Nitrates/Nitrites	Septic systems, fertilizers, manure piles
3. Volatile Organic Chemicals	Gasoline, fuels, heating oil
4. Heavy Metals	Inorganic chemicals, cyanide, landfills
5. Synthetic Organic Chemicals	Agricultural fields, utility easements, fuels
6. Other Organic Chemicals	Transformers, crude oil, industrial sources

Table C-3. Summary of Susceptibility /Vulnerability Scores and Ratings for the Water Supply Watershed and Infiltration Gallery, Eareckson Air Station, AK.

	Vulnerability Score (points)	Vulnerability Rating
WATERSHED SUSCEPTIBILITY	45	Very high
CONTAMINANT RISKS		
1. Bacteria/viruses	65	High
2. Nitrates/nitrites	70	High
3. Volatile organic chemicals	88	Very high
4. Metals, cyanide, other inorganics	90	Very high
5. Synthetic organic chemicals	80	High
6. Other synthetic organic chemicals	57	Medium
OVERALL VULNERABILITY	75	High

NOTE: watershed susceptibility (30-50) + contaminant risks (0-50) = vulnerability (30-100).

APPENDIX D

Inventory

APPENDIX D
CONTAMINANT SOURCE INVENTORY

TABLE D-1. CONTAMINANT SOURCE (CS) INVENTORY, PWSID 260511, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Source of Information	Comments
Current contaminant sources						
Aircraft maintenance shop	C1	1	A	Hangar 4, north of infiltration gallery	Field observation	Building has been removed; previously used for non-hazardous, non-liquid storage only.
Controlled waste disposal	D21	2	A	Small incinerator on east side of hangar 4	Field observation	Incinerator has been removed.
Miscellaneous – cold storage building	X27	3	B	Building 700,West of hangar 4; northwest of infiltration gallery	Field observation	Building is used for non-hazardous, non-liquid storage only.
Waste disposal-sewer lines	D1	4	A, B	building 110, hangar 4 lines run through watershed	Field observation; WTP operator	Lines in watershed are abandoned. No sewage flows through them.
Miscellaneous-paved roads	X20	5	A, B	Numerous east/west and north/ south roads cross watershed.	Field observation	Restrictions exist for transporting hazardous materials on these roads.
Miscellaneous-dirt/gravel roads	X24	6	A, B	Numerous east/west and north/ south roads cross watershed.	Field observation	Restrictions exist for transporting hazardous materials on these roads.
Waste disposal-Septic system	D10	7	B	Northeastern side of building 110	Previous Field observation	Septic system installed in 2010.
Miscellaneous – building 110	X27	8	B	Located on North Road, on the northern watershed boundary	Previous Field observation	Building is used by the Navy for Classic Owl radar operations.
Historical contaminant sources – monitoring wells						
Monitoring well WGW1	W6, U6	9	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well WGW2	W6, U6	10	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well WGW3	W6, U6	11	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well WGW4	W6, U6	12	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well WGW5	W6, U6	13	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well WGW6	W6, U6	14	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.

NOTES: 1. Categories are from AK DEC, 2001, Appendix B. 2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001, Appendix B. 3. These numbers correspond to contaminant source numbers in Figure C-10. 4. Zones A and B correspond to 1000 foot and 1 mile radius circles, on Figure C-10. 5. See Figure C-10.

TABLE D-1. CS INVENTORY, PWSID 260511, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Source of Information	Comments
Monitoring well WGW7	W6, U6	15	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well WGW8	W6, U6	16	A	immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1221	W6, U6	17	A	north of Pearl Drive and west of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1225	W6, U6	18	A	north of Pearl Drive and west of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1230	W6, U6	19	----	South of infiltration gallery, adjacent to runway	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1319	W6, U6	20	A	North of Pearl Drive and east of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1327	W6, U6	21	A	South of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1609	W6, U6	22	A	Northeast of infiltration gallery and west of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1610	W6, U6	23	A	east of infiltration gallery and just west of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1611	W6, U6	24	A	east of infiltration gallery and just west of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1612	W6, U6	25	A	east of infiltration gallery and just west of Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1614	W6, U6	26	----	Southwest of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1615	W6, U6	27	A	Southwest of infiltration gallery, east of Tower Road	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1617	W6, U6	28	A	North of infiltration gallery and south of Spine Road	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well AP 1619	W6, U6	29	A	Northwest of infiltration gallery, south of Spine Road	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well DH 1163	W6, U6	30	A	West of infiltration gallery and east of Tower Road	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.

NOTES: 1. Categories are from AK DEC, 2001, Appendix B. 2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001, Appendix B. 3. These numbers correspond to contaminant source numbers in Figure C-10. 4 Zones A and B correspond to 1000 foot and 1 mile radius circles, on Figure C-10. 5. See Figure C-10.

TABLE D-1. CS INVENTORY, PWSID 260511, EARECKSON AIR STATION, AK(continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone [4]	Location [5]	Source of Information	Comments
Monitoring well COE 18	W6, U6	31	A	east of Gallery Creek, and adjacent to Terminal Way	Jacobs Engineering, 1995a,b, 1996	Part of IRP site OT-48; detected ground water contamination.
Monitoring well ST 39-COE 12	W6, U6	32	B	About 500 feet southwest of ST 39, north of North Road	Jacobs Engineering, 1995a,b, 1996	Part of IRP site ST 39; well is upgradient; no ground water contamination found
Monitoring well SS 14-MW 01	W6, U6	33	---	Immediately downgradient of SS 14, in airport runway	Jacobs Engineering, 1995a,b, 1996	Part of IRP site SS 14; detected ground water contamination.
Monitoring well SS 14-MW 03	W6, U6	34	---	South of airport runway, west of Gallery Creek	Jacobs Engineering, 1995a,b, 1996	Part of IRP site SS 14; no ground water contamination found
Monitoring well SS 14-MW 53	W6, U6	35	---	South of airport runway, east of Gallery Creek	Jacobs Engineering, 1995a,b, 1996	Part of IRP site SS 14; no ground water contamination found
Historical contaminant sources – source areas						
Contaminated site: OT 48	U6	36	A	Immediate vicinity of infiltration gallery	Jacobs Engineering, 1995a,b, 1996	TCE contamination in ground water
Contaminated site: SS 13	U6	37	B	600 feet north of hangar 4	Jacobs Engineering, 1995a,b, 1996	Tar-contaminated soil was removed; no ground water contamination
Contaminated site: SS 14	U6	38	---	South of water gallery, north of airport runway	Jacobs Engineering, 1995a,b, 1996	50 gallons of JP-4 spilled in 1983; detected ground water contamination.
Contaminated site: ST 37	U6	39	---	Immediately south of OT 48	Jacobs Engineering, 1995a,b, 1996	USTs leaked diesel fuel; no ground water contamination found
Contaminated site: ST 39	U6	40	B	USTs around building 110	Jacobs Engineering, 1995a,b, 1996	USTs leaked fuel; well is upgradient; no ground water contamination found
Contaminated site: ST 45	U6	41	---	Immediately north of SS 14	Jacobs Engineering, 1995a,b, 1996	Possible JP-4 fuel spill; no ground water contamination found

NOTES: 1. Categories are from AK DEC, 2001, Appendix B. 2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001, Appendix B. 3. These numbers correspond to contaminant source numbers in Figure C-10. 4. Zones A and B correspond to 1000 foot and 1 mile radius circles, on Figure C-10. 5. See Figure C-10.

APPENDIX E

Inventory ranking

APPENDIX E
CONTAMINANT SOURCE SORTING AND RANKING

TABLE E-1. CS RANKING – SOURCES OF BACTERIA AND VIRUSES, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
Waste disposal-Septic system	D10	7	B	Northeastern side of building 110	high	Septic system installed in 2010; effluent supposed to flow north to Bering Sea.
Controlled waste disposal	D21	2	A	Small incinerator on east side of hangar 4	Very low	Incinerator removed. Risk rank reduced from low to very low.
Waste disposal-sewer lines	D1	4	A, B	building 110, hangar 4 lines run through watershed	low	Sewer lines are abandoned/not used. Risk rank reduced from medium to low.
paved roads	X20	5	A, B	Many roads in watershed.	low	not significant source of bacteria/viruses
dirt/gravel roads	X24	6	A, B	Many roads in watershed.	low	not significant source of bacteria/viruses
Hangar 4	C1	1	A	north of infiltration gallery	very low	Building removed, not significant source of bacteria/viruses
IRP site OT 48	U6	36	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW1	W6, U6	9	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW2	W6, U6	10	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW3	W6, U6	11	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW4	W6, U6	12	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW5	W6, U6	13	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW6	W6, U6	14	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW7	W6, U6	15	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW8	W6, U6	16	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1221	W6, U6	17	A	north of Pearl Drive	very low	not significant source of bacteria/viruses
well AP 1225	W6, U6	18	A	north of Pearl Drive	very low	not significant source of bacteria/viruses
well AP 1319	W6, U6	20	A	North of Pearl Drive	very low	not significant source of bacteria/viruses
well AP 1327	W6, U6	21	A	South of infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1609	W6, U6	22	A	NE of infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1610	W6, U6	23	A	east of infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1611	W6, U6	24	A	east of infiltration gallery	very low	not significant source of bacteria/viruses

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-1. CS RANKING – SOURCES OF BACTERIA AND VIRUSES, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
well AP 1612	W6, U6	25	A	east of infiltration gallery	very low	not significant source of bacteria / viruses
well AP 1615	W6, U6	27	A	SW of infiltration gallery	very low	not significant source of bacteria / viruses
well AP 1617	W6, U6	28	A	North of infiltration gallery	very low	not significant source of bacteria / viruses
well AP 1619	W6, U6	29	A	NW of infiltration gallery	very low	not significant source of bacteria / viruses
well DH 1163	W6, U6	30	A	West of infiltration gallery	very low	not significant source of bacteria / viruses
well COE 18	W6, U6	31	A	east of Gallery Creek,	very low	not significant source of bacteria / viruses
cold storage building	X27	3	B	West of hangar 4	very low	not significant source of bacteria / viruses
well ST 39-COE 12	W6, U6	32	B	500 feet SW of ST 39	very low	not significant source of bacteria / viruses
Building 110	X27	8	B	on North Road	very low	not significant source of bacteria / viruses
IRP site SS 13	U6	37	B	600 feet north of hangar 4	very low	not significant source of bacteria / viruses
IRP site ST 39	U6	40	B	USTs around building 110	very low	not significant source of bacteria / viruses

NOTES:

Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.

1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-2. CS RANKING – SOURCES OF NITRATES/NITRITES, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
Waste disposal-Septic system	D10	7	B	Northeastern side of building 110	high	Septic system installed in 2010; effluent supposed to flow north to Bering Sea.
Waste disposal-sewer lines	D1	4	A, B	building 110, hangar 4 lines run through watershed	low	Sewer lines are abandoned/not used. Risk rank reduced from medium to low.
incinerator	D21	2	A	East side of hangar 4	very low	Incinerator removed. Risk rank reduced from low to very low.
paved roads	X20	5	A, B	Many roads in watershed.	very low	not significant source of bacteria/viruses
dirt/gravel roads	X24	6	A, B	Many roads in watershed.	very low	not significant source of bacteria/viruses
Hangar 4	C1	1	A	north of infiltration gallery	very low	Building removed, not significant source of bacteria/viruses
IRP site OT 48	U6	36	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW1	W6, U6	9	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW2	W6, U6	10	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW3	W6, U6	11	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW4	W6, U6	12	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW5	W6, U6	13	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW6	W6, U6	14	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW7	W6, U6	15	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well WGW8	W6, U6	16	A	around infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1221	W6, U6	17	A	north of Pearl Drive	very low	not significant source of bacteria/viruses
well AP 1225	W6, U6	18	A	north of Pearl Drive	very low	not significant source of bacteria/viruses
well AP 1319	W6, U6	20	A	North of Pearl Drive	very low	not significant source of bacteria/viruses
well AP 1327	W6, U6	21	A	South of infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1609	W6, U6	22	A	NE of infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1610	W6, U6	23	A	east of infiltration gallery	very low	not significant source of bacteria/viruses
well AP 1611	W6, U6	24	A	east of infiltration gallery	very low	not significant source of bacteria/viruses

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-2. CS RANKING – SOURCES OF NITRATES/NITRITES, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
well AP 1612	W6, U6	25	A	east of infiltration gallery	very low	not significant source of bacteria / viruses
well AP 1615	W6, U6	27	A	SW of infiltration gallery	very low	not significant source of bacteria / viruses
well AP 1617	W6, U6	28	A	North of infiltration gallery	very low	not significant source of bacteria / viruses
well AP 1619	W6, U6	29	A	NW of infiltration gallery	very low	not significant source of bacteria / viruses
well DH 1163	W6, U6	30	A	West of infiltration gallery	very low	not significant source of bacteria / viruses
well COE 18	W6, U6	31	A	east of Gallery Creek,	very low	not significant source of bacteria / viruses
cold storage building	X27	3	B	West of hangar 4	very low	not significant source of bacteria / viruses
well ST 39-COE 12	W6, U6	32	B	500 feet SW of ST 39	very low	not significant source of bacteria / viruses
Building 110	X27	8	B	on North Road	very low	not significant source of bacteria / viruses
IRP site SS 13	U6	37	B	600 feet north of hangar 4	very low	not significant source of bacteria / viruses
IRP site ST 39	U6	40	B	USTs around building 110	very low	not significant source of bacteria / viruses

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-3. CS RANKING – SOURCES OF VOLATILE ORGANIC CHEMICALS, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
IRP site OT 48	U6	36	A	around infiltration gallery	high	TCE, BTEX in ground water above
Hangar 4 Site	C1	1	A	north of infiltration gallery	high	Building has been removed but floor drains were discovered. TCE, TCP, PFOA, PFOS and PCP in ground water above PAL, criteria (Note 6)
well WGW1	W6, U6	9	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW2	W6, U6	10	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW3	W6, U6	11	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW4	W6, U6	12	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW5	W6, U6	13	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW6	W6, U6	14	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW7	W6, U6	15	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well WGW8	W6, U6	16	A	around infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1221	W6, U6	17	A	north of Pearl Drive	high	TCE, BTEX in ground water above MCL, criteria
well AP 1225	W6, U6	18	A	north of Pearl Drive	high	TCE, BTEX in ground water above MCL, criteria
well AP 1319	W6, U6	20	A	North of Pearl Drive	high	TCE, BTEX in ground water above MCL, criteria
well AP 1327	W6, U6	21	A	South of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1609	W6, U6	22	A	NE of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1610	W6, U6	23	A	east of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1611	W6, U6	24	A	east of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1612	W6, U6	25	A	east of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1615	W6, U6	27	A	SW of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1617	W6, U6	28	A	North of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well AP 1619	W6, U6	29	A	NW of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well DH 1163	W6, U6	30	A	West of infiltration gallery	high	TCE, BTEX in ground water above MCL, criteria
well COE 18	W6, U6	31	A	east of Gallery Creek,	high	TCE, BTEX in ground water above MCL, criteria
well ST 39-COE 12	W6, U6	32	B	500 feet SW of ST 39	high	TCE, BTEX in ground water above MCL, criteria
incinerator	D21	2	A	Has been removed, previously on east side of hangar 4.	Very low	Removed; risk rank reduced to very low
IRP site SS 13	U6	37	B	600 feet north of hangar 4	medium	Remediated; no further action required
IRP site ST 39	U6	40	B	USTs around building 110	medium	Remediated; no further action required
cold storage building	X27	3	B	West of hangar 4	low	No hazardous materials used or stored here

NOTES:

Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.

1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.
6. Results based on the Environmental Services Waste Characterization provided by Brice Environmental

TABLE E-3. CS RANKING – SOURCES OF VOLATILE ORGANIC CHEMICALS, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
paved roads	X20	5	A, B	Many roads in watershed.	low	
dirt/gravel roads	X24	6	A, B	Many roads in watershed.	low	
Waste disposal-sewer lines	D1	4	A, B	building 110, hangar 4 lines run through watershed	low	
Building 110	X27	8	B	on North Road	low	
Waste disposal-Septic system	D10	7	B	Northeastern side of building 110	low	Septic system installed in 2010; effluent supposed to flow north to Bering Sea.

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-4. CS RANKING – SOURCES OF HEAVY METALS, CYANIDE, AND OTHER INORGANIC CHEMICALS, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
IRP site OT 48	U6	36	A	around infiltration gallery	medium	High antimony in ground water
well WGW1	W6, U6	9	A	around infiltration gallery	medium	High antimony in ground water
well WGW2	W6, U6	10	A	around infiltration gallery	medium	High antimony in ground water
well WGW3	W6, U6	11	A	around infiltration gallery	medium	High antimony in ground water
well WGW4	W6, U6	12	A	around infiltration gallery	medium	High antimony in ground water
well WGW5	W6, U6	13	A	around infiltration gallery	medium	High antimony in ground water
well WGW6	W6, U6	14	A	around infiltration gallery	medium	High antimony in ground water
well WGW7	W6, U6	15	A	around infiltration gallery	medium	High antimony in ground water
well WGW8	W6, U6	16	A	around infiltration gallery	medium	High antimony in ground water
well AP 1221	W6, U6	17	A	north of Pearl Drive	medium	High antimony in ground water
well AP 1225	W6, U6	18	A	north of Pearl Drive	medium	High antimony in ground water
well AP 1319	W6, U6	20	A	North of Pearl Drive	medium	High antimony in ground water
well AP 1327	W6, U6	21	A	South of infiltration gallery	medium	High antimony in ground water
well AP 1609	W6, U6	22	A	NE of infiltration gallery	medium	High antimony in ground water
well AP 1610	W6, U6	23	A	east of infiltration gallery	medium	High antimony in ground water
well AP 1611	W6, U6	24	A	east of infiltration gallery	medium	High antimony in ground water
well AP 1612	W6, U6	25	A	east of infiltration gallery	medium	High antimony in ground water
well AP 1615	W6, U6	27	A	SW of infiltration gallery	medium	High antimony in ground water
well AP 1617	W6, U6	28	A	North of infiltration gallery	medium	High antimony in ground water
well AP 1619	W6, U6	29	A	NW of infiltration gallery	medium	High antimony in ground water
well DH 1163	W6, U6	30	A	West of infiltration gallery	medium	High antimony in ground water
well COE 18	W6, U6	31	A	east of Gallery Creek	medium	High antimony in ground water
incinerator	D21	2	A	Removed, previously on east side of hangar 4	medium	Removed; risk rank reduced to very low.
well ST 39-COE 12	W6, U6	32	B	500 feet SW of ST 39	medium	
Hangar 4	C1	1	A	north of infiltration gallery	low	Building removed; risk rand reduce to low
cold storage building	X27	3	B	West of hangar 4	low	

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-4. CS RANKING – SOURCES OF HEAVY METALS, CYANIDE, AND OTHER INORGANIC CHEMICALS, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
paved roads	X20	5	A, B	Many roads in watershed.	low	
dirt/gravel roads	X24	6	A, B	Many roads in watershed.	low	
Waste disposal-sewer lines	D1	4	A, B	building 110, hangar 4 lines run through watershed	low	
IRP site SS 13	U6	37	B	600 feet north of hangar 4	low	Remediated; no further action required
IRP site ST 39	U6	40	B	USTs around building 110	low	Remediated; no further action required
Building 110	X27	8	B	on North Road	low	
Waste disposal-Septic system	D10	7	B	Northeastern side of building 110	low	

NOTES:

Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.

1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-5. CS RANKING – SOURCES OF SYNTHETIC ORGANIC CHEMICALS, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
Well WGW7	W6, U6	15	A	Around infiltration gallery	High	PFAS at 120 ng/L, EPA Heath Advisory Level 70 ng/L
sewer lines	D1	4	A, B	building 110, hangar 4	low	
Septic system	D10	7	B	NE side of bldg. 110	low	
IRP site OT 48	U6	36	A	around infiltration gallery	very low	Not a significant source of SOCs
incinerator	D21	2	A	Removed, previously on east side of hangar 4	very low	Removed; risk rank reduced to very low
well WGW1	W6, U6	9	A	around infiltration gallery	very low	Not a significant source of SOCs
well WGW2	W6, U6	10	A	around infiltration gallery	very low	Not a significant source of SOCs
well WGW3	W6, U6	11	A	around infiltration gallery	very low	Not a significant source of SOCs
well WGW4	W6, U6	12	A	around infiltration gallery	very low	Not a significant source of SOCs
well WGW5	W6, U6	13	A	around infiltration gallery	very low	Not a significant source of SOCs
well WGW6	W6, U6	14	A	around infiltration gallery	very low	Not a significant source of SOCs
well WGW8	W6, U6	16	A	around infiltration gallery	very low	Not a significant source of SOCs
well AP 1221	W6, U6	17	A	north of Pearl Drive	very low	Not a significant source of SOCs
well AP 1225	W6, U6	18	A	north of Pearl Drive	very low	Not a significant source of SOCs
well AP 1319	W6, U6	20	A	North of Pearl Drive	very low	Not a significant source of SOCs
well AP 1327	W6, U6	21	A	South of infiltration gallery	very low	Not a significant source of SOCs
well AP 1609	W6, U6	22	A	NE of infiltration gallery	very low	Not a significant source of SOCs
well AP 1610	W6, U6	23	A	east of infiltration gallery	very low	Not a significant source of SOCs
well AP 1611	W6, U6	24	A	east of infiltration gallery	very low	Not a significant source of SOCs
well AP 1612	W6, U6	25	A	east of infiltration gallery	very low	Not a significant source of SOCs
well AP 1615	W6, U6	27	A	SW of infiltration gallery	very low	Not a significant source of SOCs
well AP 1617	W6, U6	28	A	North of infiltration gallery	very low	Not a significant source of SOCs
well AP 1619	W6, U6	29	A	NW of infiltration gallery	very low	Not a significant source of SOCs
well DH 1163	W6, U6	30	A	West of infiltration gallery	very low	Not a significant source of SOCs
well COE 18	W6, U6	31	A	east of Gallery Creek	very low	Not a significant source of SOCs
Hangar 4	C1	1	A	north of infiltration gallery	very low	Building removed, Not a significant source of SOCs

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-5. CS RANKING – SOURCES OF SYNTHETIC ORGANIC CHEMICALS, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
paved roads	X20	5	A, B	Many roads in watershed.	very low	Not a significant source of SOCs
dirt/gravel roads	X24	6	A, B	Many roads in watershed.	very low	Not a significant source of SOCs
cold storage building	X27	3	B	West of hangar 4	very low	Not a significant source of SOCs
well ST 39-COE 12	W6, U6	32	B	500 feet SW of ST 39	very low	Not a significant source of SOCs
IRP site SS 13	U6	37	B	600 feet north of hangar 4	very low	Not a significant source of SOCs
IRP site ST 39	U6	40	B	USTs around building 110	very low	Not a significant source of SOCs
Building 110	X27	8	B	on North Road	very low	Not a significant source of SOCs

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-6. CS RANKING – SOURCES OF OTHER SYNTHETIC ORGANIC CHEMICALS, EARECKSON AIR STATION, AK

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
incinerator	D21	2	A	Removed, previously on east side of hangar 4	very low	Removed; risk rank reduced to very low
Hangar 4	C1	1	A	north of infiltration gallery	low	Building removed; risk rank reduced to low.
sewer lines	D1	4	A, B	building 110, hangar 4	low	
paved roads	X20	5	A, B	Many roads in watershed.	low	
dirt/gravel roads	X24	6	A, B	Many roads in watershed.	low	
Septic system	D10	7	B	NE side of bldg. 110	low	
Building 110	X27	8	B	on North Road	low	
cold storage building	X27	3	B	West of hangar 4	low	
IRP site OT 48	U6	36	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW1	W6, U6	9	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW2	W6, U6	10	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW3	W6, U6	11	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW4	W6, U6	12	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW5	W6, U6	13	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW6	W6, U6	14	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW7	W6, U6	15	A	around infiltration gallery	very low	Not a significant source of other SOCs
well WGW8	W6, U6	16	A	around infiltration gallery	very low	Not a significant source of other SOCs
well AP 1221	W6, U6	17	A	north of Pearl Drive	very low	Not a significant source of other SOCs
well AP 1225	W6, U6	18	A	north of Pearl Drive	very low	Not a significant source of other SOCs
well AP 1319	W6, U6	20	A	North of Pearl Drive	very low	Not a significant source of other SOCs
well AP 1327	W6, U6	21	A	South of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1609	W6, U6	22	A	NE of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1610	W6, U6	23	A	east of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1611	W6, U6	24	A	east of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1612	W6, U6	25	A	east of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1615	W6, U6	27	A	SW of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1617	W6, U6	28	A	North of infiltration gallery	very low	Not a significant source of other SOCs
well AP 1619	W6, U6	29	A	NW of infiltration gallery	very low	Not a significant source of other SOCs

NOTES:
Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.
1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

TABLE E-6. CS RANKING – SOURCES OF OTHER SYNTHETIC ORGANIC CHEMICALS, EARECKSON AIR STATION, AK (continued)

CS Category [1]	CS ID [2]	CS ID tag [3]	Zone[4]	Location [5]	Risk Ranking	Comments
well DH 1163	W6, U6	30	A	West of infiltration gallery	very low	Not a significant source of other SOCs
well COE 18	W6, U6	31	A	east of Gallery Creek	very low	Not a significant source of other SOCs
well ST 39-COE 12	W6, U6	32	B	500 feet SW of ST 39	very low	Not a significant source of other SOCs
IRP site SS 13	U6	37	B	600 feet north of hangar 4	very low	Not a significant source of other SOCs
IRP site ST 39	U6	40	B	USTs around building 110	very low	Not a significant source of other SOCs

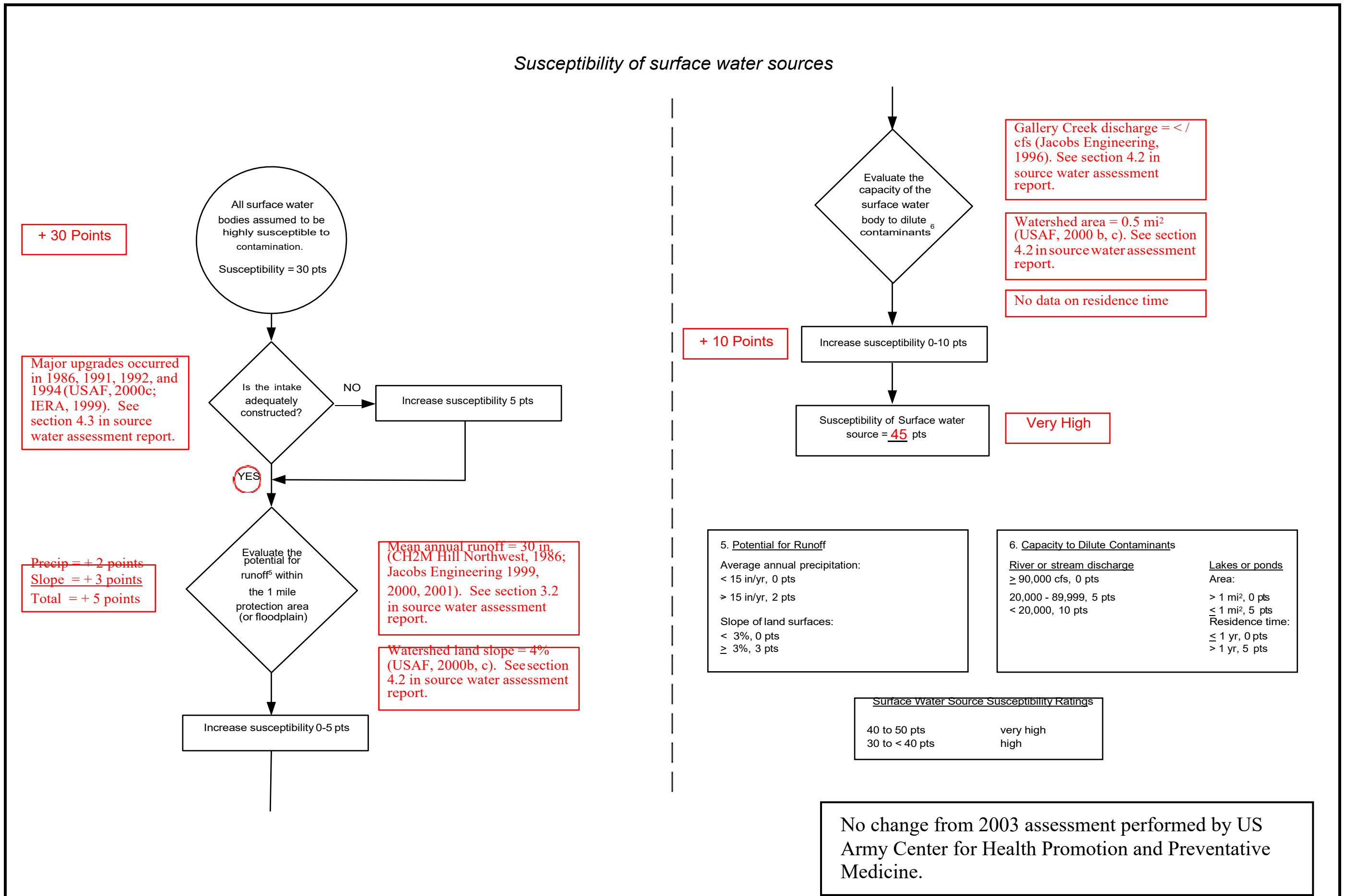
NOTES:

Only those contaminant sources that are inside the drinking water protection area shown on Figure C-10 (zones A and B) are in this list.

1. Categories are from AK DEC, 2001.
2. Contaminant source identification numbers (CS ID) are from AK DEC, 2001.
3. These numbers correspond to contaminant source numbers in Figure C-10.
4. Zones A and B correspond to 100 foot and 1 mile radius circles upstream of the infiltration gallery, as shown on Figure C-10.
5. See Figure C-10.

APPENDIX F

Flow Charts



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-1. Watershed Susceptibility , Eareckson Air Station, Alaska

DATE: MAY 2021

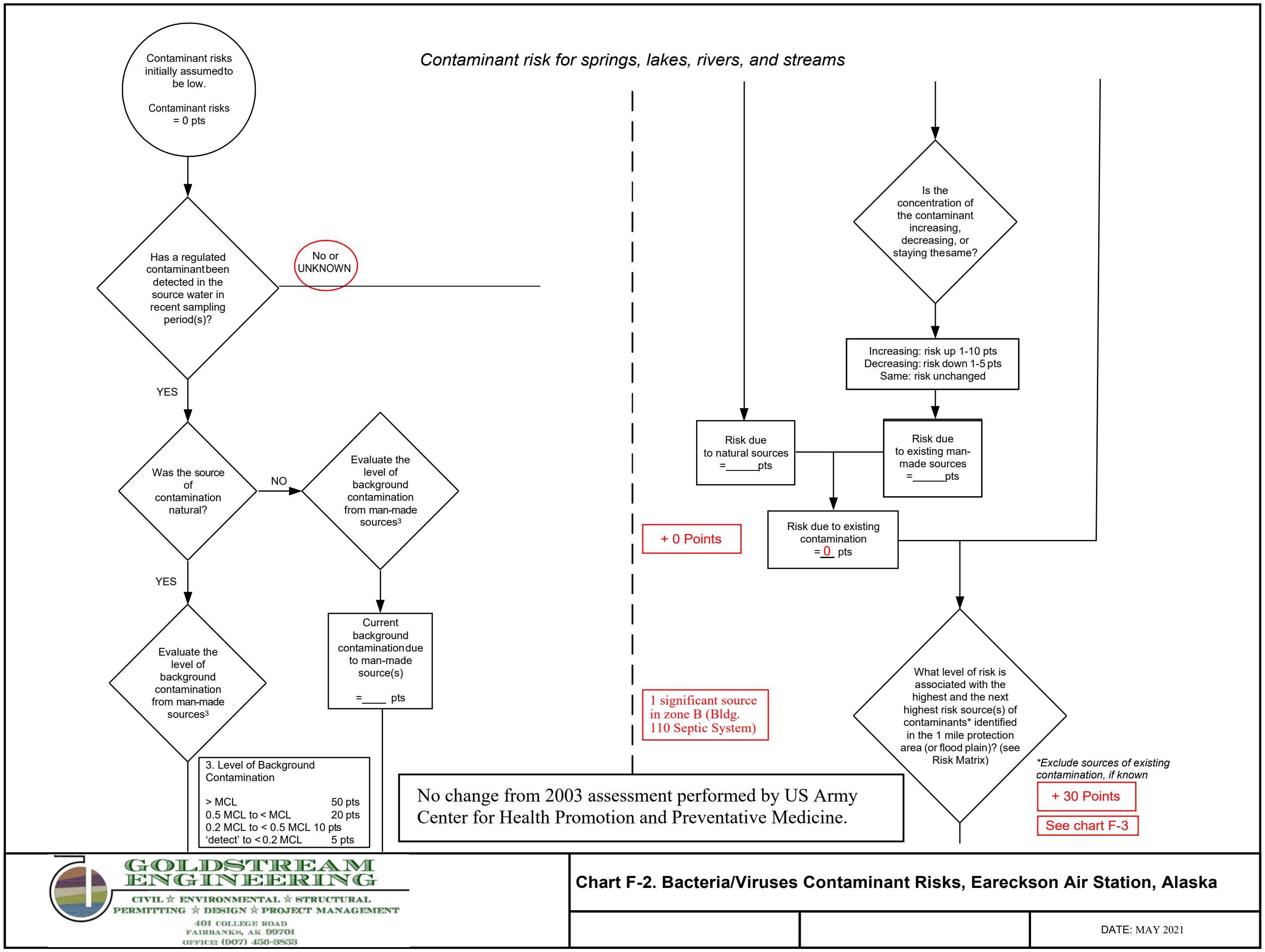
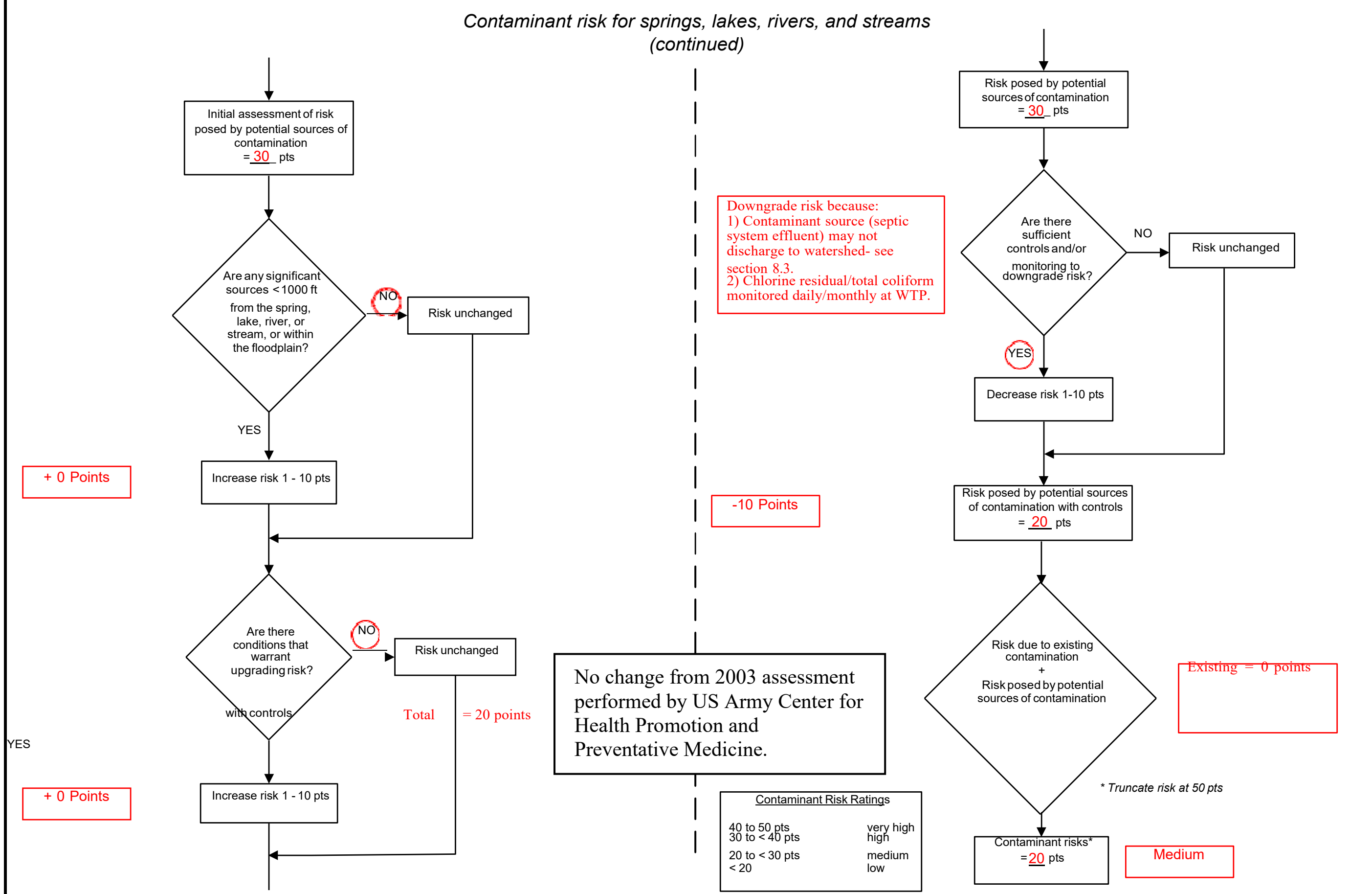


Chart F-2. Bacteria/Viruses Contaminant Risks, Eareckson Air Station, Alaska

DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-2. Bacteria/Viruses Contaminant Risks, Eareckson Air Station, Alaska (continued)

DATE: MAY 2021

Risk Matrix for Contaminant Sources

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Source(s)	Very Low 5 pts	Low 10 pts	Medium 20 pts	High 30 pts	Very High 40 pts
Very Low	≥ 10 sources + 5 pts	≥ 10 sources + 2 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

Risk levels for contaminant sources in zones A and B

	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	0	1	1
Medium(s)	0	0	0
Low(s)	3	0	3
Very Low(s)	23	5	28

Only 1 significant source of bacteria/viruses (Bldg. 110 septic system) in drinking water protection area.

No change from 2003 assessment performed by US Army Center for Health Promotion and Preventative Medicine.

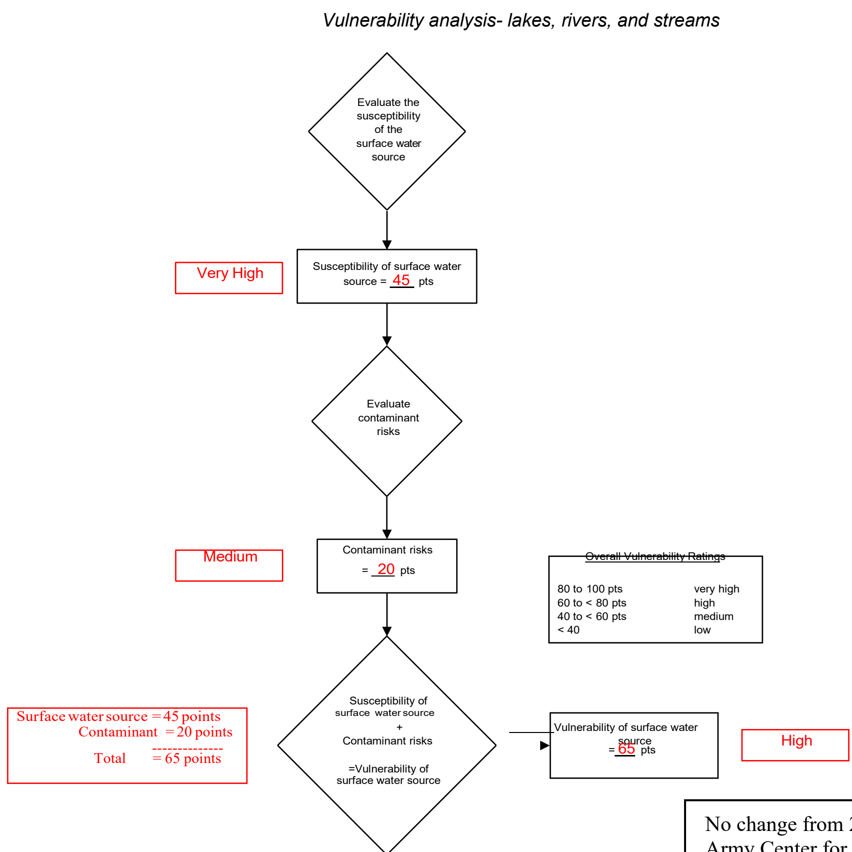
Risk Matrix Score

Highest risk source is __High__ : _30_ points
Next highest risk source is ________
_< 20_ _Low_____ risk sources: _0_ points
----
total: _30_ points

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-3. Risk Matrix for Bacteria/Viruses, Eareckson Air Station, Alaska

DATE: MAY 2021

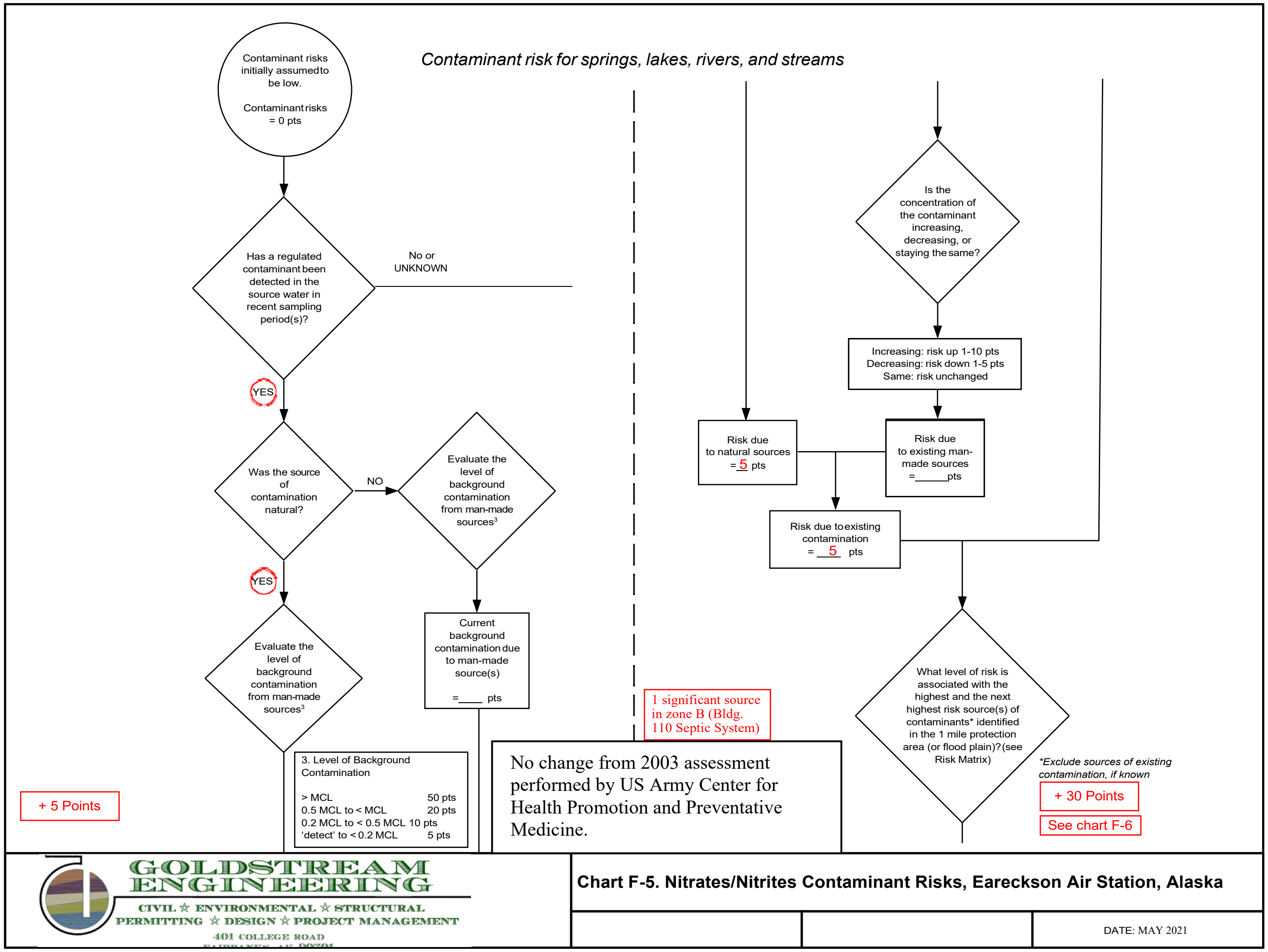


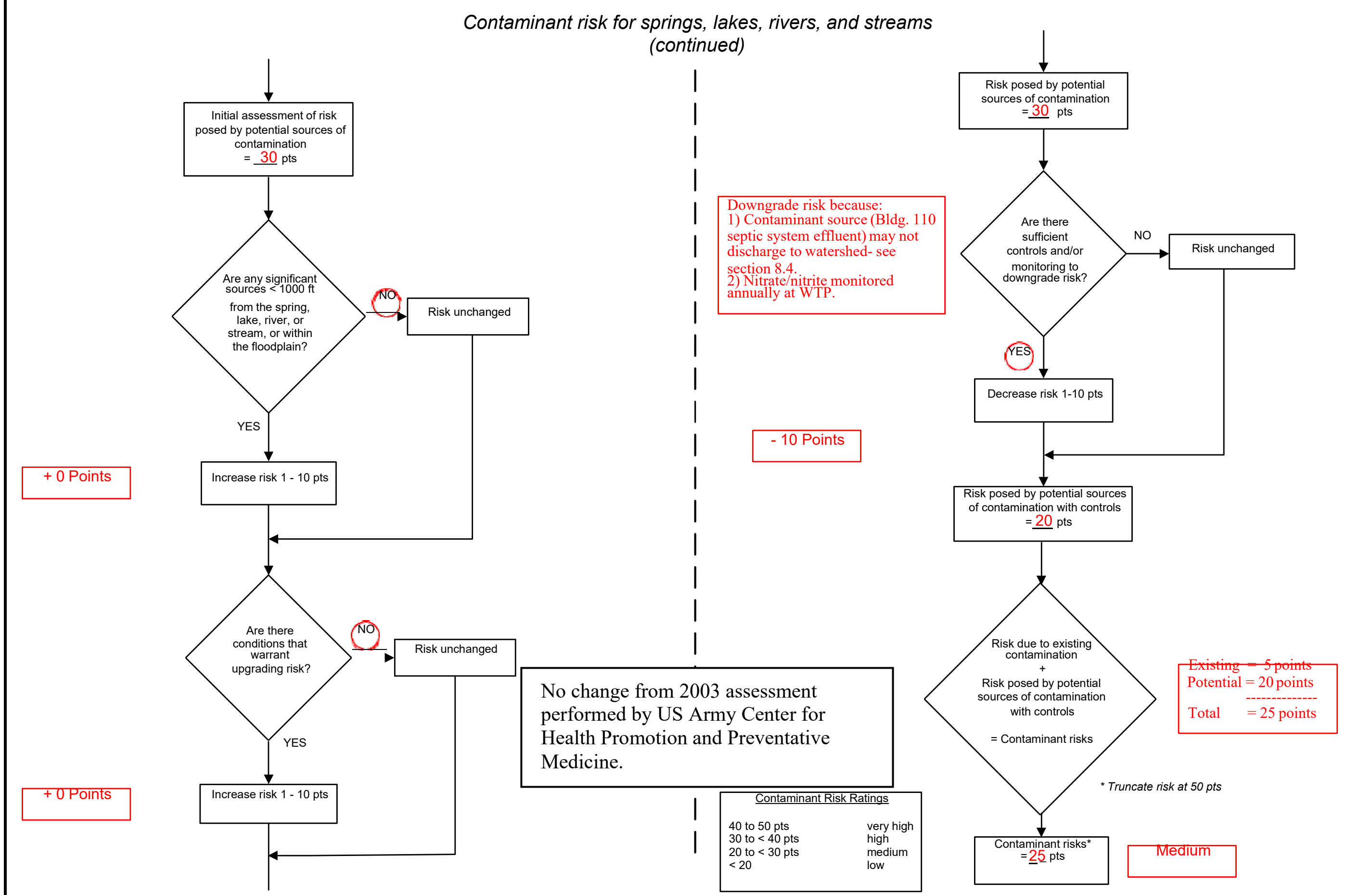
No change from 2003 assessment performed by US Army Center for Health Promotion and Preventative Medicine.

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-4. Bacteria/Viruses Vulnerability Analysis, Eareckson Air Station, Alaska

DATE: MAY 2021


Contaminant risk for springs, lakes, rivers, and streams
Contaminant risks initially assumed to be low. Contaminant risks = 0 pts
Has a regulated contaminant been detected in the source water in recent sampling period(s)?
No or UNKNOWN
YES
Was the source of contamination natural?
NO
Evaluate the level of background contamination from man-made sources³
YES
Evaluate the level of background contamination from man-made sources³
Current background contamination due to man-made source(s) = ____ pts
3. Level of Background Contamination
> MCL 50 pts
0.5 MCL to < MCL 20 pts
0.2 MCL to < 0.5 MCL 10 pts
'detect' to < 0.2 MCL 5 pts
+ 5 Points
Is the concentration of the contaminant increasing, decreasing, or staying the same?
Increasing: risk up 1-10 pts
Decreasing: risk down 1-5 pts
Same: risk unchanged
Risk due to natural sources = 5 pts
Risk due to existing man-made sources = ______pts
Risk due to existing contamination = 5 pts
1 significant source in zone B (Bldg. 110 Septic System)
No change from 2003 assessment performed by US Army Center for Health Promotion and Preventative Medicine.
What level of risk is associated with the highest and the next highest risk source(s) of contaminants* identified in the 1 mile protection area (or flood plain)? (see Risk Matrix)
*Exclude sources of existing contamination, if known
+ 30 Points
See chart F-6
GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
Chart F-5. Nitrates/Nitrites Contaminant Risks, Eareckson Air Station, Alaska
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-5. Nitrates/Nitrites Contaminant Risks, Eareckson Air Station, Alaska (continued)

DATE: MAY 2021

Risk Matrix for Contaminant Sources

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Source(s)	Very Low 5 pts	Low 10 pts	Medium 20 pts	High 30 pts	Very High 40 pts
Very Low	≥ 10 sources + 5 pts	≥ 10 sources + 2 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

Risk levels for contaminant sources in zones A and B

	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	0	1	1
Medium(s)	0	0	0
Low(s)	0	1	1
Very Low(s)	25	5	30

Only 1 significant source of nitrates/nitrites (Bldg. 110 septic system) in drinking water protection area.

Risk Matrix Score

Highest risk source is __High__ : __30__ points

Next highest risk source is __Low__

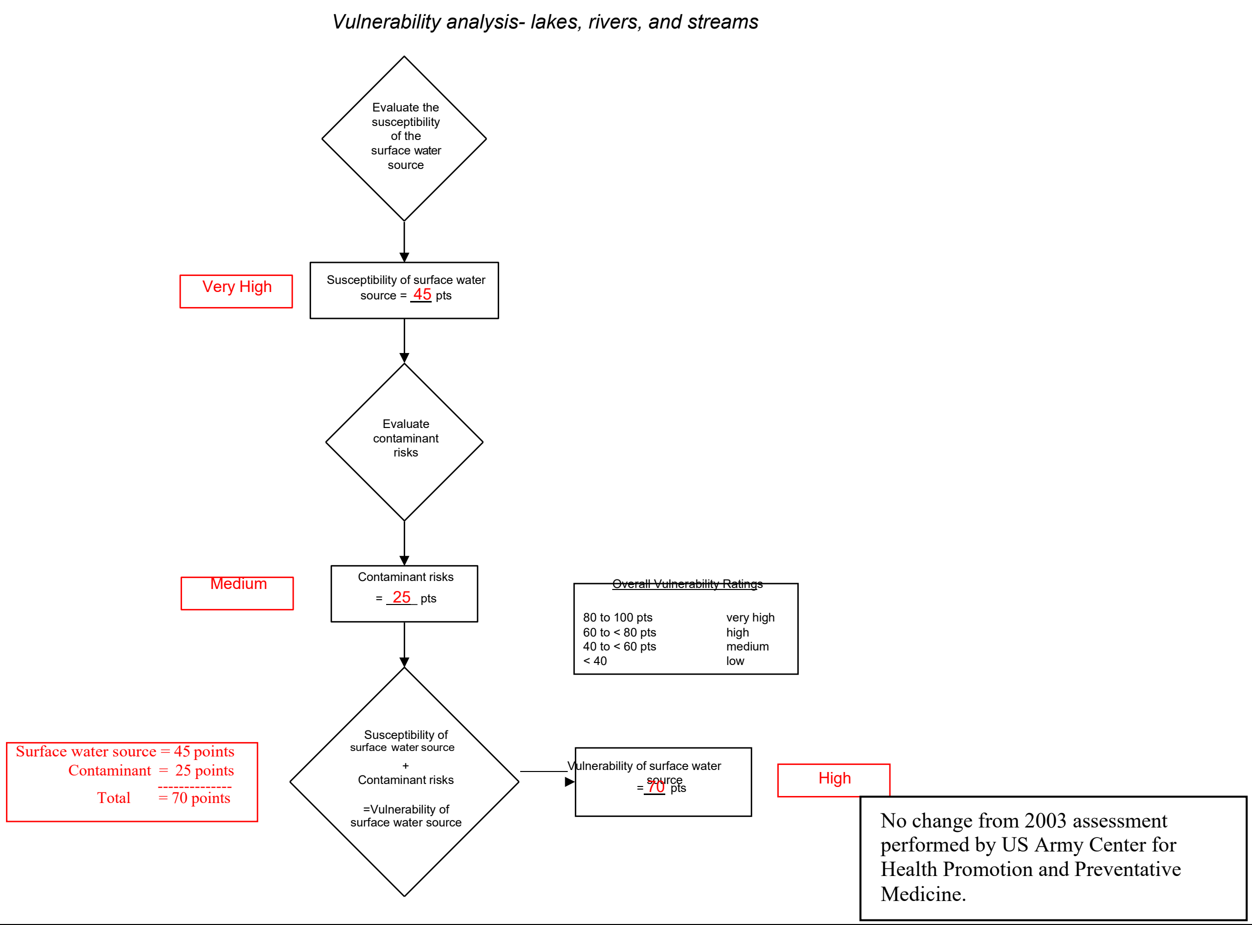
__< 20__ __Low__ risk sources: __0__ points

total: __30__ points

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 458-3853

Chart F-6. Risk Matrix for Nitrates/Nitrites, Eareckson Air Station, Alaska

DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-7. Nitrates/Nitrites Vulnerability Analysis, Eareckson Air Station, Alaska

DATE: MAY 2021

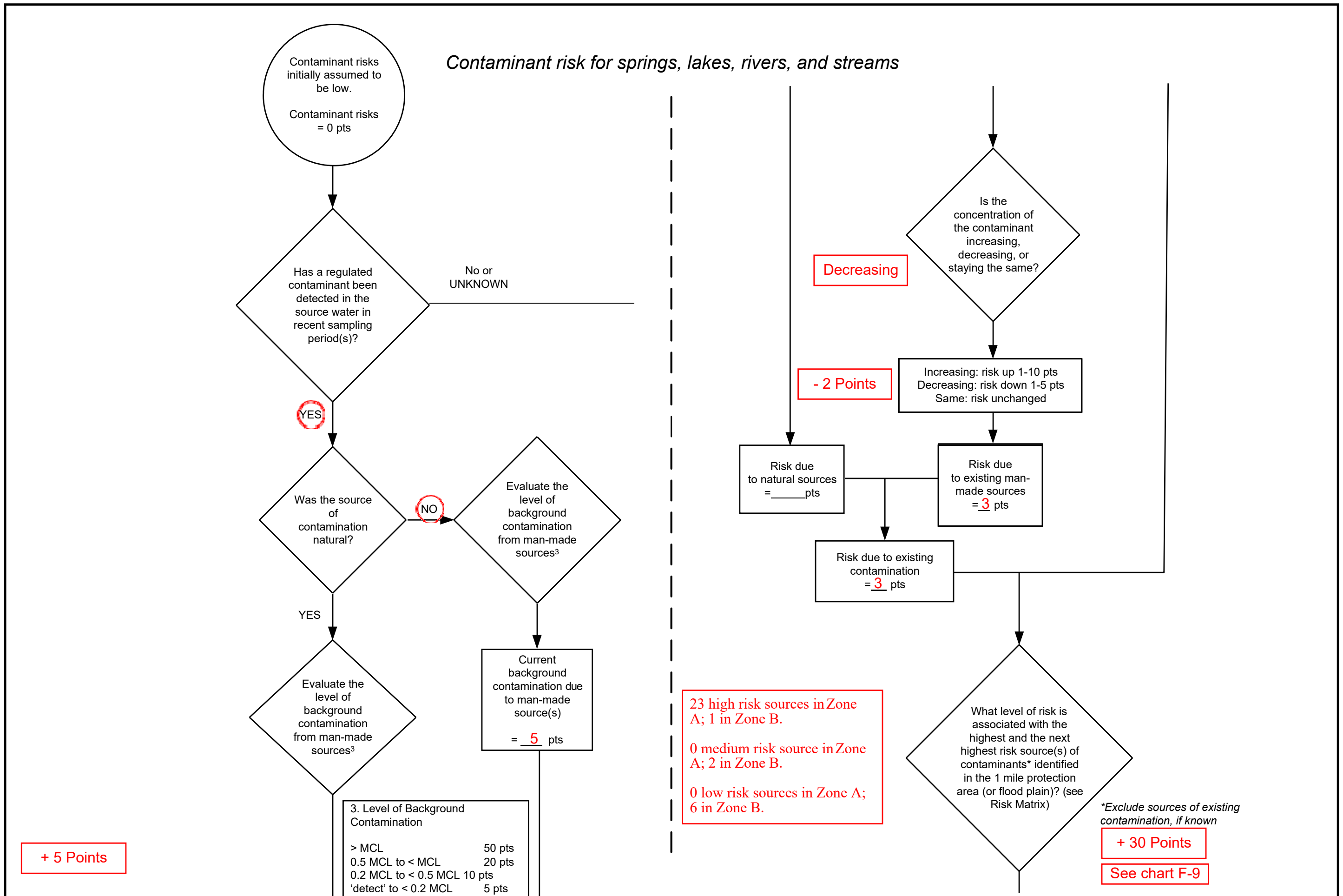
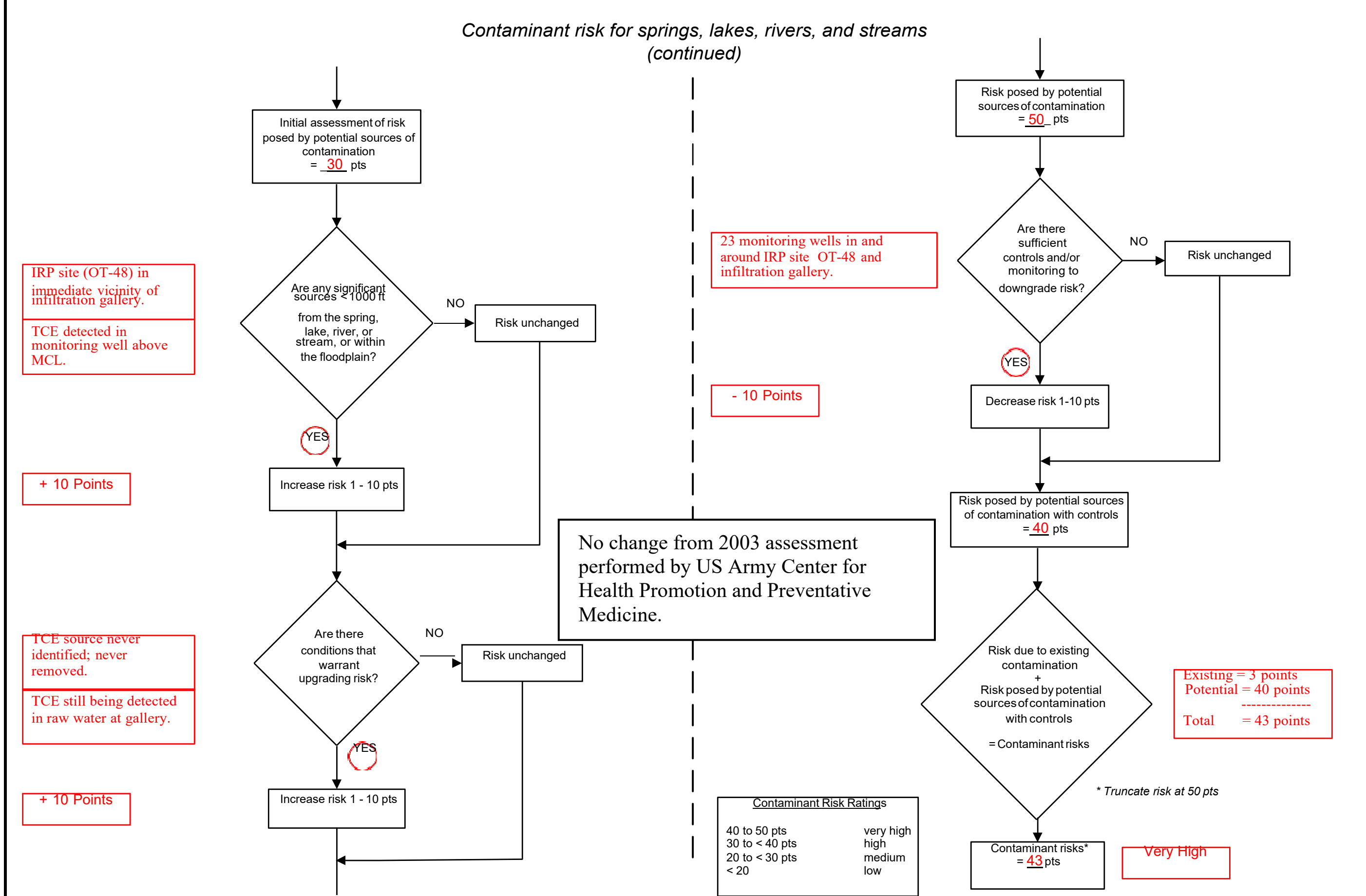


Chart F-8. Volatile Organic Chemicals Contaminant Risks, Eareckson Air Station, Alaska

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701

DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-8. Volatile Organic Chemicals Contaminant Risks, Eareckson Air Station, Alaska (continued)

DATE: MAY 2021

Risk Matrix for Contaminant Sources

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Source(s)	Very Low 5 pts	Low 10 pts	Medium 20 pts	High 30 pts	Very High 40 pts
Very Low	≥ 10 sources + 5 pts	≥ 10 sources + 2 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

Risk levels for contaminant sources in zones A and B

	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	23	1	24
Medium(s)	0	2	2
Low(s)	0	6	6
Very Low(s)	1	0	1

Risk Matrix Score

Highest risk source is High : 30 points

Next highest risk source is Medium

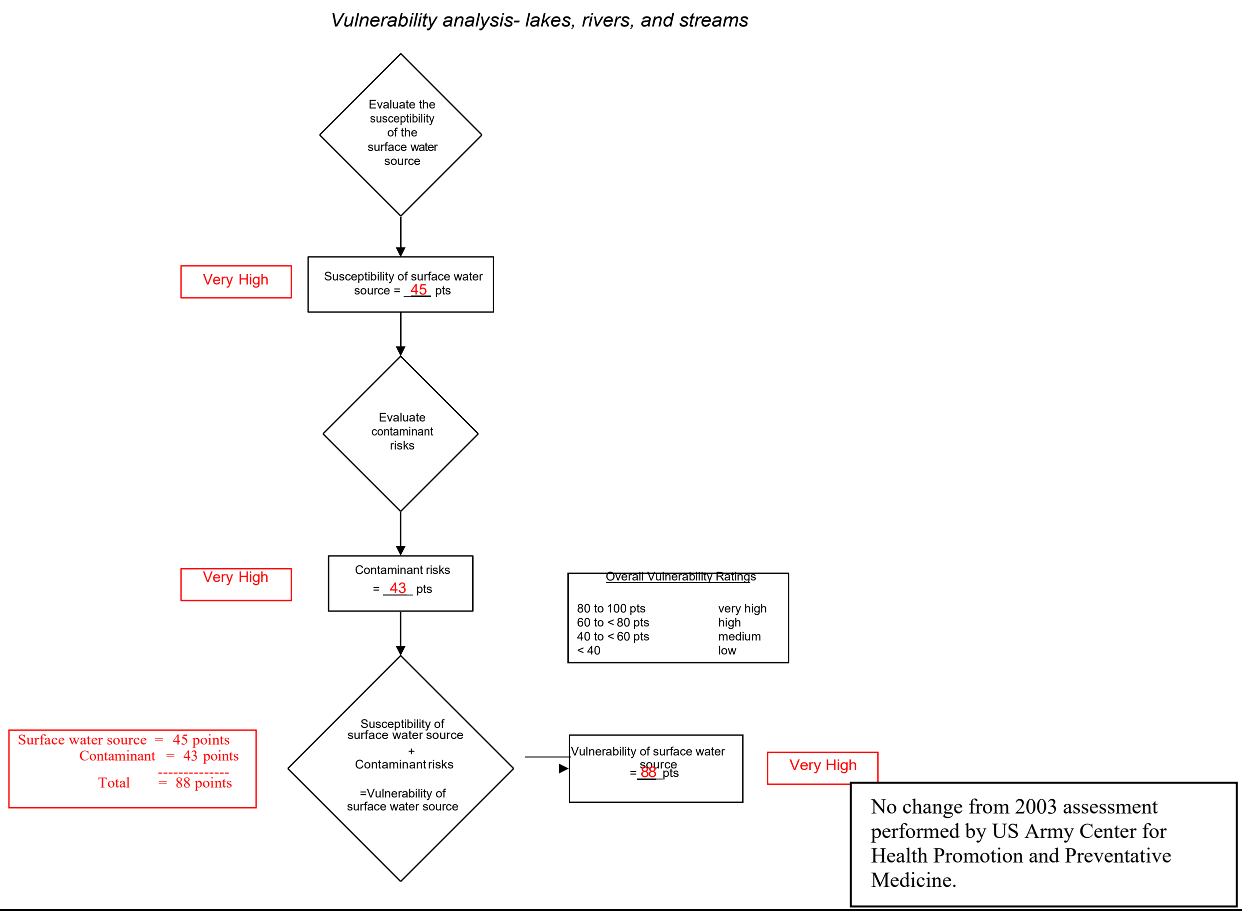
< 5 Medium risk sources: 0 points

total: 30 points

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-9. Risk Matrix for Volatile Organic Chemicals, Eareckson Air Station, Alaska

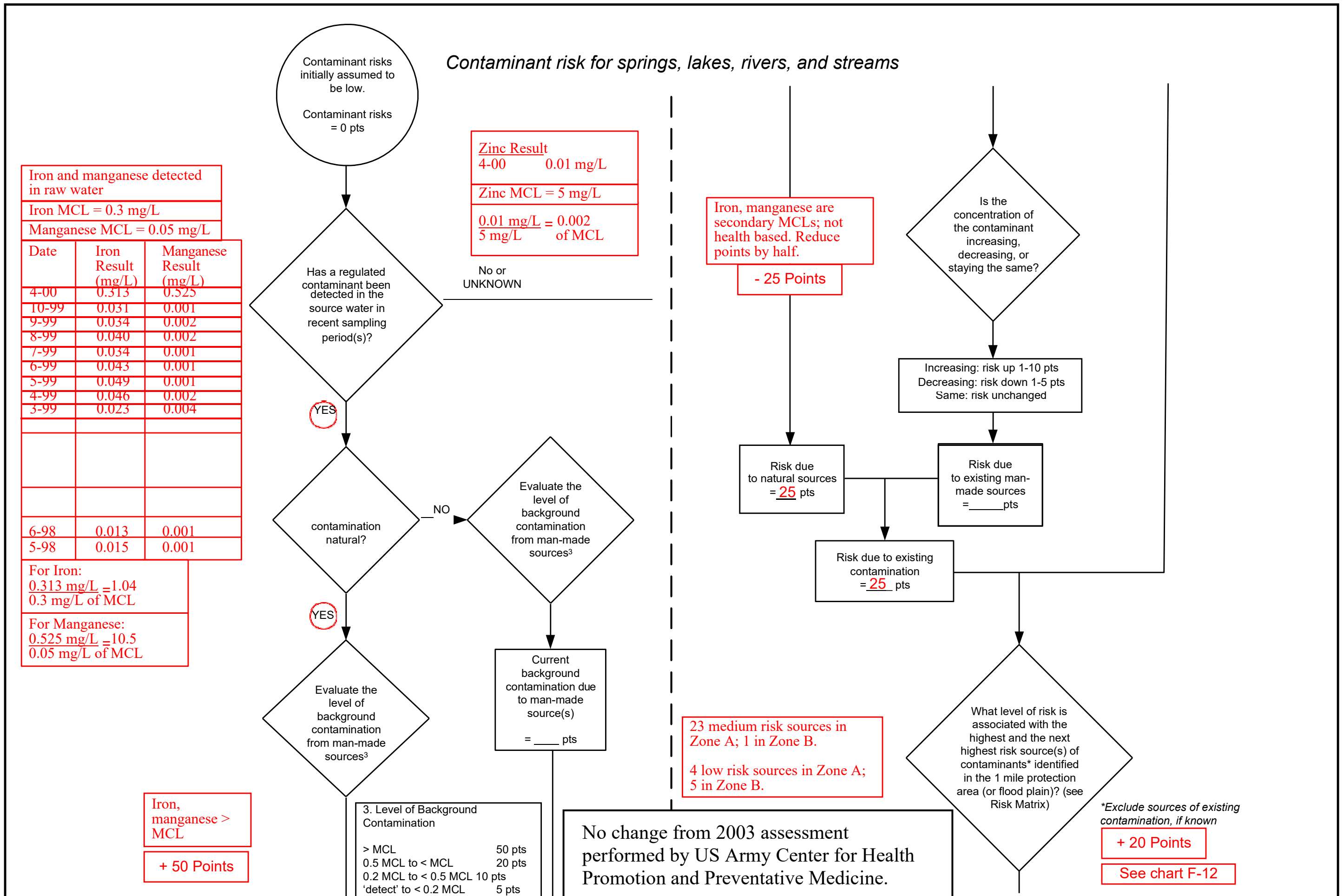
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-10. Volatile Organic Chemicals Vulnerability Analysis, Eareckson Air Station, Alaska

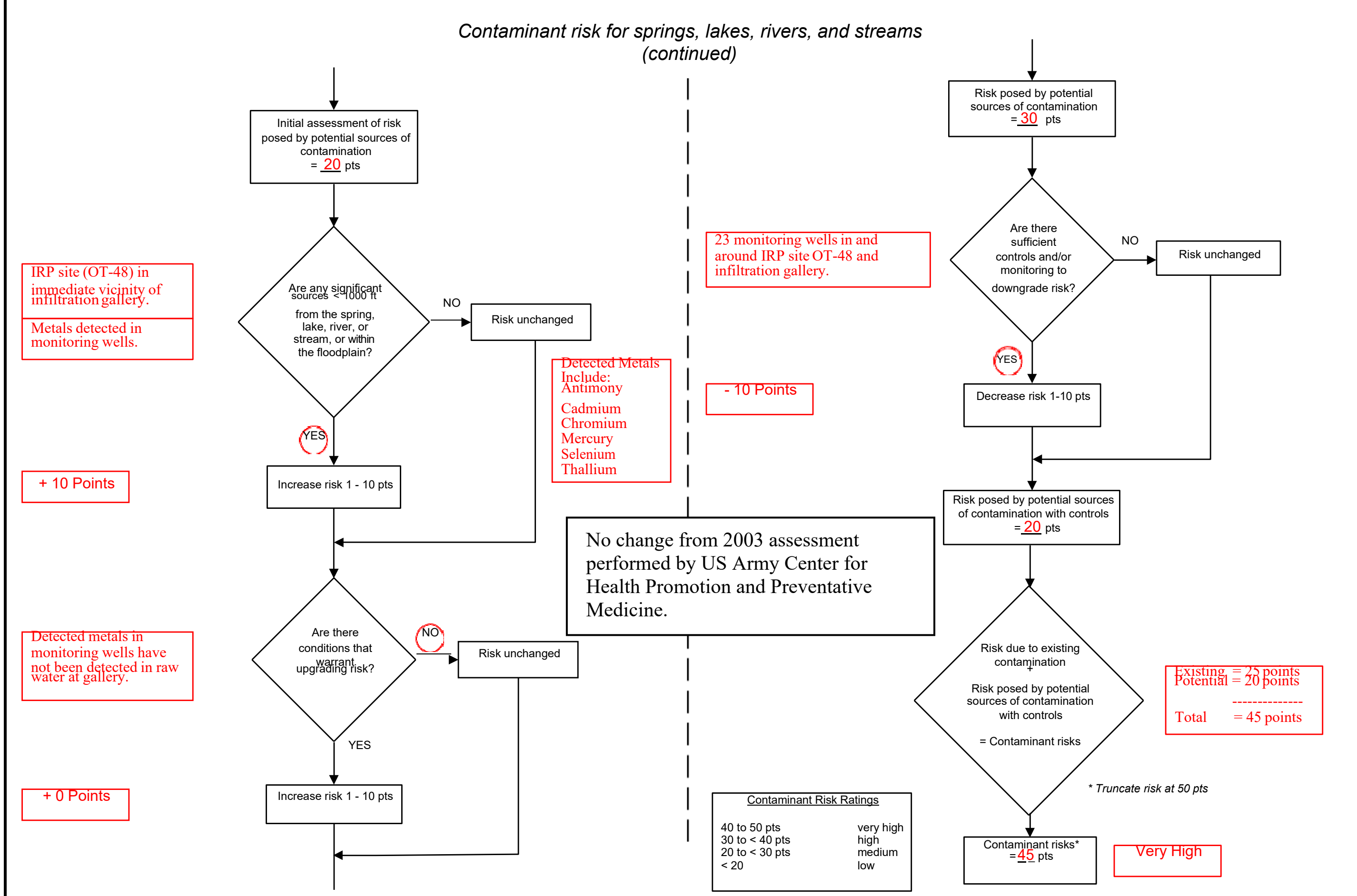
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE (907) 456-8853

Chart F-11. Heavy Metals, Cyanide, and Other Inorganic Chemicals Contaminant Risks, Eareckson Air Station, Alaska

DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 458-3853

Chart F-11. Heavy Metals, Cyanide, and Other Inorganic Chemicals Contaminant Risks, Eareckson Air Station, Alaska (continued)

DATE: MAY 2021

Risk Matrix for Contaminant Sources

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Source(s)	Very Low 5 pts	Low 10 pts	Medium 20 pts	High 30 pts	Very High 40 pts
Very Low	≥ 10 sources + 5 pts	≥ 10 sources + 2 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

Risk levels for contaminant sources in zones A and B

	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	0	0	0
Medium(s)	23	1	24
Low(s)	4	5	9
Very Low(s)	0	0	0

No change from 2003 assessment performed by US Army Center for Health Promotion and Preventative Medicine.

Risk Matrix Score

Highest risk source is __Medium_: _20_ points

Next highest risk source is Low____

_< 10_ _Low____ risk sources: _0_ points

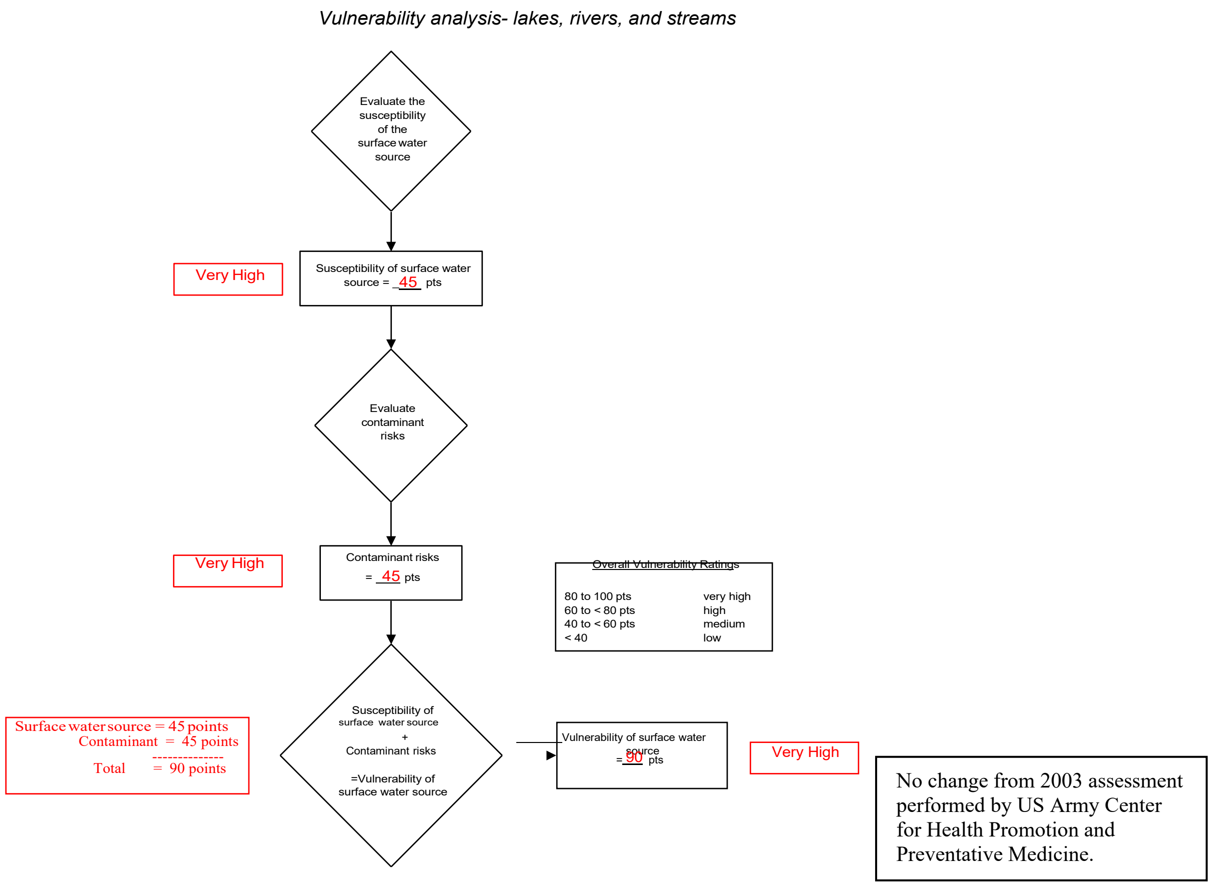
----

total: _20_ points

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-12. Risk Matrix for Heavy Metals, Cyanide, and Other Inorganic Chemicals, Eareckson Air Station, Alaska

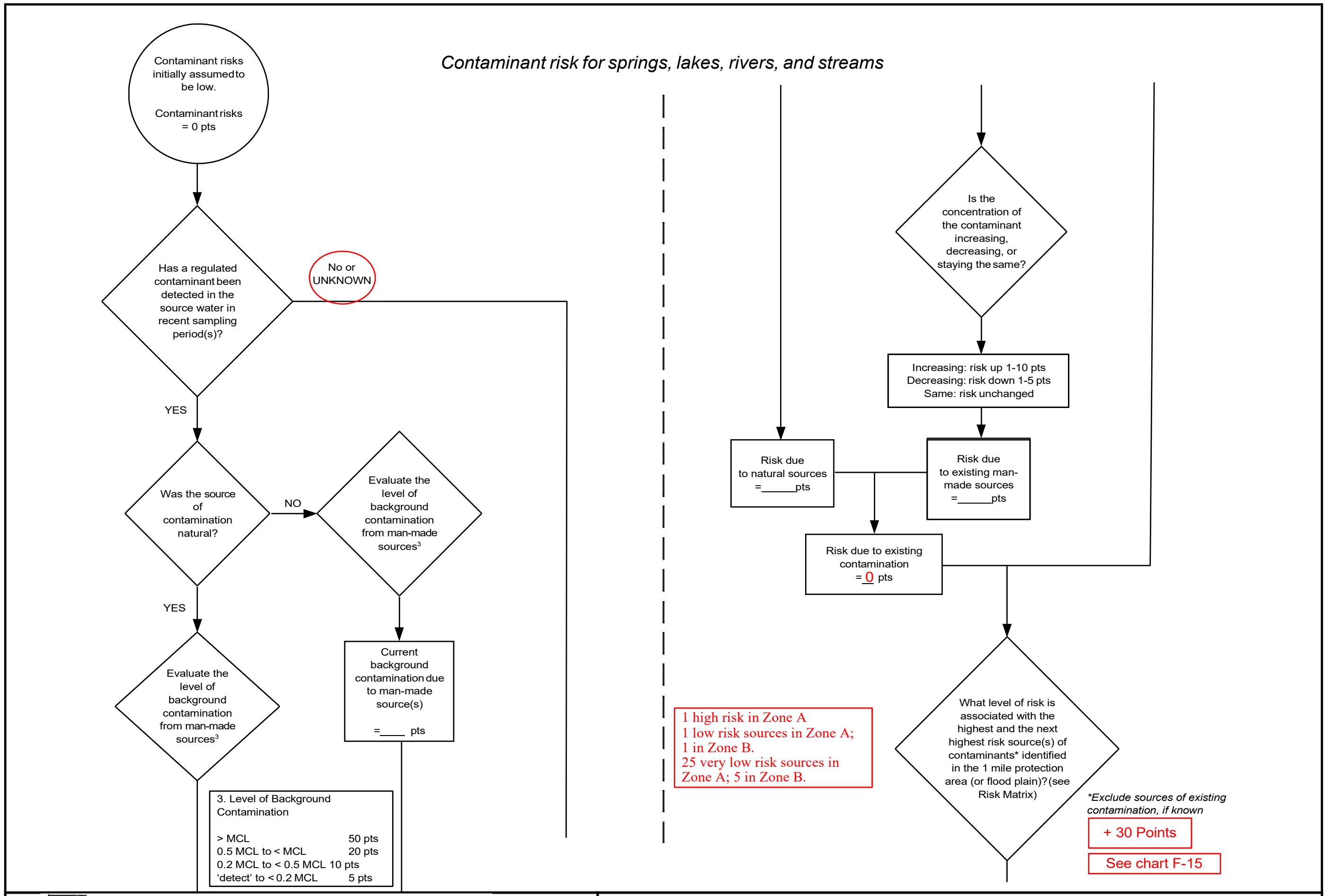
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-13. Heavy Metals, Cyanide, and Other Inorganic Chemicals Vulnerability Analysis, Eareckson Air Station, Alaska

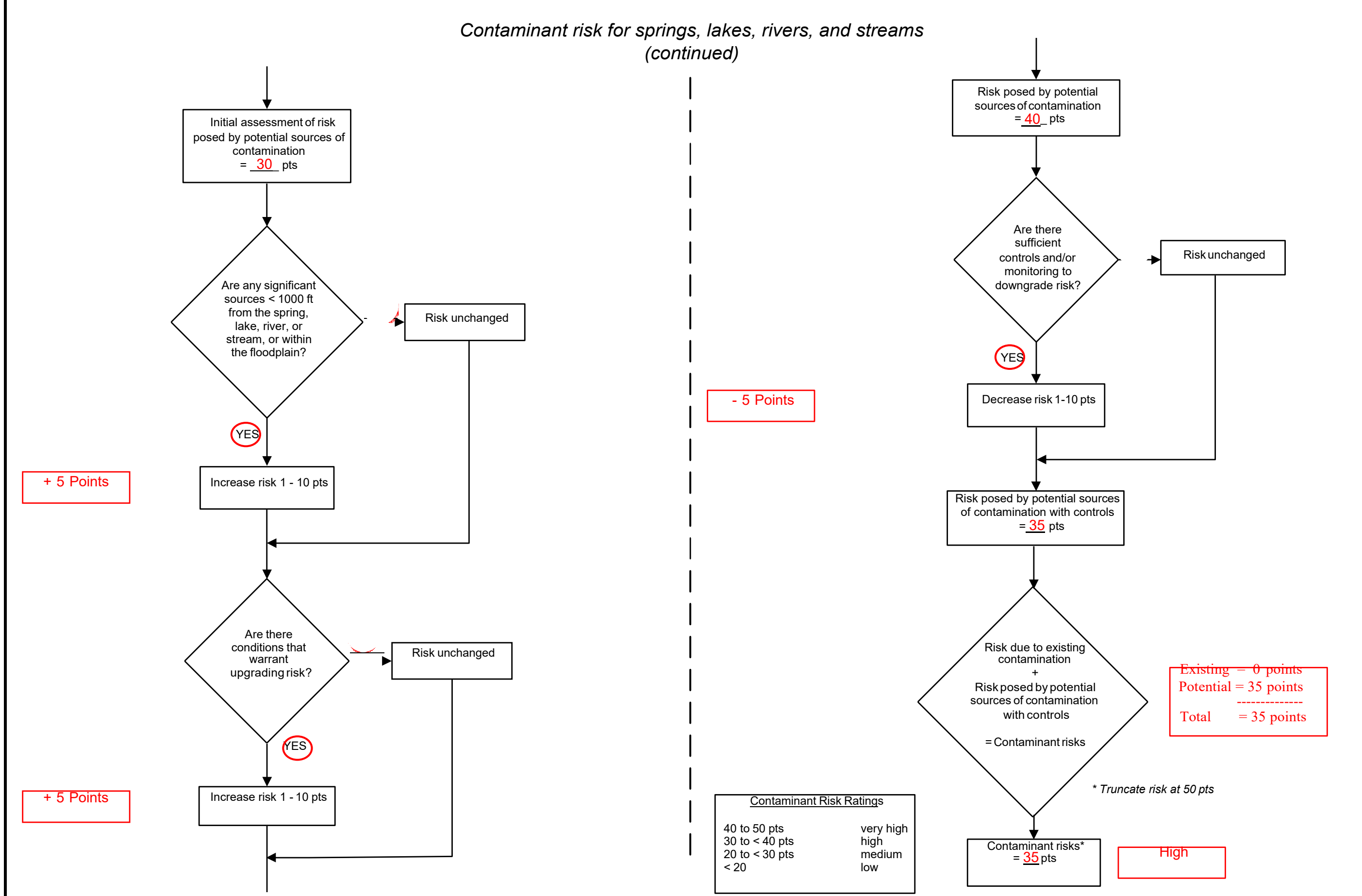
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701

Chart F-14. Synthetic Organic Chemicals Contaminant Risks, Eareckson Air Station, Alaska

DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-14. Synthetic Organic Chemicals Contaminant Risks, Eareckson Air Station, Alaska (continued)

DATE: MAY 2021

Risk Matrix for Contaminant Sources

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Source(s)	Very Low 5 pts	Low 10 pts	Medium 20 pts	High 30 pts	Very High 40 pts
Very Low	≥ 10 sources + 5 pts	≥ 10 sources + 2 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

Risk levels for contaminant sources in zones A and B

	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	1	0	1
Medium(s)	0	0	0
Low(s)	1	1	2
Very Low(s)	25	5	30

Risk Matrix Score

Highest risk source is __High__: _30_ points

Next highest risk source is __Low______

_>20_ _Low_____ risk sources: _0_ points

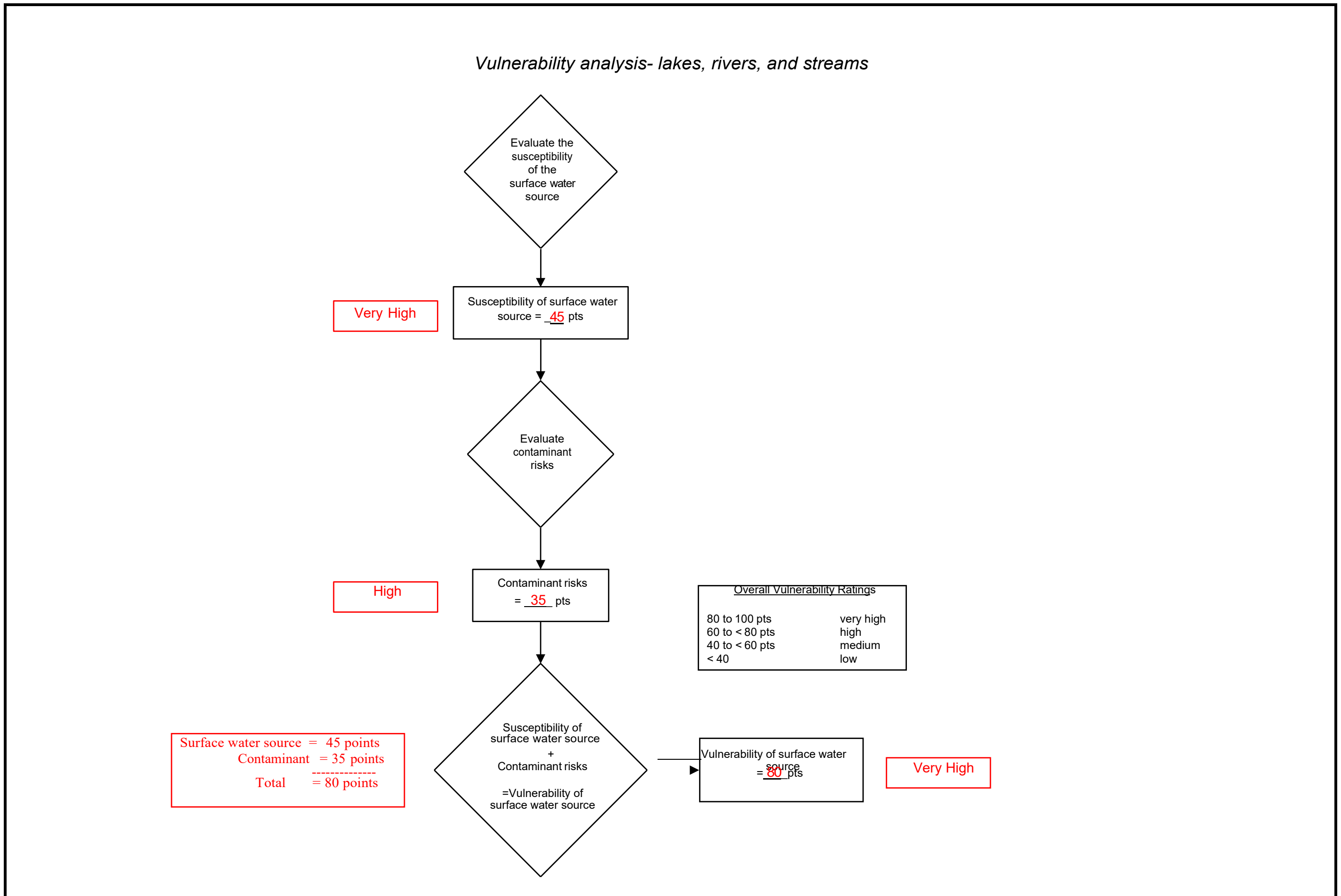
----

total: _30_ points

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-15. Risk Matrix for Synthetic Organic Chemicals, Eareckson Air Station, Alaska

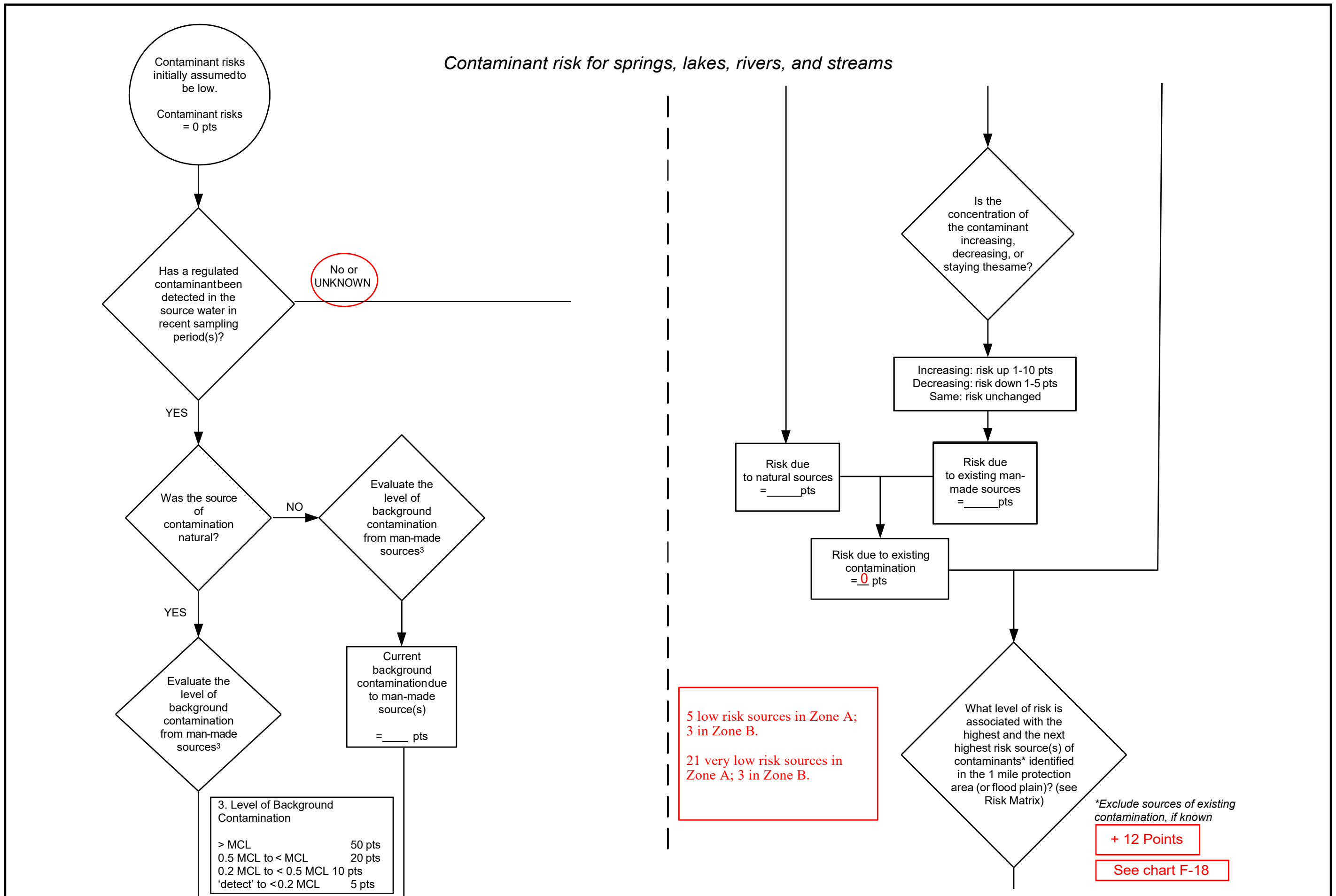
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 458-3853

Chart F-16. Synthetic Organic Chemicals Vulnerability Analysis, Eareckson Air Station, Alaska

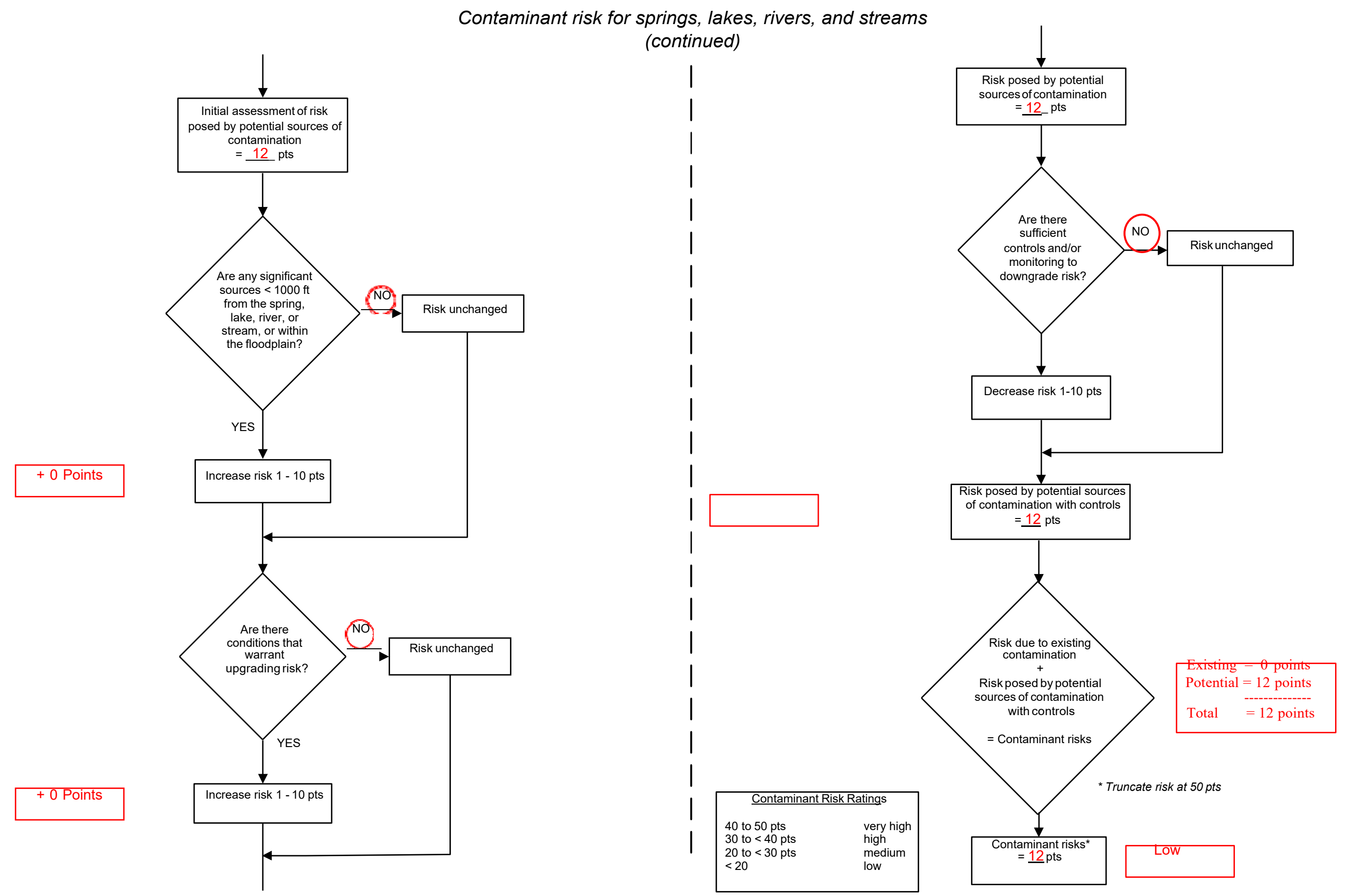
DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701

Chart F-17. Other Synthetic Organic Chemicals Contaminant Risks, Eareckson Air Station, Alaska

DATE: MAY 2021



GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-17. Other Synthetic Organic Chemicals Contaminant Risks, Eareckson Air Station, Alaska (continued)

DATE: MAY 2021

Risk Matrix for Contaminant Sources

Level of Risk Associated with the Highest Risk Sources

Next Highest Risk Source(s)	Very Low 5 pts	Low 10 pts	Medium 20 pts	High 30 pts	Very High 40 pts
Very Low	≥ 10 sources + 5 pts	≥ 10 sources + 2 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

Risk levels for contaminant sources in zones A and B

	Zone A	Zone B	Total
Very High(s)	0	0	0
High(s)	0	0	0
Medium(s)	0	0	0
Low(s)	5	3	8
Very Low(s)	21	3	24

Risk Matrix Score

Highest risk source is Low : 10 points

Next highest risk source is Very Low

< 10 Very Low risk sources: 2 points

total: 12 points

GOLDSTREAM ENGINEERING
CIVIL ☆ ENVIRONMENTAL ☆ STRUCTURAL
PERMITTING ☆ DESIGN ☆ PROJECT MANAGEMENT
401 COLLEGE ROAD
FAIRBANKS, AK 99701
OFFICE: (907) 456-3853

Chart F-18. Risk Matrix for Other Synthetic Organic Chemicals, Eareckson Air Station, Alaska

DATE: MAY 2021

Alaska Department of Environmental Conservation

Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1	**PWS Name:** USAF Eareckson
Contact Name: Jessica Morris, PE	Phone: 907-552-5655
Address: 10471 20th Street, Ste 315	E-mail: jessica.morris.14@us.af.mil
City, Zip: JBER, 99506	Other:

Each public water system (PWS) can take a few simple steps to protect their drinking water source. This checklist shows strategies for protecting your PWS source (i.e., well, intake, etc.) from existing and potential sources of contamination identified within the Protection Area for your PWS. A map of your PWS Protection Area and a table of identified existing and potential sources of contamination can be found in your Source Water Assessment (SWA) report. A copy of your SWA report can be obtained by contacting DEC Drinking Water Protection (see contact information below). The final results of the SWA report can be viewed using Drinking Water Watch, at http://dec.alaska.gov/DWW/. An interactive map of your PWS Protection Area can be found using the on-line web map titled, "Alaska DEC Drinking Water Protection Areas" at http://dec.alaska.gov/das/gis/apps.htm. Please note that the SWA report may not be current and that local knowledge of potential sources of contamination may differ. Also, please note the protective strategies in this checklist are recommended best management practices (BMPs) and are not a comprehensive list of the strategies that can be used to minimize the risk of contamination. Local ordinances or agreements and state and federal regulations may also apply. The Alaska Department of Environmental Conservation (DEC) recommends that you become familiar with the requirements of any ordinances and regulations that may apply. **This checklist was modified on 1/5/2021 by Goldstream Engineering specifically for the USAF Eareckson PWS.**

For additional information on drinking water protection, please visit to http://dec.alaska.gov/eh/dw/DWP/DWP_main.html.

The development and implementation of this checklist qualifies as your DEC Drinking Water Protection Plan, and if approved by DEC, meets the definition of a "protected groundwater source" under 18 AAC 80. This plan may make your system eligible for waivers and/or reduced monitoring associated with current and future rules promulgated by USEPA.

Completing the Checklist:

Please take a few minutes to review this checklist, then:

1. Place a checkmark in the box next to the protective strategies that you are willing to implement at your facility. Write the date you plan to implement the protective strategy in the "Planned Implementation Date" column.
2. If a strategy has already been implemented, write the approximate date implemented (if known) in the "Date Implemented" column. If the date implemented is unknown, write "date unknown".
3. If a protective strategy included in the checklist is not appropriate or applicable to the facility, please mark "N/A" next to the strategy.
4. When complete, please sign and date, and either e-mail, mail or fax a copy of the checklist to:

Drinking Water Protection
Alaska Department of Environmental Conservation
555 Cordova St.
Anchorage, AK 99501

Phone: (907) 269-7549
Fax (907) 269-7650
Toll Free: (866) 956-7656
E-mail: dec.eh.drinkingwater.reports@alaska.gov

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

For this plan to be approved by DEC, it must have one (1) strategy each for Well Construction, Education, and Emergency Response Planning, and one (1) strategy for each applicable Potential Contaminant Source category. For assistance, refer to your Source Water Assessment.

Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Source Water Protection Area (SWPA)		
☒ Install backflow prevention devices on equipment such as boilers and dishwashers.		
☒ Clearly identify the source protection boundary with signage. Signs should discourage contaminant-related activities and replaced if damaged.		
☒ No vehicle or equipment parking within the SWPA. Travel through the SWPA shall be limited to the maximum extent possible.		
☒ No contaminants shall be stored within or transfered through the SWPA.		
☒ This plan and the SWA shall be reviewed frequently and updated as conditions change.		
☒ Correct any deficiencies noted in the most recent Sanitary Survey.		
Education (must choose at least one)		
☒ nform employees about the SWPA and the potential contaminant sources identified in the SWA report.		
☒ Train employees on proper material handling and spill cleanup techniques.		
☒ Inform other personnel about drinking water protection when arriving onsite.		
☒ nform other responsible parties about potential impacts within the SWPA.		
☒ Educate the public on protective strategies that could be implemented to address prevalent contaminant sources (identified by your SWA or by local input).		
Contingency and Emergency Response Planning (must choose at least one)		
☒ Completed security vulnerability assessment (if applicable – see 18 AAC 80.055).		
☒ Current (not older than 2 years) written emergency response plan or emergency priority measures plan (if applicable – see 18 AAC 80.055).		
☒ Inform the local fire department and local emergency planning committee about the location of the PWS Protection Area.		
☒ Identify short- and long-term alternative sources of drinking water that may be available.		
☒ Prepare a list of important contacts for water supply related emergencies.		
The previous two strategies above are considered completed if you already have an emergency response plan or emergency priority measures plan.		
☐ Other appropriate protection strategies: ____________________ ____________________ ____________________		
ADD IF APPLICABLE - Overlapping PWS Protection Areas ☐ The Protection Area for this PWS overlaps the Protection Area(s) of other PWS sources. This overlap is shown in an attached figure. DEC recommends neighboring PWSs work cooperatively to protect the shared resource.		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Aboveground Storage Tanks (ASTs)	Guidance documents available at http://dec.alaska.gov/spar/PPR/hho.htm		
	☒ Place tanks on paved surfaces within secondary containment structures (berms, dikes, liners, or vaults that can hold 110% of the contents of the largest tank) or use double-walled tanks.		
	☒ Regularly remove and properly dispose of rainwater that accumulates in the secondary containment area.		
	☒ Regularly inspect and perform preventative maintenance on the storage tanks and piping systems to detect and repair potential leaks before they occur.		
	☒ Train employees on proper material handling and spill cleanup techniques.		
	☒ Install spill and overflow protection.		
	☒ Use dry clean-up methods rather than hosing fueling and loading areas down.		
	☒ Store absorbent cleaning materials in a readily accessible location.		
	☒ Cover fueling areas to reduce exposure to storm water.		
	☒ Regularly inspect storage areas (fueling and loading areas) to detect and repair problems before they occur.		
	☒ Keep storage areas secure against unauthorized entry.		
	☒ Locate ASTs as far as possible from wells, surface water bodies, and storm drains.		
	☐ Other appropriate protection strategies: ______		
Agricultural	☐ Avoid the use of drain tiles or drainage wells which could create an easy pathway for agricultural wastes to get to groundwater.		
	☐ Relocate animal waste storage areas away from wells, drains, and surface water bodies.		
	☐ Keep animal waste storage areas covered with tarps or other waterproof materials.		
	☐ Store animal wastes on paved surfaces.		
	☒ Keep animal burial areas outside of the PWS Protection Area.		
	☐ Other appropriate protection strategies: ______		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist
for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Chemical Storage Areas (Indoor)	☒ Move chemical storage as far from well(s) as possible.		
	☒ Store fuel, paints, and solvents in a protected, secure location away from floor and storm drains.		
	☒ Ensure that lids are shut and caps are closed on all containers.		
	☒ Educate personnel on proper storage, use, cleanup, and disposal of materials.		
	☒ Employ measures to protect against spills, such as using drip pans during the transfer of liquids.		
	☒ Regularly inspect shelving and replace or repair as needed.		
	☒ Regularly inspect the external condition of the containers.		
	☒ Store containers no more than 2 rows deep with large containers in back.		
	☒ Store large and heavy containers on lower shelves.		
	☒ Maintain enough space between containers so that they can be removed without knocking others over.		
	☒ Store chemicals in an area where spills can be easily monitored, contained, and cleaned up.		
	☐ Other appropriate protection strategies: ____		
Dry Wells / Waste Disposal Wells	☒ Plug or disconnect floor drains that empty into septic systems, leaching lines or drain fields.		
	☒ Sinks in service, maintenance, or shop areas should not be connected to septic systems or dry wells.		
	☒ Properly decommission dry wells and sumps.		
	☐ Other appropriate protection strategies: ____		
Floor Drains	☒ Store fuel, paints, and solvents in a protected, secure location away from drains.		
	☒ Avoid washing grease, oil, or chemicals into floor drains.		
	☒ Clean up chemical spills (even small ones) immediately.		
	☒ Have spill material (cat litter or sawdust) available.		
	☒ Train employees on proper spill cleanup.		

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Floor Drains (cont'd.)	☒ Determine whether or not floor drains connect to a septic system or surface water. If the drain is connected to a septic system and is located in an area that could receive leaks and spills, the drain should be plugged during chemical handling operations, or may need to be permanently cleaned and closed.		
	☐ Other appropriate protection strategies:		
Lawn Chemicals	☐ Select lawn chemicals that are labeled for the intended application site and break down rapidly in the environment.		
	☐ Consider the location and condition of wells when applying pesticides or fertilizer.		
	☐ Take measures to prevent spills while mixing and applying chemicals.		
	☐ Leave untreated areas around wells, streams, storm drains, ponds, and sinkholes.		
	☒ Other appropriate protection strategies: No pesticides or lawn chemicals shall be applied within the SWPA.		
Maintenance Areas (Vehicles and Equipment)	☒ Properly dispose of greasy rags, oil filters, batteries, spent coolant and vehicle degreasers.		
	☒ Do not pour liquid waste down floor drains, sinks or outdoor storm drain inlets.		
	☒ Do not dispose of old lead acid batteries, absorbents contaminated with chlorinated solvents (or other motor vehicle fluids), or used oil filters in the trash (dumpster).		
	☒ Seal all floor drains that are not attached to a recovery system.		
	☒ Train employees on proper waste control and disposal procedures.		
	☒ Install curbing, berms or dikes around storage areas.		
	☒ Cover all storage areas with a roof or temporary water proof cover.		
	☒ Store cracked batteries in a non-leaking secondary container, and new batteries upright in a secure and waterproof covered location; regularly check for leaks.		
	☒ Store all spill response equipment (absorbent materials, brooms, dust pans, etc.) in a visible location.		
	☒ Promptly transfer used fluid to the proper container.		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Maintenance Areas (Vehicles and Equipment) (cont'd.)	☒ Properly empty and clean drip pans and containers.		
	☒ Use funnels or pumps to dispense chemicals and keep all chemicals or wastes in sealed containers with tight fitting lids.		
	☒ When possible, substitute non-petroleum based cleaners, such as citrus-based solvents for organic solvents when cleaning parts.		
	☒ Determine whether or not a floor drain is connected to a septic system. If so, and it is located in an area that could receive leaks and spills, the drain should be plugged during chemical handling operations, or may need to be permanently closed.		
	☐ Other appropriate protection strategies: ____________ ____________ ____________		
Natural Gas Lines (Residential)	Important to consult with your natural gas supplier regarding safety procedures. Only qualified professionals should perform work on lines.		
	☐ Regularly check for common signs of potential leaks (e.g., "rotten egg" smell, dead or discolored vegetation, bubbling in wet areas, dirt or dust blowing from a hole in the ground, blowing or hissing sound, etc.).		
	☐ Regularly check for any drips of oil from joints or low points in the lines.		
	☐ Other appropriate protection strategies: ____________ ____________ ____________		
Oil and Gas Wells	☐ Contact the Alaska Department of Natural Resources (DNR) – Division of Oil and Gas about abandoned wells in the area.		
	☐ Install safeguards (such as dikes or berms) against accidental releases at the storage area.		
	☐ Inspect storage tanks and piping systems to detect potential leaks and perform preventative maintenance.		
	☐ Ensure proper construction of new wells.		
	☐ Other appropriate protection strategies: ____________ ____________ ____________		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Parking Areas	☐ Use dry clean-up methods rather than hosing the parking areas.		
	☐ Control storm water flow on parking lots by grading or paving the area away from wells.		
	☐ Avoid using road salt for snow/ice removal; substitute with sand or gravel.		
	☐ Other appropriate protection strategies: ______ ______ ______		
Sanitary Sewer Lines	☐ Notify the sewer district about the PWS Protection Area.		
	☐ Other appropriate protection strategies: ______ ______ ______		
Septic Systems	Guidance documents available at https://dec.alaska.gov/Water/wwdp/onsite/index.htm.		
	■ Regularly (annually) inspect your septic tank to ensure that the internal structures are in good working order and to monitor the scum level.		
	■ Regularly (every 1-2 years) pump tanks using a licensed professional.		
	■ Do not dispose of grease, oil, or chemicals in the septic system.		
	■ Garbage disposals should not be used with septic systems.		
	■ Avoid septic system additives or cleaners that contain hazardous ingredients.		
	■ Only use normal amounts of detergents, bleaches, drain cleaners, household cleaners and other products.		
	■ Divert roof run off, drains and other surface run off away from the leach field.		
	■ Reduce the amount of water that flows through the system by practicing water conservation, such as using water-saving devices and repairing leaky plumbing.		
	■ Look for signs of septic system failure.		
	■ Consider replacing old or outdated systems and removing unused systems.		
	■ Keep vehicles and other heavy objects off of the leach field and lines.		
	■ Follow manufacturers' guidelines for operation and maintenance of the system. This is particularly important for systems with aeration tanks.		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Septic Systems (cont'd.)	☐ Other appropriate protection strategies: ____________		
Storm Sewer Lines	☐ Notify the sewer district about the PWS Protection Area.		
	☐ Other appropriate protection strategies: ____________		
Storm Drains	☒ Avoid washing grease, oil, or chemicals into storm drains.		
	☒ Clean up chemical spills (even small ones) immediately.		
	☒ Keep absorbent spill materials (cat litter or sawdust) readily available.		
	☒ Determine whether or not storm drains drain to surface water (river or retention pond) or to the ground (drainage well). If the storm drain drains to the ground and is located in a loading area or other areas that could receive leaks and spills, the drain should be plugged during loading or unloading operations.		
	☐ Other appropriate protection strategies: ____________		
Wastewater Treatment Plants / Package Plants	☒ Perform preventive maintenance to detect potential problems before they occur.		
	☒ Ensure operators have the necessary training and certifications to operate the plant.		
	☒ Comply with all permit terms and conditions.		
	☒ Take steps to prevent chemical wastes from entering the treatment system.		
	☐ Other appropriate protection strategies: ____________		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Surface Water Bodies (includes ponds receiving runoff)	☒ Leave a buffer strip of grass or other vegetation around surface water bodies.		
	☐ Properly maintain retention ponds.		
	☒ Do not use pesticides and fertilizers in buffer strips around (runoff) surface water bodies.		
	☒ Do not store liquid or bulk materials near surface water bodies.		
	☐ Other appropriate protection strategies: ____________ ____________ ____________		
Transportation/ Transportation Related Spills	☐ Post the telephone number of the local fire department near telephones.		
	☐ Contact the local fire department and local emergency planning committee about the location of the PWS Protection Area.		
	☐ Reduce the use of road salt.		
	☐ Other appropriate protection strategies: ____________ ____________ ____________		
Storage Tanks (USTs)	Guidance documents available at http://dec.alaska.gov/spar/PPR/hho.htm		
	☒ Install spill and overflow protection.		
	☒ Ensure that your tanks are in compliance with leak detection requirements.		
	☒ Perform preventive maintenance on storage tank systems to detect potential leaks before they occur.		
	☒ Train employees on proper material handling and spill cleanup techniques.		
	☒ Use dry clean-up methods rather than hosing the fuel area down.		
	☒ Grade the fueling area so storm water flows off instead of pooling in this area.		
	☒ Cover the fueling area to reduce exposure to storm water.		
	☒ Inspect the fueling area to detect problems before they occur.		
	☒ Maintain accurate inventory records for USTs, and if deliveries do not match product used it may indicate a leak and the tank should be inspected.		
	☐ Other appropriate protection strategies: ____________ ____________ ____________		

DEC Drinking Water Protection Plan / RTCR Protected Water Source Checklist

for Non-Community Water Systems

PWSID: AK2 2 6 0 5 1 1

POTENTIAL CONTAMINANT SOURCES *(Review SWA)*	Suggested Protective Strategies (please check the box beside each suggestion you believe is appropriate and agree to implement)	Planned Implementation Date	Date Implemented
Unused (Abandoned) Water Wells	☒ Properly seal (decommission) unused (abandoned) wells.		
	☐ Contact your local government and/or DEC about abandoned wells in the surrounding area.		
	☐ Other appropriate protection strategies: ____ ____ ____		
Utility Sheds	☒ Move chemical storage as far from wells as possible.		
	☒ Ensure that lids are shut and caps are closed on all containers.		
	☒ Employ measures to protect against spills such as using drip pans during the transfer of liquids.		
	☒ Educate personnel on proper storage, use, cleanup, and disposal of materials.		
	☐ Other appropriate protection strategies: ____ ____ ____		
Other Contaminant Sources Not Listed	☐ ____ ____ ____		
	☐ ____ ____ ____		
	Note: Attach additional pages if needed		

Your signature below indicates your commitment to implement the protective strategies you have identified in this checklist. If changes occur, contact DEC-Drinking Water Protection to discuss any follow-up that may be needed. In order to maintain an approved Drinking Water Protection Plan, this checklist must be updated every three (3) years.

______________________________ ______________________________

Signature of PWS owner/operator responsible for implementing **Date**