EPA Region X

START

Superfund Technical Assessment and Response Team

Wilder Landfill-Hazardous Waste Pit Preliminary Assessment/Site Inspection Report

TDD: 01-09-0001

EPA Contract: 68-S0-01-02

March 21, 2003

Weston Solutions, Inc. · 190 Queen Anne Avenue North · Seattle, WA 98109-4926

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

Reply To
Attn Of: ECL-115

April 25, 2003

Charles Wilder
5950 West Table Mesa Road
New River, AZ 85087

Dear Mr. Wilder:

The U.S. Environmental Protection Agency (EPA), through its contractor, Weston Solutions, Inc., has completed a combined Preliminary Assessment/Site Inspection of the Wilder Landfill site in Ferndale, Washington. A copy of the Preliminary Assessment/Site Inspection report is enclosed. Based on this review, EPA does not anticipate further investigation under the Federal Superfund Program. EPA's no further action designation does not relieve your facility from complying with appropriate Washington state regulations. If you have any questions or need additional information please do not hesitate to contact me at (206)553-2594.

Sincerely,

Joanne LaBaw
Site Assessment Manager

Enclosure

cc: Betty A. Wilder
Thane Somerville, Short Cressman & Burgess PLLC
Roger Kennedy, Friese Hide and Tallow
Gail Colburn, WA Dept. of Ecology, NWRO
Mindy Miller, Whatcom County Health Department

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LIST OF ACRONYMS

Acronym	Definition
bgs	below ground surface
BNAs	Base/Neutral/Acid extractable compounds
BNRR	Burlington Northern Railroad
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cfs	cubic feet per second
CLP	Contract Laboratory Program
CLPAS	Contract Laboratory Program Analytical Service
DQI	Data Quality Indicator
DQO	Data Quality Objectives
Ecology	Washington State Department of Ecology
EM	Electromagnetic
EPA	United States Environmental Protection Agency
E&E	Ecology and Environment, Inc.
Friese	Friese Hide and Tallow
GPR	ground-penetrating radar
GPS	Global Positioning System
HRS	Hazard Ranking System
ICP-AES	inductively-coupled plasma—atomic emission spectrometry
ICS	interference check sample
ILM04.1	Inorganic Laboratory Method, revision 4.1
lbs	pounds
LCS	laboratory control sample
μg/g	micrograms per gram
μg/L	micrograms per liter
mg/g	milligrams per gram
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NOAA	National Oceanic and Atmospheric Association
NPL	National Priorities List
NWI	National Wetlands Inventory
PA	Preliminary Assessment
PCBs	polychlorinated biphenyls

LIST OF ACRONYMS *(Continued)*

Acronym	Definition
ppb	parts per billion
PPE	probable point of entry
ppm	parts per million
PUD	Public Utility District
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
ROW	Recomp of Washington
RSCC	Regional Sample Control Coordinator
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SOPs	Standard operating procedures
SQAP	Sampling and Quality Assurance Plan
SQL	Sample Quantitation Limit
START	Superfund Technical Assessment and Response Team
SVOCs	semivolatile organic compounds
TAL	Target Analyte List
TAT	Technical Assistance Team
TCP	Toxic Cleanup Program
TDD	Technical Direction Document
TDL	Target Distance Limit
TM	Task Monitor
TOC	Total Organic Carbon
TRC	Thermal Reduction Company
USGS	United States Geologic Survey
VOCs	volatile organic compounds
WCDHHS	Whatcom County Department of Health and Human Services
WDFW	Washington Department of Fish and Wildlife
Weston	Weston Solutions, Inc.
WRCC	Western Regional Climate Center

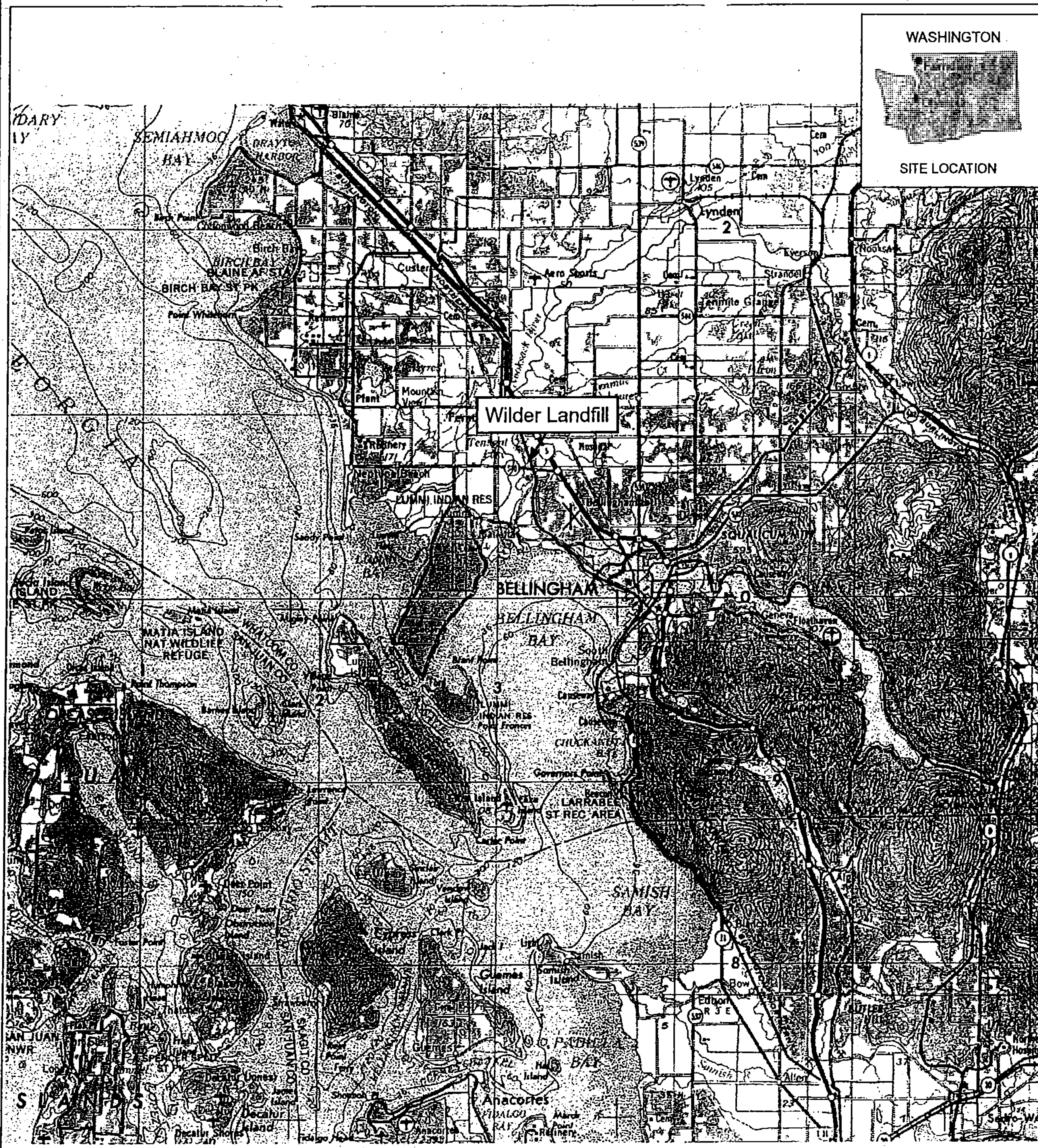
SECTION 1

INTRODUCTION

Under the authority of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980 and the 1986 Superfund Amendments and Reauthorization Act (SARA), Weston Solutions, Inc. (Weston) has completed a Preliminary Assessment and Site Inspection (PA/SI) of the Wilder Landfill—Hazardous Waste Pit site (the landfill site; CERCLIS ID No. WAN001002281) located in Whatcom County, WA (Figure 1-1). The United States Environmental Protection Agency (EPA) Region 10 retained Weston to complete this PA/SI pursuant to the EPA Superfund Technical Assessment and Response Team (START) Contract No. 68-S0-01-02 and Technical Direction Document (TDD) No. 01-09-0001. This document represents the narrative report for the Wilder Landfill—Hazardous Waste Pit PA/SI. The purpose of this report is to provide the EPA with the background information collected for the site, to discuss the sampling activities conducted and the data collected during the PA/SI, and to present the analytical results of the data obtained as part of the investigation.

PAs and SIs are generally the first and second screening investigations, respectively, in a series of assessments that EPA may complete at a known or potential hazardous waste site that is being investigated under CERCLA/SARA prior to its potential inclusion on the National Priorities List (NPL). The combined PA/SI assessment integrates activities typically conducted during the PA (e.g., information gathering, site reconnaissance) with activities typically conducted during the SI (e.g., development of site-specific Sampling Quality and Analyses Plans [SQAP], field sampling, filling data gaps) to achieve one continuous site investigation. The main objectives for the PA/SI activities are to:

- Collect and analyze samples to characterize the potential sources discussed in Section 2.3 of the report;
- Determine off-site migration of contaminants;
- Provide EPA with adequate information to determine whether the site is eligible for placement on the National Priorities List (NPL); and
- Document any threat or potential threat to public health or the environment posed by the site.



Source: USGS 1:250,000 Series Topo of Victoria, B.C., Canada; Washington, U.S. 1957 (1974)

0 2.5 5

Scale in Miles

Site Location Map
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

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Figure

1-1

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SECTION 2

SITE CHARACTERISTICS AND BACKGROUND

2.1 SITE DESCRIPTION AND BACKGROUND INFORMATION

Information presented in the following sections is based on a review of EPA CERCLA and Resource, Conservation, and Recovery Act (RCRA) records, Washington Department of Ecology (Ecology) records, Whatcom County Department of Health and Human Services (WCDHHS) records, Washington Department of Fish and Wildlife (WDFW) records, site background information, interviews with persons familiar with the site, and a site visit conducted by Weston on December 6, 2001.

This section describes the site location, site description, the site ownership history, and operational history of the landfill site. Photos of site features taken during the field effort are included in Appendix A. A diagram showing site vicinity features is presented in Figure 2-1.

2.1.1 Site Location

Site Name:	Wilder Landfill-Hazardous Waste Pit
CERCLIS ID No.:	WAN001002281
Location:	1524 Slater Road, Ferndale, Washington, north of Recomp of Washington facility
Latitude:	48° 49' 22" North
Longitude:	122° 33' 56" West
Legal Description:	The former landfill is located on a portion of the property described as: Township 39N, Range 2E, Section 33, SW ¼, NE ¼; That portion of Lot C Wilder short plat as recorded in Book 2 short plats pg 160 except portion in section 4-38-2E- except portion in SE SW.
County:	Whatcom
Site Owners:	Charles V. Wilder 5950 West Table Mesa Road New River, Arizona 85087 (623) 465-7274 Betty A. Wilder 13182 Elster Place Grass Valley, California 95949 (530) 477-5786

Site Contacts: Mr. Thane Somerville
Short Cressman & Burgess PLLC
Suite 3000, 999 Third Avenue
Seattle, Washington 98104-4088

2.1.2 Site Ownership History

The former landfill occupies approximately 1.3 acres located mainly on the southwest corner of a 40.72-acre parcel owned by Charles and Betty Wilder. Approximately 0.42 acre of the landfill extends onto the west adjacent property that was also formerly owned by Charles Wilder. Betty Wilder acquired 50 percent ownership of the current Wilder parcel in 1999 (Whatcom County, 2001). Prior to 1985, the Wilder property included the current Recomp of Washington (ROW) property located to the south of the site. Wilder Construction operated a waste incineration facility known as Thermal Reduction Company (TRC) here beginning in 1975 (EPA, 1990a; Whatcom County, 1979a). Wilder sold the TRC facility property in 1985, while retaining ownership of the current property to the north that includes the former landfill (Whatcom County, 2001).

2.1.3 Site Description

The Wilder Landfill-Hazardous Waste Pit site is a former and inactive landfill located approximately 2 miles southeast of Ferndale, Washington (Figure 2-1). It has also been referred to in previous documents as Wilder's "hazardous disposal site," and "hazardous waste pit" (Ecology, 1977a; E&E, 1981). The landfill began its operations as an open pit measuring 100 feet wide by 300 feet long and 20 feet deep (Ecology, 1987). Other estimates of the landfill dimensions range up to 200 feet wide by 500 feet long by 20 feet deep (E&E, 1989; EPA, 1979), though these estimates are likely on the high end (Bader, 2002). The site currently consists of a relatively flat vegetated field, located on the southern portion of a 40.72-acre parcel owned jointly by Charles and Betty Wilder (Whatcom County, 2001; Figure 2-1). Based on the topographic map of the area and site investigation notes, surface drainage across the former landfill site appears to drain to the southwest (USGS, 1952; EPA, 1979). One drainage ditch is located near the northwestern corner of the former landfill, and another runs east to west adjacent to the southern boundary of the site.

Land in the vicinity of the site is zoned for "residential-office" and manufacturing (Whatcom County, 2001). The property to the west includes an animal hide treatment facility (Whatcom County, 2001). According to Ecology records, the facility, Friese Hide and Tallow (Friese), preserves hides using salt only; no tanning or other chemical processes are performed (Ecology, 1989a). The property to the south of the former landfill includes a facility owned by ROW. ROW does not currently conduct any operations on this property, but leases their facilities to three companies: Regional Disposal Company, which operates a municipal waste transfer station; Stericycle, Inc., which operates a medical waste autoclave facility; and IMS General Partnership, which operates a mushroom-growing substrate production facility (Bubanich, 2001). The former landfill site is surrounded on the east and north by the remaining portion of the Wilder parcel (Whatcom County, 2001). A paved access road leading to the Friese facility is located adjacent to the former landfill and an unpaved access road is located to the east and north (Figure 3-1). Access to the site is unrestricted. According to documents reviewed during this investigation, groundwater flows predominantly to the northwest.

2.1.4 Site Operational History

Disposal of materials at the hazardous waste landfill began in the summer of 1976, when TRC was granted permission by the Whatcom County Health Board to operate a disposal site for hazardous materials under its solid waste permit (Ecology, 1987).

Wastes deposited in the former landfill were described by the Wilder Construction Company Solid Waste Manager as "approximately 1,000 partially-full oil and resin drums, solvents, asbestos, catalyst beads from the refineries, lignosite from Georgia-Pacific ..., pentathol (sic) from Crossarm and Bailey Lumber" (EPA, 1979). Insecticide from the highway department was also reportedly placed in the landfill (E&E, 1981). In a letter from Ecology to Whatcom County regarding TRC leachate, Ecology recommends, "...that the accumulated water in the industrial waste disposal area be disposed of in the spray field rather than by discharge to the surface stream," due to the fact that "parathion and mercuric pesticides" have been disposed of in that area (Ecology, 1977b). The "industrial waste disposal area," is considered likely to refer to the Wilder Landfill-Hazardous Waste Pit.

Lignosite is a wood pulp product that was mixed with metal plating sludge to make a drilling mud additive (Ecology, 1980a). A sample of this mixture, packaged in bags labeled "Q-Broxin manufactured for Baroid Petroleum Services by Georgia Pacific" was collected from the TRC facility by Ecology personnel; it was found to contain total chromium concentrations as high as 27 milligrams per gram (mg/g), or 2.7 percent (Ecology, 1980a). TRC reportedly received up to 1.5 tons of lignosite per week; the volume of lignosite buried in the Wilder Landfill-Hazardous Waste Pit is not known (E&E, 1981).

Noncompliance with the conditions of its operating permit prompted the Whatcom County Health Board to revoke its approval of the hazardous waste landfill, and it was closed by TRC in the spring of 1979 (Whatcom County, 1979b; TRC, 1979). Other sources state that the pit was in operation until 1983 (SAIC, 1993).

Contaminants of concern at the site associated with these operations include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), chlorinated pesticides/polychlorinated biphenyls (pesticides/PCBs), Target Analyte List (TAL) metals, and hexavalent chromium.

2.1.5 Site Regulatory Compliance History

As part of the PA/SI, Weston conducted a review of available site records from Ecology, WCDHHS, and CERCLA records available at the EPA Region 10 office in Seattle, Washington. Regulatory compliance records were identified for the site from these sources, and are discussed in Section 2.2 below.

2.2 SUMMARY OF PREVIOUS INVESTIGATIONS

Until 1985, the former landfill site was part of the former TRC facility, which was located on the property currently owned by ROW. Wilder sold the TRC facility in 1985, but retained ownership of the property that includes the landfill.

Numerous investigations have been conducted previously regarding the former TRC facility, including investigations under CERCLA. Following "site discovery," when the site was brought to EPA's attention in 1979, a CERCLA PA of TRC (CERCLA information system [CERCLIS] site ID WAD078207362) was completed in 1986, followed by an SI completed in 1988, and a site reassessment that was completed in 2000. As a result of the 2000 Site Reassessment, EPA determined the TRC facility to be a low priority for further assessment under the federal Superfund program, and that any other cleanup activity at the site would be lead by the State (EPA, 2000a). None of the previous investigations at the former TRC facility fully addressed conditions at the Wilder Landfill-Hazardous Waste Pit. The following is a summary of investigation results that relate to the former landfill.

2.2.1 Whatcom County Inspection, Spring 1979

Dennis Larson of the Bellingham & Whatcom County Health District Department of Public Health (the County) conducted a site inspection in the spring of 1979. He found the hazardous waste landfill nearly full of waste, and full of standing water to the point of "nearly overflowing" (EPA, 1979). The conditions reported by Larson violated the terms of Wilder's operating permit and the Health Board revoked its approval of the hazardous waste landfill that spring as a result of his inspection and recommendations (Whatcom County, 1979b; EPA, 1979). No closure requirements were made for the landfill closure with the revocation order (EPA, 1979). TRC notified the County that the landfill was closed as of 1 May 1979, with a cover that consisted of a layer of ash covered by a layer of "dirt" (TRC, 1979). The ash layer is estimated to have been three to four feet thick; the surface layer, derived from nearby soil, is estimated to have been five feet thick (Zurline, 2002).

2.2.2 Ecology Preliminary Field Investigation, August 1979

Ecology, EPA, and County personnel visited the TRC site and met with the Solid Waste Manager for Wilder Construction Company (EPA, 1979). He estimated the dimensions as 60 feet by 100 feet by 12 feet deep (EPA, 1979). When they toured the area, the investigators stated that its dimensions appeared to be closer to 150 feet by 500 feet (EPA, 1979). A clay berm was visible along the eastern border of the landfill (EPA, 1979).

The Solid Waste Manager described the waste in the landfill as, "approximately 1,000 partially full oil and resin drums, solvents, asbestos, catalyst beads from the refineries, lignosite from Georgia-Pacific ..., pentathol (sic) from Crossarm and Bailey Lumber" (EPA, 1979). Inspectors observed, "A drainage ditch along the south side of the pit was stained dark black; the discoloration originated from an open area of the pit (approximately 40 feet by 50 feet), which contained 50 pound sacks of lignosite in a black, mushy liquid. The ditch was discolored as far as could be observed, to near the Burlington-Northern Railroad tracks" (EPA, 1979). Based on their observations, Ecology and County personnel expressed interest in investigating organics concentrations in nearby Claypit Pond (EPA, 1979).

2.2.3 EPA Investigation, February 1980

During an investigation conducted in February 1980 under the Field Investigation Team (FIT) contract, EPA sampled surface water at three locations near the site: at a culvert near Labounty Road upgradient of the site, at a culvert under the Burlington Northern railroad tracks, and in a stream flowing from Claypit Pond (E&E, 1981). The culvert beneath the railroad track was receiving runoff from two drainage areas, one of which included the former Wilder Landfill-Hazardous Waste Pit property as well as extended areas to the north, and another that included the TRC facility and extended areas to the south. The surface water samples were analyzed for heavy metals and organic priority pollutants (E&E, 1981). No organic priority pollutants were detected. The results of the inorganics analyses are presented below; concentrations are listed in units of micrograms per liter (µg/L), which is equivalent to parts per billion (ppb; E&E, 1981).

Analyte	Surface Water Sample Concentration (µg/L)		
	Upstream	Culvert to Claypit Pond	Outlet from Claypit Pond
Antimony	<2.0	<2.0	<2.0
Arsenic	<2.0	3.1	<2.0
Beryllium	<0.3	<0.3	<0.3
Cadmium	0.5	4.1	1.1
Chromium	9.0	483.0	137.0
Copper	12.0	23.0	11.0
Lead	31.0	142.0	52.0
Mercury	0.78	0.91	0.78
Nickel	15.0	24.0	11.0
Selenium	<2.0	8.0	2.0
Silver	<0.3	<0.3	<0.3
Thallium	<2.0	<2.0	<2.0
Zinc	40.0	300.0	20.0

Note:
Modified from E&E, 1981.

Relative to the upstream sample, concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc were elevated in the sample from the culvert leading to Claypit Pond. Elevated cadmium, chromium, and lead concentrations in the pond effluent are also likely a result of the input from the culvert (E&E, 1981). The source of these concentrations can not be specifically identified based on the three samples collected.

2.2.4 Ecology Water Quality Survey, April and July 1980

In 1980 Ecology conducted an investigation that included the collection of surface water samples from 16 locations in the site and vicinity: 10 from the TRC facility, two from locations upgradient of the former Wilder Landfill-Hazardous Waste Pit, one from the culvert draining into Claypit Pond, and three locations in the pond (E&E, 1981).

The samples were analyzed for heavy metals and chlorides. The analytical results are presented in the table below, in concentration units of μg/L:

Sample Location/ Station #		Surface Water Sample Concentration (μg/L)									
		Cadmium	Chlorides	Chromium (total)	Chromium VI	Copper	Lead	Mercury (May)	Mercury (June)	Nickel	Zinc
BK	2	NA	16,000	NA	NA	NA	NA	<0.2	NA	NA	NA
	3	<10	170,000	<10	<50	<10	50	1.9	<0.2	NA	<10
TRC	5	40	NA	11000	NA	50	220	NA	NA	220	360
	6	<10	3,500,000	7200	<50	<10	100	0.8	NA	NA	190
	7	<10	5,800,000	<10	<50	<10	100	4.0	1.2	NA	30
	8	NA	4,400,000	NA	NA	NA	NA	NA	<0.2	NA	NA
	9	NA	7,100,000	NA	NA	NA	NA	NA	<0.2	NA	NA
	10	NA	1,400,000	NA	NA	NA	NA	NA	<0.2	NA	NA
	11	NA	6,400,000	NA	NA	NA	NA	NA	0.8	NA	NA
	12	NA	1,100,000	NA	NA	NA	NA	NA	0.48	NA	NA
	13	NA	21,000,000	NA	NA	NA	NA	NA	NA	NA	NA
Culvert	14	<10	1,200,000	80	<50	<10	<50	0.8	NA	NA	30
Claypit Pond	15	<10	640,000	200	<50	<10	<50	1.1	NA	NA	80
	16	<10	570,000	200	<50	<10	<50	0.64	NA	NA	20
	17	<10	600,000	200	<50	<10	<50	0.48	<0.2	NA	<10

Notes:
Modified from E&E, 1981.
BK: Background.
Culvert: Culvert draining into Claypit Pond.
NA: Not analyzed.
TRC: Thermal Reduction Company facility sampling locations.

The analytical data indicates that concentrations of total chromium, and zinc in the culvert and pond were elevated compared to the upgradient samples (E&E, 1981). The relatively high chloride value at Station 3 (background) was attributed to a nearby salt pile present on the Friese property (E&E, 1981). A salt pile was also present on the TRC property at the time, and these two sources were considered responsible for the elevation of Claypit Pond chloride levels to approximately 600 milligrams per liter (mg/L; E&E, 1981).

In addition to the 10 surface water samples, three fish tissue samples were collected from Claypit Pond and analyzed for mercury. All fish tissue concentrations were determined to be within federal Food and Drug Administration limits for safe human consumption (E&E, 1981).

2.2.5 Ecology Lignosite Sample

In response to the findings of elevated chromium (31 mg/L) concentrations in leachate from the TRC ash disposal area, lignosite from the ROW facility was analyzed for heavy metals (Ecology, 1980a). Lignosite analytical results are reproduced in the table below.

Analyte	Lignosite Sample Concentration (ppm)
Cadmium (total)	<5
Chromium VI	8,000
Chromium (total)	27,000
Copper (total)	<5
Iron (total)	7,000
Lead (total)	40
Manganese (total)	280
Nickel (total)	40
Zinc (total)	3,000

Note:
Modified from E&E, 1981.

2.2.6 Ecology Phase I and II PA/SI, August and September, 1986

Ecology performed a Phase I PA/SI of the TRC facility in August 1986, during which no samples were collected (Ecology, 1987). The Phase II PA/SI was conducted in October (Ecology, 1987); samples collected included (see Figure 2-2):

- One sediment and one water sample from the ditch draining the area north of the railroad culvert, including the Wilder Landfill-Hazardous Waste Pit property (Stream #1)
- One sediment and one water sample from the ditch draining the area south of the railroad culvert, including the TRC facility (Stream #2)
- A water sample from the near the southern shoreline of Claypit Pond
- A leachate sample from the TRC facility's leachate pond

The samples were analyzed for priority pollutants, VOCs, Base/Neutral/Acid extractable compounds (BNAs, also called SVOCs), and Pesticides/PCBs. No VOCs or Pesticides/PCBs were detected in any of the samples (Ecology, 1987). SVOCs detected were generally phthalates, at concentrations < 20 μg/L in water samples, and approximately 0.2 milligrams per kilogram (mg/kg) or less in the sediment samples (Ecology, 1987). Milligrams per kilogram is equivalent to ppm.

Elevated metals concentrations were detected in sediment and water samples downgradient of both the Wilder Landfill-Hazardous Waste Pit and the TRC facility. The metals concentrations (μg/L) in the surface water samples, and the drinking water standards for the parameters listed are summarized in the following table (Ecology, 1987):

Analyte	Surface Water Sample Concentration (μg/L)				
	Stream #1	Leachate Pond	Stream #2	Brennan (Claypit) Pond	Drinking Water Standards
Antimony	ND	ND	7	ND	ND
Arsenic	11	ND	30	ND	50
Beryllium	ND	ND	1.3	ND	ND
Cadmium	1.3	ND	12.4	0.5	10
Chromium	42	22	1083	2	50
Copper	10	ND	742	ND	ND
Lead	ND	15	282	ND	50
Mercury	0.15	0.15	2.55	0.15	2
Nickel	18	10	403	ND	10,000
Selenium	ND	ND	3	ND	10
Silver	ND	0.2	8.6	ND	50
Thallium	1	7	2	1	ND
Zinc	168	26	3120	53	ND

Notes:
Modified from Ecology, 1987.
ND: Metal concentration was not detected above the laboratory reporting limit (Ecology, 1987).

The metals concentrations (mg/kg, dry weight) in the sediment samples are summarized in the following table:

Analyte	Sediment Sample Concentration (mg/kg)	
	Stream #1	Stream #2
Antimony	ND	ND
Arsenic	2.6	6.1
Beryllium	0.53	0.71
Cadmium	0.6	1.7
Chromium	100.9	87.2
Copper	52.1	57.3
Lead	14.8	33.5
Mercury	0.10	0.05
Nickel	82.1	75.3
Selenium	0.3	0.4
Silver	0.22	0.30

Analyte	Sediment Sample Concentration (mg/kg)	
	Stream #1	Stream #2
Thallium	ND	ND
Zinc	286	320

Notes:
Modified from Ecology, 1987.
Blank spaces indicate metal concentration was below limit of detection (Ecology, 1987).
ND: Metal concentration was not detected above the laboratory reporting limit (Ecology, 1987).

Except for chromium and nickel in the sediment samples, concentrations in samples from the area of the former hazardous waste pit were lower than those from the area of TRC.

Based on the Phase II PA/SI analytical results, Ecology concluded:

- "...chromium in the sediments of stream #1 may indicate chronic leaching from the hazardous waste pit."
- "Lateral migration of leachate from the hazardous waste pit (now closed) occurred in the past and may still occur, although not as prolifically."

Ecology recommended that: 1) the site be scored under the HRS, 2) the cover of the Wilder Landfill-Hazardous Waste Pit be repaired with cover materials, 3) surface water be diverted around the landfill location, and 4) a determination be made as to whether the materials in the landfill were "sufficiently contained" (Ecology, 1987).

2.2.7 Ecology Sampling, January and March, 1988

Two surface water samples from the drainage culvert on the southwest corner of the Wilder property (downgradient of the former Wilder Landfill-Hazardous Waste Pit) were collected by Ecology personnel in early 1988 (Ecology, 1988). Limited results of the metals concentrations (μg/L) in these samples were included in an Ecology memorandum, and are presented in the table below (Ecology, 1988):

Sample Date	Surface Water Sample Concentration (μg/L)		
	Chromium	Nickel	Copper
January 1988	150	160	60
March 1988	180	100	59

Note:
Modified from Ecology, 1988.

2.2.8 Ecology Toxics Investigation Section Study, June 1988

Ecology's Toxics Investigation Section conducted an investigation on metals concentrations sediment and fish tissue in Claypit Pond (Ecology, 1989b). Twelve sediment stations were sampled and analyzed for metals, total organic carbon (TOC), and grain size distribution. The analytical results from the twelve sediment samples collected by Ecology, as well as reference samples cited in the report, are presented in the table below; clay and TOC concentrations are reported as percentages, while metals concentrations are reported as micrograms per gram (µg/g) or parts per million (Ecology, 1989b).

Sample ID	Location Description	Sediment Sample Concentration							
		%		µg/g					
		Clay	TOC	As	Cr	Cu	Hg	Ni	Zn
1	Hazardous waste landfill drainage	0.4	0.4	2.6	98	25	0.040	54	72
2	Friese Hide & Tallow	18.9	0.6	9.9	75	69	0.035	71	128
3	Upstream end of railroad culvert	25.7	6.9	17.9	740	52	0.60	59	347
4	Stream outside TRC berm	47.4	11.0	23.6	201	99	0.67	151	813
5	Stream downgradient of railroad culvert	23.6	1.4	1.9	74	30	0.027	43	104
6	Claypit Pond	33.1	2.3	5.9	265	47	0.048	68	166
7	Claypit Pond	37.4	2.1	8.3	277	50	0.051	75	176
8	Claypit Pond	38.1	1.1	7.4	100	44	0.040	65	115
10	Outlet Claypit Pond	37.5	0.5	6.4	69	51	0.043	73	104
11	Silver Creek above highway	21.3	2.4	5.9	98	44	0.044	114	113
12	Silver Creek above mouth	26.4	3.1	8.1	64	48	0.030	95	110
13	Silver Creek mouth	6.5	1.3	8.6	86	41	0.043	157	98
E	Silver Creek mouth[1]	3.1	NA	7.5	66	43	0.044	156	82
A	Silver Creek tributary	10.8	NA	4.1	49	31	0.027	38	83
B	Nooksack River "control"	4.3	0.4	5.2	38	26	NA	109	62
F	Whatcom Creek	3.1	1.0	3.3	24	22	0.049	27	110
G	Whatcom Creek	0.7	0.4	3.1	26	13	0.042	21	72
H	Whatcom Creek	3.4	4.0	6.1	40	47	0.071	35	170
I	Whatcom Creek	2.2	0.8	4.9	25	12	0.040	23	45

Notes:
Modified from Ecology, 1989b
[1] Unpublished data from joint EPA/Lummi Tribe sampling
NA: Not analyzed/not available

The highest concentrations of all parameters except chromium were found in sediments in the drainage ditch alongside the TRC facility (Sample 4; Ecology, 1989b). A statistical evaluation of the analytical results indicated that "onsite" chromium and copper concentrations (indicated by numeric sample IDs) were significantly higher than those of the reference samples (indicated by alphabetic sample IDs; Ecology, 1989b). Ratios calculated to compare chromium concentrations to other metals (arsenic, copper, nickel, and zinc) in each sample indicated chromium concentrations were highest in the pond and the streams that feed the pond from TRC's active and inactive waste sites (Ecology, 1989b).

Metals concentrations in fish caught from Claypit Pond were determined to be below the legal limits set by the USA and Canada (Ecology, 1988). Subsequently, Claypit Pond was reopened for fishing (SAIC, 1993).

2.2.9 EPA Phase I of TRC, November 1988

The EPA Technical Assistance Team (TAT) performed a Phase I sampling investigation of TRC in November 1988 (E&E, 1989). Twenty-seven field samples were collected during the study, including: six ash samples from the TRC ash pile, six surface water samples and six sediment samples from surface water drainage routes in the vicinity, and nine groundwater samples from wells present on the TRC property. Surface water, sediment, and groundwater samples were analyzed for VOCs, SVOCs, organochlorine pesticides, PCBs, metals, and cyanide. Three of the surface sediment water sampling stations are considered relevant to the Wilder Landfill-Hazardous Waste Pit: one from upgradient of the landfill; one from downgradient of the landfill; and one from south of the culvert under the railroad tracks, which includes drainage from and south of the TRC facility. The water sample analytical results (µg/L) from the these stations are summarized in the table below (modified from E&E, 1989):

Analyte	Surface Water Sample Concentration (µg/L)		
	Upgradient of Hazardous Waste Landfill	Downgradient of Hazardous Waste Landfill	South of Railroad Culvert
Aluminum	100 UJ	100 UJ	787 J
Antimony	R	R	R
Arsenic	R	R	R
Beryllium	40.0 U	40.0 U	58.8
Cadmium	68.0	61.7	62.0
Calcium	28200	27600	33300
Chromium	14.3	18.6	9.0 J
Cobalt	4.0 U	4.0 U	10.2 J
Copper	31.5	43.8	79.9
Iron	828 J	1060 J	3620 J
Lead	R	R	R
Magnesium	12900	12400	13700
Manganese	87.0 J	103 J	1610 J
Mercury	0.6	0.3	0.2 U
Nickel	8.0 UJ	8.0 UJ	8.0 UJ
Potassium	7300	6800	5900
Selenium	R	R	R
Silver	R	R	R
Sodium	66300	60500	63400
Thallium	R	R	R
Vanadium	12.0 U	12.0 U	12.0 U
Zinc	13.8 J	19.8 J	314 J

Notes:
Modified from E&E, 1989.
R: Data rejected due to deficient quality control criteria.
U: The analyte was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit.
J: The associated numerical value is an estimated quantity because the reported concentrations were less than the contract required detection limits or quality control criteria were not met.

The sediment sample analytical results (mg/kg) from the three stations relevant to the Wilder Landfill-Hazardous Waste Pit are summarized in the table below (modified from E&E, 1989):

Analyte	Sediment Sample Concentration (mg/kg)		
	Upgradient of Hazardous Waste Landfill	Downgradient of Hazardous Waste Landfill	South of Railroad Culvert
Aluminum	21000	27000	21300
Antimony	R	R	R
Arsenic	R	R	R
Barium	148	85.8	163
Beryllium	1.1 J	1.4 J	1.1 U
Cadmium	4.2 J	2.3 J	4.5 U
Calcium	6220	4340	4200
Chromium	53.0 J	50.2 J	69.3 J
Cobalt	14.5 J	10.9 J	13.5 J
Copper	57.6 J	65.2 J	68.4 J
Iron	29300	23500	37700
Lead	R	R	R
Magnesium	6470	5060	9800
Manganese	506 J	654 J	337 J
Mercury	0.1 J	0.1 J	0.1 J
Nickel	28.5	73.5	44.3
Potassium	243 J	350 J	1060 J
Selenium	R	R	R
Silver	R	R	R
Sodium	1070 J	846 J	1110 J
Thallium	2.0 U	1.7 U	2.9 U
Vanadium	56.8	66.4	64.5
Zinc	142 J	308 J	148 J
Cyanide	10.0 U	10.0 U	10.0 U

Notes:
Modified from E&E, 1989.
R: Data rejected due to deficient quality control criteria.
U: The analyte was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit.
J: The associated numerical value is an estimated quantity because the reported concentrations were less than the contract required detection limits or quality control criteria were not met.

The TAT data showed that the surface water sample from downgradient of the hazardous waste landfill contained concentrations of chromium, copper, iron, manganese, and zinc above those detected in the background sample. The sediment sample from downgradient of the hazardous waste landfill contained concentrations of aluminum, beryllium, copper, manganese, mercury, nickel, potassium, vanadium, and zinc above those detected in the background sample. Nickel and zinc values were twice as large as the background concentrations detected.

No VOCs other than acetone were detected in any of the sediment samples. No VOCs were detected in sediments from downgradient of the Wilder Landfill-Hazardous Waste Pit. Eleven SVOCs and one PCB Aroclor were detected in the sediment sample downgradient of the Wilder

Landfill-Hazardous Waste Pit; none were detected in the sample upgradient of the waste landfill. The concentrations (ppb) of compounds detected in the sediment sample downgradient of the landfill are summarized in the table below:

Analyte	Sediment Sample Concentration (ppb)
Acenaphthene	1200
Fluorene	820
Phenanthrene	9200
Fluoranthene	22000
Pyrene	18000 J
Benzo(a)anthracene	12000
Chrysene	21000
Benzo(b)fluoranthene	36000
Benzo(k)fluoranthene	35000 E
Benzo(a)pyrene	18000
Indeno(1, 2, 3-cd)pyrene	22000 J
Arochlor 1248	5700

Notes:
Modified from E&E, 1989.
J: The associated numerical value is an estimated quantity because the reported concentrations were less than the contract required detection limits or quality control criteria were not met.
E: Indicates a compound whose concentration exceeded the calibration range of the instrument.

Based on their data, the TAT stated that leachate from the Wilder Landfill-Hazardous Waste Pit is a possible source of these contaminant concentrations (E&E, 1989).

2.2.10 ROW Quarterly Monitoring, 1988–2002

Quarterly monitoring of groundwater and surface water stations began at the ROW facility in 1988 (Vasey Engineering, 1994). Surface water stations include the railroad culvert draining to Claypit Pond, and the streams draining to the culvert from the north and the south. Occasional exceedances of inorganic surface water criteria were reported at various surface water stations in the first decade of sampling, but recent data indicates no ongoing surface water issues (Dodd, 2002a).

2.2.11 Ecology, 1991

Personnel from Ecology's Toxics Cleanup Program (TCP) collected two surface water samples from the surface water discharge areas on the northwest and southwest corners of the former Wilder Landfill-Hazardous Waste Pit on March 27, 1991 (Ecology, 1991). The samples were analyzed for metals, VOCs, and pesticides/herbicides (Ecology, 1999). Certain metals were the only constituents detected (Ecology, 1991). The concentrations reported by Ecology in ppm were converted to ppb and are shown in the table below (Ecology, 1991):

Analyte	Concentration (ppb)
Barium	59.1
Copper	19.0
Manganese	696
Zinc	21.0
Aluminum	2180
Calcium	40.0
Iron	32.3
Magnesium	16.4
Sodium	78.4
Strontium	230
Titanium	111

Based on these results and citing Ecology's limited resources and the existence of higher priority sites, no further action regarding the former Wilder Landfill-Hazardous Waste Pit was recommended at the time (Ecology, 1991).

2.3 KNOWN AND POTENTIAL HAZARDOUS WASTE SOURCE AREAS

Samples for the PA/SI were collected from the area considered to be the potential hazardous waste source (the former landfill) and in areas that may have been contaminated through the migration of hazardous substances from the sources. Based on the information obtained during the investigation, potential contaminants of concern associated with the site operations include TAL metals, hexavalent chromium, SVOCs, VOCs, and organochlorine pesticides and PCBs. The areas and media identified as potential hazardous waste sources are described below. Descriptions, capacities, and locations of these source areas are summarized in Table 2-1 and shown on Figure 2-1. Known and potential hazardous waste source areas are discussed below.

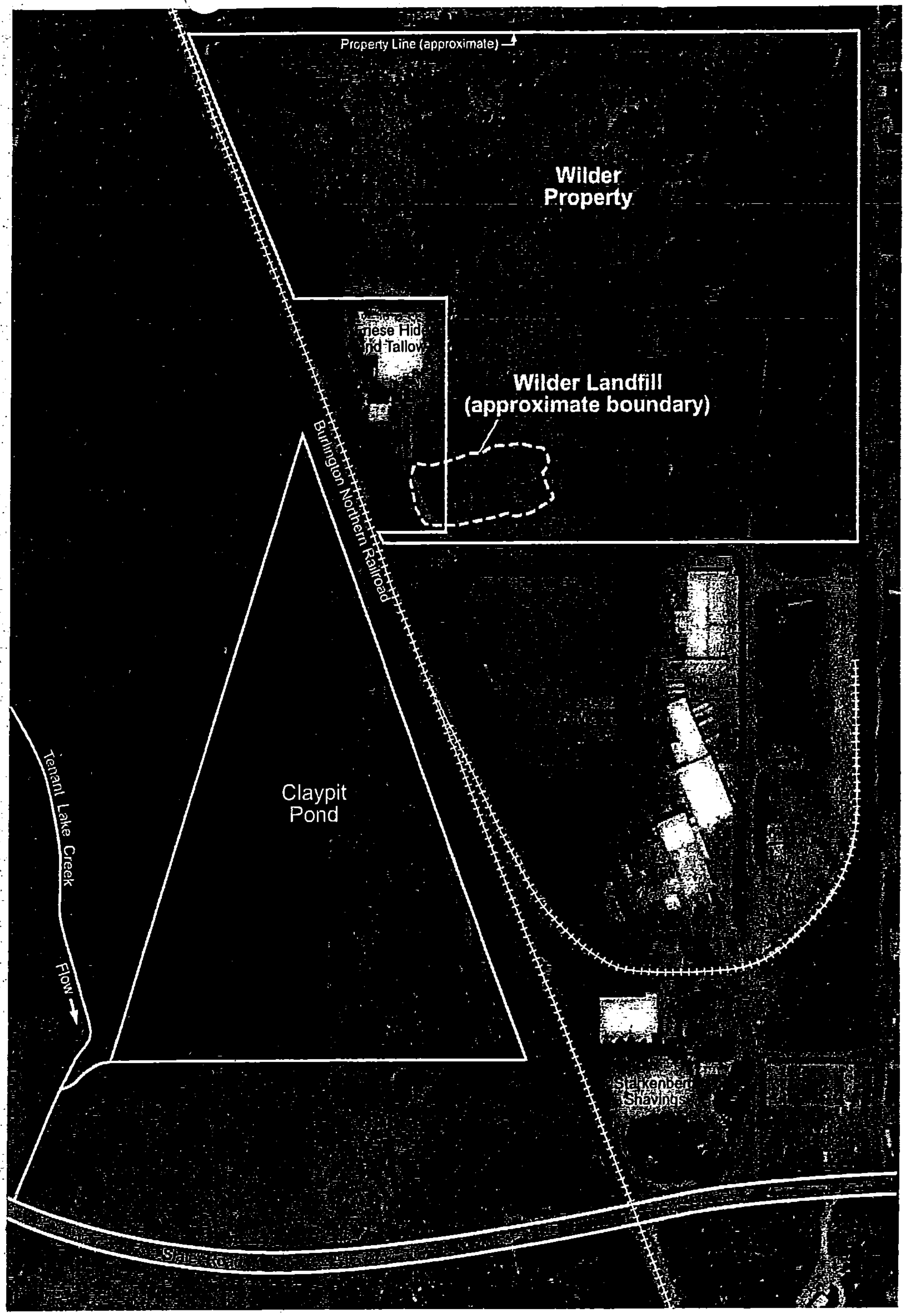
2.3.1 Landfill Waste

Based on previous statements regarding the contents of the landfill, potential contaminants of concern include TAL metals, hexavalent chromium, SVOCs, VOCs, organochlorine pesticides, and PCBs. The volume of the landfill was estimated to be approximately 41,500 cubic yards, based on historical sources stating the landfill was 20 feet in depth, and on the results of a geophysical investigation conducted during this PA/SI, which determined the landfill area to be approximately 160 feet wide by 350 feet long.

2.3.2 Landfill Surface Soil and Water

Available records indicate that the adequacy of the cover material on the landfill has not been properly evaluated (EPA, 1982; Ecology, 1987). Previous inspections determined that leachate generation and migration from the landfill cover material may be possible (Whatcom County, 1982). The potential leachate generated since the landfill was covered may contaminate surface soils covering the landfill. There are no containment features associated with the landfill surface soil. Analytical results of surface soil samples (refer to Section 6.1.2) collected from the landfill cover revealed concentrations of pesticides and metals significantly above background. The area of the landfill cover soil delineated by these surface soil samples is estimated at approximately 1,991 square feet.

Standing water has been observed on the landfill cover on occasion (Whatcom County, 1982), which may also become contaminated by any release of leachate. No surface water was observed on the landfill cover during the PA/SI sampling event.



Source: Walker and Associates Aerial Photograph, 9 August 2001.

Site Vicinity Diagram
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

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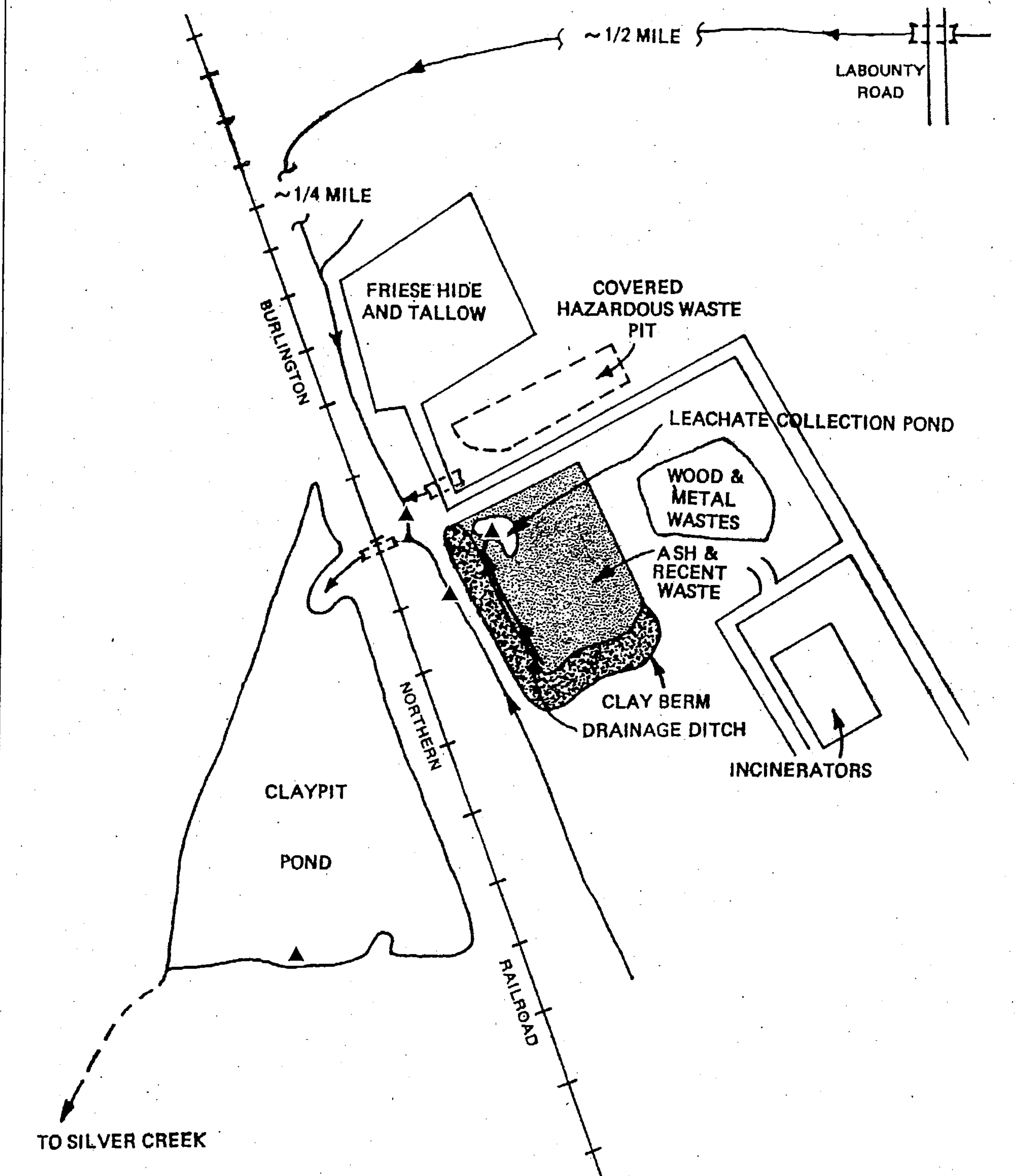
Figure
2-1

03-0008 Fig2-1.ai



Source: Modified from Ecology 1987.

Ecology 1986 PA/SI Sampling Locations
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

Not to Scale

▲ Ecology Sampling Location

Figure **2-2**

03-0008 Fig2-2.ai

Table 2-1—Known and Potential Source Areas
Wilder Landfill—Hazardous Waste Pit PA/SI

Source Name	Source Type	Estimated Waste Quantity	Source Location
Landfill Cover Surface Soil	Contaminated Soil Area	1,991 square feet	Central Site Area
Landfill	Landfill	41,481 cubic yards	Central Site Area

SECTION 3

FIELD ACTIVITIES AND ANALYTICAL PROTOCOLS

Weston prepared a SQAP (Weston, 2002) based on site information available prior to conducting any field activities. The SQAP presented sampling objectives, logistics, sampling design and methodology, custody requirements, and analytical methods to be used for the collection and processing of samples during this investigation. In general, sampling activities were conducted in accordance with the site-specific SQAP. The following sections present a summary of sampling protocols and exceptions to the procedures outlined in the SQAP due to field conditions encountered during sampling. Site features and sample locations are presented in Figures 3-1 and 3-2. Table 3-1 presents a detailed summary of the location, sample information, and analyses conducted for each sample collected during the field effort. Sample location coordinates are presented in Table 3-2.

3.1 SAMPLING DESIGN (TYPES, NUMBERS, AND RATIONALE)

Field activities at the site began on June 19, 2002 with a geophysical investigation. The purpose of this investigation was to delineate the boundaries of the former landfill and to identify locations where drums might be buried. The information derived from the geophysical investigation was used to determine appropriate surface and subsurface sample locations. Field sampling activities were conducted during the week of July 8, 2002 and included the collection of 41 samples as described below (Table 3-1):

- Four source samples of surface soil within the boundaries of the landfill, collected from 0 to 6 inches below ground surface (bgs; LF001 to LF004)
- Six source samples (landfill waste), collected from test pits in the landfill at depths ranging from approximately 0.5 to 5 feet bgs (LF012 to LF017)
- One surface soil sample (0 to 6 inches bgs) from a location upgradient of all site sources (LF005)
- Twelve surface sediment (and/or soil) samples (from 0-6 inches), from both the overland flow pathway and the in-water segment of the surface water pathway (SD001 to SD012)
- Eight subsurface soil samples collected from intervals of 9-12 feet and 20-24 feet bgs at four points near the perimeter of the landfill (LF008 to LF011)
- One groundwater sample from a location upgradient of the landfill (LF009)
- Four Quality Assurance/Quality Control (QA/QC) equipment rinsate samples
- Four trip blanks
- One investigation-derived waste sample

The following sections present the rationale used in the selection of the PA/SI sample locations. As shown in Table 3-1, all samples collected for the Wilder Landfill—Hazardous Waste Pit PA/SI were assigned internal Weston sample identification numbers, Contract Laboratory

Program (CLP) sample identification numbers, and EPA sample identification numbers. For simplicity, samples discussed in this report will be referred to using their Weston station IDs (e.g., sample LF001 refers to Weston sample ID WL-SS-LF001-0000; sample LF002 refers to Weston sample ID WL-SS-LF002-0000, etc.). Subsurface pushprobe samples will include a four-digit depth suffix to indicate the depth interval (e.g., -0100 indicates the 8 to 12 feet bgs interval; 0200 indicates the 20 to 24 feet bgs interval [Table 3-1]). The Weston sample designation code is presented in the SQAP (Weston, 2002).

3.1.1 Source Delineation and Characterization

The geophysical investigation to delineate the landfill was conducted at the site on June 19-21, 2002 (Williamson & Associates, 2002). The investigation consisted of an electromagnetic (EM) survey performed over a 430-foot by 260-foot grid with 10-foot spacing. The survey grid initially focused on the southwestern corner of the Wilder property. Based on early survey results that indicated an area of high returns extending to the west beyond the current property boundary, the grid was expanded to include a portion of the Friese property. Several transects were surveyed with a magnetometer to assist in the interpretation of the EM data. Select areas of the grid were also surveyed using ground-penetrating radar (GPR), which achieved limited penetration (approximately 3 feet bgs) due to the clayey soils present (Williamson & Associates, 2002). An approximate boundary for the Wilder Landfill/Hazardous Waste Pit was delineated based on the data obtained during the geophysical investigation (Figure 2-1). The boundaries outline an area approximately 350 feet by 160 feet (1.28 acre). A portion of this area, approximately 125 feet by 145 feet (0.42 acre) extends nearly 125 feet onto the Friese property. No historical records made available to Weston indicate that the Wilder Landfill/Hazardous Waste Pit extended onto what is now the Friese property.

Samples were collected to characterize the landfill waste and the landfill cover soil, which were considered the potential site sources. These source samples include (Figure 3-1) surface soil samples LF001, LF002, LF003, and LF004 collected from within the boundaries of the landfill (as determined from the geophysical investigation), and surface and subsurface soil samples LF012, LF013, LF014, LF015, LF016, and LF017 collected from four test pits within the boundaries of the landfill.

3.1.2 Attribution Samples

Four surface sediment samples were collected to assess whether hazardous substances identified at on-site sources are migrating off-site and into Claypit Pond. Samples SD009 and SD011 were collected downgradient of the landfill from within drainage ditches located north and south of the landfill, respectively (Figure 3-1). SD006 was collected from a drainage ditch adjacent to the Burlington Northern Railroad (BNRR), from a location north of a culvert that leads beneath the railroad to Claypit Pond. This sample was collected to document contaminant levels attributable to sources upgradient and to the north of the culvert (including the Wilder Landfill). SD007 was collected from the same drainage ditch adjacent to the BNRR, at a location south of the railroad culvert to document contaminant levels attributable to sources upgradient and to the south of the culvert.

3.1.3 Target Samples

Three sediment samples (SD001, SD003, and SD004) were collected from Claypit Pond, the Claypit Pond drainage stream, and Tennant Lake Creek downstream of the Landfill site (Figure 3-2). These samples were collected to document the presence or absence of hazardous substances released to the surface water pathway.

Subsurface soil samples were collected from three pushprobes advanced at the landfill. One pushprobe was advanced at a location northwest (downgradient) of the landfill boundary, and soil samples were collected from the 9-foot to 12-foot bgs intervals (LF008-0100) and the 20-foot to 24-foot bgs (LF008-0200) intervals. Similarly, samples were collected from the 9-foot to 12-foot bgs and 20-foot to 24-foot bgs intervals in pushprobes advanced to the south (LF010-0100 and LF010-0200, respectively) and north (samples LF011-0100 and LF011-0200, respectively) of the landfill boundaries. Subsurface samples were collected to assess whether potential hazardous substances in the landfill have migrated beyond the landfill boundaries, and may pose a threat to local groundwater.

3.1.4 Background Samples

Sediment and soil samples were collected from areas in the vicinity having similar physical characteristics and (in the case of sediment samples) depositional environments to the target, attribution, and source sediment and soil samples (Figures 3-1 and 3-2). These samples were collected to establish background concentrations present in sediment and soil in the vicinity of the site. Background samples were collected from Tennant Lake Creek (SD002), Claypit Pond (SD005), the drainage stream near the railroad upgradient of the Friese property (SD008), the northern and southern landfill drainage ditches (samples SD010 and SD012, respectively), and from the field on Wilder property north of the landfill and former access road (LF005).

Background subsurface samples were collected from a pushprobe advanced to the southeast (hydraulically upgradient) of the landfill boundary. Soil samples were collected from the 9-foot to 12-foot bgs (LF009-0100) and 20-foot to 24-foot bgs (LF009-0200) intervals, similar to those sampled at the downgradient pushprobe location. A background groundwater sample (LF009-240) was also collected from this location.

3.2 SAMPLE GLOBAL POSITIONING SYSTEM LOCATIONS

A Trimble GeoExplorer 2.2 global positioning system (GPS) receiver with data logger was used to record the location coordinates of selected site features and every sampling station except one; the location of the downgradient pushprobe station (LF008) was inadvertently not recorded. GPS position readings were recorded on field sampling forms and in digital files in the receiver's data logger. Upon return from the field, EPA processed the data files for differential correction, which increases the resolution of the data. According to the manufacturer, location accuracy with differential correction is within 10 to 16 feet, and 33 to 99 feet without correction. Differentially corrected GPS sample location coordinates are provided in Table 3-2.

3.3 SAMPLING METHODS

Field activities included the collection of surface sediment samples, surface and subsurface soil samples, and groundwater samples at the site and vicinity. At the time of sampling, site-specific conditions (i.e., topography, accessibility, and visual evidence of contamination) were incorporated, when applicable, into the placement of sample locations. Deviations from the planned sample locations during the field effort are presented in Section 6.1.2.1 and 6.1.3.1. These deviations were discussed with the EPA Task Monitor (TM) before implementation and were documented in the Sample Plan Alteration forms included in Appendix B. This section presents a brief summary of field methods and procedures used during the Wilder Landfill—Hazardous Waste Pit PA/ SI field effort. All samples were collected in accordance with Weston's Standard Operating Procedures (SOPs) and site-specific SQAP (Weston, 2002).

3.3.1 Test Pit Sampling

Soil samples from test pits excavated in the landfill were collected either directly from the excavation, or from the excavator bucket (avoiding contact with the sides) in accordance with Weston's SOP RFW/R10-001 using decontaminated stainless steel spoons and stainless steel bowls.

3.3.2 Surface Soil Sampling

Surface soil samples (0 to 6 inches bgs) were collected in accordance with Weston's SOP RFW/R10-001 using decontaminated stainless steel spoons and stainless steel bowls.

3.3.3 Pushprobe Sampling

Subsurface soil samples from the 9-12 feet bgs and 20-24 feet bgs subsurface soil horizons, and one groundwater sample from 24 feet bgs, were collected using direct push (push-probe) technology. Push-probe explorations were advanced in accordance with the State of Washington Minimum Construction Standards (WAC 173-160) and Weston's SOP RFW/R10-007. Multiple borings at each location were advanced in order to collect the large volume of soil required to conduct the laboratory analyses.

3.3.4 Surface Sediment Sampling

In accordance with Weston's SOP RFW/R10-003, stream sediment samples for bulk sediment chemistry were collected within 0 to 6 inches bgs using a decontaminated ponar dredge and/or stainless steel spoon and placed into a decontaminated stainless steel bowl. To avoid cross-contamination of stations due to disturbances during sampling activities, sampling progressed from downstream to upstream sample locations.

3.4 INVESTIGATION-DERIVED WASTES

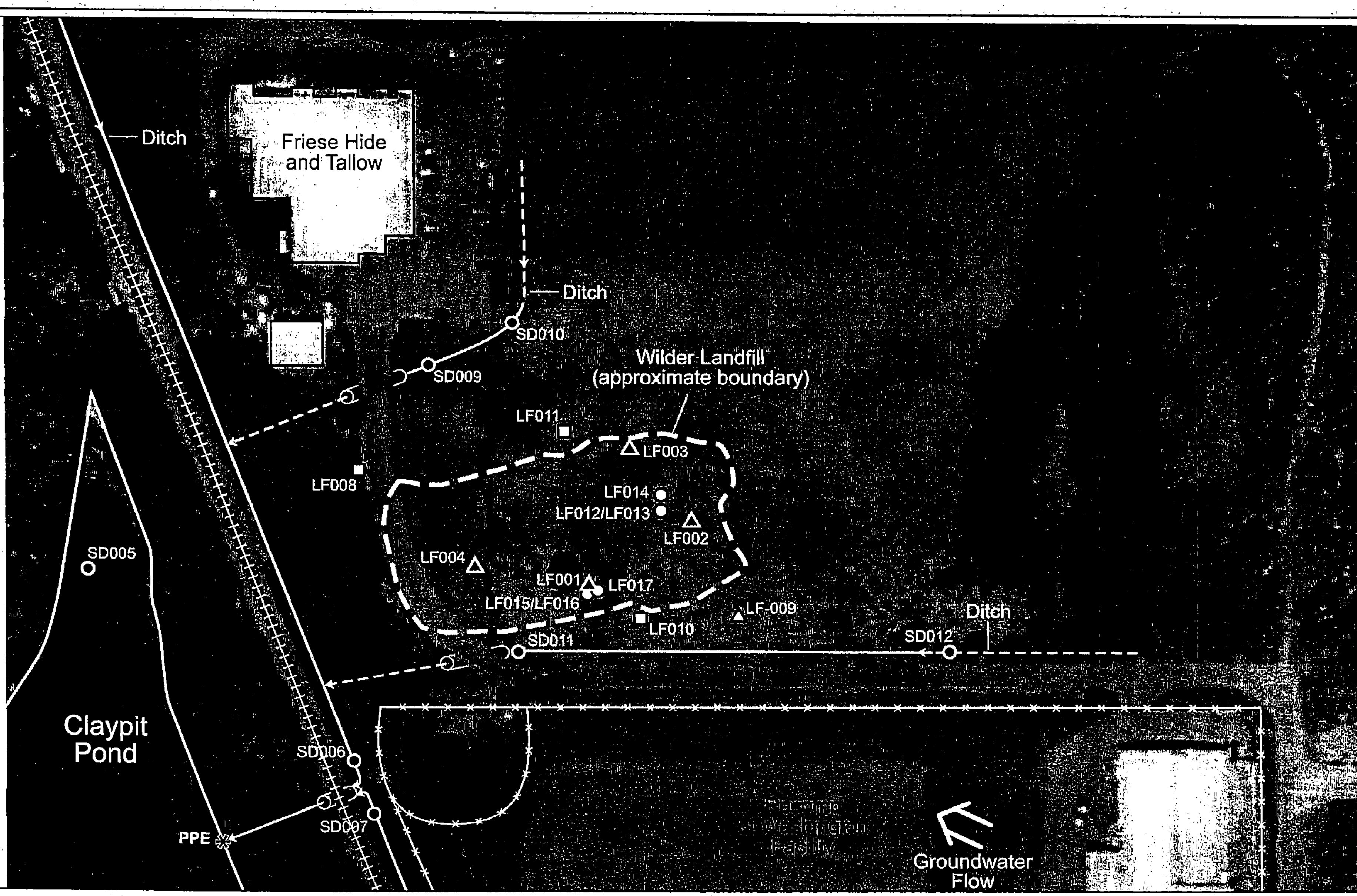
Wastewater from decontamination procedures that could not be evaporated was contained in one labeled 55-gallon drum, and sampled for disposal. Soil cuttings and plastic sheeting generated from pushprobing activities was contained in one labeled 55-gallon drum. Wooden stakes from the geophysical investigation, and personal protective equipment and other disposable equipment and supplies used in test pitting were contained in two labeled 85-gallon overpack drums. Weston disposed the wastewater, soil cuttings, and other disposable supplies at a permitted facility. Non-hazardous personal protective equipment and waste generated during field activities was double bagged in opaque plastic garbage bags and disposed as solid waste.

3.5 SAMPLE HANDLING AND CUSTODY

Chain-of-custody practices complied with Weston's SOPs for sample handling, sample control, and chain-of-custody procedures contained in the *Contract Laboratory Program Guidance for Field Samplers* (EPA, 2001). Samples were identified using the regional tracking numbers and CLP identifications assigned by the EPA Regional Sample Control Coordinator (RSCC) in addition to a unique Weston identification number based on the sample designation scheme presented in the SQAP. Information obtained during sampling was recorded in the project logbook and/or data forms in accordance with the SQAP. Samples were also documented with photographs including sample locations and site features as deemed appropriate.

3.6 ANALYTICAL METHODS

All samples collected during the investigation were submitted for off-site, fixed laboratory analyses for TAL metals by the Contract Laboratory Program Analytical Services (CLPAS) Method ILM04.1. All samples except the groundwater sample were also submitted for SVOCs, Pest/PCBs analyses by the CLPAS Methods OLM04.2, and for hexavalent chromium analysis by Method 7196A. Selected samples were also submitted for VOCs analysis by the CLPAS Methods OLM04.2. Two different CLP laboratories conducted all TAL metals, VOC, SVOC, and Pest/PCB analyses. An EPA laboratory conducted the hexavalent chromium analyses. Specific information regarding sample locations, analyses, and rationale is presented in Table 3-1.



Note: Sample locations shown are approximate. See Figure 3-2 for site vicinity sample locations.
Source: Walker and Associates aerial photograph, 9 August 2001.

0 70 140
Approximate Scale in Feet

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- ● Surface Sediment Sample
- ▲ Surface Soil Sample
- ■ Possible Surface Water Sample
- ○ Waste Samples
- △ Subsurface Soil & Groundwater Samples
- □ Subsurface Soil Samples

- Fencing
- Burlington Northern Railroad
- Surface Water Flow Direction
- ✱ Probable Point of Entry (PPE)

Site Sample Location Diagram
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

Figure
3-1

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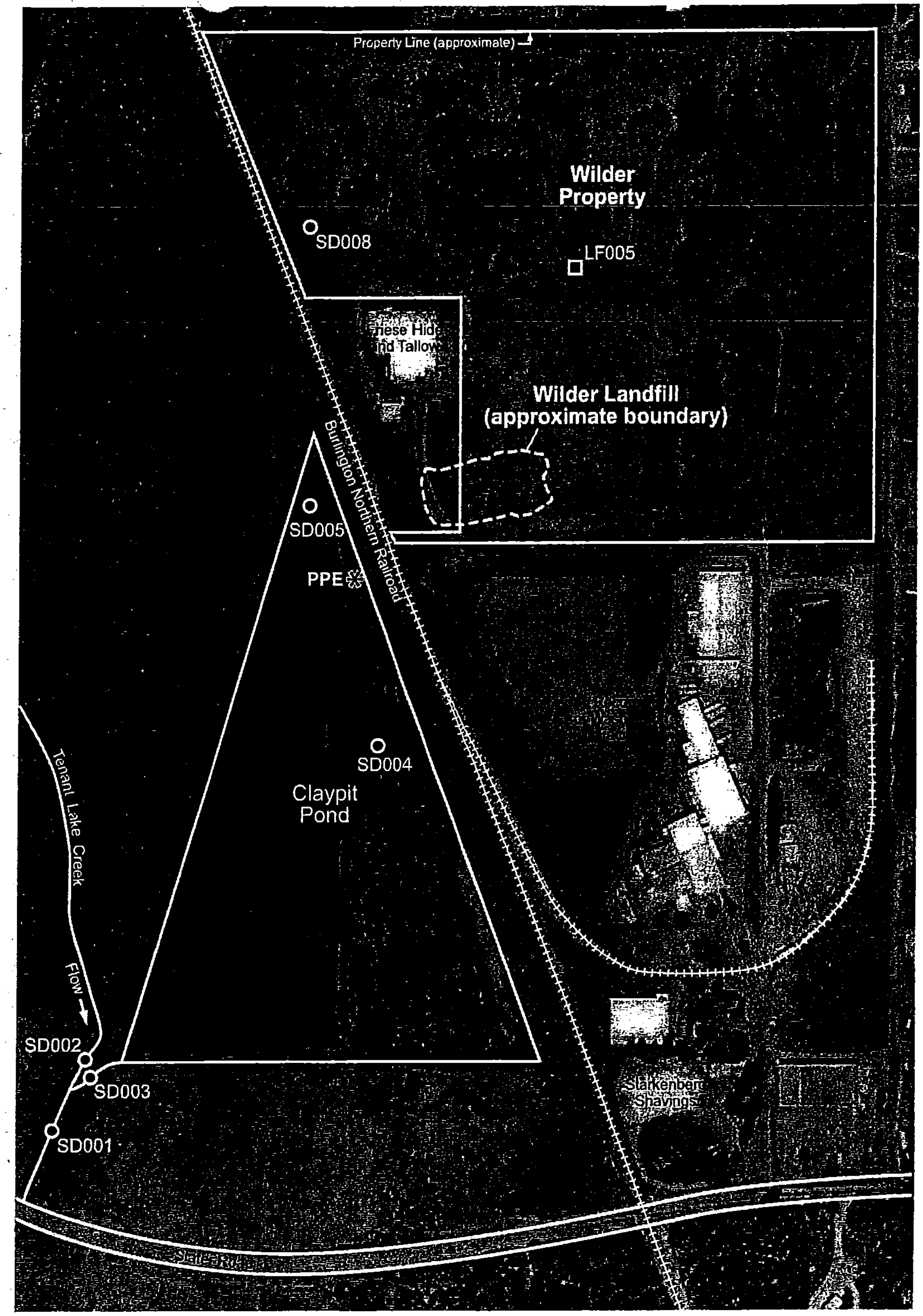


Note: Sample locations shown are approximate. See Figure 3-1 for site sample locations.
Source: Walker and Associates aerial photograph, 9 August 2001.

Site Vicinity Sample Locations Diagram
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

0 210 420
Scale in Feet

WESTON SOLUTIONS

- ● Surface Sediment Sample
- ■ Surface Soil Sample
- * Probable Point of Entry (PPE)

Figure
3-2

03-0008 Fig3-2.ai

Table 3-1—Sample Locations and Analyses Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Sample Number	EPA Regional Tracking	Inorganic CLP ID	Organic CLP ID	Time	Date	Sample Interval	Analyses					Notes
							TAL Metals	Cr(VI)	SVOCs	VOCs	Pest/ PCBs	
Sediment Samples												
WL-SD-SD001 - 0000	02284100	MJ0CM1	J0E00	1245	8-Jul-02	0-5"	X	X	X	NA	X	Tenant Lake Creek downgradient of Claypit Pond
WL-SD-SD002 - 0000	02284101	MJ0CM2	J0E01	1319	8-Jul-02	0-4"	X	X	X	NA	X	Tenant Lake Creek upgradient of Claypit Pond
WL-SD-SD003 - 0000	02284102	MJ0CM3	J0E02	1351	8-Jul-02	0-3"	X	X	X	NA	X	Claypit Pond drainage
WL-SD-SD004 - 4000	02284131	MJ0CW4	J0E31	0945	8-Jul-02	NA	X		X	NA	X	Ponar dredge rinsate
WL-SD-SD004 - 0000	02284103	MJ0CM4	J0E03	1539	8-Jul-02	0-6"	X	X	X	NA	X	Claypit Pond in vicinity of railroad culvert
WL-SD-SD005 - 0000	02284104	MJ0CM5	J0E04	1610	8-Jul-02	0-5"	X	X	X	NA	X	Claypit Pond Background
WL-SD-SD006 - 0000	02284105	MJ0CM6	J0E05	0830	9-Jul-02	0-6"	X	X	X	NA	X	Railroad ditch north of culvert
WL-SD-SD007 - 0000	02284106	MJ0CM7	J0E06	0855	9-Jul-02	0-6"	X	X	X	NA	X	Railroad ditch south of culvert
WL-SD-SD008 - 0000	02284107	MJ0CM8	J0E07	1015	9-Jul-02	0-5"	X	X	X	NA	X	Drainage upgradient of Friese Hide and Tallow
WL-SD-SD009 - 0000	02284108	MJ0CM9	J0E08	1110	9-Jul-02	0-4"	X	X	X	NA	X	Northern landfill drainage ditch, downgradient
WL-SD-SD010 - 0000	02284109	MJ0CN0	J0E09	1145	9-Jul-02	1-6"	X	X	X	NA	X	Northern landfill drainage ditch, upgradient
WL-SD-SD011 - 0000	02284110	MJ0CN1	J0E10	1220	9-Jul-02	0-6"	X	X	X	NA	X	Southern landfill drainage ditch, downgradient
WL-SD-SD012 - 0000	02284111	MJ0CN2	J0E11	1305	9-Jul-02	0-6"	X	X	X	NA	X	Southern landfill drainage ditch, upgradient
Surface Soil Samples												
WL-SS-LF001 - 4000	02284132	MJ0CW5	J0E32	1010	8-Jul-02	NA	X	NA	X	X	X	Bowl & Spoon Rinsate
WL-SS-LF001 - 0000	02284112	MJ0CR0	J0E12	1430	9-Jul-02	0-6"	X	X	X	NA	X	Landfill cover, area of stressed vegetation
WL-SS-LF002 - 0000	02284113	MJ0CR1	J0E13	1515	9-Jul-02	0-4"	X	X	X	NA	X	Landfill cover, near odor area
WL-SS-LF003 - 0000	02284114	MJ0CR2	J0E14	1605	9-Jul-02	2-5"	X	X	X	NA	X	Landfill cover, north-central area

Table 3-1—Sample Locations and Analyses Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Sample Number	EPA Regional Tracking	Inorganic CLP ID	Organic CLP ID	Time	Date	Sample Interval	Analyses					Notes
							TAL Metals	Cr(VI)	SVOCs	VOCs	Pest/ PCBs	
WL-SS-LF004 - 0000	02284115	MJ0CR3	J0E15	1230	10-Jul-02	0-6"	X	X	X	NA	X	Friese Hide and Tallow, area of distressed vegetation
WL-SS-LF005 - 0000	02284116	MJ0CR4	J0E16	1615	10-Jul-02	0-6"	X	X	X		X	Surface Soil Background
Subsurface Samples												
WL-SB-LF008 - 4100	02284133	MJ0CW6	J0E33	1510	9-Jul-02	NA	X	NA	X	X	X	Probe Shoe, Bowl & Spoon Rinsate
WL-SB-LF008 - 0100	02284117	MJ0CR5	J0E17	1345	10-Jul-02	9-12'	X	X	X	X	X	Subsurface Soil - northwest of landfill
WL-SB-LF008 - 0200	02284118	MJ0CR6	J0E18	1400	10-Jul-02	20-24'	X	X	X	X	X	
WL-GW-LF009 - 4240	02284134	MJ0CW7	J0E34	0920	10-Jul-02	NA	X		X	X	X	GW Screen Rinsate
WL-SB-LF009 - 0100	02284119	MJ0CR7	J0E19	0955	10-Jul-02	9-12'	X	X	X	X	X	Subsurface Soil Background - southeast of landfill
WL-SB-LF009 - 0200	02284120	MJ0CR8	J0E20	1010	10-Jul-02	21-24'	X	X	X	X	X	
WL-GW-LF009 - 0240	02284142	MJ0CW8		1130	10-Jul-02	24'	X	NA	NA	NA	NA	GW Background
WL-SB-LF010 - 0100	02284121	MJ0CR9	J0E21	1350	9-Jul-02	9-12'	X	X	X	X	X	Subsurface Soil - south of landfill
WL-SB-LF010 - 0200	02284122	MJ0CS0	J0E22	1410	9-Jul-02	20-24'	X	X	X	X	X	
WL-SB-LF011 - 0100	02284123	MJ0CS1	J0E23	1535	9-Jul-02	9-12'	X	X	X	X	X	Subsurface Soil - north of landfill
WL-SB-LF011 - 0200	02284124	MJ0CS2	J0E24	1550	9-Jul-02	20-24'	X	X	X	X	X	
Test Pit Samples												
WL-WS-LF012 - 0020	02284125	MJ0CS3	J0E25	1310	10-Jul-02	2'	X	X	X	X	X	Test Pit 1 Sample 1 of 2
WL-WS-LF013 - 0050	02284126	MJ0CT9	J0E26	1320	10-Jul-02	5'	X	X	X	X	X	Test Pit 1 Sample 2 of 2
WL-WS-LF014 - 0020	02284127	MJ0CW0	J0E27	1420	10-Jul-02	2'	X	X	X	X	X	Test Pit 2 Sample 1 of 1
WL-WS-LF015 - 0005	02284128	MJ0CW1	J0E28	0903	11-Jul-02	0.5'	X	X	X	X	X	Test Pit 3 Sample 1 of 2
WL-WS-LF016 - 0010	02284129	MJ0CW2	J0E29	0914	11-Jul-02	1'	X	X	X	X	X	Test Pit 3 Sample 2 of 2
WL-WS-LF017 - 0020	02284130	MJ0CW3	J0E30	0937	11-Jul-02	2'	X	X	X	X	X	Test Pit 4 Sample 1 of 1

Table 3-1—Sample Locations and Analyses Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Sample Number	EPA Regional Tracking	Inorganic CLP ID	Organic CLP ID	Time	Date	Sample Interval	Analyses					Notes
							TAL Metals	Cr(VI)	SVOCs	VOCs	Pest/ PCBs	
Trip Blanks/IDW Samples												
WL-WS-LF010 - 2200	02284135		J0E35	0950	8-Jul-02	NA	NA	NA	NA	X	NA	Trip Blanks
WL-SB-LF008 - 2100	02284136		J0E36	0800	10-Jul-02	NA	NA	NA	NA	X	NA	
WL-WS-LF015 - 2005	02284137		J0E37	0800	11-Jul-02	NA	NA	NA	NA	X	NA	
WL-WS-LF016 - 2010	02284138		J0E38	0805	11-Jul-02	NA	NA	NA	NA	X	NA	
WL-WT-IW001 - 0000	02284140	MJ0CW9	J0E40	1225	11-Jul-02	NA	X	NA	X	X	X	IDW

Notes:

CLP - Contract Laboratory Program.
Cr(VI) - Hexavalent chromium.
GW - Groundwater.
IDW - Investigation-derived waste.
IW - Investigation-derived waste.
LF - Landfill.
NA - Not analyzed.
Pest/PCBs - Pesticides and polychlorinated biphenyls.
SB - Subsurface soil.
SD - Sediment.
SS - Surface soil.
SVOCs - Semivolatile organic compounds.
TAL - Target Analyte List.
VOCs - Volatile organic compounds.
WL - Wilder Landfill.
WS - Landfill waste.
WT - Water.
X - Analysis conducted.
" - inches.
' - feet.

Table 3-2—Differentially-Corrected GPS Sample Station Location Coordinates Wilder Landfill—Hazardous Waste Pit PA/SI

Station ID	Datafile	Longitude	Latitude
SD001	U070819A	-122.5720738	48.81840166
SD002	U070820A	-122.5716511	48.81950855
SD003	U070820B	-122.5715155	48.81896635
SD004	U070822A	-122.5683143	48.82137997
SD005	U070822B	-122.5692271	48.82337124
SD006	U070915A	-122.5681386	48.82236084
SD007	U070915B	-122.5681073	48.82230405
SD008	U070917A	-122.5690845	48.82492937
SD009	U070918A	-122.5679652	48.82349727
SD010	U070918B	-122.5675129	48.82366809
SD011	U070919A	-122.5674865	48.82268608
SD012	U070920A	-122.5661184	48.82267408
LF001	U070921A	-122.5672139	48.82291008
LF002	U070922A	-122.5667951	48.82302414
LF003	U070923A	-122.5670531	48.82325255
LF004	U071019A	-122.5677322	48.82310825
LF005	U071023A	-122.5665546	48.82466683
LF008	NA	NA	NA
LF009	U071114A	-122.566451	48.82288508
LF010	U071015A	-122.5670431	48.82277686
LF011	U070923B	-122.5672987	48.82330544
LF012	U071114B	-122.5668677	48.82310823
LF013			
LF014	U071114C	-122.5668633	48.82315272
LF015	U071117E	-122.5671977	48.82286747
LF016			
LF017	U071118A	-122.5671451	48.82288885

Notes:

NA - Coordinate data not recorded.

Horizontal Datum is North American Datum 1983 (NAD 1983).

SECTION 4

QUALITY ASSURANCE/QUALITY CONTROL

In order to ensure data quality objectives are met, data quality indicators are evaluated to determine sample and laboratory performance. These data, known as QA/QC data, are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of sampling equipment, glassware, and reagents due to sample collection, preparation, and analysis activities.

Specific QC requirements for laboratory analyses are incorporated in the *USEPA Contract Laboratory Program Statement or Work for Inorganic Analyses, Multi-Media, Multi Concentration* (EPA, 2000b) and *USEPA Contract Laboratory Program Statement of Work for Organic Analyses, Multi-Media, Multi Concentration* (EPA, 1999a) and in the Sampling and Quality Assurance Plan for the Wilder Landfill (SQAP; Weston, 2002). These QC requirements or equivalent requirements were followed for analytical work on *Wilder Landfill—Hazardous Waste Pit site*. This section describes the QA/QC measures taken for work associated with the PA/SI and provides evaluation for the end user regarding usability of the data presented in this report.

All samples were collected following procedures outlined in the Sampling and Quality Assurance Plan for the site (Weston, 2002).

Soil and water samples were analyzed for total TAL metals following the CLP ILM04.1 SOW. Soil samples were analyzed for hexavalent chromium by a USEPA laboratory following EPA SW-846 Methods 3060A (preparation) and 7196A (analysis).

Soil and water analyses for organochlorine pesticides/PCBs, volatile organic compounds, and semivolatile organic compounds were performed following the CLP OLM04.2 SOW.

All data from analyses performed by the CLP laboratory were validated by EPA Region 10 Quality Assurance Unit. All data generated by the EPA laboratory were reviewed by the laboratory. Some of the following comments are based on Weston's review of the validated data packages.

Data qualifiers were applied as required by *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (1994), Contract Laboratory Program National Functional Guidelines for Organic Data Review (1999),* and criteria identified in the individual methods.

4.1 SATISFACTION OF DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The project data quality objectives for the field effort were designed to produce data of known and documented quality in order to characterize sources, determine off-site migration of contaminants, determine whether the site is eligible for placement on the NPL, and to document threat(s) or potential threat(s) to public health or the environment posed by the site. The Data Quality Objective (DQO) process applied to this project followed that described in the EPA document, *Guidance for the Data Quality Objectives Process* (EPA, 1994b).

All samples collected during the PA/SI investigation were analyzed using definitive analytical methods, and all analytical methods employed for this project were accepted for use by EPA. The data generated for this project met or exceeded requirements for the definitive data category as defined in *Data Quality Objective Process for Superfund* (EPA 540/G-93/71). A detailed discussion of the objectives achieved during the PA/SI is presented in the following sections.

4.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Quality control checks for sample collection were evaluated by a combination of Chain-of-Custody protocols and laboratory quality assurance as prescribed in the sampling or analytical methods. Quality control samples (e.g., matrix spike/duplicate samples, rinseate samples) at a frequency of one per 20 samples (or per method) per media were collected during the PA/SI field effort. Results from these samples were compared to each method's criteria.

All of the analyses conducted during this project produced definitive data. Data quality indicator targets for this project are specified below—DQOs are summarized in the SQAP. Bias on estimated, flagged data was determined through the validation process. The laboratories' DQOs for completeness and the field team's ability to meet the DQO for representativeness were set at 90% for soil and water samples. Precision and accuracy requirements are outlined also in the SQAP.

4.3 PROJECT-SPECIFIC DATA QUALITY OBJECTIVES

Data quality indicator (DQI) goals— precision, accuracy, representativeness, comparability, and completeness—for this project were developed following guidelines presented in EPA *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 Final, Appendix D. The basis for assessing each of the elements of data quality is discussed in the following subsections. QA objectives for measurement of analytical data and QC guidelines for precision and accuracy are presented in the SQAP. Other DQI goals are included in the individual SOPs and in the CLP Statements of Work (SOW), ILM04.1 and OLM04.2.

The laboratory and field team were able to meet project DQOs.

4.3.1.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions.

Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. When recovery results between different analytical batches are compared, the laboratory control sample (LCS) may be used to determine the precision of the analytical method. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch. Rather, the comparison is between the sample and samples analyzed in previous batches. An LCS may be prepared and analyzed within a given batch; in this case, the analytical precision is associated with a particular preparation and analysis sequence.

Total precision is the measurement of the variability associated with the entire sampling and analysis process for one sampling event. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference between the duplicate sample results. The laboratory was able to meet project DQOs, with the exceptions listed in Section 4.4.

4.3.1.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS or into a field sample (to prepare a matrix-spiked sample or matrix-spiked duplicate sample) to a control limit. The laboratory was able to meet project DQOs, with the exceptions listed in Section 4.4.

4.3.1.3 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a population, including a sampling point, a process condition, or an environmental condition. Representativeness is the qualitative term that should be evaluated to determine that measurements are made and physical samples collected at locations and in a manner resulting in characterizing a matrix or media. Subsequently, representativeness is used to ensure that a sampled population represents the target population and an aliquot represents a sampling unit. The field team was able to meet project DQOs.

4.3.1.4 Comparability

Comparability is the qualitative term that expresses the measure of confidence that two data sets or batches can contribute to a common analysis and evaluation. Comparability with respect to laboratory analyses pertains to method type comparison, holding times, stability issues, and aspects of overall analytical quantitation. The following items are evaluated when assessing data comparability:

- Determining if two data sets or batches contain the same set of parameters.
- Determining if the units used for each data set are convertible to a common metric.
- Determining if similar analytical procedures and quality assurance were used to collect data for both data sets.
- Determining if the analytical instruments used for both data sets have approximately similar detection levels.
- Determining if samples within data sets were selected and collected in a similar manner.

To ensure comparability of data collected during this investigation to other data that may have been or may be collected for the site, standard collection and measurement techniques were used. The field team was able to meet project DQOs.

4.3.1.5 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not rejected through data validation. The requirement for completeness for this project is 90% for water and soil samples.

The following formula is used to calculate completeness:

$$\%\ \text{completeness} = \frac{\text{number of valid results}}{\text{number of possible results}}$$

For this investigation, all samples are considered critical. Therefore, standard collection and measurement methods will be used to achieve the completeness goal. All laboratory data were reviewed for usability, and nearly all data (>99%) were determined to be useable. The project DQO of 90% for completeness were met.

4.4 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PARAMETERS

The laboratory data also were reviewed for technical holding time compliance, blank samples contamination, laboratory control sample recovery, surrogate and internal standard recoveries, inductively-coupled plasma-atomic emission spectrometry (ICP-AES) interference check sample (ICS) performance, duplicate sample analysis, matrix spike sample analysis, and serial dilution performance. These parameters are described below in more detail, and sample-specific detail is provided in the data validation memoranda (Appendix C).

4.4.1 Holding Times

All analyses were completed within the technical holding times for all analyses, with the following exception:

- One or more samples were extracted for SVOC analysis at 16-days following collection. All analyte results associated with the samples were qualified as estimated (J) due to holding time exceedance.

4.4.2 Initial Calibration

All initial calibration QC criteria were met, with the following exception:

- The low-concentration calibration standard associated with 1,2,4-trichlorobenzene exceeded average response factor precision criteria and was not used in quantification. The reporting limit was raised to reflect omission of this standard.

4.4.3 Blank Sample Results

All blank sample analyses met the frequency criteria. The following contaminants of concern were detected in the blank samples:

- Thallium recoveries exhibited negative results whose absolute values were greater than the instrument detection limit (IDL) in one or more water preparation blanks.
- Aluminum, barium, iron, and magnesium recoveries were greater than the IDLs in one or more water preparation blanks.
- Silver recoveries were greater than the IDL in one or more soil preparation blanks.
- Selenium recoveries exhibited negative results whose absolute values were greater than the IDL in one or more soil preparation blanks.
- Methylene chloride, toluene, and 1,2,4-dichlorobenzene were detected in one or more VOC blank sample analyses.
- Acetophenone, bis(2-ethylhexyl)phthalate, benzaldehyde, and indeno(1,2,3-c,d)pyrene were detected in one or more SVOC preparation blanks.
- Alpha-BHC was detected in one or more pest/PCB preparation blanks.

For inorganic analyses, any associated sample result less than five-times the blank level was qualified as non-detected (U). Associated sample results were qualified as estimated concentrations (J or UJ), unknown bias, if the sample result was less than five-times the absolute value of the negative blank concentration.

For organic analyses, any associated sample result less than five-times the blank level was qualified as non-detected (U). If the analyte is considered a common laboratory contaminant, any associated sample result less than ten-times the blank level was qualified as non-detected (U).

4.4.4 Calibration Check Sample Analysis

All calibration check sample analyses met frequency and recovery criteria, with the following exceptions:

- The percent difference determination for acetone, methyl acetate, 4-methyl-2-pentanone, 2-hexanone, bromoform, 1,1,2,2-tetrachloroethane, and 1,2-dibromo-3-chloropropane in one or more VOC continuing calibration verification (CCV) check sample analyses exceeded the accepted criteria. Associated analyte results for all samples were qualified as estimated (J), unknown bias.

- The percent difference determinations for hexachlorocyclopentadiene and 2,4-dinitrophenol exceeded the acceptance criteria for SVOC CCV analysis. Results for these analytes in the associated samples were qualified as estimated (J), unknown bias.

4.4.5 Laboratory Control Samples

All laboratory control samples analyzed met frequency and recovery criteria, with the following exceptions:

- Sodium recovery exceeded the upper control limit for one or more LCS analyses. All detected sodium results associated with these LCS analyses were qualified as estimated (J), unknown bias.

4.4.6 ICP-AES Interference Check Samples

All analytical sequences met frequency and recovery criteria for ICS analysis.

4.4.7 Duplicate Sample Analysis

Duplicate sample precision and frequency criteria were met, with the following exception:

- Lead and manganese duplicate precision exceed the acceptance criteria in one or more samples. All sample results for these analytes were qualified as estimated (J), unknown bias.

4.4.8 Matrix Spike Sample Analysis

Matrix spike analysis met recovery requirements, with the following exceptions:

- MS/MSD recoveries were below acceptance criteria for one or more pesticide/PCB analyses, as were surrogate recoveries. All pest/PCB results for the associated samples were qualified as estimated (J), possible low bias.
- Antimony exhibited low matrix spike recovery in one or more soil/sediment samples. This effect is well documented in the SW-846 preparation method. All associated data were qualified as estimated concentrations (J), possible low bias.
- Lead exhibited low matrix spike recovery in one or more soil/sediment samples. All associated data were qualified as estimated concentrations (J), possible low bias.
- Recoveries of hexavalent chromium from each of the matrix spike and duplicate spike sample pair were near zero. Recovery of the post-digestion spike failed also. Results for all samples associated with this MS/MSD pair were rejected (R) for use.

4.4.9 System Monitoring Compound (Surrogate) Spike Analysis

Surrogate spike analysis is used to assess recovery of organic compounds from the matrix that are structurally similar to the target compounds but are unlikely to occur naturally.

All Pest/PCB surrogate recoveries met acceptance criteria, with the following exception:

- Surrogate recoveries were below acceptance criteria in one or more samples, as were MS/MSD recoveries. All pest/PCB results for the samples were qualified as estimated (J), possible low bias.

4.4.10 Internal Standard Spike Analysis

Internal standard analysis was acceptable for the applicable analyses included in this investigation.

4.4.11 Serial Dilutions

All serial dilutions met the frequency criteria. The following analytes exceeded serial dilution QC limits:

- Calcium, copper, and potassium exceeded the recovery criteria in one or more soil/sediment samples. All associated data were qualified as estimated concentrations (J), unknown bias.

4.4.12 Other Data Assessment

No other data were considered in qualifying the analytical results for the project, with the following exceptions:

- Metals results from the analysis one or more soil samples were qualified based on percent solids recovery. In some of the samples, all results were qualified as estimated, unknown bias, due to low percent solids content. In the remaining samples, detected analyte results were qualified as estimated (J), unknown bias, and non-detected results rejected for use (R) due to extremely low percent solids content.
- Beta-BHC failed dual-column confirmation criteria for pest/PCB analysis of one or more samples; the associated analytical results have been qualified as estimated (J), tentative identification (N), unknown bias.
- Compounds 2,2'-oxybis(1-chloropropane) and benzaldehyde exhibited poor spectral match for SVOC in one or more samples. The results for these two analytes in the affected samples have been qualified as non-detected (U).

SECTION 5

ANALYTICAL RESULT REPORTING AND BACKGROUND SAMPLES

The following sections present the reporting criteria and reporting methods applied to the PA/SI data set. This section also presents the locations, analyses conducted, and analytical results of designated background samples collected during this PA/SI. Sample locations are presented in Figures 3-1 and 3-2. Tables 5-1, 5-2, 5-3, and 5-4 present the analytical results for the background surface soil, subsurface soil, sediment, and groundwater samples collected. Data validation memoranda and Form I analytical results are included in Appendix C.

5.1 EVALUATION CRITERIA AND RATIONALE

Analytical results of samples collected during this PA/SI are presented in summary tables in Sections 5.2 (background samples), 6 (potential source characterization), and 7 (migration/ exposure pathways and targets). The first column of each analytical summary table presents background sample concentrations (where appropriate) followed by the analytical results of samples collected for that particular media. The background sample concentrations were used for comparison purposes to determine detections at or above background. All compounds detected above laboratory detection limits are presented in bold type. Analytical results indicating significant concentrations in source samples (Section 6) relative to background concentrations are presented in underlined and bold type. Similarly, analytical results indicating elevated concentrations of contaminants in target samples (Section 7) relative to background concentrations are presented in underlined and bold type. For target sample results, only analytes that were also detected in a source at the site were evaluated to determine whether the concentrations were elevated. For the purposes of this investigation, significant/elevated concentrations are:

- Equal to or greater than the sample's quantitation limit (SQL) if the analyte was not detected in the background samples collected for that media.
- Equal to or greater than the background sample's SQL when background concentrations were detected below the SQL (B- or Q- flagged).
- At least three times greater than the background concentration when the background concentration equals or exceeds the SQL.

Based on the EPA Region 10 policy regarding common earth crust elements, aluminum, calcium, iron, magnesium, potassium, and sodium are listed if detected; however, the concentrations were not evaluated or discussed in the text.

5.2 BACKGROUND SAMPLE LOCATIONS AND ANALYTICAL RESULTS

A total of nine background samples: one surface soil, one groundwater, two subsurface soil, and five sediment, were collected in areas believed to represent background environmental conditions in the site vicinity.

5.2.1 Background Surface Soil Sample

5.2.1.1 Sample Location

One surface soil background sample (LF005) was collected approximately 500 feet north of the landfill site, in an open field on the Wilder property (Figure 3-2). The sample consisted of grayish brown silty clay with sand.

5.2.1.2 Analytical Results

The analytical results summary for the background soil sample (LF005) is presented in Table 6-2. Concentrations of SVOCs, pesticides, PCBs, and hexavalent chromium were not reported above the SQLs in LF005 (Table 6-2). Eleven TAL metals were detected above their respective SQLs, including: arsenic, barium, chromium, cobalt, copper, lead, manganese, nickel, mercury, vanadium, and zinc.

5.2.2 Background Subsurface Soil Samples

5.2.2.1 Sample Location

Two subsurface soil samples were collected from a pushprobe located directly upgradient (southeast) of the landfill boundary. Sample LF009-0100, collected from the nine-to-twelve-feet bgs interval, consisted of greenish gray silty clay with a very thin bed of very fine sand. Sample LF009-0200, collected from the 21-24 feet bgs interval, consisted of greenish gray silty clay.

5.2.2.2 Analytical Results

The analytical results summary for LF009-0100 is presented in Table 6-3, and the analytical results summary for LF009-0200 is presented in Table 6-4. Neither sample contained concentrations of VOCs, SVOCs, pesticides, PCBs, or hexavalent chromium above the SQL. LF009-0100 and LF009-0200 each contained concentrations of at least 10 of the 23 TAL metals above the SQLs, including: arsenic, barium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc. LF009-0100 also contained concentrations of selenium above the SQL.

5.2.3 Background Sediment Samples

5.2.3.1 Sample Locations

Three background samples were collected from drainage ditches along the overland flow pathway to Claypit Pond. SD010 was collected from the drainage ditch north of the landfill, at a point upgradient of the site (Figure 3-1). This sample resembled soil, consisting of medium grayish brown silt with clay, with abundant organic matter and lenses of clayey silt with redox staining. Sample SD012 was collected from the drainage ditch south of the landfill, at a point upgradient of the landfill boundary (Figure 3-1). This sample also resembled soil and consisted of dark grayish brown clayey silt with abundant organic matter. SD008 was collected from a drainage stream near the BNRR north of the Friese facility, on Wilder property, approximately 989 feet upgradient of the railroad culvert draining to Claypit Pond (Figure 3-2). This sample consisted of gray clayey silt with few orange redox staining or mottling.

Two background sediment samples were collected from the in-water segment of the surface water pathway. One sample (SD005) was collected from the north end of Claypit Pond (Figure 3-2), and consisted of dark brownish gray clayey silt with a trace of sand, with few organics. The other sample (SD002) was collected from Tennant Lake Creek, approximately 200 feet upgradient of the Claypit Pond drainage stream (Figure 3-2). This sample consisted of medium gray clayey silt with lenses of silty clay, with some plant debris.

5.2.3.2 Analytical Results

A summary of analytical results for SD010 are included in Table 7-2; those for SD012 are included in Table 7-3; those for SD008 are included in Table 7-4, those for SD005 are included in Table 7-5, and those for SD002 are included in Table 7-6.

No SVOCs were detected above SQLs in any of the background samples collected during the investigation. One pesticide (dieldrin) was detected in sample SD010 collected from the drainage ditch north of the landfill. No PCBs or hexavalent chromium were detected in any of the background sediment samples. Chromium, copper, lead, and zinc were detected above the SQLs in each background sediment sample. In addition detections, the following metals were also detected above the SQLs in the following samples:

- Arsenic, barium, nickel, and vanadium were detected in background sediment sample SD0002.
- Vanadium were detected in SD005.
- Arsenic, barium, cadmium, cobalt, nickel, selenium, and vanadium were detected in SD012.
- Nickel and vanadium were detected in SD010.

5.2.4 Background Groundwater Sample

5.2.4.1 Sample Location

Groundwater encountered in the upgradient boring (LF009) during the PA/SI field event. The boring yielded only approximately 0.5 liter of groundwater; this sample was analyzed for TAL metals.

5.2.4.2 Analytical Results

TAL metals were detected in the groundwater sample from LF009, including: arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc (Table 5-1).

Table 5-1—Background Groundwater Sample Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Upgradient Groundwater
Location	LF009
CLP Sample ID	MJ0CW8
EPA Sample Number	02284142
Weston Sample ID:	WL-GW-LF009-0240
STATION ID:	LF009
Depth (feet)	24
Inorganics (µg/L)	
Aluminum	**405,000**
Arsenic	**166**
Barium	**2,100**
Beryllium	**6.3**
Cadmium	**34.6**
Calcium	**203,000**
Chromium	**1,110**
Cobalt	**321**
Copper	**1,640**
Iron	**637,000**
Lead	**110**
Magnesium	**291,000**
Manganese	**10,200**
Nickel	**1,190**
Potassium	**52,700**
Selenium	**122**
Silver	**15.3**
Sodium	**286,000**
Total Mercury	**2.3**
Vanadium	**1,400**
Zinc	**1,620**

Notes:

Bold - The reported concentration exceeds the sample quantitation limit (SQL).

CLP - Contract Laboratory Program.

GW - Groundwater.

J - The analyte was positively identified; the associated numerical result is an estimate.

K - Unknown Bias.

LF - Landfill.

µg/L - micrograms per liter.

NA - Not analyzed.

U - The analyte was not detected at or above the reported result.

SECTION 6

WASTE SOURCE CHARACTERIZATION

The following section presents the locations, analyses conducted, and analytical results of samples collected from potential site sources identified during this PA/SI, as well as for subsurface soil samples collected. Source sample locations are presented in Figure 3-2. Table 6-1 presents the analytical results of the landfill test pit samples that were collected for attribution purposes. Table 6-2 presents the analytical results of the landfill cover surface soil samples and a comparison to background soil concentrations. Data validation memoranda and Form I Analytical Results are included in Appendix C.

6.1 WASTE SOURCE SAMPLE LOCATIONS AND ANALYTICAL RESULTS

As presented in Section 3.1.1, samples for source characterization were collected from within the landfill boundary as determined by the geophysical investigation. These samples consisted of landfill cover surface soil and landfill subsurface soil, which were collected on July 9, 10, and 11, 2002.

Sample locations were selected at those places most likely to contain detectable concentrations of hazardous substances (e. g., exposed debris, stressed vegetation, noticeable odors) within the landfill boundary. The following sections present the locations and analytical results of samples collected from these sources. Since potentially contaminated subsurface soil could be a source to the groundwater and groundwater to surface water pathways, analytical results of subsurface soil samples collected during this investigation are also addressed in this section. Analytical results of potentially contaminated surface soils are also presented in Section 7 (Migration/Exposure Pathways and Targets).

6.1.1 Landfill Waste

6.1.1.1 Sample Locations

Six waste samples (LF012 to LF017) were collected from four test pits excavated within the boundary of the landfill (Figure 3-1). Test pit locations were selected based on surface evidence of odors or stressed vegetation, and were approved by the EPA TM prior to excavation.

Samples LF012 and LF013 were collected from a test pit excavated at the point at which a strong odor (similar to mercaptan) seemed to emanate from the ground. LF012 was collected from approximately 2 feet bgs, and LF013 was collected from approximately 5 feet bgs. LF014 was collected from a second test pit excavated approximately 15 feet north of the first test pit, at approximately 2 feet bgs.

Samples LF015 and LF016 were collected from a third test pit excavated in an area of stressed vegetation (near the location of surface soil sample LF001). LF015 was collected from approximately 0.5 feet bgs, and LF016 was collected from approximately 1 foot bgs. Sample LF017 was collected from a fourth test pit excavated approximately 15 feet east of the third test pit, at approximately 2 feet bgs.

6.1.1.2 Analytical Results

The summary of analytical results for the landfill waste samples is presented in Table 6-1. Acetone was the only VOC detected above SQLs; it was detected in sample LF013.

Bis(2-ethylhexyl) phthalate was the only SVOC detected above SQLs in four of the six waste samples collected, including LF012, LF013, LF014, and LF015. No additional SVOCs were detected in the remainder of the waste samples collected from the landfill.

Waste samples also contained concentrations of seven pesticides (4,4'-DDD, 4,4-DDT, Alpha-chordane, Beta-BHC, dieldrin, beta endosulfan, and gamma-chlordane), two PCB Aroclors (1254 and 1260), and several TAL metals reported above SQLs (Table 6-1).

6.1.2 Landfill Cover Surface Soil

6.1.2.1 Sample Locations

Four surface soil samples (LF001, LF002, LF003, and LF004) were collected from within the landfill boundary (Figure 3-1). LF001 was collected from an area of apparently stressed vegetation that also had metal debris protruding from the surface. This sample consisted of dark brown silt with fine sand and clay. A rusted bolt was also observed in the volume initially collected.

LF002 was collected in the vicinity of where a strong odor (similar to mercaptan) seemed to emanate from the ground. This sample consisted of dark grayish brown clayey silt with fine sand and a trace of glass debris.

LF003 was collected from the north-central area of the landfill cover. This sample consisted of dark grayish brown clayey silt with sand.

LF004 was collected from an area of apparently stressed vegetation on the Friese property lawn, and consisted of dark medium brown sandy clayey silt with lenses of orange and gray clayey silt.

6.1.2.2 Analytical Results

A summary of the analytical results of the landfill cover surface soil is included in Table 6-2. No concentrations of SVOCs were reported above SQLs in any of the samples collected from the landfill cover. Two pesticides were detected at significant concentrations: alpha-BHC detected in sample LF001 at 3.6 μg/kg, and dieldrin detected in LF004 at 6.7 μg/kg. Significant concentrations of cadmium (2.6 mg/kg), copper (estimated at 539 mg/kg), lead (345 mg/kg), selenium (2.8 mg/kg), silver (3.9 mg/kg), thallium (3.9 mg/kg), and zinc (1,400 mg/kg) were detected in LF001, as was the chromium concentration detected in LF002 (382 mg/kg), and selenium (1.5 mg/kg) in LF003.

6.1.3 Vicinity Subsurface Soil

6.1.3.1 Sample Locations

Three subsurface pushprobes were advanced near the boundaries of the landfill, and samples were collected from the 9 feet to 12 feet bgs interval, and approximately from 20 feet to 24 feet bgs interval in each pushprobe. LF008 was advanced to the northeast (downgradient) of the landfill, on Friese property. LF010 was advanced to the southeast (cross-gradient) of the landfill, and LF011 was advanced to the north (cross-gradient) of the landfill.

6.1.3.2 Analytical Results

The analytical results summary for the 9 feet to 12 feet bgs interval samples is presented in Table 6-3. Only one of the detected constituents (acetone; VOCs) is present at concentrations significantly above background in LF008 (23 μg/kg) and LF011 (16 μg/kg). Since acetone is a common laboratory contaminant, the low detected concentrations may be indicative of this rather than actual concentrations in soil.

The analytical results summary for the 20 feet to 245 feet bgs interval samples is presented in Table 6-4. None of the detected constituents is present at concentrations significantly above background.

Table 6-1—Landfill Waste Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Test Pit Excavation Samples					
Location	Within Landfill Boundary					
Organic CLP Sample ID	J0E25	J0E26	J0E27	J0E28	J0E29	J0E30
Inorganic CLP Sample ID	MJ0CS3	MJ0CT9	MJ0CW0	MJ0CW1	MJ0CW2	MJ0CW3
EPA Sample Number	02284125	02284126	02284127	02284128	02284129	02284130
Weston Sample ID:	LF012	LF013	LF014	LF015	LF016	LF017
STATION ID:	WL-WS-LF012-0020	WL-WS-LF013-0050	WL-WS-LF014-0020	WL-WS-LF015-0005	WL-WS-LF016-0010	WL-WS-LF017-0020
Depth (feet)	2	5	2	1	1	2
VOCS (μg/kg)						
Acetone	30 U	**69**	12 U	12 U	13 U	12 U
Isopropylbenzene	30 U	4 QJK	12 U	12 U	13 U	12 U
Methylcyclohexane	30 U	5 QJK	12 U	12 U	13 U	12 U
SVOCs (μg/kg)						
1,1-Biphenyl	33 QJK	130 QJK	71 QJK	25 QJK	2,100 U	13 QJK
2,4-dimethylphenol	1,000 U	200 QJK	450 U	410 U	2,100 U	400 U
2-methylnaphthalene	77 QJK	370 QJK	140 QJK	110 QJK	1,600 QJK	29 QJK
4-Methylphenol	300 QJK	1,900 QJK	91 QJK	410 U	2,100 U	400 U
Acenaphthene	1,000 U	290 QJK	19 QJK	410 U	2,100 U	400 U
Acenaphthylene	1,000 U	150 QJK	19 QJK	410 U	2,100 U	400 U
Acetophenone	78 QJK	310 QJK	79 QJK	37 QJK	2,100 U	38 QJK
Anthracene	1,000 U	2,500 U	23 QJK	410 U	2,100 U	12 QJK
Benzaldehyde	1,000 U	200 QJK	96 QJK	70 QJK	2,100 U	99 QJK
Benzo(a)anthracene	42 QJK	390 QJK	27 QJK	410 U	2,100 U	50 QJK
Benzo(b)fluoranthene	1,000 U	340 QJK	19 QJK	410 U	2,100 U	51 QJK
Benzo(k)fluoranthene	1,000 U	170 QJK	450 U	410 U	2,100 U	44 QJK
Benzo-a-pyrene	1,000 U	2,500 U	24 QJK	410 U	2,100 U	47 QJK
Benzyl Butyl Phthalate	1,000 U	2,500 U	75 QJK	35 QJK	2,100 U	30 QJK
Bis(2-ethylhexyl) Phthalate	**1,700**	**3,600**	**1,100**	**520**	1,900 QJK	340 QJK
Carbazole	1,000 U	2,500 U	450 U	410 U	2,100 U	16 QJK
Chrysene	60 QJK	980 QJK	54 QJK	410 U	2,100 U	66 QJK
Di-n-butylphthalate	58 QJK	2,500 U	33 QJK	18 QJK	2,100 U	13 QJK
Di-n-octylphthalate	1,000 U	2,500 U	51 QJK	410 U	2,100 U	32 QJK
Dibenzofuran	1,000 U	2,500 U	17 QJK	410 U	2,100 U	400 U
Diethyl Phthalate	1,000 U	2,500 U	20 QJK	410 U	2,100 U	400 U
Dimethyl Phthalate	110 QJK	2,500 U	170 QJK	31 QJK	2,100 U	300 QJK
Fluoranthene	94 QJK	1,500 QJK	79 QJK	24 QJK	2,100 U	110 QJK
Fluorene	42 QJK	380 QJK	33 QJK	410 U	2,100 U	400 U
Indeno (1,2,3-cd) Pyrene	1,000 U	2,500 U	450 U	410 U	2,100 U	25 QJK
N-nitrosodiphenylamine	1,000 U	2,500 U	34 QJK	410 U	2,100 U	400 U
Naphthalene	99 QJK	450 QJK	150 QJK	71 QJK	2,100 U	25 QJK
Pentachlorophenol	160 QJK	6,200 U	1,100 U	1,000 U	5,400 U	1,000 U
Phenanthrene	150 QJK	1,400 QJK	140 QJK	43 QJK	130 QJK	72 QJK
Pyrene	130 QJK	2,200 QJK	160 QJK	25 QJK	2,100 U	120 QJK
Pesticides & PCBS (μg/kg)						
4,4'-DDD (p,p'-DDD)	10 U	**11**	4.5 U	**4.4**	4.3 U	4.0 U
4,4'-DDT (p,p'-DDT)	10 U	7.1 JNK	4.5 U	**52**	4.3 U	4.0 U
Aldrin	5.2 U	6.0 JNK	2.3 U	2.1 U	2.2 U	2.1 U
Alpha-chlordane	5.2 U	4.8 JNK	**26 JK**	1.9 QJK	2.2 U	2.2 U
Beta-BHC	**6.4 JK**	14 JNK	2.3 U	3.4 JNK	2.2 U	2.7 JNK
Dieldrin	10 U	**18 JK**	4.5 U	4.1 U	5.4 U	4.0 U
Endosulfan II (beta)	10 U	**12 JK**	4.5 U	4.1 U	4.3 U	4.0 U
Endrin	10 U	5.5 JNK	4.5 U	4.1 U	4.3 U	4.0 U
Gamma-Chlordane	5.2 U	5.3 JNK	**27**	2.1 U	2.2 U	2.1 U
PCB-1254 (Aroclor 1254)	100 U	49 U	45 U	41 U	**340**	**65**
PCB-1260 (Aroclor 1260)	100 U	49 U	45 U	41 U	**86**	40 U
Inorganics (mg/kg)						
Aluminum	**5,410**	**40,600**	**43,300**	**24,400**	**28,900**	**19,500**
Antimony	2.0 UJK	11.0 BJK	12.8 BJK	**34.9 JL**	6.9 BJK	14.2 BJK
Arsenic	1.7 U	**11.7**	**22.0**	**22.6**	**13.9**	**13.9**
Barium	**148**	**431**	**361**	**304**	**223**	**378**
Beryllium	1.8 BJK	0.19 BJK	0.09 BJK	0.10 BJK	0.47 BJK	0.08 BJK
Cadmium	1.9 BJK	**8.5**	**6.3**	**4.3**	**3.3**	**3.7**
Calcium	**11,800**	**30,100**	**31,700**	**27,800**	**39,700**	**24,200**
Chromium	**37,200**	**267**	**68.7**	**71.2**	**72.4**	**346**
Chromium (Hexavalent)	R	2.0 U	R	R	R	R
Cobalt	7.9 BJK	10.8 BJK	**15.2**	**19.9**	**19.0**	**21.0**
Copper	**344 JL**	**693 JL**	**1,820 JL**	**1,050 JL**	**582 JL**	**24,400 JL**
Iron	**32,700**	**54,900**	**91,300**	**109,000**	**39,400**	**70,300**
Lead	**223 JL**	**462 JL**	**729 JL**	**8,300 JL**	**367 JL**	**795 JL**
Magnesium	2,500 BJK	**3,250**	**3,080**	**2,950**	**8,200**	**2,450**
Manganese	**270 JK**	**786 JK**	**1,200 JK**	**1,140 JK**	**873 JK**	**912 JK**
Nickel	17.7 BJK	**35.2**	**107**	**98.1**	**51.7**	**401**
Potassium	495 BJK	**1,520 JL**	1,260 BJK	834 BJK	**1,660 JL**	**1,250 JL**
Selenium	1.7 UJK	**2.5**	**3.7**	**4.4**	**1.5 JL**	**2.8**
Silver	2.9 U	**5.0**	**10.3**	**8.8**	**3.7**	**9.0**

Table 6-1—Landfill Waste Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Test Pit Excavation Samples					
Location	Within Landfill Boundary					
Organic CLP Sample ID	J0E25	J0E26	J0E27	J0E28	J0E29	J0E30
Inorganic CLP Sample ID	MJ0CS3	MJ0CT9	MJ0CW0	MJ0CW1	MJ0CW2	MJ0CW3
EPA Sample Number	02284125	02284126	02284127	02284128	02284129	02284130
Weston Sample ID:	LF012	LF013	LF014	LF015	LF016	LF017
STATION ID:	WL-WS-LF012-0020	WL-WS-LF013-0050	WL-WS-LF014-0020	WL-WS-LF015-0005	WL-WS-LF016-0010	WL-WS-LF017-0020
Depth (feet)	2	5	2	1	1	2
Sodium	2,240 BJK	**5,730 JH**	**6,320 JH**	**5,380 JH**	**4,660 JH**	**9,820 JH**
Thallium	3.2 BJK	2.0 BJK	**6.8**	**6.5**	**2.9**	**4.5**
Total Mercury	**0.61**	**0.51**	**0.47**	**0.47**	**1.2**	**0.68**
Vanadium	**103**	**20.1**	**23.9**	**16.0**	**32.8**	**16.8**
Zinc	**403**	**1,710**	**2,920**	**2,080**	**1,360**	**4,700**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
H - high bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
LF - Landfill.
µg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
N - The analyte was tentatively identified.
PCBs - Polychlorinated Biphenyls.
Q - The result is above the method detection limit (MDL), but below the SQL.
R - Quality control indicates the data are unusable (analyte may or may not be present).
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
VOCs - Volatile organic compounds.
WL - Wilder Landfill.
WS - Landfill waste.

Table 6-2—Landfill Cover Surface Soil Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background Soil	Landfill Cover Soil			
Location	North of Site	Within Landfill Boundary			
Organic CLP Sample ID	J0E16	J0E12	J0E13	J0E14	J0E15
Inorganic CLP Sample ID	MJ0CR4	MJ0CR0	MJ0CR1	MJ0CR2	MJ0CR3
EPA Sample Number	02284116	02284112	02284113	02284114	02284115
Weston Sample ID:	WL-SS-LF005-0000	WL-SS-LF001-0000	WL-SS-LF002-0000	WL-SS-LF003-0000	WL-SS-LF004-0000
STATION ID:	LF005	LF001	LF002	LF003	LF004
Depth (feet)	0 to 0.5	0 to 0.5	0 to 0.33	0.17 to 0.42	0 to 0.5
SVOCs (μg/kg)					
1,1-Biphenyl	460 U	24 QJK	460 U	420 U	400 U
2-methylnaphthalene	460 U	110 QJK	460 U	420 U	400 U
Benzo(a)anthracene	460 U	14 QJK	460 U	420 U	400 U
Benzo-a-pyrene	460 U	16 QJK	460 U	420 U	400 U
Benzyl Butyl Phthalate	460 U	380 QJK	460 U	420 U	400 U
Bis(2-ethylhexyl) Phthalate	460 U	330 QJK	410 QJK	420 U	47 QJK
Chrysene	460 U	26 QJK	460 U	420 U	400 U
Di-n-octylphthalate	460 U	39 QJK	460 U	93 QJK	400 U
Dimethyl Phthalate	460 U	82 QJK	460 U	420 U	400 U
Fluoranthene	460 U	35 QJK	460 U	420 U	400 U
Naphthalene	460 U	61 QJK	460 U	420 U	400 U
Phenanthrene	460 U	43 QJK	460 U	420 U	400 U
Pyrene	460 U	36 QJK	460 U	420 U	400 U
Pesticides & PCBs (μg/kg)					
Alpha-BHC	2.4 U	**3.6**	2.4 U	2.2 U	2.1 U
Dieldrin	4.6 U	4.1 U	4.6 U	4.2 U	**6.7**
Inorganics (mg/kg)					
Aluminum	**15,900**	**13,900**	**18,000**	**16,700**	**16,800**
Antimony	1.6 BJK SQL = 16.5 U	7.3 BJK	1.1 UJK	0.98 UJK	0.97 UJK
Arsenic	**5.1**	**11.5**	**6.5**	**5.6**	**5.1**
Barium	**116**	**199**	**117**	**115**	**109**
Beryllium	0.27 BJK SQL = 1.37 U	0.12 BJK	0.30 BJK	0.26 BJK	**0.22 JK**
Cadmium	0.17 U	**2.6**	0.44 BJK	0.23 BJK	0.15 U
Calcium	**4,800**	**8,780 JL**	**3,870 JL**	**4,080 JL**	**3,390 JL**
Chromium	**39.1**	**58.5**	**382**	**40.9**	**39.4**
Cobalt	**14.5**	**12.7**	**16.8**	**14.1**	**14.6**
Copper	**35.6 JL**	**539 JL**	**55.7 JL**	**35.6 JL**	**32.6 JL**
Iron	**25,500**	**68,200**	**30,400**	**26,800**	**25,400**
Lead	**12.2 JL**	**345**	**22.2**	**14.7**	**8.3**
Magnesium	**7,840**	**2,790**	**6,570**	**6,190**	**6,330**
Manganese	**566 JK**	**576**	**711**	**565**	**515**
Nickel	**42.5**	**73.6**	**38.5**	**34.5**	**38.8**
Potassium	1,370 BJK	1,080 BJK	**1,520 JL**	**1,430 JL**	1,150 BJK
Selenium	1.2 BJK SQL = 1.38 U	**2.8**	1.4 BJK	**1.5**	1.2 BJK
Silver	0.67 U	**3.9**	0.33 U	0.30 U	0.30 U
Sodium	999 BJK	**4,650 JH**	1,360 BJK	802 BJK	855 BJK
Thallium	1.3 U	**3.9**	1.3 U	1.2 U	1.2 U
Total Mercury	**0.29**	**0.38**	**0.15**	**0.19**	0.09 BJK
Vanadium	**55.2**	**23.0**	**65.0**	**58.1**	**55.5**
Zinc	69.1	**1,400**	**110**	**84.5**	62.9

Notes:

Bold - The reported concentration exceeds the sample quantitation limit (SQL).
Bold and Underlined - The reported concentration is significantly above background concentrations and was attributed to a source (see Section 5 for detailed explanation).
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
H - High bias.
L - Low bias.
LF - Landfill.
μg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
PCBs - Polychlorinated Biphenyls.
Q - The result is above the method detection limit (MDL), but below the SQL.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.
WS - Landfill waste.

Table 6-3—Landfill Vicinity Subsurface Soil Samples (9-12 feet bgs) Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Landfill Vicinity Subsurface Soil (9-12 feet bgs)		
Location	Southeast	Northwest of Landfill	South of Landfill	North of Landfill
Organic CLP Sample ID	J0E19	J0E17	J0E21	J0E23
Inorganic CLP Sample ID	MJ0CR7	MJ0CR5	MJ0CR9	MJ0CS1
EPA Sample Number	02284119	02284117	02284121	02284123
Weston Sample ID:	WL-SB-LF009-0100	WL-SB-LF008-0100	WL-SB-LF010-0100	WL-SB-LF011-0100
STATION ID:	LF009	LF008	LF010	LF011
Depth (feet)	9 to 12	9 to 12	9 to 12	9 to 12
VOCS (μg/kg)				
Acetone	13 U	**23**	14 U	**16**
SVOCs (μg/kg)				
Bis(2-ethylhexyl) Phthalate	430 U	66 QJK	75 QJK	110 QJK
Inorganics (mg/kg)				
Aluminum (EC)	**15,400**	**18,700**	**21,800**	**19,500**
Antimony	1.3 BJK SQL = 15.48 U	**1.0 UJK**	1.3 BJK	1.4 BJK
Arsenic	**6.7**	**5.8**	**6.6**	**5.8**
Barium	**92.7**	**114**	**120**	**115**
Beryllium	0.25 BJK SQL = 1.29 U	0.40 BJK	0.40 BJK	0.37 BJK
Cadmium	0.15 U	0.16 U	0.18 BJK	0.16 U
Calcium (EC)	**5,230**	**6,050**	**6,700**	**5,900**
Chromium	**45.9**	**55.5**	**57.7**	**52.1**
Cobalt	**16.0**	**13.7**	**20.1**	**18.6**
Copper	**45.2 JL**	**45.0 JL**	**61.4 JL**	**54.3 JL**
Iron (EC)	**29,000**	**32,000**	**37,500**	**33,700**
Lead	**4.1 JL**	**4.4 JL**	**5.8 JL**	**5.7 JL**
Magnesium (EC)	**9,380**	**10,200**	**13,800**	**11,900**
Manganese	**609 JK**	**447 JK**	**631 JK**	**739 JK**
Nickel	**53.4**	**58.0**	**67.3**	**65.2**
Potassium (EC)	**1,700 JL**	1,130 BJK	**2,420 JL**	**1,860 JL**
Selenium	**1.6 JL**	0.88 BJK	**1.6 JL**	**1.1 BJK**
Silver	0.41 BJK SQL = 2.58 U	0.66 U	0.63 BJK	0.78 U
Sodium (EC)	1,230 BJK	**1,430 JH**	**1,520 JH**	**1,620 JH**
Total Mercury	0.06 U	0.07 U	0.07 BJK	0.08 BJK
Vanadium	**60.6**	**69.1**	**73.1**	**69.2**
Zinc	**66.9**	**63.6**	**91.9**	**83.6**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
EC - Earth Crust metal.
H - High bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
LF - Landfill.
μg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Q - The result is above the method detection limit (MDL), but below the SQL.
SB - Subsurface soil.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
VOCs - Volatile organic compounds.
WL - Wilder Landfill.

Table 6-4—Landfill Vicinity Subsurface Soil Samples (20-24 feet bgs) Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Landfill Vicinity Subsurface Soil Samples (20-24 feet bgs)		
Location	Southeast	Northwest of Landfill	South of Landfill	North of Landfill
Organic CLP Sample ID	J0E20	J0E18	J0E22	J0E24
Inorganic CLP Sample ID	MJ0CR8	MJ0CR6	MJ0CS0	MJ0CS2
EPA Sample Number	02284120	02284118	02284122	02284124
Weston Sample ID:	WL-SB-LF009-0200	WL-SB-LF008-0200	WL-SB-SB010-0200	WL-SB-SB011-0200
STATION ID:	LF009	LF008	LF010	LF011
Depth (feet)	21 to 24	20 to 24	20 to 24	20 to 24
SVOCs (μg/kg)				
Bis(2-ethylhexyl) Phthalate	81 QJK	140 QJK	49 QJK	56 QJK
Pesticides & PCBS (μg/kg)				
Dieldrin	4.5 U	4.5 U	4.6 U	2.1 QJK
Inorganics (mg/kg)				
Aluminum (EC)	**15,200**	**16,600**	**15,600**	**17,600**
Antimony	1.3 BJK SQL = 16.57 U	1.1 UJK	1.1 UJK	1.1 UJK
Arsenic	**9.1**	**5.7**	**8.8**	**5.5**
Barium	**88.1**	**99.7**	**94.3**	**107**
Beryllium	0.22 BJK SQL = 1.38 U	0.27 BJK	0.24 BJK	0.27 BJK
Cadmium	0.24 BJK SQL = 1.38 U	0.17 U	0.16 U	0.17 U
Calcium (EC)	**5,780**	**11,400**	**10,700**	**11,200**
Chromium	**46.0**	**46.4**	**40.5**	**45.1**
Cobalt	**15.4**	**16.1**	**15.8**	**17.0**
Copper	**42.7 JL**	**45.5 JL**	**45.7 JL**	**47.2 JL**
Iron (EC)	**28,900**	**29,500**	**30,000**	**30,100**
Lead	**3.8 JL**	**4.7 JL**	**4.5 JL**	**4.8 JL**
Magnesium (EC)	**10,300**	**11,900**	**12,200**	**13,100**
Manganese	**461 JK**	**542 JK**	**522 JK**	**613 JK**
Nickel	**51.8**	**54.4**	**51.9**	**56.5**
Potassium (EC)	**1,970 JL**	**2,110 JL**	**2,370 JL**	**2,390 JL**
Selenium	1.1 BJK SQL = 2.76 U	1.3 BJK	**1.6 JL**	**1.8 JL**
Silver	0.66 BJK SQL = 2.76 U	0.33 U	0.33 U	0.44 U
Sodium (EC)	1,380 BJK	**1,470 JH**	**1,610 JH**	**1,770 JH**
Total Mercury	0.07 U	0.07 U	0.07 U	0.07 U
Vanadium	**59.9**	**59.9**	**57.1**	**60.6**
Zinc	**70.7**	**71.9**	**72.4**	**73.9**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
EC - Earth Crust metal.
H - High bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
LF - Landfill.
μg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
PCBs - Polychlorinated Biphenyls.
Q - The result is above the method detection limit (MDL), but below the SQL.
SB - Subsurface soil.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.

SECTION 7

MIGRATION/EXPOSURE PATHWAYS AND TARGETS

The following sections describe the migration/exposure pathways and potential targets within the site target distance limits (TDLs). Sample locations are presented in Figures 3-1 and 3-2. Tables 7-1 through 7-6 present the analytical results of the samples collected and a comparison to background concentrations, where applicable. Data validation memoranda and Form I analytical results are included in Appendix C.

7.1 GROUNDWATER MIGRATION PATHWAY

The following section presents the findings obtained for the groundwater migration pathway during this PA/SI as well as the location and analytical results of target groundwater samples collected. Based on hydrogeologic conditions at the side (discussed below), the lack of significant constituent concentrations in subsurface soil samples collected (see Section 6.1.3), and communications with EPA, the groundwater mitigation pathway is not considered to be a significant pathway at the site, and was not evaluated.

7.1.1 Groundwater Pathway Description

The Wilder Landfill-Hazardous Waste Pit is located within the Bellingham Basin, a structural basin formed during the early part of the Tertiary Age (Golder, 1988).

Natural surface soils surrounding the landfill are derived from the glaciomarine deposits of the Bellingham Drift, which are described as soft to firm, olive gray, silty clay, with traces of shell material and localized zones of fine to coarse sand with traces of gravel (Vasey Engineering, 1994; Golder, 1988). In borings collected at the ROW facility, Bellingham Drift sediments have been identified to depths of at least 60 feet above mean sea level, or 30 feet bgs (Golder, 1988). The Bellingham Drift is underlain by a similar unit of glaciomarine deposits known as the Kulshan Drift. Similarities between the two units make it very difficult to distinguish between them, but the contact is reported to exist at approximately 50 feet bgs (Vasey Engineering, 1994).

Monitoring wells have been installed at the ROW facility during various studies conducted at that site. There have been groundwater quality contaminant exceedances but they have been attributed to relic marine water and naturally occurring elements (Dodd, 2002b). The characteristics of the groundwater obtained in the ROW studies are representative of the groundwater upgradient of the Wilder Landfill-Hazardous Waste Pit.

A groundwater zone exists in the Bellingham soils from approximately 16 feet to 35 feet bgs, which is characterized as "alternating layers of sandy silt, sand and silt, and silty sand within a deposit composed primarily of clay and silt" (Golder, 1988). Another water-bearing zone exists in the Kulshan/Bellingham Drift between 54 and 90 feet bgs (Golder, 1988). This zone is pressurized due to the low permeability of the soil under the water table.

Samples from undisturbed silt and clay deposits of the Bellingham Drift were tested for permeability; the results showed a very low vertical permeability of 10^{-8} centimeters per second (cm/s; Golder, 1988). Both water-bearing zones reportedly produce little water and have very low flow rates. ROW monitoring wells have a very slow groundwater recharge rate (Golder, 1988).

Groundwater flow in the vicinity of the site is generally west northwest (Dodd, 2002a). There is a divide in the vertical groundwater gradient that runs diagonally from northeast to southwest across the Recomp Facility; the vertical groundwater gradient is upward to the west of this divide and downward to the east (Golder, 1988). Based on the location and trend direction of this divide, an upward groundwater gradient may exist in the vicinity of the Wilder Landfill-Hazardous Waste Pit.

The nearest weather station is located at the Washington State Nursery in Bellingham, approximately four miles southeast of the site. The mean annual precipitation over a 50-year period (1915-1965) was 33.6 inches, with an estimated potential evapotranspiration of 24.6 inches (Ecology, 1987). This results in an annual surplus of at least nine inches of rain for the period.

Based on available information, groundwater drinking water wells in the vicinity of the site draw from formations approximately 80 to 100 feet bgs (WCDHHS, 2001). No well logs were available for these wells, but their completed depths imply they may draw from the water-bearing zone that exists in the Kulshan/Bellingham Drift (Golder, 1988).

The vertical hydraulic conductivity of the Bellingham Drift in the vicinity of the site has been measured at 10^{-8} cm/s (Golder, 1988). Groundwater was encountered at 11.2 feet bgs in one boring at the site. Static groundwater levels in ROW monitoring wells appear typically to be within 5 to 10 feet bgs. No reports of hazardous substance contamination at any drinking groundwater wells was identified within the 4-mile TDL (Miller, 2002). The depth to contamination in the site vicinity, if present, is unknown.

7.1.2 Groundwater Pathway Targets

The 4-mile TDL for the groundwater pathway is presented in Figure 7-1. Within the 4-mile TDL, there are approximately 249 private wells serving approximately 649 people and 34 municipal wells serving approximately 9,715 people (Table 7-1). The Whatcom County Health and Human Services provided the location and description of drinking water wells in Whatcom County. The private well population was estimated based on the average number of 2.6 residents per household for Whatcom County (EPA, 1990b). The municipal well population was based on information obtained from the Washington State Department of Health Water System Data (2001). The closest domestic drinking water well is located 0.4 mile south of the site and is privately serving two people. No drinking water wells are located directly on the Wilder Landfill-Hazardous Waste Pit. No documented wellhead protection areas were identified within the TDL. A summary of the groundwater drinking water population served within the 4-mile TDL is presented in Table 7-1.

According to Ecology's Water Right Applications list, groundwater is also used for irrigation and stock watering within the TDL (Ecology, 2002).

7.1.3 Groundwater Target Samples

The target pushprobes did not yield sufficient groundwater for sampling; therefore, no target groundwater samples were collected during this investigation.

7.2 SURFACE WATER MIGRATION PATHWAY

The following sections present the findings obtained for the surface water pathway during this PA/SI, including the locations, analyses conducted, and analytical results of samples collected from the overland flow path segments, the probable point of entry (PPE), and in-water segments of the surface water pathway. Sample locations are presented in Figures 3-1 and 3-2. The surface water pathway TDL is represented in Figure 7-2. Tables 7-2 through 7-6 present the analytical results of the samples collected and a comparison to background concentrations. Data validation memoranda and Form I analytical results are included in Appendix C.

7.2.1 Hydrologic Setting

The soil at the site is identified as Bellingham silty clay loam, which is formed from a mixture of alluvium, loess, and glaciolacustrine deposits (USDA, 1992). Permeability is typically slow, runoff is very slow, and water capacity is high. A seasonally high water table is located at or near the surface from November through April (USDA, 1992).

Weston estimated the drainage area for the site from a topographic map to be approximately 7.3 acres. The site property is not located within a mapped 100-year or 500-year floodplain (Environmental Systems Research Institute, Inc., 2002). The 2-year, 24-hour rainfall for the area is 3.3 inches (Western Regional Climate Center [WRCC], 2001).

7.2.1.1 Overland Flow Segments

The surface water hazardous substance migration path includes both overland segments and in-water segments. Three primary overland flow path segments were identified leading from the site sources to the PPE into Claypit Pond (Figure 3-1). The northern drainage ditch overland flow path segment originates in the drainage ditch to the north of the landfill, and flows to the drainage ditch that runs parallel to the BNRR railroad tracks.

The southern drainage ditch overland flow path segment originates in the drainage ditch to the south of the landfill. This ditch flows to the west where it joins with the railroad drainage ditch segment.

The railroad drainage ditch overland flow path segment, running parallel to the BNRR tracks, flows south to the culvert that discharges to Claypit Pond PPE. The length of the railroad ditch from the northern drainage ditch to the PPE is approximately 600 feet (0.11 mile).

7.2.1.2 Probable Point of Entry

One PPE to Claypit Pond was identified at the site during the PA/SI field effort. Due to access constraints, the PPE was not directly observed during the field event, but its location was assumed to be near the effluent point of the railroad culvert. The shortest distance from the site source to the PPE is approximately 0.09 mile via the southern drainage ditch and railroad culvert.

7.2.1.3 In-Water Flow Segments

The primary surface water pathway is illustrated in Figure 7-2. The flow path of surface water from the site to the 15-mile TDL begins at the PPE to Claypit Pond, extends approximately 0.25 mile (1,300 feet) southwest to the outlet at the pond's southwestern tip. The outlet drains into a small ditch, which flows westward approximately 0.03 mile (160 feet) to Tennant Lake Creek. In Tennant Lake Creek the flowpath continues south for approximately one mile, where it converges with Silver Creek. Silver Creek flows south for an additional 1.5 miles before reaching the Nooksack River delta in Bellingham Bay. The shortest channel through the delta extends 1.15 miles southeast to Bellingham Bay. The remainder of the surface water TDL extends as an arc with a radius of approximately 11.07 miles into Bellingham Bay, and includes Hale Passage, Lummi Bay, portions of the Strait of Georgia, Rosario Strait, and Samish Bay (Figure 7-2).

The Nooksack River is tidally influenced at least 5.2 miles upstream to the Main Street Bridge in the City of Ferndale (Lisser, 2002a). Nooksack River flow at Ferndale averages 3,801 cubic feet per second (cfs; USGS 2003). This stretch of the river is also included in the surface water pathway within the TDL.

7.2.2 Surface Water Pathway Targets

7.2.2.1 Drinking Water Intakes

Two surface water intakes were identified within the 15-mile surface water pathway TDL (WCDHHS, 2001). These intakes are located on the east and west banks of the Nooksack River near the Main Street bridge in Ferndale, and both belong to the Whatcom County Public Utility District (PUD; Lisser, 2002b). The PUD withdraws approximately 17 to 20 million gallons of water per day through these intakes. After primary treatment by the PUD, the City of Ferndale and the Alcoa/Intalco facility receive this non-potable water and treat it further to potable standards (Lisser, 2002b). Alcoa/Intalco supplies potable water to approximately 1,000 employees (Lisser, 2002a). The City of Ferndale drinking water system receives 100 percent of its water supply from the PUD (Radder, 2002). According to Department of Public Works personnel, the City system includes approximately 3,500 connections that serve nearly all residents of the City of Ferndale, plus some residents outside the city limits (approximately 8.925; Radder, 2002). The total number of residents served by Nooksack River drinking water is estimated as 9,925 (Lisser, 2002a; Radder, 2002).

7.2.2.2 Wetlands and Other Sensitive Environments

Claypit Pond, approximately 0.1 mile west of the site, is part of WDFW's 720-acre Tennant Lake Wildlife Area. Silver Creek is a coho salmon (*Oncorhyncus kisutch*) and cutthroat trout (*Oncorhyncus clarki lewisi*) migration route (SAIC, 1993).

The Nooksack river contains winter and spring runs of chinook salmon (*Oncorhynchus tshawytscha*), which is a federally-listed threatened species (WDFW, 2002a). Large portions of the Nooksack River delta are designated by Washington State as territory and wintering areas for bald eagle (*Haliaeetus leucocephalus*), a state and federal threatened species. A bald eagle was observed flying over the site by Weston personnel during the field sampling event (July 10, 2002).

A conservative estimate of linear wetlands within the 15-mile TDL was measured from National Wetland Inventory (NWI) maps to be at least 18.65 miles (NWI, 1987a,b,c,d). In addition, approximately four acres of wetlands were observed by Weston personnel in the southeastern portion of Claypit Pond during the field event.

7.2.2.3 Fisheries

Washington Department of Fisheries stocked Claypit Pond with coho salmon fry in 1992 (SAIC, 1993). Claypit Pond currently includes spiney ray and large mouth bass recreational fisheries, but harvest data are not available (Reed, 2002). Fishery information for Silver Creek was not available.

The main stem of the Nooksack River is estimated to be approximately 32 miles long (USGS, 1975). The WDFW 1998 Sport Catch Report indicates that 39 steelhead were harvested from the main stem of the Nooksack in 1998, which averages to a catch of 1.2 steelhead per river mile (Manning and Smith, 2001). Since 5.2 miles of the Nooksack River is included in the TDL (exclusive of the delta), six steelhead are estimated to be caught within the TDL. Average weights for steelhead range from 8-11 pounds (lbs); therefore the estimated steelhead harvest within the TDL section of the Nooksack River is approximately 48 lbs. In addition, 4,067 freshwater salmon were caught by sport fishermen in the Nooksack River system in 1998 (Manning and Smith, 2001). The length of the river system (including the North, Middle, and South Forks) is estimated at 142 miles (USGS, 1975; Cohen, 2000). Assuming a minimum weight of one pound per fish, approximately 28.6 lbs of freshwater salmon were harvested per mile along the Nooksack River, indicating an estimated 148 lbs harvested from the Nooksack River within the TDL. The total harvest of steelhead and freshwater salmon from the Nooksack River within the TDL is 196 lbs (Table 7-7).

Bellingham Bay is used for recreational boating and fishing. Harvest numbers reported for Fish Area 7 (which includes the marine portion of the 15-mile TDL) in the 1998 WDFW Sport Catch Report indicates that 5,801 salmon (3,069 chinook, 2,487 coho, 92 pink, 48 sockeye, and 105 chum) and 9,293 bottomfish were caught for sport (Table 7-4; Manning and Smith, 2001). It was visually estimated that the TDL constitutes approximately 20% of this entire area; therefore, approximately 1,160 salmon (613 chinook, 497 coho, 18 pink, 9 sockeye, and 21 chum)] and 1,858 bottomfish were caught for sport in 1998 within the TDL. Estimated average weights for salmon are: chinook—10 to 15 pounds; coho—6 to 12 pounds; pink—3 to 5 pounds; sockeye—5 to 8 pounds; chum—10 to 15 pounds (Table 7-7; WDFW, 2002b). Bottomfish actual weights were not available; a minimum weight of one pound per fish is assumed. Based on this information, approximately 11,279 pounds of fish were caught by sport fishermen within the marine portion of the TDL in 1998 (6,130 lbs of chinook; 2,982 lbs of coho; 54 lbs of pink; 45 lbs of sockeye; and 1,050 lbs of chum). In addition, 1,352 pounds of clams, and 15,109 Dungeness Crabs were also harvested within the TDL in Bellingham Bay in 1998 (Manning and Smith, 2001). At an estimated average weight of 2.11 lbs per Dungeness crab (Fisheries and Oceans Canada, 2002), a total of 33,231 lbs of shellfish were harvested by sport fishermen from Bellingham Bay in 1998.

Commercial fishing for salmon and shellfish is also conducted in Bellingham Bay, but harvest information was unavailable. Table 7-7 presents the estimated known sport fish harvest within the TDL.

7.2.2.4 Resources

Surface water from the Nooksack River within the TDL is currently used to irrigate commercial food crops, water commercial livestock, and for drinking water (Lisser, 2002a). A search of Ecology's Water Right Applications list did not identify any surface water rights within the TDL other than those of the Whatcom County PUD.

7.2.3 Surface Water Pathway Sample Locations and Analytical Results

7.2.3.1 Overland Flow Segments

7.2.3.1.1 Sample Locations

Four surface samples (SD006, SD007, SD009, and SD012) were collected from the drainage ditches of the overland flow segments leading to Claypit Pond. SD009 was collected from the drainage ditch north of the landfill. The sample resembled soil, consisting of medium grayish brown clayey silt with abundant organics. SD011, collected from the drainage ditch south of the landfill, also resembled soil, consisting of dark brown clayey silt with abundant organics.

SD006 was collected from the railroad ditch approximately 15 feet north of the railroad culvert leading to Claypit Pond. The constituent concentrations in SD006 represent the contribution to Claypit Pond of constituents originating from the drainage area that includes the site. SD006 consisted of medium brown silt with clay and abundant organics. SD007 was collected from the same ditch, approximately 20 feet south of the railroad culvert. The constituent concentrations in SD007 represent the contribution to Claypit Pond of constituents originating from the drainage area south of the culvert, which does not include the site. SD007 consisted of medium to dark brown silt with clay and abundant organics.

7.2.3.1.2 Analytical Results

The analytical results summary of sample SD009 collected from the northern drainage ditch is presented in Table 7-2. Mercury was the only analyte detected in this sample at an elevated concentration (0.34 mg/kg).

The analytical results summary of sample SD011 collected from the southern drainage ditch is presented in Table 7-3. None of the detected concentrations in this sample are elevated relative to background.

The analytical results summary of samples from the railroad drainage ditch (SD006 and SD007) are presented in Table 7-4. Constituents detected at elevated concentrations in SD006 (north of the railroad culvert) include arsenic (estimated at 26.2 mg/kg), barium (estimated at 515 mg/kg), chromium (estimated at 137 mg/kg), manganese (estimated at 6,520 mg/kg), and zinc (estimated at 477 mg/kg).

Arsenic (estimated at 41.6 mg/kg), manganese (estimated at 2,660 mg/kg), and zinc (estimated at 857 mg/kg) were also detected at elevated concentrations in sample SD007 (south of the railroad culvert). SD007 was collected to assess the constituent concentrations originating in the separate drainage area south of the culvert; constituent concentrations present in this sample are not likely attributable to the landfill site.

As indicated by the analytical results of both SD006 and SD007, sediments in both the drainage area that includes the site and the drainage area south of the culvert contain elevated concentrations of arsenic, manganese, and zinc. Concentrations of these elements in Claypit Pond may be attributable to either drainage area.

7.2.3.2 Claypit Pond Sediments

7.2.3.2.1 Sample Locations

Sample SD004 was collected from Claypit Pond in the vicinity of the railroad culvert (Figure 3-2). The sample material consisted of dark brown and dark gray clayey silt with a trace of organics.

7.2.3.2.2 Analytical Results

The analytical results summary for sample SD004 from Claypit Pond are included in Table 7-5. The nickel concentration in sample SD004, estimated at 54.4 mg/kg, appears elevated relative to that of the background sample. The nickel concentration in SD004 is qualified as estimated (J) due to a low percent solids content of the analyzed sample, and the bias of the reported result is unknown (K). Applying an adjustment factor to this value according to the EPA fact sheet *Using Qualified Data to Document an Observed Release and Observed Contamination*, the adjusted nickel value for this sample becomes 40.29 mg/kg, which is below the background sample SQL (41.4 mg/kg; EPA 1996).

7.2.3.3 Claypit Pond Drainage Stream and Tenant Lake Creek Sediments

7.2.3.3.1 Sample Locations

Sample SD003 was collected from the stream draining Claypit Pond, and consisted of nearly 100 percent fines (medium gray in color), with a trace of sand and some organics. Sample SD001 was collected from Tennant Lake Creek, downgradient of Claypit Pond. This sample consisted medium gray clayey silt with few organics.

7.2.3.3.2 Analytical Results

The analytical results summary for the samples from the Claypit Pond drainage stream (SD003) and Tenant Lake Creek (SD001) is included in Table 7-6. None of the concentrations detected in these samples are elevated relative to background.

7.3 SOIL EXPOSURE PATHWAY

Bellingham soils are the most relevant soil type at the site. The soil is generally described as very dark grayish brown silty clay loam 10 inches thick, with a very dark grayish brown, dark brown and olive brown, mottled silty clay loam subsoil 14 inches thick (USDA 1992). The effective vegetation rooting depth is limited by a seasonal high water table, located at or near the surface from November through April (USDA, 1992). Runoff is usually very slow and water may be ponded over surface soils during the winter (USDA, 1992). Very little irrigated acreage lies within one mile of the site (Ecology, 1987).

7.3.1 Area of Contamination

The Wilder Landfill-Hazardous Waste Pit underlies a large open field and landscaped area with no buildings or structures built directly on the site. The landfill area is largely unpaved and covered with vegetation. There are no boundaries around the site such as fencing or trees to limit access to the public.

7.3.2 Soil Sample Locations and Analytical Results

In accordance with the SQAP (Weston, 2002), surface soil sampling was performed only to characterize site sources. Sample locations and analytical results were presented in Section 6.1.2 and Table 6-2. The results indicate contamination in surface soils at the site.

7.3.3 Soil Exposure Targets

Portions of both the Friese and ROW facilities are located within 200 feet of the former landfill site. A total of approximately 44 workers are employed at these facilities (Friese, 2002; Moscone, 2001). Although a chain-link fence surrounding ROW limits access to the former landfill site from that facility, there are no boundaries such as a fence or trees that would limit access to the site from the Friese property. There are no schools or day care facilities within 200 feet of the landfill.

Approximately 305 people live within one mile of the site (EPA, 2002).

No sensitive terrestrial environments, commercial agriculture, silviculture, or commercial livestock production or grazing were identified at the site during the field effort.

7.4 AIR PATHWAY

Since the site is currently inactive, the potential to release to the air pathway at the site stems mainly from the potential to release by particulate migration, and from noxious odors.

7.4.1 Air Quality Sampling and Analytical Results

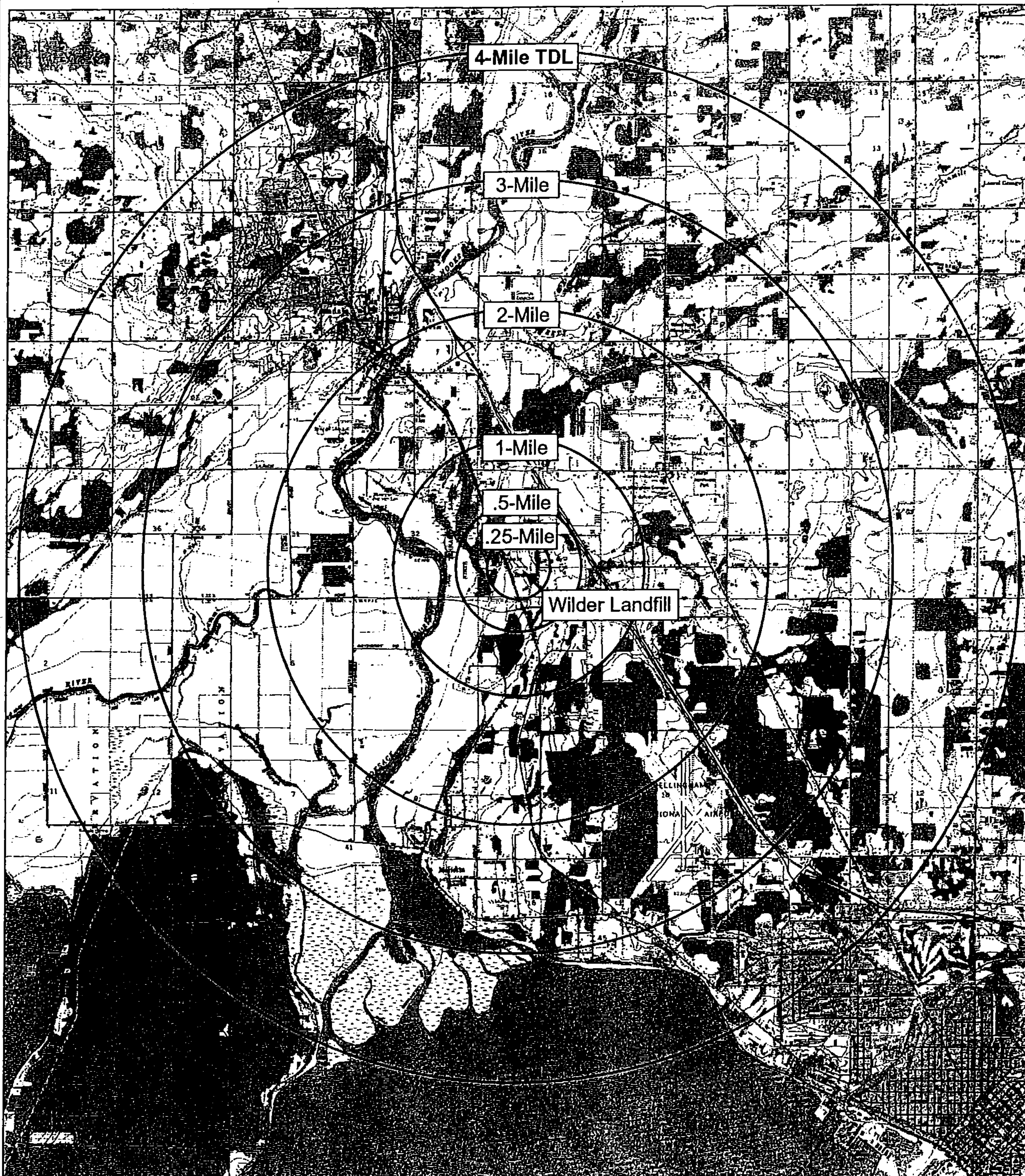
No air samples were collected during this PA/SI.

7.4.2 Air Pathway Targets

Twenty-five employees work at the Friese facility located approximately 80 feet from the northwest corner of the landfill (Friese Hide and Tallow, 2002). Approximately 19 people work at the ROW facility located approximately 100 feet south of the landfill. According to the 1990 census 15,056 people are reported to live within 4 miles of the site (EPA, 2002).

As presented in Section 7.2.3.2, the federally listed threatened bald eagle (*Haliaeetus leucocephalus*) has been observed to winter and nest within the Nooksack River delta. The closest bald eagle habitat inside the TDL is approximately 0.5 mile northwest of the site. A bald eagle was observed over the site on July 10, 2002, during the field sampling event.

Approximately 3,839 acres of wetlands exist within four miles of the site (EPA, 2002). Agricultural fields were observed within 0.5 mile of the site.



Source: USGS 7.5' Series Topo map of Bellingham North, WA 1954 (1994), and Ferndale, WA 1952 (1994).

0 0.55 1.1

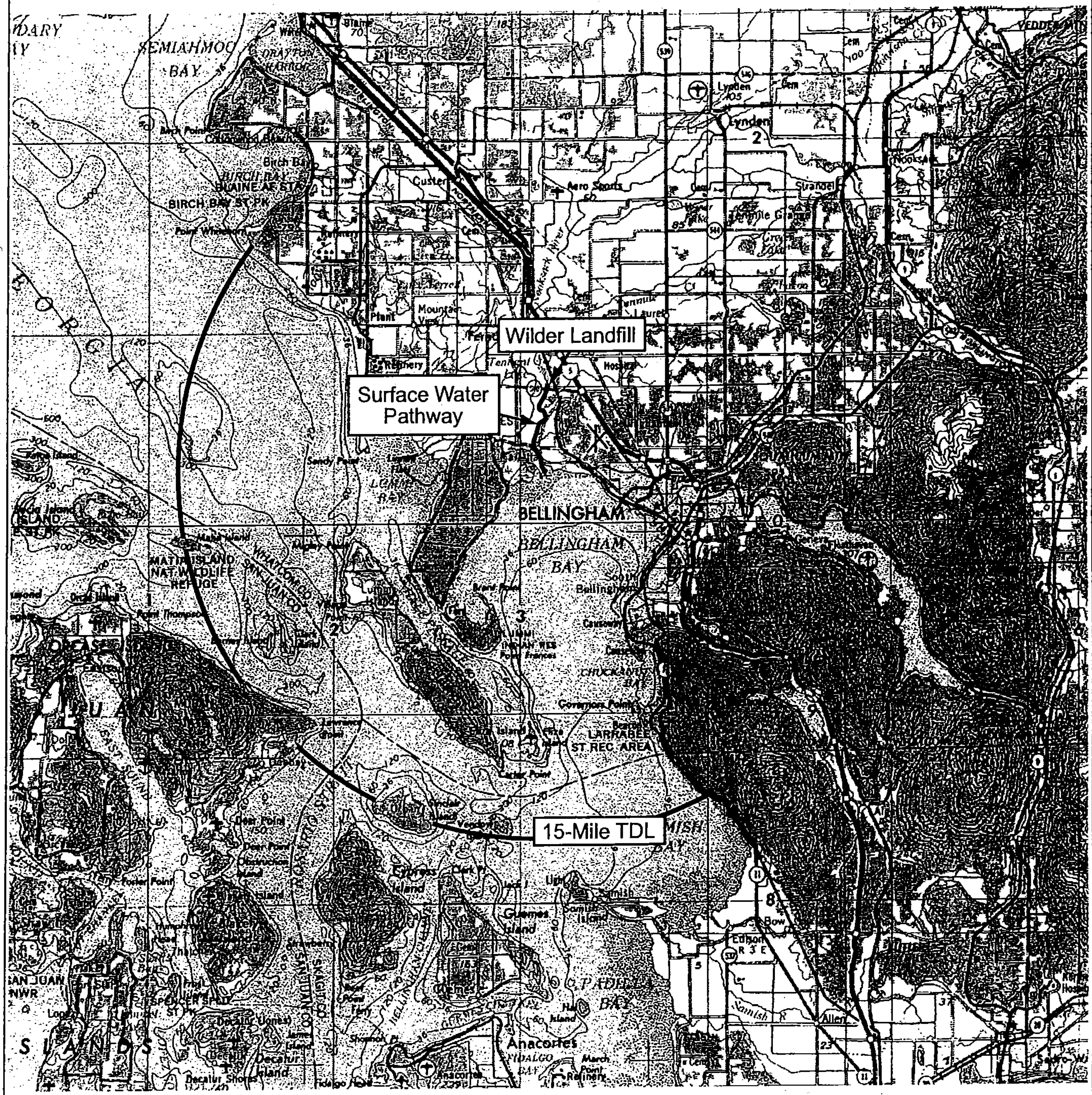
Scale in Miles

4-Mile Target Distance Limit (TDL) Map
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

WESTON SOLUTIONS

Figure
7-1

03-0008 Fig7-1.ai



Source: USGS 1:250,000 Series Topo of Victoria, B.C., Canada; Washington, U.S. 1957 (1974)

15-Mile Target Distance Limit (TDL) Map
Wilder Landfill-Hazardous Waste Pit PA/SI
Ferndale, Washington

N

0 2.5 5

Scale in Miles

WESTON SOLUTIONS

Figure

7-2

03-0008 Fig7-2.ai

Table 7-1—Groundwater Drinking Water Population Within 4-Mile Radius
Wilder Landfill—Hazardous Waste Pit PA/SI

Distance (miles)	Well Identification	Well Population	Total Groundwater Drinking Population Per Distance Ring
0 to ¼	Domestic	0	0
	Municipal	0	
¼ to ½	Domestic	5	7
	Municipal	2	
½ to 1	Domestic	63	151
	Municipal	88	
1 to 2	Domestic	185	960
	Municipal	775	
2 to 3	Domestic	146	8,689
	Municipal	8,543	
3 to 4	Domestic	250	557
	Municipal	307	
		Total	10,364

Notes:

Sources:

Domestic and municipal well information was obtained from WCHHS, 2001.

Municipal Well population was based on Washington State Department of Health, 2001.

Domestic well population was estimated based on the average number of persons per household for Whatcom County of 2.6 people (EPA, 1990b).

Table 7-2—Northern Drainage Ditch Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Downgradient
Location	Northern Drainage Ditch	Northern Drainage Ditch
Organic CLP Sample ID	J0E09	J0E08
Inorganic CLP Sample ID	MJ0CN0	MJ0CM9
EPA Sample Number	02284109	02284108
Weston Sample ID:	WL-SD-SD010-0000	WL-SD-SD009-0000
STATION ID:	SD010	SD009
Depth (feet)	0.1 to 0.5	0 to 0.33
Pesticides & PCBS (μg/kg)		
Dieldrin	**9.2**	6.2 U
Inorganics (mg/kg)		
Aluminum	**13,100**	**17,300**
Arsenic	4.1 BJK SQL = 4.86 U	**6.0**
Barium	93.9 BJK SQL = 97 U	**122**
Beryllium	0.18 BJK SQL = 2.43 U	0.23 BJK
Calcium	**3,180 JL**	**5,190 JL**
Chromium	**34.7**	**46.3**
Cobalt	11.3 BJK SQL = 24.3 U	15.2 BJK
Copper	**31.0 JL**	**38.5 JL**
Iron	**22,600**	**29,600**
Lead	**13.5**	**8.2**
Magnesium	**4,940**	**7,340**
Manganese	**416**	**746**
Nickel	**29.6**	**40.0**
Potassium	1,060 BJK	1,310 BJK
Selenium	1.9 BJK SQL = 2.4 U	1.6 U
Sodium	2,120 BJK	1,910 BJK
Total Mercury	0.17 BJK SQL = 0.24 U	**<u>0.34</u>**
Vanadium	**48.4**	**62.9**
Zinc	**98.5**	**72.9**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
Bold and Underlined - The reported concentration is elevated as defined in Section 5.
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
H - High bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
μg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
PCBs - Polychlorinated Biphenyls.
Q - The result is above the method detection limit (MDL), but below the SQL.
SD - Sediment.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.

Table 7-3—Southern Drainage Ditch Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Downgradient
Location	Southern Drainage Ditch	Southern Drainage Ditch
Organic CLP Sample ID	J0E11	J0E10
Inorganic CLP Sample ID	MJ0CN2	MJ0CN1
EPA Sample Number	02284111	02284110
Weston Sample ID:	WL-SD-SD012-0000	WL-SD-SD011-0000
STATION ID:	SD012	SD011
Depth (feet)	0 to 0.5	0 to 0.5
SVOCs (µg/kg)		
Chrysene	450 U	23 QJK
Di-n-octylphthalate	74 QJK	520 U
Dimethyl Phthalate	43 QJK	520 U
Fluoranthene	450 U	30 QJK
Pyrene	450 U	29 QJK
Inorganics (mg/kg)		
Aluminum	**15,500**	**8,680**
Arsenic	**6.6**	**5.4**
Barium	**112**	**114**
Beryllium	0.20 BJK SQL = 1.35 U	0.13 BJK
Cadmium	0.51 BJK SQL = 1.35 U	0.82 BJK
Calcium	**5,480 JL**	**3,440 JL**
Chromium	**40.8**	**44.0**
Cobalt	**17.4**	14.0 BJK
Copper	**38.8 JL**	**63.9 JL**
Iron	**26,300**	**25,000**
Lead	**22.5**	**34.0**
Magnesium	**5,810**	**4,270**
Manganese	**600**	**1,370**
Nickel	**36.7**	**30.0**
Potassium	**1,410 JL**	716 BJK
Selenium	**1.6**	1.1 BJK
Silver	0.40 BJK SQL = 2.70 U	0.82 BJK
Sodium	968 BJK	1,080 BJK
Total Mercury	**0.41**	**0.24**
Vanadium	**56.0**	**34.0**
Zinc	**101**	**166**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
H - High bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
µg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Q - The result is above the method detection limit (MDL), but below the SQL.
SD - Sediment.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.

Table 7-4—Railroad Ditch Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Downgradient	Attribution
Location	Railroad Drainage Ditch North of Friese Facility	Railroad Drainage Ditch North of Culvert	Railroad Drainage Ditch South of Culvert
Organic CLP Sample ID	J0E07	J0E05	J0E06
Inorganic CLP Sample ID	MJ0CM8	MJ0CM6	MJ0CM7
EPA Sample Number	02284107	02284105	02284106
Weston Sample ID:	WL-SD-SD008-0000	WL-SD-SD006-0000	WL-SD-SD007-0000
STATION ID:	SD008	SD006	SD007
Depth (feet)	0 to 0.42	0 to 0.5	0 to 0.5
SVOCs (μg/kg)			
Benzaldehyde	260 QJK	2,500 U	3,700 U
Di-n-octylphthalate	2,200 U	2,500 U	620 QJK
Inorganics (mg/kg)			
Aluminum	**13,900 JK**	**16,800 JK**	**14,000 JK**
Antimony	6.5 UJK	R	R
Arsenic	5.3 UJK	**26.2 JK**	**41.6 JK**
Barium	131 BJK SQL = 430 U	**515 JK**	433 BJK
Beryllium	0.33 UJK	R	1.6 BJK
Cadmium	2.1 BJK SQL = 11 U	1.6 BJK	2.1 BJK
Calcium	6,150 BJK	**11,100 JL**	13,300 BJK
Chromium	**29.3 JK**	**137 JK**	**39.3 JK**
Cobalt	10.3 BJK SQL = 108 U	56.6 BJK	12.5 BJK
Copper	**44.8 JL**	**80.0 JL**	**83.7 JL**
Iron	**14,000 JK**	**91,200 JK**	**111,000 JK**
Lead	**60.3 JK**	**35.7 JK**	**122 JK**
Magnesium	4,600 BJK	6,980 BJK	4,440 BJK
Manganese	**304 JK**	**6,520 JK**	**2,660 JK**
Nickel	34.6 BJK SQL = 86 U	44.8 BJK	34.6 BJK
Potassium	1,400 BJK	2,160 BJK	2,130 BJK
Selenium	5.3 UJK	R	R
Silver	2.0 UJK	R	R
Sodium	4,800 BJK	7,160 BJK	7,090 BJK
Thallium	8.2 UJK	R	R
Total Mercury	0.65 BJK	R	R
Vanadium	44.1 BJK SQL = 108 U	72.1 BJK	95.6 BJK
Zinc	**130 JK**	**477 JK**	**857 JK**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
Bold and Underlined - The reported concentration is elevated as defined in Section 5.
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
H - High bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
μg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Q - The result is above the method detection limit (MDL), but below the SQL.
R - Quality control indicates that the data are unusable (analyte may or may not be present).
SD - Sediment.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.

Table 7-5—Claypit Pond Sediment Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Claypit Pond Target
Location	Claypit Pond North End	Near PPE
Organic CLP Sample ID	J0E04	J0E03
Inorganic CLP Sample ID	MJ0CM5	MJ0CM4
EPA Sample Number	02284104	02284103
Weston Sample ID:	WL-SD-SD005-0000	WL-SD-SD004-0000
STATION ID:	SD005	SD004
Depth (feet)	0 to 0.42	0 to 0.5
SVOCs (μg/kg)		
4-Methylphenol	890 U	1,700 U
Benzaldehyde	86 QJK	1,700 U
Di-n-octylphthalate	890 U	1,700 U
Fluoranthene	56 QJK	58 QJK
Phenanthrene	32 QJK	1,700 U
Pyrene	46 QJK	1,700 U
Inorganics (mg/kg)		
Aluminum	**14,100 JK**	**18,900 JK**
Arsenic	5.9 BJK SQL = 10 U	7.2 BJK
Barium	91.1 BJK SQL = 207 U	144 BJK
Beryllium	0.30 BJK SQL = 5.18 U	0.29 BJK
Calcium	5,010 BJK	**5,990 JL**
Chromium	**42.2 JK**	**108 JK**
Cobalt	12.5 BJK SQL = 51.8 U	16.9 BJK
Copper	**37.7 JL**	**53.4 JL**
Iron	**21,000 JK**	**28,700 JK**
Lead	**16.6 JK**	**19.9 JK**
Magnesium	**5,710 JK**	**9,090 JK**
Manganese	**435 JK**	**507 JK**
Nickel	35.1 BJK SQL = 41.4 U	**54.4 JK** AC = 40.29
Potassium	1,430 BJK	2,370 BJK
Selenium	3.3 UJK	3.3 UJK
Sodium	1,840 BJK	2,290 BJK
Vanadium	**52.6 JK**	**58.0 JK**
Zinc	**90.8 JK**	**120 JK**

Notes:
AC - Adjusted concentration.
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
B - The result is above the instrument detection limit (IDL), but below the SQL.
CLP - Contract Laboratory Program.
H - High bias.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
μg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Q - The result is above the method detection limit (MDL), but below the SQL.
SD - Sediment.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.

Table 7-6–[illegible]nnant Lake Creek and Claypit Pond Dr[illegible]ge Stream
Sediment Samples Analytical Results Summary
Wilder Landfill—Hazardous Waste Pit PA/SI

Description	Background	Downgradient	Upgradient
Location	Tennant Lake Creek	Tennant Lake Creek	Pond Drainage Stream
Organic CLP Sample ID	J0E01	J0E00	J0E02
Inorganic CLP Sample ID	MJ0CM2	MJ0CM1	MJ0CM3
EPA Sample Number	02284101	02284100	02284102
Weston Sample ID:	WL-SD-SD002-0000	WL-SD-SD001-0000	WL-SD-SD003-0000
STATION ID:	SD002	SD001	SD003
Depth (feet)	0 to 0.33	0 to 0.42	0 to 0.25
SVOCs (ug/kg)			
4-Methylphenol	890 U	790 U	**26 JQK**
Benzaldehyde	**130 JQK**	**69 JQK**	670 U
Di-n-octylphthalate	890 U	790 U	**190 JQK**
Inorganics (mg/kg)			
Aluminum	**35,300 JK**	**17,500**	**20,400**
Arsenic	**34.9 JK**	**7.5**	**8.2**
Barium	**313 JK**	**97.3**	**126**
Beryllium	**0.72 BJK** SQL = 5.32 U	**0.23 BJK**	**0.30 BJK**
Calcium	**12,100 JL**	**4,720 JL**	**6,920 JL**
Chromium	**97.7 JK**	**45.2**	**53.5**
Cobalt	**50.0 BJK** SQL = 53.2 U	**16.2 BJK**	**26.7**
Copper	**75.0 JL**	**34.2 JL**	**49.8 JL**
Iron	**88,700 JK**	**31,500**	**36,700**
Lead	**22.1 JK**	**7.9**	**9.2**
Magnesium	**22,000 JK**	**10,400**	**11,200**
Manganese	**3,120 JK**	**549**	**848**
Nickel	**184 JK**	**79.2**	**58.1**
Potassium	**2,090 BJK**	**1,140 BJK**	**2,540 JL**
Selenium	**4.9 BJK** SQL = 5.32 U	**2.3 BJK**	**2.1 BJK**
Silver	**1.7 BJK** SQL = 10.64 U	0.57 U	0.59 U
Sodium	**2,920 BJK**	**1,310 BJK**	**1,690 BJK**
Thallium	**5.2 BJK** SQL = 10.64 U	2.3 U	2.4 U
Vanadium	**107 JK**	**52.2**	**77.6**
Zinc	**173 JK**	**86.8**	**139**

Notes:
Bold - The reported concentration exceeds the sample quantitation limit (SQL).
B - The result is below the instrument detection limit (IDL) but below the SQL.
CLP - Contract Laboratory Program.
J - The analyte was positively identified; the associated numerical result is an estimate.
K - Unknown bias.
L - Low bias.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Q - The result is above the method detection limit (MDL) but below the SQL.
SD - Sediment.
SVOCs - Semivolatile organic compounds.
U - The analyte was not detected at or above the reported result.
WL - Wilder Landfill.

Table 7-7—1998 Sport Fish Harvest Within 15-Mile TDL
Wilder Landfill—Hazardous Waste Pit PA/SI

TDL Segment	Fish		Calculated Number Harvested within TDL	Assumed Weight Per Fish (lbs)	Pounds Harvested
Nooksack River	Steelhead		6	8[1]	48
	Freshwater Salmon		148	1	148
Bellingham Bay/ San Juan Islands	Salmon	chinook	613	10[1]	6,130
		coho	497	6[1]	2,982
		pink	18	3[1]	54
		sockeye	9	5[1]	45
		chum	21	10[1]	210
	Bottomfish		1,858	1	1,858
	Shellfish	Clams			1,352
		Dungeness Crabs	15,109	2.11	31,880
				Total Harvest:	44,707

Notes:
[1] Minimum of average weight range for fish species reported in WDFW 2002b.
lbs - pounds.

SECTION 8

CONCLUSIONS

The Wilder Landfill—Hazardous Waste Pit is a former landfill located approximately 2 miles southeast of Ferndale, Washington, immediately north of the ROW facility located at 1524 Slater Road. The landfill was permitted by Whatcom County for operation from 1976 to 1979. Noncompliance with the conditions of its operating permit prompted the County to revoke its permit, and the site was closed in 1979 (Whatcom County, 1979b; TRC, 1979). Other sources state that the pit was in operation until 1983 (SAIC, 1993). The site is currently inactive.

A geophysical survey was conducted to delineate the boundaries of the landfill. The results indicate that the landfill extends west of the Wilder property and onto the adjacent Friese Hide and Tallow facility property. The total landfill area is estimated at 1.3 acres.

Contamination sources investigated at the site included the landfill waste and landfill cover surface soil. Analytical results from samples collected during this PA/SI indicate the presence of several organic and inorganic constituents present in both site sources. One SVOC, seven pesticides, two PCB Aroclors, and 16 TAL metals were detected in landfill waste samples. Two pesticides (alpha-BHC and dieldrin) and eight TAL metals (cadmium, chromium, copper, lead, selenium silver, thallium, and zinc) were detected in landfill cover surface soil at concentrations significantly above background.

The potential for subsurface soil in the vicinity of the former landfill to serve as a contamination source to groundwater was assessed; however no detected constituent concentrations were significantly above background levels.

Three primary overland flow segments were identified along drainage ditches leading from the site sources to the PPE into Claypit Pond west of the landfill. Inorganic constituents attributable to site sources (arsenic, barium, chromium, manganese, mercury, and zinc) were detected at elevated concentrations in surface soil and sediment along the overland flow segments. Based on adjusted values, no constituent concentrations were determined to be elevated in Claypit Pond. No constituent concentrations were determined to be elevated in the sediment samples from the stream that drains Claypit Pond or from Tenant Lake Creek.

Two surface water intakes were identified within the 15-mile surface water pathway TDL. They are located on the tidally-influenced portion of the Nooksack River in Ferndale, and belong to the Whatcom County PUD. The surface water drinking water population within the TDL is estimated to be 9,925 (Lisser 2002a; Radder 2002).

The Nooksack river contains winter and spring runs of Chinook salmon (*Oncorhynchus tshawytscha*), which is a federally-listed threatened species (WDFW, 2002a). Large portions of the Nooksack River delta are designated by Washington State as territory and wintering areas for bald eagle (*Haliaeetus leucocephalus*), a state and federal threatened species. Claypit Pond and the marine portion of the TDL contain recreational fisheries. A conservative estimate of linear wetlands within the 15-mile TDL was measured from NWI maps to be at least 18.65 miles

(NWI, 1987a,b,c,d). In addition, approximately four acres of wetlands were observed in Claypit Pond, which is part of the WDFW Tennant Lake Wildlife Area.

Property in the vicinity of the site is zoned for "residential-office" and manufacturing (Whatcom County, 2001). An animal hide treatment facility borders the site to the west, and an industrial park is located to the south. The undeveloped remainder of the Wilder parcel borders the site to the east and north. An estimated 15,056 people are reported to live within 4 miles of the site, and 305 people live within one mile (EPA, 2002). Approximately 44 employees work at the facilities bordering and within 200 feet of the site (Friese Hide and Tallow, 2002; Moscone, 2001). There are no boundaries around the site such as fencing or trees to limit access to the public. No schools or day care facilities are located within 200 feet.

Based on the conditions at the site and the human health and ecological targets identified during this PA/SI, it was determined that the surface water pathway was the primary significant migration pathway at the Wilder Landfill-Hazardous Waste Pit site. Based on hydrogeologic conditions at the site, the lack of significant constituent concentrations in subsurface soil samples collected during this investigation, and communications with EPA, the groundwater pathway was not considered a significant pathway at the site and therefore was not evaluated. The potential for contamination to the air migration and soil exposure pathways would not significantly contribute to the site HRS score; therefore these pathways were also not evaluated.

SECTION 9

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